STANDARD BID DOCUMENT
FOR
DEVELOPMENT OF BRAHMANI RIVERFRONT
AT ROURKELA

Procurement of Works on
Turnkey Basis (Design, Execution & Maintenance)
GOVERNMENT OF ODISHA

Development of Brahmani Riverfront at ABD Area of Rourkela

NATIONAL COMPETITIVE BIDDING

(WORKS ON TURN KEY BASIS WITH DESIGN, EXECUTION & Maintenance)

NAME OF WORK : Development of Brahmani Riverfront Project at ABD Area of Rourkela.

PERIOD OF SALE OF BIDDING DOCUMENT : DATE 24/03/2020 to 23/04/2020

TIME AND DATE OF PRE-BID CONFERENCE : DATE 06/04/2020 TIME 11:00 HOURS

LAST DATE AND TIME FOR RECEIPT OF BIDS : DATE 23/04/2020 TIME 17:00 HOURS

*TIME AND DATE OF OPENING TECHNICAL BIDS : DATE 27/04/2020 TIME 16:00 HOURS.

TIME AND DATE OF CONCEPT DRAWING PRESENTATION : To be notified later

*TIME AND DATE OF OPENING FINANCIAL BIDS : To be notified later

PLACE OF OPENING OF BIDS : RSCL office, Rourkela

OFFICER INVITING BIDS : Chief Executive Officer, Rourkela Smart City Limited
OFFICE OF THE CHIEF EXECUTIVE OFFICER, ROURKELA
SMART CITY LIMITED, ROURKELA

File No. RSCL/100/2018

Rourkela, the 18th March. 2020

INVITATIONS FOR BIDS (IFB)

NATIONAL COMPETITIVE BIDDING

Bid Identification No. RSCL – 649/16/03/2020

1. The Chief Executive Officer, Rourkela Smart City Limited on behalf of Rourkela Smart City Limited invites bids from reputed Indian firms registered with the State Government and bidders of equivalent Grade / Class registered with Central Government / MES / Railways for the building works detailed in the table below on turnkey basis (i.e. Architectural planning with design & execution).

<table>
<thead>
<tr>
<th>Packag e No</th>
<th>Name of the building</th>
<th>Bid security (₹)</th>
<th>Cost of bid document + GST (₹)</th>
<th>Period of Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Development of Brahman Riverfront Project at ABD Area of Rourkela.</td>
<td>₹40,00,000/-</td>
<td>₹11,200/-</td>
<td>Twenty Four Months</td>
</tr>
</tbody>
</table>

2. The Bidders have to participate in ONLINE bidding only. Further details can be seen from the website: https://tendersodisha.gov.in. Any addendum / corrigendum / cancellation of tender can also be seen in the said website.

3. The Bid documents shall be available for downloading in the website: https://tendersodisha.gov.in from Dt. 24/03/2020 at 12:00 AM.

4. A pre-bid meeting shall be held on Dt.06/04/2020 at 11:00 AM at the Conference Hall of Office of the Rourkela Smart City Limited, Rourkela.

5. Online Submission of Bids shall be on or before Dt.23/04/2020 up to 5:00 PM and hardcopies shall be received on or before Dt. 27/04/2020 up to 3:00 PM by this office. The bidder must possess compatible Digital Signature Certificate (DSC) of Class-II or Class- III.

6. Bids received online on due date and time, shall be opened at Dt. 27/04/2020 at 4:00 PM in the Office of the Chief Executive Officer. Rourkela Smart City Limited.

7. Other details can be seen in the bidding documents.

8. The authority reserves the right to cancel any or all bids without assigning any reason.

Sd/-

Chief Executive Officer,
Rourkela Smart City Limited
Memo No. Dt. 16 /03/2020
Copy forwarded to the Deputy Director (Advertisement) & Deputy Secretary to Govt., I. & P.R. Dept., Odisha, and Bhubaneswar with a request to get the Invitation for Bids (IFB) published in two nos. of leading Odia Daily and two nos. of National English Daily Newspapers at an early date for wide circulation.

Since the date of download of Bid documents for the work starts from dt. 24 /03/2020, it is requested that the Invitation for Bids may be published prior to dt. 24 /03/2020

Complimentary copy of the Newspapers publishing Invitation for Bids (IFB) may be sent to this office for reference and record. The approximate indicative cost of the project is ₹39.55 Crore (Rs. Thirty Nine Cr. and fifty five Lakhs Only.).

Sd/-
Chief Executive Officer, RSCL

Memo No. Dt.16/03/2020
Copy with enclosure forwarded to the Deputy Commissioner, Rourkela Municipal Corporation, for publication in the Rourkela Municipal Corporation website for wide circulation.

Sd/-
Chief Executive Officer, RSCL
SECTION 1

INSTRUCTION TO BIDDERS
(ITB)
A. General Instructions

1. Scope of Bid:

1.1 The Chief Executive Officer, Rourkela Smart City Limited, Rourkela invites bids for the building works "Development of Brahmani Riverfront Project in ABD Area of Rourkela"

1.2 The successful bidder shall be expected to complete the works by the intended completion date specified in the Contract.

1.3 Throughout these bidding documents, the terms 'bid' and 'tender' and their derivatives (bidder, tenderer, bid/ tender, bidding/ tendering, etc.) are synonymous. Contractor means the selected bidder for the work.

2. Source of Funds:

The expenditure on this project shall be met from the Smart City Mission Grant Fund, Rourkela Smart City Limited

3. Eligible Bidders:

3.1 This Invitation for Bids is open to all bidders registered with the Government of Odisha or other State Governments / Government of India / MES / Railways for execution of Civil works in general and Road & Building work in particular. Bidders are advised to note the minimum qualification criteria specified in the "Instruction to Bidders" to qualify for the award of contract.

3.2 All bidders shall provide in Section 2, Forms of Bid and Qualification Information.

3.3 Bidders shall not be under a declaration of ineligibility for corrupt and fraudulent practices.

4. Qualification of the Bidder:

4.1 All bidders shall provide Forms of Bid and Qualification Information under Section 2, a preliminary description of the proposed work method and schedule, including drawings and charts, as necessary. The proposed methodology should include programme of construction backed with equipment planning and deployment duly supported with broad calculations and quality – assurance procedures proposed to be adopted justifying their capability of execution and completion of work as per technical specifications, within stipulated period of completion.

4.2 If the Employer has not undertaken prequalification of potential bidders, all bidders shall include the following information and documents with their bids in Section 2:

(a) Copies of original documents defining the constitution or legal status, place of registration, and principal place of business, written power of attorney of the signatory of the Bid to commit the Bidder;

(b) Financial Turnover of the bidder during last five financial years.

(c) Experience in building project works and size for each of the last seven financial years, and details of works under way or contractually committed and clients who may be contacted for further information on those contracts;

(d) Major items of construction equipment proposed to carry out the Contract;
(e) Qualifications and experience of key site management and technical personnel proposed for the Contract;

(f) Reports on the financial standing of the Bidder, such as profit and loss statements and auditor's reports for the past five financial years;

(g) Evidence of adequacy of working capital for this contract (access to line (s) of credit and availability of other financial resources);

(h) Authority to seek references from the Bidder's bankers;

(i) Information regarding any litigation or arbitration resulting from contracts executed by the bidder in the last five years or currently under execution. The information shall include the names of the parties concerned, the disputed amount, cause of litigation, and matter in dispute;

(j) Proposals for subcontracting components of the Works amounting to more than 20 percent of the Bid Price (for each, the qualifications and experience of the identified subcontractor in the relevant field should be annexed); and

(k) The proposed methodology and program of construction, backed with equipment planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones as mentioned in the Contract data..

4.3 Bids from Joint ventures/association of firms are not acceptable:

4.3.1 For determining the eligibility of Applicants for their qualification hereunder, the following shall apply:

(a) The Applicant for qualification may be a single entity or a group of entities (the “Joint Venture”), coming together to implement the Project. However, no applicant applying individually or as a member of a Joint Venture, as the case may be, can be member of another Applicant. The term Applicant used herein would apply to both a single entity and a Joint Venture.

(b) An Applicant may be a company incorporated under the Indian Companies Act, 1956/2013 or a combination of companies with a formal intent to enter into a Joint Venture agreement or under an existing agreement to form a Joint Venture. A Joint Venture shall be eligible for consideration subject to the conditions set out in Clause 4.3.6 below.

(c) An Applicant shall not have a conflict of interest (the “Conflict of Interest”) that affects the Bidding Process. Any Applicant found to have a Conflict of Interest shall be disqualified. An Applicant shall be deemed to have a Conflict of Interest affecting the Bidding Process, if:

(i) the Applicant, its Member or any constituent thereof and any other Applicant, its Member or any constituent thereof have common controlling shareholders or other ownership interest; provided that this disqualification shall not apply in cases where the direct or indirect shareholding of an Applicant, its Member thereof (or any shareholder thereof having a shareholding of more than 5 per cent of the paid up and subscribed share capital of such Applicant, Member, as the case may be), in the other Applicant, its Member is less than 5 per cent of the subscribed and paid up equity share capital thereof; provided further that this disqualification shall not apply to any ownership by a bank, insurance company, pension fund or a public financial institution referred to in section 4A of the Companies Act 1956/2013. For the purposes of this Clause 4.3.1(c), indirect shareholding held
through one or more intermediate persons shall be computed as follows: (aa) where any intermediary is controlled by a person through management control or otherwise, the entire shareholding held by such controlled intermediary in any other person (the “Subject Person”) shall be taken into account for computing the shareholding of such controlling person in the Subject Person; and (bb) subject always to sub-clause (aa) above, where a person does not exercise control over an intermediary, which has shareholding in the Subject Person, the computation of indirect shareholding of such person in the Subject Person shall be undertaken on a proportionate basis; provided, however, that no such shareholding shall be reckoned under this sub-clause (bb) if the shareholding of such person in the intermediary is less than 26% of the subscribed and paid up equity shareholding of such intermediary; or

(ii) a constituent of such Applicant is also a constituent of another Applicant; or

(iii) such Applicant receives or has received any direct or indirect subsidy, grant, concessional loan or subordinated debt from any other Applicant, or has provided any such subsidy, grant, concessional loan or subordinated debt to any other Applicant, its Member thereof; or

(iv) such Applicant has the same legal representative for purposes of this Application as any other Applicant; or

(v) such Applicant has a relationship with another Applicant, directly or through common third party/ parties, that puts either or both of them in a position to have access to each others’ information about, or to influence the Application of either or each other; or

(vi) such Applicant has participated as a consultant to the Authority in the preparation of any documents, design or technical specifications of the Project.

(d) An Applicant shall be liable for disqualification if any legal, financial or technical adviser of the Authority in relation to the Project is engaged by the Applicant, or any of its Members, as the case may be, in any manner for matters related to or incidental to the Project. For the avoidance of doubt, this disqualification shall not apply where such adviser was engaged by the Applicant, its Member in the past but its assignment expired or was terminated 6 (six) months prior to the date of issue of the NIT. Nor will this disqualification apply where such adviser is engaged after a period of 3 (three) years from the date of commercial operation of the Project.

Explanation: In case an Applicant is a Joint Venture, then the term Applicant as used in this Clause 4.3.1, shall include each Member of such Joint Venture.

(e) Other eligibility conditions shall include:

Bidders who meet the minimum qualification criteria will be qualified only if their available bid capacity is more than the total bid value. The available bid capacity will be calculated as under:

Assessed Available Bid capacity = ( A*N*2 – B)

where

A = Maximum value of civil engineering works in respect of Civil Engineering Projects executed in any one year during the last Five years (updated to the price level of the year as indicated in clause 4.6) taking into account the completed as well as works in progress.

N = Number of years prescribed for completion of the works for which bids are invited i.e. 2 (Two ) years.

B = Value (updated to the price level of the year indicated in Clause-4.4 A-II of section-I, ITB) of existing commitments and on-going works to be completed during the next two. Years (period of completion of the works for which bids are invited).

Note: The statement showing the value of existing commitments and on-going works as well as the stipulated period completion remaining for each of the works listed should be
countersigned by the Engineer in the charge, not below the rank of an Executive Engineer or equivalent.

4.3.2 To be eligible for qualification, an Applicant, shall fulfil the following conditions of eligibility:

(A) Technical Capacity: Deleted

(B) Financial Capacity: The Applicant shall have a minimum Net Worth\(^2\) (the “Financial Capacity”) of Rs.4 Crore (Rs. Four Crores only) at the close of the preceding financial year.

4.3.3 In case of a Joint Venture, the Financial Capacity of all the Members of Joint Venture would be taken into account for satisfying the above conditions of eligibility. Further, Lead Member shall meet at least 60% requirement of Technical and Financial Capacity required as per Clause 4.3.2 (B) and all the criteria of 4.4 (A), however other JV members shall meet at least 40% requirement of Financial capacity as per Clause 4.3.2 (B) and 4.4(A). For avoidance of doubt it is further clarified that the Joint Venture must collectively and individually satisfy the above qualification criteria.

4.3.4 The Applicant shall enclose with its application, to be submitted as per the format at Appendix-I, complete with its Annexes, the following:

(i) Deleted

(ii) certificate(s) from its statutory auditors specifying the net worth of the Applicant, as at the close of the preceding financial year, and also specifying that the methodology adopted for calculating such net worth conforms to the provisions of this Clause 4.3.4 (ii). For the purposes of this Bid, net worth (the “Net Worth”) shall mean the sum of subscribed and paid up equity and reserves from which shall be deducted the sum of revaluation reserves, miscellaneous expenditure not written off and reserves not available for distribution to equity share holders.

4.3.5 The Applicant should submit a Power of Attorney as per the format at Appendix-I, authorising the signatory of the Application to commit the Applicant. In the case of a Joint Venture, the Members should submit a Power of Attorney in favour of the Lead Member as per format at Appendix-II.

4.3.6 In case the Applicant is a Joint Venture, it shall comply with the following additional requirements:

(a) Joint Venture shall not be allowed;

(b) subject to the provisions of clause (a) above, the Application should contain the information required for each Member of the Joint Venture;

(c) Members of the Joint Venture shall nominate one member as the lead member (the “Lead Member”). Lead Member shall meet at least 60% requirement of Financial Capacity required as per Clause 4.3.2 (B) & 4.4(A). The nomination(s) shall be supported by a Power of Attorney, as per the format at Appendix-III, signed by all the other Members of the Joint Venture;

(d) the Application should include a brief description of the roles and responsibilities of individual members, particularly with reference to financial, technical and defect liability obligations;

(e) an individual Applicant cannot at the same time be member of a Joint Venture applying for qualification. Further, a member of a particular Applicant Joint Venture cannot be member of any other Applicant Joint Venture applying for qualification;
(f) the Lead Member shall itself undertake and perform at least 50 (Fifty) per cent of the total Project.

(g) members of the Joint Venture shall have entered into a binding Joint Bidding Agreement, substantially in the form specified at Appendix-III (the “Jt. Bidding Agreement”), for the purpose of making the Application and submitting a Bid in the event of being qualified. The Jt. Bidding Agreement, to be submitted along with the Application, shall, inter alia:

(i) convey the commitment(s) of the Lead Member in accordance with this SBD, in case the contract to undertake the Project is awarded to the Joint Venture;

(ii) clearly outline the proposed roles and responsibilities, if any, of each member;

(iii) commit the approximate share of work to be undertaken by each member;

(iv) include a statement to the effect that all members of the Joint Venture shall be liable jointly and severally for all obligations of the Contractor in relation to the Project until the completion of the Project (the “Defects Liability Period”) is achieved in accordance with the Turnkey Contract; and

(h) except as provided under this Turnkey Bidding Documents, there shall not be any amendment to the Jt. Bidding Agreement.

4.3.7 Any entity which has been barred by the Central/State Government, or any entity controlled by it, from participating in any project, and the bar subsists as on the date of Application, would not be eligible to submit an Application, either individually or as member of a Joint Venture.

4.3.8 An Applicant including any Member should, in the last 3 (three) years, have neither failed to perform on any contract, as evidenced by imposition of a penalty by an arbitral or judicial authority or a judicial pronouncement or arbitration award against the Applicant or Member, as the case may be, nor has been expelled from any project or contract by any public entity nor have had any contract terminated by any public entity for breach by such Applicant or Member.

4.3.8.1 The Applicant including any Member may provide details of all their on-going projects along with stage of litigation, if so, against the Authority/Governments.

4.3.8.2 The Applicant including any member may also provide details of on-going process of blacklisting if so, under any contract with Authority/Government.

4.4A :-I Only Reputed Indian firms [It is meant for the Indian Firm having reputation in the specific area of operation for which tender is being invited as defined in Note under Rule-2, Appendix-VIII of OPWD Code Vol-II] are allowed to apply for this Project.

II The bidder must have completed or substantially completed similar nature of work i.e. Development and Construction of Riverfront, Beachfront /Reclamation of Water Bodies/Building/Irrigation Works (except lift irrigation)/Parks Beautification consisting of civil works, architectural works, landscaping works, electrical works and plumbing works /Bridge work with Park Beautification of minimum 4 Acre consisting of civil works, architectural works, landscaping works and electrical works) within last seven financial years i.e. up to 31.03.2020 on Design & Build Basis.

• Experience of following having successfully completed /substantially Completed any of the similar Nature of works in India during last 7 years ending One Month Prior to Bid due date. The Value of executed work shall be brought to current actual value at simple rate of 7% per annum
- One Contract of Rs. 18.00 Cr. Or
- Two Contract of Rs.10.00 Cr. Or
- Three Contract of Rs.6.00 Cr.

Substantially Completed: Substantial Completion shall be based on 80 (eighty) percent value wise or more works completed under the contract and Completed value must be equal or more of 18.00 Cr in case of single work, value must be equal or more of 10 Cr. in case of two contract and value must be equal or more of 6 Cr. in case of Three contract. More than 80% of Contract Value certified by Executive Engineer in Charge or equivalent.

a) Bidder should submit completion certificate for central / state government projects. For private sector projects, completion certificate with TDS shall be submitted.

III Should have an average annual turnover of Rs.50 Crores (Fifty Crores only) certified by chartered accountant (mention UDIN No.) during the last five financial years. (2014-15 to 2018-19)

IV Should have latest bank solvency certificate for amount of at least (50% of the bid value) in the current financial year. Certificate should be issued after 31.03.2020 and clearly state that Banker shall be extending necessary financial support required for execution of the subject work.

V Should have valid GST registration number.

VI Deleted

VII Joint venture / Consortium are not permitted to bid.

VIII Overseas Experience of the bidder shall not be considered.

IX Preference shall be given to applicants who has in-house design expertise and in-house MEP execution capabilities

X The Firm should be making profit during each of the last three financial years, ending on March 31, 2019. Financial data for previous 5 years shall be submitted as per format in Annexure 3.

XI Bidders who meet the minimum qualification criteria will be qualified only if their available bid capacity is more than the total bid value. The available bid capacity will be calculated as under:

Assessed Available Bid capacity = (A x N x 2) - B

Where
A = Maximum value of civil engineering works executed in any one financial year during the last Five financial years (updated to bid invitation year price level) taking into account the completed as well as works in progress.

N = Number of years prescribed for completion of the works for which bids are invited.
STANDARD BID DOCUMENT FOR DEVELOPMENT OF BRAHMANI RIVERFRONT IN ABD AREA OF ROURKELA

B = Value (updated at simple rate of 7% per annum to the price level on the year in which bids are received) of existing commitments and on-going works to be completed during the next 24 calendar months.

XII Bidders must furnish with their bid, a detailed construction, planning and methodology supported with layout and necessary drawings and detail calculations to allow the Employer to review their proposals. The banker shall be extending necessary financial support required for execution of the subject work.

4.4B. Each bidder should further demonstrate:-

A) Availability (either owned or leased) of the following key and critical equipment for this work:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>List of plants and equipments</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cement Concrete batch mix plant arrangement (with capacity of 30cum/hr)</td>
<td>One</td>
</tr>
<tr>
<td>2.</td>
<td>Vibrator / Equipment</td>
<td>Four</td>
</tr>
<tr>
<td>3.</td>
<td>Excavator</td>
<td>Two</td>
</tr>
<tr>
<td>4.</td>
<td>Complete steel staging and shuttering materials.</td>
<td>40000 SFT</td>
</tr>
<tr>
<td>5.</td>
<td>Field Testing equipment</td>
<td>As per requirement</td>
</tr>
<tr>
<td>6.</td>
<td>Truck &amp; Tipper</td>
<td>Six Nos</td>
</tr>
<tr>
<td>7.</td>
<td>Modern sophisticated theodolite with leveling machine/Total Station</td>
<td>One</td>
</tr>
<tr>
<td>8.</td>
<td>Truck mounted transit mixture with concrete pump</td>
<td>Four nos</td>
</tr>
<tr>
<td>9.</td>
<td>Dewatering Pump(7.5 HP)</td>
<td>Five Nos</td>
</tr>
<tr>
<td>10.</td>
<td>125KVA DG</td>
<td>One</td>
</tr>
<tr>
<td>11.</td>
<td>15 Ton Hydra Crane</td>
<td>One</td>
</tr>
</tbody>
</table>

B) The bidders should, however, undertake their own studies and furnish with their bid, a detailed construction planning and methodology supported with layout and necessary drawings and detail calculations to allow the employer to review their proposals. The numbers, types and capacities of each plant/equipment shall be shown in the proposals along with the cycle time for each operation for the given production capacity to match the requirements.

C) Liquid assets and/or availability of credit facilities of not less than the amount of Rs.7(Seven) Crores (Credit lines / letter of Credit / Certificate from banks for meeting the fund requirements etc. – usually the equivalent of the estimated cash flow for three months in peak construction period)

4.4C. To qualify for a package of contracts made up of this and other contracts for which bids are invited in the IFB, the bidder must demonstrate having experience and resources sufficient to meet the aggregate of the qualifying criteria for the individual contracts.

4.5 Sub-contractors' experience and resources shall not be taken into account in determining the bidder's compliance with the qualifying criteria

4.6 Bidders who meet the minimum qualification criteria will be qualified only if their available bid capacity is more than the total bid value. The available bid capacity will be calculated as under:

\[
\text{Assessed Available Bid capacity} = (A \times N \times 2) - B
\]

Where
A = Maximum value of civil engineering works executed in any one financial year during the last Five financial years (updated to bid invitation year price level) taking into account the completed as well as works in progress.

N = Number of years prescribed for completion of the works for which bids are invited.

B = Value (updated at simple rate of 7% per annum to the price level on the year in which bids are received) of existing commitments and on-going works to be completed during the next 18 calendar months.

Note: The statements showing the value of existing commitments and on-going works as well as the stipulated period of completion remaining for each of the works listed should be countersigned by the Engineer in charge, not below the rank of an Executive Engineer or equivalent.

4.7 Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they have:
- Made any misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
- Record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures etc.; and/or
- Participated in the previous bidding for the same work and had quoted unreasonably high bid prices and could not furnish rational justification to the employer.

5. One Bid per Bidder:
Each bidder shall submit only one bid for one package. A bidder who submits or participates in more than one Bid (other than as a subcontractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Bidder's participation to be disqualified.

6. Cost of Bidding:
The bidder shall bear all costs associated with the preparation and submission of his Bid, and the Employer will in no case be responsible and liable for those costs.

7. Site visit
The Bidder, at the Bidder's own responsibility and risk is encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.
B. Bidding Documents

8. Content of Bidding Documents:

8.1 The set of bidding documents comprises the documents listed below and addenda issued in accordance with Clause 10:

<table>
<thead>
<tr>
<th>Section</th>
<th>Particulars</th>
<th>Volume No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Invitation for Bids</td>
<td>I</td>
</tr>
<tr>
<td>1</td>
<td>Instructions to Bidders</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Form of bid, Qualification Information, and other forms</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Conditions of Contract</td>
<td>II</td>
</tr>
<tr>
<td>4</td>
<td>Contract data</td>
<td>III</td>
</tr>
<tr>
<td>5</td>
<td>Technical Specifications</td>
<td>IV</td>
</tr>
<tr>
<td>6</td>
<td>Securities and other forms</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Drawings (Conceptual and broad specification, technical parameters)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Terms of Reference (TOR) for design</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Project execution &amp; supervision aspects, Contract Management Framework &amp;</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Documents to be furnished by bidder</td>
<td>V</td>
</tr>
</tbody>
</table>

8.2 The Bidder shall download the above listed documents as listed under Volume I, II, III and IV and shall submit his bid after preparing the same in compliance to section 2 (refer clause 12)

8.3 The bidder shall be expected to examine carefully all instructions, conditions of contract, contract data, forms, terms, technical specifications, forms, annexes and drawings in the Bid Document. Failure to comply with the requirements of Bid Documents shall be at the bidder's own risk. Pursuant to clause 26 hereof, bids, which are not substantially responsive to the requirements of the Bid Documents, shall be rejected.

9. Clarification of Bidding Documents:

9.1 A prospective bidder requiring any clarification of the bidding documents may notify the Employer in writing or by cable (hereinafter "cable" includes telex, facsimile and e-mail) at the Employer's address indicated in the invitation to bid. The Employer will respond to any request for clarification, which he received earlier than 15 days prior to the deadline for submission of bids. Copies of the Employer's response will be forwarded to all purchasers of the bidding documents, including a description of the enquiry but without identifying its source.
9.2 Pre-bid meeting:

9.2.1 The bidder or his official representative is invited to attend a pre-bid meeting which shall be held on date 06.04.2020 at 11:00 AM at the office of the Rourkela Smart City Limited, Rourkela.

9.2.2 The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.

9.2.3 The bidder is requested to submit any questions in writing to reach the Employer not later than one week before the meeting.

9.2.4 Minutes of the meeting, including the text of the questions raised (without identifying the source of enquiry) and the responses given will be transmitted without delay to all purchasers of the bidding documents. Any modification of the bidding documents listed in Sub-Clause 8.1 which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause 10 and not through the minutes of the pre-bid meeting.

9.2.5 Non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

10. Amendment of Bidding Documents:

10.1 Before the deadline for submission of bids, the Employer may modify the bidding documents by issuing addenda.

10.2 Any addendum thus issued shall be part of the bidding documents and shall be communicated in writing or by cable/e-mail to all the purchasers of the bidding documents. Prospective bidders shall acknowledge receipt of each addendum in writing or by cable/e-mail to the Employer. The Employer will assume no responsibility for postal delays.

10.3 To give prospective bidders reasonable time of one month in which to take an addendum into account in preparing their bids, the Employer shall extend as necessary the deadline for submission of bids, in accordance with Sub-Clause 20.2 below.

10.4 The addendum shall also be available in official website as mentioned at Para 3 of IFB.

11. The bidders who are qualified in the general assessment stated above have to give a presentation of concept design along with implementation programme.
C. Preparation of Bids

11. **Language of the Bid:**

   All documents relating to the bid shall be in the English language.

12. **Documents comprising the Bid:**

   The bid to be submitted by the bidder as Volume V of the bid document (refer Clause 8.1) shall be in two separate parts:

   **Cover-I:** Shall be named "Technical Bid" and shall comprise (to be submitted in online) of:-
   
   (i) Technical Bid (in the format indicated at Section 2);
   
   (ii) Bid Security in the form specified in Section 6 & cost of bid documents.
   
   (iii) Qualification Information and supporting documents as specified in Section -2
   
   (iv) Certificates, undertakings, affidavits as specified in Section 2,
   
   (v) Undertaking that the bid shall remain valid for the period specified in Clause 15.1

   **Cover –II:** Shall be named "Financial Bid" and shall comprise (to be submitted in online)
   
   The Lump sum Price Bid;

   **Cover –III:** To be submitted in sealed cover and shall comprise of :-
   
   i) Conceptual drawings, ii) Work programme,
   
   iii) Modalities of execution, iv) Specification

   The sealed cover shall be received in the office of Chief Executive Officer, Rourkela Smart City Limited, Udit Nagar,Rourkela-769012 only during the office hours up to 7 working days from the last date of submission of the bid (cover-I, cover-II) in online. The sealed covers (cover- I & III) submitted by post should reach and delivered in the above office within the stipulated date and time positively. The department will not be held responsible for any delay or loss or damage of the Bid documents during transit and in such events the bids stands rejected summarily. If cover- I & III is not received in due date and time the bid shall be declared non-responsive.

13. **Bid Price:**

13.1 The contract shall be for the whole work as described in Sub-Clause 1.1, based on the Lump Sum Price Bid submitted by the Bidder.

13.2 The bidder shall fill the total bid price as **Lump Sum Price** (both in figures and words) for all items of works as specified in the Bid document. Corrections, if any, shall be made by crossing out, initialing, dating and rewriting.

13.3 The prices tendered shall except in so far as it is otherwise, provided under the contract, include all constructional plant, labour, supervision, materials, erection maintenance, insurance, profit, taxes and duties & other levies together with all general risks, liabilities and obligations set out or implied in the contract.

13.4 The lump sum bid price quoted by the bidder shall be fixed for the duration of the Contract and shall not be subject to adjustment on any account.
14. Currencies of Bid and Payment:

The currency of bid and payment shall be quoted by the bidder entirely in Indian Rupees. All payments shall be made in Indian Rupees.

15. Bid Validity:

15.1 Bids shall remain valid for a period not less than (180) One Eighty days after the deadline date for bid submission specified in Clause 20. A bid valid for a shorter period shall be rejected by the Employer as non-responsive. In case of discrepancy in bid validity period between that given in the undertaking pursuant to Clause 12.1 (v) and the Form of Bid submitted by the bidder, the latter shall be deemed to stand corrected in accordance with the former and the bidder has to provide for any additional security that is required.

15.2. In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the bidders and the bidder may extend the period of validity for a specified additional period. The request and the bidders' responses shall be made in writing or by cable / e-mail. A bidder may refuse the request without forfeiting his bid security. A bidder agreeing to the request will not be required or permitted to modify his bid but will be required to extend the validity of his bid security for a period of the extension, and in compliance with Clause 16 in all respects.

16. Bid Security :

16.1 The Bidder shall furnish, as part of his Bid, a Bid security of an amount as shown in column 3 of the table of IFB for this particular work. Bid security in the shape such as Deposit Receipt of Scheduled Bank (Term Deposit Receipt) / Post Office Savings Bank Account / National Savings Certificate / Postal Office Time Deposit Account duly pledged in favour of the Chief Executive Officer, Rourkela Smart City Limited is acceptable. The bidder has the option of furnishing Bid Security in the form of Bank Guarantee from a Nationalized Bank of India, counter guaranteed by its branch at Bhubaneswar.

16.2. Any bid not accompanied by an acceptable Bid Security and not secured as indicated in sub-clauses 16.1 shall be rejected by the Employer as non-responsive.

16.3. The Bid Security of unsuccessful bidders shall be returned within 28 days of the end of the bid validity period specified in sub-clause 15.1.

16.4. The Bid Security of the successful bidder shall be discharged when the bidder has signed the Agreement and furnished the required Performance Security

16.5 The Bid Security may be forfeited

(a) If the Bidder withdraws the Bid after Bid opening during the period of Bid validity;

(b) In the case of a successful Bidder, if the Bidder fails within the specified time limit to

(i) Sign the Agreement; or

(ii) Furnish the required Performance Security.

(iii) Deposit the required license fees with State Government to register itself as a Special / Super Class contractor with Government of Odisha within 15 (fifteen) days of issue of Letter of Acceptance of Bid.
17. **Alternative Proposals by Bidders:**

Bidders shall submit offers as per his own estimate based on his own design & drawing but complying with the requirements of the bidding documents, including the basic technical design parameters and as per regulations of Rourkela Development Authority, OECBC, specifications relevant IS Codes & NBC. **Conditional offer or alternative offers will not be considered further in the process of tender evaluation.**

18. **Format and Signing of Bid:**

18.1 The bidder shall submit one set of the bid comprising the documents as described in clause-12 of ITB.

18.2. The Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder. All pages of the Bid shall be signed by the person or persons signing the Bid.

18.3. The Bid shall contain no overwriting alternations or additions, except those to comply with instruction issued by the Employer or as necessary to correct errors made by the Bidder, in which case such corrections shall be made by scoring out the cancelled portion, writing the correction and initialing and dating it by the person or persons signing the Bid.
D. Submission of Bids

Online submission as per Govt. of Odisha e-Procurement Procedure annexed

19. Sealing and Marking of Bids – Refer e-procurement procedure as annexed in Annexure-I to ITB for cover-I and cover-II of the bid (clause-12.1).

19.1. The bid documents as per cover-III of clause-12.1 shall be submitted in sealed cover (in off line).

   Technical Bid: To be opened on dt. 27.04.2020 at 16:00 Hour.

   Financial Bid: Not to be opened except with approval of the Employer. The contents of the “Technical Bid” and “Financial Bid” shall be as specified in clause-12.1 of ITB.

19.2. The sealed envelope (cover-III) as per clause-12.1 shall be -

   a) be addressed to the Employer at the address provided in the clause-1.1 of the ITB.

   b) bear the name and identification number provided in clause-1 of IFB.

   c) provide a warning not to be opened before the specified time and date for opening as mentioned in clause-23.1 of ITB.

19.3. In addition to the identification required in clause-19.2, each of the envelopes shall indicate the name and address of Bidder to enable the Bid to be returned unopened in case it is declared late pursuant to clause-20.1 of ITB or declared non-responsive, pursuant to clause-27 of the ITB.

20. Deadline for Submission of the Bids

20.1 Bid shall be received on or before Dt. 23.04.2020 up to 5:00 PM as notified in IFB.

20.2 The Employer may extend the deadline for submission of bids by issuing an amendment in accordance with Clause 10, in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will then be subject to the new deadline.

21. Late Bids:

   Any Bid received by the Employer after the dead line prescribed in clause-20 of ITB will be returned unopened to the Bidder.

E. BID OPENING AND EVALUATION

22. Bid Opening:

22.1 All the bids received shall be opened in the Office of Chief Executive Officer Rourkela Smart City Limited, Udit Nagar, Rourkela-769012 on dt._27.04.2020 at 16:00 Hours in the presence of the Bidders or their representatives who choose to attend. In the event of the specified date of Bid opening being declared a holiday, the Bids will be opened at the appointed time and location on the next working day.

22.2 The Employer shall prepare minutes of the Bid opening.

23. Process to be Confidential:
Information relating to the examination, clarification, evaluation, and comparison of Bids and recommendations for the award of a contract shall not be disclosed to Bidders or any other persons not officially concerned with such process until the award is successful and Bidder has been announced. Any effort by a Bidder to influence the Employer's processing of Bids or award decisions may result in the rejection of his Bid.

24. Clarification of Financial Bids:

24.1. To assist in the examination, evaluation, and comparison of Bids, the Employer may, at his discretion, ask the lowest evaluated responsive bidder for clarification of his Bid, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable/e-mail, but no change in the price or substance of the Bid shall be sought, offered, or permitted.

24.2. Subject to sub-clause 24.1, no Bidder shall contact the Employer on any matter relating to his bid from the time of the bid opening to the time the contract is awarded. If the Bidder wishes to bring additional information to the notice of the Employer, it should do so writing.

24.3. Any effort by the Bidder to influence the Employer in the Employer's bid evaluation, bid comparison or contract award decisions may result in the rejection of the Bidders' bid.

25. Examination of Bids and Determination of Responsiveness:

During the detailed evaluation of "Technical Bids", the Employer will determine whether each Bid

(a) Meets the eligibility criteria defined in Clause 3 and 4;
(b) Is accompanied by the required securities and;
(c) Is substantially responsive to the requirements of the Bidding documents.

26. Evaluations and Comparison of Financial Bids

26.1. The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with the procedure as per Annexure-II.

26.2. The Employer reserves the right to accept or reject any variation arising out of change in scope of work. Such variations, which are in excess of the requirements of the Bidding documents, shall not be taken into account in Bid evaluation.

F. AWARD OF CONTRACT

27. Award Criteria:

27.1 Subject to Clause 28, the Employer will award the Contract to the Bidder whose Bid has been determined to be substantially responsive to the Bidding documents and who has been selected in compliance to clause-26.1, provided that such Bidder has been determined to be (a) eligible in accordance with the provisions of Clause 3 and (b) qualified in accordance with the provisions of Clause 4.

27.2 In no case, the contract shall be awarded to any bidder whose available bid capacity is less than the evaluated bid price, even if the said bid is the lowest evaluated bid. The contract will in such cases be awarded to the next lowest bidder at his evaluated bid price.

28. Employer's Right to accept any Bid and to reject any or all Bids:
28.1 Notwithstanding Clause 27, the Employer reserves the right to accept or reject any Bid and to cancel the Bidding process and reject all Bids at any time prior to the award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the Employer's action.

29. **Notification of Award and Signing of Agreement:**

29.1 The Bidder whose Bid has been accepted will be notified of the award by the Employer prior to expiration of the Bid validity period by cable, telex, facsimile or e-mail confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Bidder in consideration of the design and execution the Works on a turnkey basis by the Bidder as prescribed by the Contract (hereinafter and by the Contract called the "Contract Price").

29.2 The notification of award will constitute the formation of the Contract, subject to condition that after furnishing of a performance security in accordance with the provisions of Clause 30 the award will be complete.

29.3 The Contract will incorporate all agreements between the Employer and the successful Bidder. The detail work programme and milestone wise activity shall be finalized during contract negotiation with the successful bidder within 14 days after notification of award. The agreed work programme / milestone shall form part of the contract agreement. The agreement will be signed by the Employer and sent to the successful Bidder, within 28 days following the notification of award along with the Letter of Acceptance. Within 21 days of receipt, the successful Bidder will sign the Agreement and deliver it to the Employer.

29.4 Upon the furnishing by the successful Bidder of the Performance Security, the Employer will promptly notify the other Bidders that their Bids have been unsuccessful.

29.5 In the event of non-payment of the performance security by the L1 bidder, the successful bidders in sequence (L2, L3 ….) may be asked for negotiation for execution of the work with the bid price quoted by the L1 bidder.

30 **Performance Security:**

30.1 Within 21 days of receipt of the Letter of Acceptance, the successful Bidder shall deliver to the Employer a Performance Security [ valid for a period as stipulated in Cl. 48 of Conditions of Contract & in the contract data ] in any of the forms given below for an amount equivalent to 5% of the Contract price:

- a bank guarantee in the form given in Section 6; or

- a deposit receipt of Schedule Bank / Post Office Savings Bank Account / National Savings Certificate / Postal Office Time Deposit Account duly pledged in favour of the Chief Executive Officer, Rourkela Smart City Limited . The bidder has the option of furnishing Bid Security in the form of Bank Guarantee from a Nationalized Bank of India, counter guaranteed by its branch at Rourkela.

30.2 If the performance security is provided by the successful Bidder in the form of a Bank Guarantee, it shall be issued either (a) at the Bidder's option, by a Nationalized/ Scheduled Indian bank or (b) by a foreign bank located in State and acceptable to the Employer.

30.3 Failure of the successful Bidder to comply with the requirements of Sub-Clause 30.1 and/or 30.2 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Bid
31. **Advance Payment and Security** - The Employer shall make advance payment to the Contractor of the amounts stated in the Contract Data by the date stated in the Contract Data, against provision by the Contractor of an Unconditional Bank Guarantee in a form and by a Bank acceptable to the Employer in amounts and currencies equal to the advance payment.

32. **Corrupt or Fraudulent Practices**:

32.1 It is required that the bidders / contractors observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, it is:

(a) Defined, for the purposes of this provision, the terms set forth below as follows:

(i) “Corrupt practice” means the offering, giving, receiving or soliciting of any thing of value to influence the action of a public official in the procurement process or in contract execution and

(ii) “Fraudulent practice” means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Employer and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Government of the benefits of free and open competition.

The Employer will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question and will declare the firm ineligible, either indefinitely or for a stated period of time, to be awarded a contract, if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing the contract.

32.2 Further more, Bidders shall be aware of the provision stated in sub-clause 23.2 and sub-clause 54.2 of the Conditions of Contract.
ANNEXURE-I

Procedure to participate in online bidding- e-procurement
(Refer clause-19 of ITB)

1. PARTICIPATING IN THE BID IN THE E-PROCUREMENT PORTAL: The Contractor/Bidder intending to participate in the bid is required to register in the Portal with some information about the firm/Contractor. This is a onetime activity for registering in Portal. During registration, the contractor has to attach a Digital Signature Certificate (DSC) to his / her unique user ID. The DSC used must be of appropriate class (Class II or Class III) issued from a registered Certifying Authority such as n-Code, Sify, TCS, MTNL etc. and:

(a) To log on to the portal the Contractor/Bidder is required to type his/her username and password. The system will again ask to select the DSC and confirm it with the password of DSC. For each login, a user’s DSC will be validated against its date of validity and also against the Certificate Revocation List (CRL) of respective CAs stored in system database. The system checks the unique ID, password and DSC combination and authenticates the login process for use of portal.

(b) The tender documents uploaded by the Tender Inviting Officer in the website www.tendersorissa.gov.in will appear in the section of “Upcoming Tender” before the due date of tender sale. Once the due date has arrived, the tender will move to “Active Tender” Section of the homepage. Only a small notification will be published in the newspaper specifying the work details along with mention of the specific website for details. The publication of the tender will be for specific period of time till the last date of submission of bids as mentioned in the ‘Invitation for Bid’ after which the same will be removed from the list of Active tenders. Any bidder can view or download the bid documents from the website.

(c) Contractor exempted from payment of EMD will be able to participate in the tender directly by uploading documentary evidences towards his eligibility for such exemption.

(d) If the software application has the provision of payment of cost of tender document through payment gateways of authorized bankers by directly debiting the account of the bidders, bidders will be required to avail on-line payment.

1.1. Furnishing scanned copy of such documents is mandatory along with the tender documents otherwise his/her bid shall be declared as non-responsive and thus liable for rejection.

1.2. In the case of any failure, malfunction, or breakdown of the electronic system used during the e-procurement process, the tender inviting officer shall not accept any responsibility for failures or breakdowns other than in those systems strictly within their own control.

1.3. Any third party/company/person under a service contract for operation of e-procurement system in the State or his/their subsidiaries or their parent companies shall be ineligible to participate in the procurement processes that are undertaken through the e-procurement system irrespective of who operates the system.

1.4. For submission of Bids through the E-Procurement Portal, the bidder shall upload the scanned copy/copies of document in prescribed format wherever warranted in support of eligibility criteria and qualification information. The online bidder shall have to produce the original documents in support of the scanned copies and statements uploaded in the portal before the specified date as per SBD.
1.5. Each bidder shall submit only one bid for one package. A bid is said to be complete if accompanied by cost of bid document and appropriate bid security. The system shall consider only the last bid submitted through the E-Procurement portal.

1.6. The Officer inviting the bid / Engineer-in-Charge will clarify queries on the Contract Data on requisition by the intending Bidder. The bidder may ask question in the e-procurement portal using his DSC; provided the questions are raised before the date mentioned in the home page under critical dates.

1.7. The bids uploaded by the Tender Inviting Officer may consist of general arrangements drawings or typical sections of the project. Bidder may down load these drawings and take out the print for detail study. Any other drawings and documents pertaining to the works available with the officer inviting the Bid as well as in the office of the Superintending Engineer and Executive Engineer as mentioned in the Contract Data will be open for inspection by the bidders. The bidder is required to down load all the documents including the drawings for preparation of his bid. It is not necessary for the part of the Bidder to up load the drawings other Bid documents (after signing) while up-loading his bid. He is required to up load documents related to his eligibility criteria and qualification information and Bill of Quantities duly filled in. It is assumed that while participating in the bid, the bidder has referred all the drawings and documents uploaded by the Officer Inviting the Bid. Seeking any revision of rates or backing out of the bid claiming for not having referred to any or all documents provided in the Bid by the Officer Inviting the Bid will be construed as plea to disrupt the bidding process and in such cases the bid security shall be forfeited.

1.8. Any addendum issued shall be part of the bidding documents and shall be notified in the website www.tendersorissa.gov.in / notice board and through paper publication.

1.8.1. All the volumes/documents shall be provided in the portal by the Officer inviting the bid. The bidder shall carefully go through the document and prepare the required documents and up load the scanned documents in Portable Document Format to the portal in the designated locations of Technical Bid. He will fill up the rates of items or percentage in the BOQ down loaded for the work in designated Cell and up loads the same in designated locations of Financial Bid. Submission of document shall be effected by using DSC of appropriate class.

2. **BID SECURITY:** The Bidder shall furnish, as part of his Bid, a Bid security for the amount mentioned under NIT/Contract Data. The bidder shall scan all the written pages of the bid security and up load the same to the system in designated place. The on line bidder shall deposit the original copy of the ‘bid security’ with in the specified period mentioned in the SBD (after receipt date of bid but before opening date & time of bid) with the “Officer inviting the Bid”. The Officer inviting the bid shall not be responsible for any postal delay and/or non-receipt of the original copy of the bid security on or before specified date and time. Non-submission of bid security with in the designated period shall debar the bidder from participating in the on-line bidding system and his portal registration shall be cancelled. His name shall also be informed to the registering authority for cancellation of his registration.

3. **FORMAT AND SIGNING OF BID:** The bidder can download the tender of his choice and save it in his system and undertake the necessary preparatory work off-line and upload the completed tender at his convenience within the final date and time of submission. The bidder
shall only submit single copy of the required documents and Price Bid in the portal. In the Financial bid, the bidder can not leave any figure blank. He has to only write the figures, the words will be self generated. The Bidders are advised to upload the completed Bid document well ahead of the last date & time of receipt to avoid any last moment problem of power failures etc.

3.1. The Bidder shall go through the Bid carefully and list the documents those are asked for submission. He shall prepare all documents including cost of Bid Document, Bid Security, Declaration form, price bid etc and store in the system.

3.2. The bidder shall log on to the portal with his DSC and move to the desired tender for uploading the documents in appropriate place one by one simultaneously checking the documents. Once the Bidder makes sure that all the documents have been uploaded in appropriate place he clicks the submit button to submit the bid to the portal.

3.2.1. The bids once submitted cannot be retrieved or corrected. Tender cannot be pre-opened and cannot be submitted after due date and time. Therefore only after satisfying that all the documents have been uploaded, the Bidder should activate submit button.

3.2.2. In the e-procurement process each processes are time stamped. The system can identify each individual who has entered in to the portal for any bid and the time of entering in to the portal.

3.2.3. The Bidder should ensure clarity of the document up loaded by him to the portal especially the scanned documents by taking out sample printing. Non-submission of legible documents may render the bid non-responsive. However, the Officer inviting the Bid if so desires can ask for legible copies or original copies for verification with in a stipulated period provided such document in no way alters the Bidder’s price bid. If the Bidder fails to submit the original documents with in the stipulated date, his bid security shall be forfeited.

4. SECURITY OF BID SUBMISSION:

4.1. All bid data uploaded by the Bidder to the portal will be encrypted by the DSC. The system shall require all the mandatory forms and fields filled up by the contractor during the process of submission of the bid/tender.

4.2. The Bid shall be received in encrypted format by the system which can only be decrypted / opened by the authorized openers only on or after the due date and time.

5. DEADLINE FOR SUBMISSION OF THE BIDS :

The online bidding will remain active till the last date and time of the bid submission. Once the date and time (Server date and time) is over, the bidder will not be able to submit the bid. The date & time of bid submission shall remain unaltered even if the specified date for the submission of bids declared as a holiday for the Officer inviting the Bid.

6. LATE BIDS :

The system shall reject submission of any bid through portal after closure of the receipt time. For all purpose the server time displayed in the e-procurement portal shall be the time to be followed by the bidder and concerned officers.

7. MODIFICATION AND WITHDRAWAL OF BIDS :

7.1. In the E-Procurement Portal, it is allowed to modify the bid any number of times before the final date and time of submission. The bidder shall have to log on to the system and resubmit the documents as asked for by the system including the price bid. In doing so, the bids already submitted by the bidder will be removed automatically from the system and the latest bid only will be admitted. But the bidder should avoid modification of bid at the last
moment to avoid system failure or malfunction of internet or traffic jam or power failure. If the bidder fails to submit his modified bids with in the designated time of receipt, the bid already in the system shall be taken for evaluation.

7.2. In the E-Procurement Portal, withdrawal of bid is allowed. But in such case he has to write a letter with appropriate reasons for his withdrawal addressed to the Officer inviting the bid and upload the scanned document to portal in the respective bid before the closure date and time of receipt of the bid. The system shall not allow any withdrawal after expiry of the closure time of the bid.

8. OPENING OF THE BID:

8.1. Bid opening date is specified during tender creation or can be extended with corrigendum. This date is available in IFB, tender document as well as the home page of portal. Bid opening can be done by the authorized users which are defined during the tender publication / approval stage. The bids are encrypted using there public keys and can be decrypted only on or after the Bid Opening due date and time. The bid openers private key will be required to open the bids and all the openers have to log on to the portal during that time.

8.1.1. The bidders who participated in the online bidding can witness opening of the bid from any system logging on to the portal with the DSC away from opening place. Contractors are not required to be present during the bid opening at the opening location if they so desire.

8.1.2. Each activity is date and time stamped with user details. For time stamping, server time is taken as the reference.

8.2. In the event of the specified date of bid opening being declared a holiday for the Officer inviting the Bid/Engineer-in-Charge, the bids will be opened at the appointed time on the next working day.

8.3. In case bids are invited for more than one package, the order for opening of the “Bid” shall be that in which they appear in the “Invitation for Bid”.

8.4. During bid opening, the covers containing original financial instruments towards Cost of bid and Bid Security in the form specified in the DTCN, received after last date of receipt of bid and before opening of the bids shall be opened and declared.

8.4.1. Combined bid security for more than one work is not acceptable.

8.5. The Bid openers; who have been pre-defined shall log on to the portal with their respective DSC. Unless all the Officers who have been declared as Opening officers, log on the portal with their DSC the Tender cannot be opened.

8.5.1. The Opening Officers will systematically check the scanned demand draft towards cost of the bid document and the scanned document of Bid security with that of the original submitted. If found in order, they will continue opening of all other documents in the system provided under Technical Bid.

8.5.2. Subject to confirmation of the bid security by the issuing institutions, the bids accompanied with appropriate bid cost and valid bid security will be taken up for evaluation with respect to the qualification Information and other information furnished.

8.5.3. After receipt of confirmation of the bid security, the bidder may be asked in writing to clarify to the documents in the Technical Bid, if necessary, with respect to any doubts or illegible documents required for Technical Evaluation.

8.5.4. The bidders will respond in not more than 7 days of issue of the clarification letter, failing which the bid of the bidder will be evaluated on its own merit.
8.5.5. Immediately, on receipt of these clarifications, the Evaluating Officers; predefined in the system for the bid, will finalize the list of responsive bidders. They will log on to the site with their DSC and record their comments on the Technical evaluation page in the system. The Officer Inviting the Bid if also the accepting authority, shall log on to the system with his digital signature and check the technical evaluation. He can either accept or pass on to the evaluating officers for re-evaluation. Upon acceptance of technical evaluation by the Accepting authority in the system, the system shall automatically generate letter to all the responsive bidders and the system shall forward the letter to all the responsive bidder that their technical bid has been evaluated responsive with respect to the data/information furnished by him and the letter shall also intimate him the date & time of opening of financial bid. The system shall also inform the non-responsive bidders in their e-mail ID that their bid has been found non-responsive.

8.6. The Technical evaluation of all the bids will be taken up as per the information furnished by the Bidders. But evaluation of the bid does not exonerate the bidders from checking their original documents and if at a later date the bidder is found to have misled the evaluation through wrong information, action as per relevant clause of DTCN shall be taken against the bidder/contractor.

8.7. After technical evaluation of the bidders and selection of the qualified bidders, the financial bids of the technically qualified bidders shall be opened on the due date of opening. Members of the bid opening committee log on to the system in sequence and open the financial bids for the technically qualified bidders. The opening of financial bid by the opening officer using their DSC shall decrypt the financial bids in the following manner :-

8.7.1. Opening of price bid and evaluation of lowest bidder is subject to satisfaction of other qualification information.

8.7.2. The Financial Bid will be opened on the notified date & time in the presence of bidders or their authorised representative who wish to be present.

8.7.3. At the time of opening of “Financial Bid”, the names of the bidders whose technical bids were found responsive will be announced and the bids of only those bidders will be opened. The remaining bids will be rejected.

8.7.4. The responsive bidders’ name, the bid prices, the item wise rates the total amount of each item, any discounts and withdrawals, and such other details as the officer inviting the tender may consider appropriate, will be announced by him or his authorized representatives at the time of opening.

8.7.5. Rebate/discount offer if any uploaded to the system shall be declared and recorded first.

8.7.6. The Financial bid of the bidders shall be opened one by one by the designated officers. The system shall auto-generate the Comparative statement.

8.7.7. The Bidder can witness the principal activities and view the documents/summary reports for that particular work by logging on to the portal with his DSC from anywhere.

9. CLARIFICATION OF BIDS:

9.1. For examination, evaluation, and comparison of bids, the officer inviting the bid may, at his discretion, ask lowest bidder for clarification of his rates including reduction of rate on negotiation and breakdowns of unit rates.

9.2. On opening of the price bid the system shall arrange the financial bids in order of their value (L1 first, followed by L2, L3 ….) for subsequent evaluation. The evaluation status (Sheet) will be visible to all the participating bidders after opening on their respective logins. Each
activity is recorded in the system with date and time stamping.

10. **NOTIFICATION OF AWARD AND SIGNING OF AGREEMENT:**

In the E-Procurement Portal, the system shall generate the template of award letter and the Officer Inviting the Bid shall mention the amount of Performance Security and additional security required to be furnished in the letter and intimate the bidders in his e-mail ID. The issue of the letter of acceptance shall be treated as closure of the Bid process and commencement of the contract.
ANNEXURE-II
EVALUATION CRITERIA (Clause-26.1 of ITB)

1.1 INTRODUCTION

Evaluation Criteria contains the broad criteria based on which the applicants shall be evaluated.

1.2 EVALUATION CRITERIA

Applicants Technical Bid will be evaluated based on their financial standing, technical and organizational capability and past experience and track record. The Applicants are required to submit all the necessary details including certificates from the client agencies in support of their application.

CRITERIA FOR EVALUATION OF THE PERFORMANCE OF CONTRACTORS FOR PRE-ELIGIBILITY

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Attributes</th>
<th>Marks</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>Financial strength</td>
<td>(25 marks)</td>
<td>60% marks for minimum eligibility criteria. 100% marks for twice the minimum eligibility criteria or more in between (i) &amp; (ii) – on pro-rata basis.</td>
</tr>
<tr>
<td></td>
<td>(i) Average annual Turnover</td>
<td>21 marks</td>
<td>60% marks for minimum eligibility criteria. 100% marks for twice the minimum eligibility criteria or more in between (i) &amp; (ii) – on pro-rata basis.</td>
</tr>
<tr>
<td></td>
<td>(ii) Solvency Certificate as per clause-4.4A.iv of ITB</td>
<td>4 marks</td>
<td>60% marks for minimum eligibility criteria. 100% marks for twice the minimum eligibility criteria or more in between (i) &amp; (ii) – on pro-rata basis.</td>
</tr>
<tr>
<td>(b)</td>
<td>Experience in building project works</td>
<td>(25 marks)</td>
<td>60% marks for minimum eligibility criteria. 100% marks for twice the minimum eligibility criteria or more – on pro-rata basis.</td>
</tr>
<tr>
<td>(c)</td>
<td>Personnel and Establishment</td>
<td>(25 Marks)</td>
<td></td>
</tr>
<tr>
<td>(i) Project Coordinator Cum Project Manager(Civil): Graduate Engineer (civil) with 15 years experience</td>
<td>3 marks for minimum eligibility with 1 additional mark for each three years of experience with max 6 marks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(ii) Design Manager: Graduate Engineer (civil) with 10 years of experience</td>
<td>2 marks for minimum eligibility with 1 additional mark for each three years of experience with max 4 marks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(iii) Dy Project Manager Graduate Engineer (Civil) with 5 years experience.</td>
<td>2 marks for minimum eligibility with 1 additional mark for each three years of experience with max 4 marks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(iv) Support Engineer (3 Nos:- One each from Civil/Mechanical/Electrical (Civil/Electrical/Mechanical): Graduate Degree (Civil/Mechanical/Electrical) with 3 Years experience or Diploma Engineer (civil/Mechanical/Electrical) with 10 years experience</td>
<td>1 mark for minimum eligibility for each position max 6 marks for three positions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(v) Landscape Architect with 10 years experience: B.Arch affiliated to COA</td>
<td>2 marks for minimum eligibility with 1 additional mark for each three years of experience with max 5 marks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(d) Plant &amp; Equipment</td>
<td>(25 Marks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Cement Concrete batch mix plant</td>
<td>4 marks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Vibrator / Equipment</td>
<td>2 marks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Excavator</td>
<td>3 marks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. No.</td>
<td>Criteria</td>
<td>Maximum Marks</td>
<td>Minimum to be scored</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>4.</td>
<td>Complete steel staging and shuttering materials.</td>
<td>2 marks</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Field Testing equipment</td>
<td>2 marks</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Truck &amp; Tipper</td>
<td>2 marks</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Modern sophisticated theodolite with leveling machine</td>
<td>2 marks</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Truck mounted transit mixture with concrete pump</td>
<td>2 marks</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Dewatering Pump (7.5HP)</td>
<td>2 marks</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>125 KVA Diesel Generator</td>
<td>2 marks</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>15 Ton Hydra Crane</td>
<td>2 marks</td>
<td></td>
</tr>
</tbody>
</table>

The bidders qualifying the initial criteria as set out will be evaluated for following criteria by scoring method on the basis of details furnished by them.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Criteria</th>
<th>Maximum Marks</th>
<th>Minimum to be scored</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Financial Strength</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>b</td>
<td>Experience in Similar Nature of work during last 7 years</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>c</td>
<td>Personnel and Establishment</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td>d</td>
<td>Plant &amp; Equipment</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td><strong>Total Marks</strong></td>
<td><strong>100</strong></td>
<td><strong>70</strong></td>
</tr>
</tbody>
</table>

2.1 The bidders who qualify as per Clause 1 above securing 70 marks out of 100 only will be asked to apprise before a High Level Committee (to be notified) about their work programme modalities of execution along with conceptual drawings and specification of finishing items of the proposed buildings on the schedule date and time (to be intimated to the qualified bidders as per clause 1 above only by post / E-mail / FAX).

2.2 The Technical presentation as per clause 2.1 shall be done before a high level committee headed by the client department. The presentation will awarded marks out of 100 (hundred). The bidders securing 70% and above marks will be qualified.

The results of technical presentation would be conveyed to the participated bidders.

2.3 The financial bid (in cover-II) will only be opened after completion of stage (as per clause 2.2) and evaluated as under.

The proposal with the lowest financial bid will be awarded the work.

2.4 The Evaluation of the bid will be based on clause 2.2 and 2.3 taken together.
SECTION 2

FORMS OF BID, QUALIFICATION INFORMATION
AND LETTER OF ACCEPTANCE

TABLE OF FORMS:

- CONTRACTOR’S BID
- QUALIFICATION INFORMATION
- LETTER OF ACCEPTANCE
- NOTICE TO PROCEED WITH THE WORK
- AGREEMENT FORM
Contractor's Bid

DESCRIPTION OF THE WORKS: BID FOR DESIGN, EXECUTION & MAINTAINANCE ON TURN KEY BASIS FOR DEVELOPMENT OF BRAHMANI RIVERFRONT AT ROURKELA ABD AREA.

BID

To:

The Chief Executive Officer
Rourkela Smart City Limited

Address: [Udit Nagar, Rourkela-769012, Sundergarh]

Having examined the bidding documents including addendum, I/we offer to execute the Works described above in accordance with the conditions of contract, specifications, accepted tendered drawing, and Payment schedule accompanying this Bid for the Contract Price as tendered in our price bid document separately.

The advance Payment required is: Rupees ________________________

This Bid and your written acceptance of it shall constitute a binding contract between us. We understand that you are not bound to accept the lowest or any Bid you receive.

We undertake that, in competing for (and if the award is made to us, in executing) the above contract, we will strictly observe the laws against fraud and corruption in force in India namely "Prevention of Corruption Act 1988".

We hereby confirm that this Bid complies with the Bid Validity and Bid Security required by the Bidding documents.

We attach herewith our current income-tax clearance certificate.

Yours faithfully,

Authorized Signature:
Name & Title of Signatory: ______________________________
Name of Bidder: __________________________________
Address: ____________________________________
Qualification Information

The information to be filled in by the Bidder in the following pages will be used for purposes of post qualification as provided for in Clause 4 of the Instructions to Bidders. This information will not be incorporated in the Contract.

1. For Individual Bidders

1.1 Constitution or legal status of Bidder

[Attach copy]

Place of registration: _______________________________

Principal place of business: _______________________________

Power of attorney of signatory of Bid

[Attach]

1.2 Financial average annual turnover of the bidder during the last five financial years duly certified by the registered chartered accountant. (in Rs.50.00 Crores)

1.3.1 Work performed as prime contractor (in the same name) on similar nature of project works over the last seven financial years. From one month prior to bid due date **

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Name of the Employer *</th>
<th>Description of work</th>
<th>Contract No.</th>
<th>Value of contract (Rs.Lakhs)</th>
<th>Date of issue of work order</th>
<th>Stipulated period of completion</th>
<th>Actual date of completion</th>
<th>Remarks explaining reasons for delay and work completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
<td>(8)</td>
<td>(9)</td>
</tr>
</tbody>
</table>

*Attach certificate (s) from the Engineer(s)-in-Charge

@The item of work for which data is requested should tally with that specified in ITB clause 4.4A.

** Immediately preceding the financial year in which bids are received.

1.4 Information on Bid Capacity (works for which bids have been submitted and works which are yet to be completed) as on the date of this bid.

(A) Existing commitments and on-going works:

<table>
<thead>
<tr>
<th>Description of Work</th>
<th>Place &amp; State</th>
<th>Contract No. &amp; Date</th>
<th>Name and Address of Employer</th>
<th>Value of Contract (Rs. Lakhs)</th>
<th>Stipulated period of completion</th>
<th>Value of works* remaining to be completed (Rs. Lakhs)</th>
<th>Anticipated date of completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
<td>(8)</td>
</tr>
</tbody>
</table>
(B) Works for which bids already submitted:

<table>
<thead>
<tr>
<th>Description of Work</th>
<th>Place &amp; State</th>
<th>Name and Address of Employer</th>
<th>Estimated value of works (Rs. In lakhs)</th>
<th>Stipulated period of completion</th>
<th>Date when decision is expected</th>
<th>Remarks if any</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
</tr>
</tbody>
</table>

(C) Deleted
* Attach certificate(s) from the Engineer(s)-in-Charge.

1.5 The following items of Contractor's Equipment are essential for carrying out the Works. The Bidder should list all the information requested below. Refer also to Sub Clause 4.2(d) read with 4.4 (B) & Clause No.1.2(d) of Annexure-II of the Instructions to Bidders. **(Bidder has to obtain 100% mark i.e 25 marks to Qualify)**

<table>
<thead>
<tr>
<th>Item of Equipment</th>
<th>Requirement</th>
<th>Availability</th>
<th>Proposals</th>
<th>Age/Condition</th>
<th>Remarks (From whom to be purchased)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Nos./Capacity</td>
<td>Owned/Leased/ to be procured</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.6 Qualifications and experience of key personnel proposed for administration and execution of the Contract. Attach biographical data. Refer also to 4.2(e) read with annexure of instructions to Bidders and Sub Clause 9.1 of the Conditions of Contract.

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Qualifications</th>
<th>Years of experience (general)</th>
<th>Years of experience in the proposed position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Manager etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.7 Proposed subcontracts and firms involved. [Refer ITB Clause 4.2 (j)]

<table>
<thead>
<tr>
<th>Sections of the works</th>
<th>Value of Sub-contract (name and address)</th>
<th>Experience in similar work</th>
</tr>
</thead>
</table>

---
1.8 Financial reports for the last five financial years: balance sheets, profit and loss statements, Net Worth auditors' reports (in case of companies/corporation), etc. List them below and attach copies.

1.9 Evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit, etc. List them below and attach copies of support documents [sample format attached].

1.10. Name, address, and telephone, telex, and fax numbers of the Bidders' Bankers who may provide references if contacted by the Employer.

1.11 Information on litigation history in which the Bidder is involved.

<table>
<thead>
<tr>
<th>Other party(ies)</th>
<th>Employer</th>
<th>Cause of dispute</th>
<th>Amount involved</th>
<th>Remarks showing Present status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.12 Statement of compliance under the requirements of Sub Clause 3.2 of the instructions to Bidders.

|                  |          |                  |                |                               |
|                  |          |                  |                |                               |
|                  |          |                  |                |                               |

1.13 Proposed work method and schedule. The Bidder should attach descriptions, drawings and charts as necessary to comply with the requirements of the Bidding documents. [Refer ITB Clause 4.1 and 4.2 (k)].
SAMPLE FORMAT FOR EVIDENCE OF ACCESS TO OR AVAILABILITY OF CREDIT FACILITIES – CLAUSE 4.4 [B] [C] OF ITB

BANK CERTIFICATE

This is to certify that M/s. ………………………….. is a reputed company with a good financial standing.

If the contract for the work, namely “Development of Brahmani Riverfront Project at ABD Area of Rourkela” on Turn key basis involving design and execution of works is awarded to the above firm, we shall be able to provide overdraft/credit facilities to the extent of Rs. ……………………… to meet their working capital requirements for executing the above contract.

Name of Bank
Senior Bank Manager
Address of the Bank
AFFIDAVIT

1. I, the undersigned, do hereby certify that all the statements made in the required attachments are true and correct.

2. The undersigned also hereby certifies that neither our firm M/s........................................... have abandoned any work on building in India nor any contract awarded to us by the State of Odisha for such works have been rescinded, during last five years prior to the date of this bid.

3. The undersigned hereby authorize(s) and request(s) any bank, person, firm or corporation to furnish pertinent information deemed necessary and requested by the Department to verify this statement or regarding my (our) competence and general reputation.

4. The undersigned understand and agrees that further qualifying information may be requested, and agrees to furnish any such information at the request of the Department/ Project implementing agency.

(Signed by an Authorized Officer of the Firm)
Title of Officer :
Name of Firm :
Date :
Letter of Acceptance  
(letterhead paper of the Employer)

[(date)]

To: _____________________________________________ [name and address of the Contractor]

Dear Sir(s)

This is to notify you that your Bid dated ____________ for execution of the work “Development of Brahmani Riverfront Project at ABD Area of Rourkela” on turn key basis involving design and execution of works ____________________________ [Name of the contract and identification number, as given in the Instructions to Bidders] for the Contract Price of Rupees ____________________________ (_____________) [amount in words and figures], as corrected and modified in accordance with the Instructions to Bidders\(^1\) is hereby accepted by our Agency.

We note that as per bid, you do not intend to subcontract any component of work

(Or)

We note that as per bid, you propose to employ ___________________________ as sub-contractor for executing _____________________________

(Delete whichever is not applicable)

You are hereby requested to furnish Performance Security and Additional Performance Security (if any) in the form detailed in Para 30.1 of ITB for an amount of Rs…………… within 15 days of the receipt of this letter of acceptance and sign the contract failing which action as stated in Para 30.3 of ITB will be taken.

Yours faithfully,

[Authorized Signature]

[Name and Title of Signatory]

[Name of Agency]
1.

**Issue of Notice to proceed with the work**

_(Letterhead of the Employer)_

------ (date)

To

---------------------- (name and address of the Contractor)

----------------------

----------------------

Dear Sirs:

Pursuant to your furnishing the requisite security as stipulated in ITB clause 30.1 and signing of the contract agreement for the work **[Development of Brahmani Riverfront Project at ABD Area of Rourkela]** on Turn key basis involving design and execution of works @ a Bid Price of Rs._________________, you are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

(Signature, name and title of signatory authorized to sign on behalf of Employer)
Agreement Form

This agreement, made the ______________ day of ____________________________, 2020, between the Chief Executive Officer, Rourkela Smart City Limited [name and address of Employer] (hereinafter called “the Employer”) of the one part and

____________________________________________________________

____ [name and address of contractor] (hereinafter called “the Contractor” ) of the other part.

Whereas the Employer is desirous that the Contractor “Development of Brahmani Riverfront Project at ABD Area of Rourkela”, [name and identification number of Contract] (hereinafter called “the Works”) and the Employer has accepted the Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein, at a contract price of Rs._____________________.

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to, and they shall be deemed to form and be read and construed as part of this Agreement.

2. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all aspects with the provisions of the Contract.

3. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of the defects wherein the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

4. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz.:

   i) Letter of Acceptance
   ii) Notice to proceed with the works
   iii) Contractor’s Bid
   iv) Contract Data
   v) Conditions of contract (including Special Conditions of Contract)
   vi) Specifications
   vii) Drawings
   viii) Bill of Quantities (Optional)
   ix) Payment Schedule and
   x) Minimum Development Obligation
   xi) Any other document listed in the Contract Data as forming part of the contract.

In witness whereof the parties thereto have caused this Agreement to be executed the day and year first before written.

The Common Seal of

____________________________________________________________

was hereunto affixed in the presence of:

Signed, Sealed and Delivered by the said
SECTION 3: CONDITIONS OF CONTRACT
Conditions of Contract

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CONDITIONS OF CONTRACT
A. GENERAL

1. Definitions

1.1. Terms, which are defined in the Contract Data and not defined in the Conditions of Contract shall keep their defined meanings. Capital initials are used to identify defined terms.

1.1.1 Bill of Quantities means the priced and completed Bill of Quantities;

1.1.2 Compensation Events are those defined in Clause 41 hereunder;

1.1.3 The Completion Date is the date of completion of the Works as certified by the Engineer in accordance with sub-clause (1) of clause 50;

1.1.4 The Contract is the contract between the Employer and the Contractor to execute, complete and maintain the Works. It consists of the documents listed in Clause 2.3 below.

1.1.5 The Contract Data defines the documents and other information, which comprise the Contract;

1.1.6 The Contractor is a person or corporate body whose Bid to carry out the Works has been accepted by the Employer;

1.1.7 The Contractor’s Bid is the completed Bidding document submitted by the Contractor to the Employer and includes Technical and Financial bids;

1.1.8 The Contract Price is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract;

1.1.9 Days are calendar days; months are calendar months;

1.1.10 A Defect is any part of the Works not completed in accordance with the Contract;

1.1.11 The Defects Liability Period is the period named in the Contract Data and calculated from the Completion Date;

1.1.12 The Employer is the party who will employ the Contractor to carry out the Works;

1.1.13 The Engineer is the person named in the Contract Data (or any other competent person appointed and notified to the contractor to act in replacement of the Engineer) who is responsible for supervising the Contractor’s work, administering the Contract, certifying payments due to the Contractor, issuing and valuing Variations to the Contract, recommending extensions of time, and valuing the Compensation Events;

1.1.14 Equipment is the Contractor’s machinery and vehicles brought temporarily to the Site to construct the Works;

1.1.15 Initial Contract Price is the Contract Price listed in the Employer’s Letter of Acceptance;

1.1.16 Intended Completion Date is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Employer by issuing an extension of time;
1.1.17 **Materials** are all supplies, including consumables, used by the contractor for incorporation in the Works;

1.1.18 **Plant** is any integral part of the Works, which is to have a mechanical, electrical, electronic or chemical or biological function;

1.1.19 The **Site** is the area defined as such in the Contract Data;

1.1.20 **Site Investigation Reports** are those, which were included in the Bidding documents and are factual interpretative reports about the surface and sub-surface conditions at the site;

1.1.21 **Specification** means the Specification of the works included in the Contract and any modification or addition made or approved by the Employer;

1.1.22 The **Start Date / Date of Commencement** is given in the Contract Data. It is the date when the Contractor shall commence execution of the works. It does not necessarily coincide with any of the Site Possession Dates;

1.1.23 A **Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract, which includes work on the Site;

1.1.24 **Temporary Works** are works designed, constructed, installed, and removed by the Contractor, which are needed for construction or installation of the Works;

1.1.25 A **Variation or Change in Scope** is an instruction given by the Employer, which varies and change the scope of Works;

1.1.26 **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the Contract Data;

1.1.27 Year may be understood as financial year;

2. **Interpretation**

2.1. In interpreting the Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their general meaning under the language of the Contract unless specifically defined. The Employer will provide instructions clarifying queries about the Conditions of Contract.

2.2. If sectional completion is specified in the Contract Data, references in the Conditions of Contract to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion date for the whole of the Works).

2.3. The documents forming the Contract shall be interpreted in the following order of priority:

   a) Agreement
   b) Letter of Acceptance, notice to proceed with the works
   c) Contractor’s Bid
   d) Contract Data
   e) Conditions of Contract including Special Conditions of Contract
   f) Specifications
   g) Drawings
   h) Bill of quantities (optional) and
   i) Minimum Development Obligation
j) Any other document listed in the Contract Data as forming part of the Contract.

3. **Languages and Law**

   The language of the Contract and the law governing the Contract are stated in the Contract Data.

4. **Engineer's Decisions:**

   Except where otherwise specifically stated, the Engineer will decide contractual matters between the Employer and the Contractor in the role representing the Employer as per the provision of the contract.
5. **Delegation:**

The Engineer may delegate any of his duties and responsibilities to other people after notifying the Contractor and may cancel any delegation after notifying the Contractor.

6. **Communications:**

Communications between parties which are referred to in the conditions are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act).

7. **Sub-contracting:**

The Contractor may sub-contract any portion of work, up to a limit specified in Contract Data, with the approval of the Engineer but may not assign the Contract without the approval of the Employer in writing. Sub-contracting does not alter the Contractor's obligations.

8. **Other Contractors:**

The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer between the dates given in the Schedule of other Contractors. The Contractor shall as referred to in the Contract Data, also provide facilities and services for them as described in the Schedule. The employer may modify the schedule of other contractors and shall notify the contractor of any such modification.

9. **Personnel:**

9.1. The Contractor shall employ the key personnel named in the Schedule of Key Personnel as referred to in the Contract Data besides those as listed at section-8 and Section-9 to carry out the functions stated in the Schedule or other personnel approved by the Engineer. The Engineer will approve any proposed replacement of key personnel only if their qualifications, abilities, and relevant experience are substantially equal to or better than those of the personnel listed in the Schedule.

9.2. If the Engineer asks the Contractor to remove a person who is a member of the Contractor's staff or his work force stating the reasons the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. **Employer's and Contractor's Risks:**

The Employer carries the risks which this Contract states are Employer's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

11. **Employer's Risks:**

The Employer is responsible for the excepted risks which are in so far as they directly affect the execution of the Works in India, the risks of war, hostilities, invasion, act of foreign enemies, rebellion, revolution, insurrection or military or usurped power, civil war, riot commotion or disorder (unless restricted to the Contractor's employees), and contamination from any nuclear fuel or nuclear waste or radioactive toxic explosive.
12. **Contractor’s Risks:**

All risks of loss of or damage to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

13. **Insurance:**

13.1 The Contractor shall provide, in the joint names of the Employer and the Contractor, insurance cover *for the period as stated below against the events and* in the amounts and deductibles stated in the Contract Data for the following events which are due to the Contractor’s risks:

A) **From the starting date to the end of defect liability period:**

   Loss of or damage to the works

B) **From the start date till completion of the work as per agreement:**

   a) Loss of or damage to plant, materials and equipment,
   b) Loss of or damage of property (except the works, plant, materials and equipment) in connection with the contract, and
   c) Personal injury or death.

13.2 If all the items as listed at Cl.13.1(B) can be combined / grouped under one insurance cover like Contractor’s, All Risks (CAR) Policy, then the same is acceptable.

13.3 Prior to seven days before the start date, the Contractor shall furnish to the Engineer notarized true copies of the certificates of insurance, copies of insurance polices and premia payment receipts in respect of such insurance for the Employer’s approval. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

13.4 If the contractor does not provide any of the policies and certificates required, the Employer may effect the insurance which the contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the contractor or, if no payment is due, the payment of the premiums shall be a debt due.

13.5 Alterations to the terms of insurance shall not be made without the approval of the Employer.

13.6 Both parties shall comply with any conditions of the insurance policies.

14. **Site Investigation Reports:**

The Contractor, in preparing the Bid, may rely on any site Investigation Reports referred to in the Contract Data, which are indicative and not exhaustive. The Employer shall provide all available details to the Contractor (Bidder) for his information, if requested by him at least one week prior to the bid submission date. The bidder shall be responsible for interpreting all such data. After award of work, the Contractor shall carryout detail survey and investigation for preparation of detail designs as per the scope of work and time period stipulated at Section-8.

To the extent which was practicable (taking account of cost and time), the Contractor (Bidder) shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Tender or Works. To the same extent, the Contractor (Bidder) shall be deemed to have inspected and examined the Site, its surroundings, the above data and other available information,
and to have been satisfied before submitting the Tender as to all relevant matters, including (without limitation):

(a) the form and nature of the Site, including sub-surface conditions,
(b) the climatic conditions,
(c) the extent and nature of the work and Goods necessary for the execution and completion of the Works and the remedying of any defects,
(d) the Laws, procedures and labour practices of the Country, and
(e) the Contractor's requirements for access, accommodation, facilities, personnel, power, transport, water and other services.
(f) availability of required materials

15. Queries about the Contract Data:

The Employer will clarify queries on the Contract Data if any during the Pre-bid meeting.

16. Contractor to Construct the Works:

The Contractor shall construct and install the Works in accordance with the approved specification and drawings. All designs, drawings and specifications to be furnished by the contractor shall be approved by the Employer before execution in accordance with Cl. 18.

17. The Works to be completed by the Intended Completion Date:

The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the programme submitted by the Contractor, as updated with the approval of the Engineer, and complete them by the Intended Completion Date.

18. Approval by the Engineer:

18.1 The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Engineer, who is to approve them if they comply with the Specifications and Drawings.

18.2 The Contractor shall be responsible for design of Temporary Works.

18.3 The Engineer's approval shall not alter the Contractor's responsibility for design of the Temporary Works.

18.4 The Contractor shall obtain approval to the design, drawings and specifications of all components of the building, except those for the temporary works as stated at Cl. 18.1, from any National Institute of Repute such as Indian Institute of Technology (IIT)/NIT at its own cost. Such approved documents need to be furnished to the Employer within the stipulated datelines as mentioned in the contract data and at Section-8.

18.5 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Employer / Engineer before their use.

19. Safety:

The Contractor shall be responsible for the safety of all activities on the Site.

20. Discoveries:
Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Employer. The Contractor is to notify the Engineer of such discoveries and carry out the Engineer's instructions for dealing with them.

21. **Possession of the Site**:

The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the Contract Data the Employer is deemed to have delayed the start of the relevant activities and this will be Compensation Event.

22. **Access to the Site**:

The Contractor shall allow the Employer and any person authorized by the Employer access to the Site, to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials or plant are being manufactured / fabricated / assembled for the works.

23. **Instructions**:

23.1 The Contractor shall carry out all instructions of the Engineer pertaining to works, which comply with the applicable laws where the Site is located.

23.2 The Contractor shall permit the Employer to inspect the Contractor's accounts and records relating to the performance of the Contractor and to have them audited by auditors appointed by the Employer, if so required by the Employer.

24. **Disputes**:

That for the purpose of jurisdiction in the event of disputes if any of the Contract would be deemed to have been entered into within the State of Odisha and it is agreed that neither party to the Contract will be competent to bring a suit in regard to the matter by this Contract at any place outside the State of Odisha.

25. **Procedure for Settlement of Disputes**:

In case of Dispute or difference arising between the Employer and the contractor relating to any matter arising out of or connected with this agreement, such disputes or difference shall be settled in accordance with the Arbitration and Conciliation Act, 1996.

26. **Replacement of Adjudicator**: Not applicable

**B. TIME CONTROL**

27. **Programme**:

27.1 Within 14 days of issue of letter of award, the successful bidder shall submit to the Employer detail work programme for approval showing the general methods, arrangements, order and timing for all the activities in the Works along with monthly cash flow forecast. The agreed work programme / milestones during such contract negotiation shall form part of the agreement.

27.2 An update of the Programme shall be a programme showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work including any changes to the sequence of the activities.
27.3 The contractor shall submit to the Employer, for approval, an updated Programme at intervals no longer than the period stated in the Contract Data. If the Contractor does not submit an updated Programme with in this period, the Engineer may withhold the amount stated in the Contract Data from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue programme has been submitted.

27.4 The Employer's approval of the Programme shall not alter the Contractor's obligations. The Contractor may revise the Programme and submit it to the Employer again at any time. A revised Programme is to show the effect of Variations and Compensation Events.

28 Extension of the Intended Completion Date:

28.1 The Employer shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the intended Completion Date without the Contractor taking steps to accelerate the remaining work and which would cause the Contractor to incur additional cost.

28.2 The Employer shall decide whether and by how much to extend the Intended Completion Date within 35 days of the Contractor asking the Engineer for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.

28.3 The Engineer shall within 14 days of receiving full justification from the contractor for extension of Intended Completion Date refer to the Employer his recommendation. The Employer shall in not more than 21 days communicate to the Engineer the Employer's decision.

29 Delays Ordered by the Engineer:

The Engineer may instruct the Contractor to delay the start or progress of any activity within the Works.

30 Management Meetings:

30.1 Either the Engineer or the Contractor may require the other to attend a management meeting. The business of a management meeting shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.

30.2 The Engineer shall record the business of management meetings and is to provide copies of his record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken is to be decided by the Engineer either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

31 Early Warning:

31.1 The Contractor is to warn the Engineer at the earliest opportunity of specific likely future events or circumstances that may adversely affect the work resulting delay in
the execution. The Engineer may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Completion Date.

31.2 The Contractor shall cooperate with the Engineer in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Engineer.

C. QUALITY CONTROL

32. Identifying Defects:

The Engineer shall check the Contractor's work regularly and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Engineer may instruct the Contractor to search for defects and to uncover and test any work that the Engineer considers may have a Defect.

33. Tests:

If the Engineer instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect the test shall be a Compensation Event.

34. Correction of Defects:

34.1 The Engineer shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion and is defined in the Contract Data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

34.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Engineer's notice.

35. Uncorrected Defects:

If the Contractor has not corrected a Defect within the time specified in the Engineer's notice, the Engineer will assess the cost of having the Defect corrected, and the Contractor will pay this amount.

D. COST CONTROL

36. Changes in the Quantities: (OPTIONAL)

37. Change of Scope (Variations) and Procedure for change of Scope:

37.1. The Employer may, require the Contractor to make modifications/alterations to the construction works before the issue of the completion certificate either by giving an instruction or by requesting the contractor to submit a proposal for change of scope involving additional cost or reduction in cost. Any such change of scope shall be made and valued in accordance with the provisions of this contract and the contractor, in that event, will have no further claim on the ground that had it been known / disclosed earlier he would have made such charges in other connected work in their design, construction which would have saved him some cost and given him other consequential benefits.
37.2 Change in scope may include:

(a) Change in specifications of any item of works
(b) omission/ deletion of any item of work from the scope of work
(c) any additional work (such as addition of extra plinth area) which are not included in the scope of work including any additional test on completion

37.3 In the event of the Employer determining that a change of scope is necessary, it shall issue notice to the contractor a notice specifying in reasonable detail the works contemplated there under (“Change in scope notice”)

37.4 Upon receipt of change in scope notice, the contractor shall with due diligence, provide to the Employer through the Engineer within seven days time such information as is necessary together with documentation in support of:

(a) the impact, of any, which the change in scope is likely to have on the completion of the work
(b) the options for implementing the proposed change of scope and the effect, if any, each on the cost and time thereof including the following details:
   (i) break down of quantities, unit rates and cost for different items of work
   (ii) proposed design for the change of scope
   (iii) proposed modifications, if any, to the construction period with updated work programmes (all Variations shall be included in updated Programmes produced by the Contractor).

37.5 The contractor’s quotation for change of scope shall be based on the detail design and rates for various item of works as derived on the basis of his original bid price (in case of repetition of similar item as per original contract) or CSR of the State and prevailing market rates (in case of new item not envisaged in the CSR)

37.6 The total value of all change of scope of work shall not exceed 5% of total contract price for the construction work.

38. **Payments for Change of Scope (Variations):**

38.1 The Employer shall assess the change in scope proposal and Contractor’s quotation and upon reaching an agreement; the Employer shall issue the Change Scope Order requiring the contractor to proceed with the performance thereof.

38.2 If the Contractor's quotation is unreasonable, the Employer may order the Variation and make a change to the Contract Price which shall be based on Employer’s own forecast of the effects of the Variation on the Contractor's costs.

38.3 If the Employer decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event, subject to condition that such variation shall not exceed 5% of the total contract price for the contract work.

38.4 The Contractor shall not be entitled to additional payment for costs, which could have been avoided by giving early warning.

39. **Payment Certificates:**
39.1 The Contractor shall submit to the Engineer statements of the value of the work completed.

39.2 The Engineer shall check the Contractor's statement within 14 days and certify the amount to be paid to the Contractor as per contract payment schedule after taking into account any credit or debit for the month in question in respect of materials for the works in the relevant amounts and under conditions set forth in sub-clause 47.3 of the Contract Data (Secured Advance).

39.3 The value of work executed shall be determined by the Engineer.

39.4 The value of work executed shall comprise the value of the quantities of the items as per the mile stone and work programme attached to the contract.

39.5 The value of work executed shall include the valuation of Change in Scope (Variation) and Compensation Events, if any.

39.6 The Engineer may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.

40. Payments:

Payments shall be adjusted for deductions for retention, other recoveries in terms of the contract and taxes at source, as applicable under the law. The Engineer shall pay the Contractor the amounts as per the payment schedule attached to the contract.

41. Compensation Events:

41.1 The following are Compensation Events unless they are caused by the Contractor:

(a) The Employer does not give access to a part of the Site by the Site Possession Date stated in the Contract Data.

(b) Other contractors, public authorities of utilities or the Employer does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.

41.2 If a Compensation Event would prevent the work being completed before the Intended Completion Date, the Intended Completion Date shall be extended. The Contractor will react competently and promptly to the event and shall submit information demonstrating the effect of the Compensation Event and the required extended time period for completion.

41.3 The Engineer shall examine the information furnished by the Contractor and shall recommend to the Employer by how much time the Intended Completion Date shall be extended. The Employer shall decide / sanction the required extension of time due to such compensation event.

41.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor not having given early warning or not having cooperated with the Engineer.

42. Tax:

The rates quoted by the Contractor shall be deemed to be inclusive Royalty, Income Tax, Labour CESS and all other statutory taxes except Goods and Service Tax that the Contractor will have to pay for the performance of this Contract. The Employer will
perform such duties in regard to the deduction of such taxes at source as per applicable law.

43. **Currencies:**

   All payments shall be made in Indian Rupees.

44. **Retention:**

44.1 The Employer shall retain from each payment due to the Contractor the proportion stated in the Contract Data until Completion of the whole of the works or settlement of final payment.

44.2 On completion of the whole of the works half the total amount retained is repaid to the contractor and half when the Defects Liability Period has passed and the Engineer has certified that all defects notified by the Engineer to the contractor before the end of the period have been corrected.

45. **Liquidated Damages:**

45.1 The Contractor shall pay liquidated damages to the Employer at the rate per week stated in the Contract Data for each week that the Completion Date is later than the Intended Completion Date (for the whole of the works or the milestone as stated in the contract data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not relieve the contractor from his / her / their obligation to complete the works or from any other duties, obligations or responsibilities which he / she / they may have under the contract.

45.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Engineer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate.

45.3 If the contractor fails to comply with the time for completion as stipulated in the tender, then the contractor shall pay to the employer the relevant sum stated in the Contract Data as Liquidated damages for such default and not as penalty for every week or part of week which shall elapse between relevant time for completion and the date stated in the taking over certificate of the whole of the works on the relevant section, subject to the limit stated in the contract data.

   The employer may, without prejudice to any other method of recovery deduct the amount of such damages from any money due or to become due to the contractor. The payment or deduction of such damages shall not relieve the contractor from his obligation to complete the works or from any other of his obligations and liabilities under the contract.

45.4 If, before the Time for Completion of the whole of the Works or, if applicable, any Section, a Taking - Over Certificate has been issued for any part of the Works or of a Section, the liquidated damages for delay in completion of the remainder of the Works or of that Section shall, for any period of delay after the date stated in such Taking-Over Certificate, and in the absence of alternative provisions in the Contract, be reduced in the proportion which the value of the part so certified bears to the value of the whole of the Works or Section, as applicable. The provisions of this Sub-Clause shall only apply to the rate of liquidated damages and shall not affect the limit thereof.

46. **Bonus Payment:**
46.1 The procedure for payment of bonus (incentive) shall be as per the latest amendment to Para 3.5.5 of OPWD code, Vol-I.

46.2 If the contractor achieves completion of the whole of the works prior to the Intended Completion Date prescribed in Contract Data the Employer shall pay to the contractor a sum stated in Contract Data as bonus (incentive) for every completed month which shall elapse between the date of completion of all items of works as stipulated in the Contract and the time prescribed in Clause 17.

46.3 For the purpose of calculating bonus payments, the time given in the Bid for completion of the whole of the works is fixed and unless otherwise agreed, no adjustments of the time by reason of granting an extension of time pursuant to Clause 28 or any other clause of these conditions will be allowed. Any period falling short of a complete month shall be ignored for the purpose of computing the period relevant for the payment of bonus.

47. **Advance Payment (Mobilisation and machinery advance):**

47.1 The Engineer shall make advance payment to the Contractor for mobilization and cash flow support of the amounts stated in the Contract Data by the date stated in the Contract Data, only against provision by the Contractor of an Unconditional Bank Guarantee in a form and by a Bank acceptable to the Engineer in amounts and currencies equal to the advance payment.

47.2 An interest @ 10% per annum shall be charged on the advance payment.

47.3 The Advance Payment shall not be released until the conceptual design is finalized and establishment of camp at work site is completed.

47.4 The guarantee shall remain effective until the advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. The contractor shall ensure that the Bank Guarantee remain enforceable until the advance payment has been fully repaid and accordingly renew it, from time to time, until the advance payment has been fully repaid.

47.5 If the terms of guarantee specify its expiry date, and the advance payment has not been repaid by the date then 28 days prior to the expiry date, the contractor shall extend the validity of the guarantee until the advance payment has been fully repaid.

47.6 The advance payment shall be repaid through percentage deductions from the interim payments as follows :-

a) Deductions shall commence from the 1st interim payment.

b) Deductions shall be made in proportions of the advance payment until such time as the advance payment has been repaid: provided that the advance payment shall be completely repaid prior to the time when 90 percent of the accepted contract amount has been repaid.

47.7 If the advance payment has not been repaid prior to the issue of the Taking over Certificate for the work or prior to termination under Section – 3 Clause -54 of (termination by employer), the balance advance is payable by the contractor to the employer.

48. **Securities:**

The Performance Security shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and
by a bank or surety acceptable to the Employer, and denominated in Indian Rupees. The Performance Security shall be valid up to the end of defect liability period.

49. **Cost of Repairs** :

Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions including the situation as stipulated at Cl. 12.

**E. FINISHING THE CONTRACT**

50. **Completion** :

The Contractor shall request the Engineer to issue a Certificate of Completion of the Works and the Engineer will do so upon deciding that the Work is completed.

51. **Taking Over** :

The Employer shall take over the Site and the Works within seven days of the Engineer issuing a certificate of Completion.

52. **Final Account** :

The Contractor shall supply to the Engineer a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Engineer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 56 days of receiving the Contractor's account if it is correct and complete. If it is not, the Engineer shall issue within 56 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Employer shall decide on the amount payable to the Contractor and issue a payment certificate, within 56 days of receiving the Contractor's revised account.

53. **Operating and Maintenance Manuals** :

If "as built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the Contract Data.

or

If the Contractor does not supply the Drawings and/or manuals by the dates stated in the Contract Data, or they do not receive the Employer's approval, the Engineer shall withhold the amount stated in the Contract Data from payments due to the Contractor.

54. **Termination** :

54.1 The Employer may terminate the Contract if the other party causes a fundamental breach of the Contract.

54.2 Fundamental breaches of Contract include, but shall not be limited to the following:

(a) the Contractor stops work for 28 days when no stoppage of work is shown on the current Programme and the stoppage has not been authorized by the Engineer;

(b) the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation;
(c) the Engineer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Engineer;

(d) the Contractor does not maintain a security which is required;

(e) the Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages can be paid as defined in the Contract data; and

(f) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in executing the Contract.

For the purpose of this paragraph: "corrupt practice" means the offering, giving, receiving or soliciting of any thing of value to influence the action of a public official in the procurement process or in contract execution. "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower, and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition."

54.3 When either party to the Contract gives notice of a breach of contract to the Engineer for a cause other than those listed under Sub Clause 54.2 above, the Engineer shall decide whether the breach is fundamental or not.

54.4 Notwithstanding the above, the Employer may terminate the Contract for convenience.

54.5 If the Contract is terminated the Contractor shall stop work immediately, make the Site safe and secure and leave the Site, as soon as reasonably possible.

55. Payment upon Termination :

55.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Engineer shall issue a certificate for the value of the work done less advance payments received up to the date of the issue of the certificate, less other recoveries due in terms of the contract, less taxes due to be deducted at source as per applicable law and less the percentage to apply to the work not completed as indicated in the Contract Data. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor, the difference shall be a debt payable to the Employer.

55.2 If the Contract is terminated at the Employer's convenience, the Engineer shall issue a certificate for the value of the work done, less advance payments received up to the date of the certificate, less other recoveries due in terms of the contract and less taxes due to be deducted at source as per applicable law. No extra cost will be paid by the employer for expenditure towards removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works and the Contractor's costs of protecting and securing the Works.

56. Property :

All materials on the Site, Plant, Equipment, Temporary Works and Works are deemed to be the property of the Employer, if the Contract is terminated because of a Contractor's default.

57. Release from Performance :
57. If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Employer or the Contractor, the Engineer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which commitment was made.

58. Approval of Architectural Plans:

58.1 All architectural plans shall be approved by the bidders at his own cost from concerned development authorities within stipulated time.

58.2 Compliance with environmental and energy efficiency norms and obtaining at least three star GRIHA rating.

F. Special Conditions of Contract

1. LABOUR:

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

The Contractor shall, if required by the Engineer, deliver to the Engineer a return in detail, in such form and at such intervals as the Engineer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such other information as the Engineer may require.

2. COMPLIANCE WITH LABOUR REGULATIONS:

During continuance of the contract, the Contractor and his sub contractors shall abide at all times by all existing labour enactments and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. Salient features of some of the major labour laws that are applicable to construction industry are given below. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made there under, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/ regulations including amendments, if any, on the part of the Contractor, the Engineer/Employer shall have the right to deduct any money due to the Contractor including his amount of performance security. The Employer/Engineer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point of time.
a) **Workmen Compensation Act 1923**: The Act provides for compensation in case of injury by accident arising out of and during the course of employment.

b) **Payment of Gratuity Act 1972**: Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years service or more or on death the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.

c) **Employees P.F. and Miscellaneous Provision Act 1952**: The Act provides for monthly contributions by the employer plus workers @ 10% or 8.33%. The benefits payable under the Act are:
   
   (i) Pension or family pension on retirement or death, as the case may be.
   
   (ii) Deposit linked insurance on the death in harness of the worker.
   
   (iii) Payment of P.F. accumulation on retirement/death etc.

d) **Maternity Benefit Act 1951**: The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.

e) **Contract Labour (Regulation & Abolition) Act 1970**: The Act provides for certain welfare measures to be provided by the Contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided, by the Principal Employer by Law. The Principal Employer is required to take Certificate of Registration and the Contractor is required to take license from the designated Officer. The Act is applicable to the establishments or Contractor of Principal Employer if they employ 20 or more contract labour.

f) **Minimum Wages Act 1948**: The Employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of Buildings, Roads, Runways are scheduled employment.

g) **Payment of Wages Act 1936**: It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.

h) **Equal Remuneration Act 1979**: The Act provides for payment of equal wages for work of equal nature to Male and Female workers and for not making discrimination against Female employees in the matters of transfers, training and promotions etc.

i) **Payment of Bonus Act 1965**: The Act is applicable to all establishments employing 20 or more employees. The Act provides for payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20% of wages to employees drawing Rs.3500/-per month or less. The bonus to be paid to employees getting Rs.2500/- per month or above up to Rs.3500/- per month shall be worked out by taking wages as Rs.2500/-per month only. The Act does not apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of this Act.

j) **Industrial Disputes Act 1947**: The Act lays down the machinery and procedure for resolution of Industrial disputes, in what situations a strike or lock-out becomes illegal and
what are the requirements for laying off or retrenching the employees or closing down the establishment.

k) **Industrial Employment (Standing Orders) Act 1946:** It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the Employer on matters provided in the Act and get the same certified by the designated Authority.

l) **Trade Unions Act 1926:** The Act lays down the procedure for registration of trade unions of workmen and employers. The Trade Unions registered under the Act have been given certain immunities from civil and criminal liabilities.

m) **Child Labour (Prohibition & Regulation) Act 1986:** The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of Child Labour is prohibited in Building and Construction Industry.

n) **Inter-State Migrant workmen’s (Regulation of Employment & Conditions of Service) Act 1979:** The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The Inter-State migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home upto the establishment and back, etc.

o) **The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and the Cess Act of 1996:** All the establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act. All such establishments are required to pay cess at the rate not exceeding 2% of the cost of construction as may be modified by the Government. The Employer of the establishment is required to provide safety measures at the Building or construction work and other welfare measures, such as Canteens, First-Aid facilities, Ambulance, Housing accommodations for workers near the work place etc. The Employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.

p) **Factories Act 1948:** The Act lays down the procedure for approval at plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 persons or more with aid of power or 20 or more persons without the aid of power engaged in manufacturing process.

q) **Employee State Insurance Act.1950**

3. **SUB-CONTRACTING (GCC Clause 7):**

Please add the following as Clause 7.2:

The contractor shall not be required to obtain any consent from the employer for:

a) the Sub-contracting of any part of the works for which the sub-contractor is named in the contract;

b) the provision of labour; and
c) the purchase of materials which are in accordance with the standards specified in the Contract.

d) Beyond this if the contractor proposes sub-contracting any part of the work during execution of works, because of some unforeseen circumstances to enable him to complete the work as per terms of the contract, the Engineer / Employer will consider the following before according approval:

- The contractor shall not sub-contract the whole of the works.

- The contractor shall not sub-contract any part of the work without prior consent of the Engineer. Any such consent shall not relieve at the contractor from any liability or obligations under the contract and he shall be responsible for the acts, defaults and neglects of any sub-contractor, his agents or workmen as fully as if they were the acts, defaults or neglects of the contractor, his agents or workmen.

- The Engineer should satisfy whether (a) the circumstances warrant such sub-contracting; and (b) the sub-contractors so proposed for the work possess the experience, qualification and equipment necessary for the job proposed to be entrusted to them in proportion to the quantum of work to be sub-contracted.

- If payments are proposed to be made directly to that sub-contractor, this should be subject to specific authorization by the prime contractor so that this arrangement does not alter the contractor’s liability or obligations under the contract.

Note: All bidders are expected to indicate clearly in the bid, if they proposed sub-contracting elements of the works amounting to more than 20 percent of the Bid Price. For each such proposal the qualification and the experience of the identified sub-contractor in the relevant field should be furnished along with the bid to enable the employer to satisfy himself about their qualifications before agreeing for such sub-contracting and include it in the contract.

In view of the above, normally no additional sub-contracting should arise during execution of the contract.

4. **PROTECTION OF ENVIRONMENT:**

Add the following as GCC Clause 16.2:

The Contractor shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or other resulting from pollution, noise or other causes arising as a consequence of his methods of operation.

During continuance of the contract, the Contractor and his sub-contractors shall abide at all times by all existing enactments on environmental protection and rules made there under, regulations, notifications and bye-laws of the State or Central Government, or local authorities and any other law, by-law, regulations that may be passed or notification that may be issued in this respect in future by the State or Central Government or the local authority. The contractor shall also abide by the requirements as per Attachment-X of the Bid Document.

**Salient features of some of the major laws that are applicable are given below:**

**The Water (prevention and Control of Pollution) Act, 1974:** This provides for the prevention and control of water pollution and the maintaining and restoring of wholesomeness of water. ‘Pollution’ means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to, create a nuisance or render such water harmful or injurious to public health or safety, or to
domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health or animals or plants or of aquatic organisms.

**The Air (prevention and Control of Pollution) Act, 1981:** This provides for prevention, control and abatement of air pollution. ‘Air Pollution’ means the presence in the atmosphere of any ‘air pollutant’, which means any solid, liquid or gaseous substance (including noise) present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment.

**The Environment (Protection) Act, 1986:** This provides for the protection and improvement of environment and for matters connected therewith, and the prevention of hazards to human beings, other living creatures, plants and property. ‘Environment’ includes water, air and land and the inter-relationship which exists among and between water, air and land, and human being, other living creatures, plants, micro-organism and property.

**The public Liability Insurance Act, 1991:** This provides for public liability insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling hazardous substances and for matters connected herewith or incidental thereto. Hazardous substance means any substance or preparation which is defined as hazardous substance under the Environment (Protection) Act 1986, and exceeding such quantity as may be specified by notification by the Central Government.
## 5 Attachment - X

### 6 Environmental Mitigation Measures during Construction – ROAD AND BUILDINGS

<table>
<thead>
<tr>
<th>Environmental Impact/Issue</th>
<th>Mitigation / Management Measures</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Implementatio n</td>
</tr>
<tr>
<td>1. Removal of Trees</td>
<td>Trees will be removed from the corridor of impact (or, site) before the commencement of construction with prior clearance from the Forest Department.</td>
<td>Contractor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supervision</td>
</tr>
<tr>
<td>2. Generation of Debris</td>
<td>Debris generated due to the dismantling of the existing pavement structure shall be suitably reused in the proposed construction, subject to the suitability of the material and the approval of the Engineer. Unutilisable debris material shall be suitably disposed off by the contractor, either for the filling up of borrow areas created for the project or at pre-designated dump locations.</td>
<td>Contractor</td>
</tr>
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<td></td>
<td></td>
<td>Departmen t</td>
</tr>
</tbody>
</table>
| 3. Loss of Topsoil              | (a) The topsoil from all areas of cutting and all areas to be permanently covered shall be stripped to a specified depth of 150 mm and stored in stockpiles (maximum slope 1:2, and maximum height 2m). To retail soil and to allow percolation of water, the edges of the stockpile shall be protected by slit fencing.  
(b) Stockpiles will not be surcharges or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur. It shall be ensured by the contractor that the topsoil will not be unnecessarily trafficked either before stripping or when in stockpiles.  
(c) Such stockpiled topsoil will be returned to cover the disturbed area and cut slopes. Residual topsoil will be distributed on adjoining/proximate barren/rocky areas as identified by the Engineer in a layer of thickness of 75 – 150 mm. Top soil shall also be utilized for redevelopment of borrow areas, landscaping along slopes, medians, incidental spaces etc. | Contractor                          |
|                                 |                                                                                                                                                                                                                                | Departmen t                          |
| 4. Borrowing of Earth           | The borrowing shall not be carried out in cultivable lands, unless agreed upon by the Engineer. Borrowing of earth shall be carried out as per the IRC Guidelines.                                                                 | Contractor                          |
|                                 |                                                                                                                                                                                                                                | Departmen t                          |
| 5. Degradation of Borrow Areas  | The location, shape and size of the designated borrow areas shall be as approved by the Engineer and in accordance to the IRC recommended practice for borrow pits for road embankments. Borrow pits shall be re-developed, spoils shall be dumped with an overly of stockpiled topsoil. Redevelopment of borrow areas shall be taken up in accordance with the | Contractor                          |
|                                 |                                                                                                                                                                                                                                | Departmen t                          |
plans approved by the Engineer.

6. Soil Erosion
   Along sections abutting water bodies, stone pitching needs to be carried out for slopes between 1:4 and 1:2 Gabion structures/ Grass turfing shall be provided for slopes steeper than 1 vertical to 2 horizontal. The work shall consist of measures as per design or as directed by the Engineer to control soil erosion, sedimentation and water pollution, through use of berms, dikes, sediment basins, fiber mats, mulches, grasses, slope drains and other devices.

   Contractor
   Department:

7. Construction Wastes & their disposal
   Spoil from excavation of riverbed shall be managed and disposed off as directed by the Engineer. No new disposal site shall be created as part of the project, which is not redeveloped. All waste material shall be completely disposed as desired and the site shall be fully cleaned before handing over.

   Contractor
   Department:

8. Quarry Operations
   The Contractor shall open and use quarries, as per the Odisha Mining Rules. Alternatively the Contractor shall acquire the required material from quarries licensed by the OSPCB and having an approved redevelopment plan.

   Contractor
   Department:

Environment Impact/Issue | Mitigation / Management Measures | Responsibility
---|---|---
9. Loss of Water Bodies
   a. Filling of surface water bodies shall be compensated by digging an equal volume of soil for water storage. Such dug-up soil shall be used for spreading as topsoil.
   b. Wherever earthwork is undertaken, the banks shall be protected by means as designed or as approved by the Engineer. Construction shall be carried out in a manner so that the side slopes are no steeper than 1:4, otherwise slope protection work shall be provided, as approved by the Engineer and as per item 6 of these specifications. For drains carrying run-off from the highways entering, into surface water bodies/channels, with a fall exceeding 1.5 m cascading or sedimentation traps shall be provided.

   Contractor
   Department:

10. Loss of Other Water Sources
    The replacement shall be ready prior to demolition / dismantling of the existing source. Any damage to the existing sources of water (hand pump, tube well etc.) shall be made good by the Contractor at his expense.

    Contractor
    Department:

11. Flooding
    In addition to the design requirements, the contractor shall take all desired measures as directed by the Engineer to prevent temporary or permanent flooding of the site or any adjacent area.

    Contractor
    Department:

12. Alteration of
    a. In sections along water courses, and close to cross-drainage channels, earth, stone or any

    Contractor
    Department:
<table>
<thead>
<tr>
<th>Environment Impact/Issue</th>
<th>Mitigation / Management Measures</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage</td>
<td>other construction materials or appendage shall be properly disposed off so as not to block the flow of water. b. All necessary measures shall be taken to prevent earthwork, stonework, materials and appendage as well as the method of operation from impending cross-drainage at rivers, streams, water canals and existing and existing irrigation and drainage systems.</td>
<td>Contractor Department.</td>
</tr>
<tr>
<td>13. Contamination from Construction Wastes, fuel and Lubricants</td>
<td>At construction vehicle parking locations and at fuel/lubricant storage sites, oil and grease traps shall be provided. Fuel storage shall be in proper bunded areas. The discharge standards promulgated under the Environmental Protection Act, 1986 shall be strictly adhered to.</td>
<td>Contractor Department.</td>
</tr>
<tr>
<td>14. Sanitation and Waste disposal in construction camps</td>
<td>Construction labourers’ camps shall be located at least 200 m away from the nearest habitation and as approved by the Engineer. The sewage system for a construction labourers’ camp shall be designed, built and as per the Factories Act, 1948 and the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996.</td>
<td>Contractor Department.</td>
</tr>
<tr>
<td>15. Generation of Dust</td>
<td>All vehicles delivering materials to the site shall be covered to avoid spillage of materials. Clearance shall be effected by manual sweeping and removal of debris, or, if so directed by the Engineer, by mechanical sweeping and cleaning equipment, an all dust, mud and other debris shall be removed completely.</td>
<td>Contractor Department.</td>
</tr>
<tr>
<td>16. Emission from Hot-Mix Plants and Batching Plants.</td>
<td>Hot mix plants and batching plants shall be located sufficiently away from habitation, agricultural operations or industrial establishments. Where possible such plants will be located at least 1000 m downwind from the nearest habitation. The exhaust gases, and operation of the plants shall comply with the requirements of the relevant current emission control rules (as per OSPCB).</td>
<td>Contractor Department.</td>
</tr>
<tr>
<td>17. Emission and noise</td>
<td>All vehicles, equipment and machinery used for construction shall conform to the relevant Bureau of Indian Standard (BIS) norms. All vehicles, equipment and machinery used for</td>
<td>Contractor Department.</td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
<td>Requirement</td>
</tr>
<tr>
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<td>-------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>18.</td>
<td>Pollution from Crusher</td>
<td>All crushers used in construction shall conform to relevant dust emission control rules. Clearance for siting shall be obtained from the OSPCB. Alternatively, only crushers already licensed by the OSPCB shall be used.</td>
</tr>
<tr>
<td>19.</td>
<td>Loss, Damage or Disruption of/to Fauna.</td>
<td>All works are to be carried out in such a fashion that the damage and disruption to fauna is minimum. Construction workers shall be instructed to protect natural resources and fauna, including wild animals and aquatic life. Hunting and unauthorized fishing are prohibited.</td>
</tr>
<tr>
<td>20.</td>
<td>Chance-found important Flora/Fauna.</td>
<td>If a rare/endangered/threatened flora/fauna species is spotted, the contractor shall make all arrangements to intimate the Forest/Wildlife authorities without delay, and measures will be taken for its conservation. Work would be suspended, until the relevant authorities are consulted, unless specifically directly by the Engineer.</td>
</tr>
<tr>
<td>21.</td>
<td>Traffic Control and Safety</td>
<td>The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the section of the road under improvement.</td>
</tr>
<tr>
<td>22.</td>
<td>Risk from Construction Operations</td>
<td>The contractor is required to comply with all the precautions as required for the safety of the workmen as per the international Labour Organisation (ILO) Convention No. 62 as far as those are applicable to this contract. The contractor shall also comply with the national Building Code for this purpose.</td>
</tr>
<tr>
<td>23.</td>
<td>Potable Water and Hygiene</td>
<td>Potable water supply will be provided, at every workplace, as per the Factory Rules of Odisha. All requirements as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 shall be fulfilled.</td>
</tr>
<tr>
<td>24.</td>
<td>Protection of Cultural Heritage / Property</td>
<td>All the necessary and adequate care shall be taken to minimize impact on cultural properties (which includes cultural sites and remains, places of worship, graveyards, monuments and any other important properties/sites/remains notified under the Ancient Sites and Remains Act)</td>
</tr>
<tr>
<td>25.</td>
<td>Chance</td>
<td>All fossils, coins, articles of value of antiquity and structures and other remains or things of</td>
</tr>
</tbody>
</table>

Bidder

-67-

Executive Engineer
found Archaeological property geological or archaeological interest discovered on the site shall be the property of the Government. The contractor shall all work within 100 m in all directions from the site. The Engineer shall seek direction from the Archaeological Society of India (ASI) before instructing the Contractor to recommence work on the site.

26. Risk from explosives Except as may be provided in the contract or ordered or authorized by the Engineer, the contractor shall not use explosives. Where the use of explosives is so provided or ordered or authorized, the contractor shall comply with the requirements of the explosives Act. First aid and medical care shall be provided, as per the factory Rules of Odisha.
The procedure for arbitration will be as follows:

25 (a) In case of Dispute or difference arising between the Employer and a domestic contractor relating to any matter arising out of or connected with this agreement, such disputes or difference shall be settled in accordance with the Arbitration and Conciliation Act, 1996. The parties shall make efforts to agree on a sole arbitrator and only if such an attempt does not succeed and the Arbitral Tribunal consisting of 3 arbitrators one each to be appointed by the Employer and the Contractor and the third Arbitrator to be chosen by the two Arbitrators so appointed by the Parties to act as Presiding Arbitrator shall be considered. In case of failure of the two arbitrators appointed by the parties to reach upon a consensus within a period of 30 days from the appointment of the arbitrator appointed subsequently, the Presiding Arbitrator shall be appointed by the *Council, Indian Road Congress.

(b) The Arbitral Tribunal shall consist of three Arbitrators one each to be appointed by the Employer and the Contractor. The third Arbitrator shall be chosen by the two Arbitrators so appointed by the Parties, and shall act as Presiding arbitrator. In case of failure of the two arbitrators appointed by the parties to reach upon a consensus within a period of 30 days from the appointment of the arbitrator appointed subsequently, the Presiding arbitrator shall be appointed by the * Council, Indian Road Congress.

(c) If one of the parties fails to appoint its arbitrator in pursuance of sub clause (a) and (b) above within 30 days after receipt of the notice of the appointment of its arbitrator by the other party, then the * Council, Indian Roads Congress shall appoint the arbitrator. A certified copy of the order of the Council, Indian Roads Congress making such an appointment shall be furnished to each of the parties.

(d) Arbitration proceedings shall be held in Rourkela, and the language of the arbitrator proceedings and that of all documents and communications between the parties shall be English.

(e) The decision of the majority of arbitrators shall be final and binding upon both parties. The cost and expenses of Arbitration proceedings will be paid as determined by the arbitral tribunal. However, the expenses incurred by each party in connection with the preparation, presentation, etc. of its proceedings as also the fees and expenses paid to the arbitrator appointed by such party or on its behalf shall be borne by each party itself.

(f) Performance under the contract shall continue during the arbitration proceedings and payments due to the contractor by the owners shall not be withheld, unless they are the subject matter of the arbitration proceedings.
SECTION 4:
CONTRACT DATA
Items marked "N/A" do not apply in this Contract.

The following documents are also part of the Contract:
- The Schedule of Operating and Maintenance Manuals [53]
- The Schedule of Other Contractors [8]
- The Schedule of Key Personnel [9]
- The Methodology and Program of construction [27]
- The Schedule of Key and Critical equipment to be deployed on the work as per agreed program of construction[27]
- Site Investigation reports [14]

The Employer is [Chief Executive Officer, Rourkela Smart City Limited, Udit Nagar, Rourkela-769012]
The Site is located at [Rourkela, Area Based Development Area]
Name of authorized Representatives: [Sri Sanjay Kumar Nanda, General Manager (Operation), Rourkela Smart City Limited, Udit Nagar, Rourkela]
The Engineer is General Manager (E&T), Rourkela Smart City Limited [1.1]
Name: Sri Minaketan Sahooi,
Address: Udit Nagar, Rourkela-769012
M- 8249833105
E.mail: rourkelascl@gmail.com

The name and identification number of the Contract [insert identification] [1.1]
The Works consist of: [Refer the site plan, technical specifications etc. attached at Section-7 Vol-II]
The Start Date / Commencement Date :- Date of issue of notice to proceed with the work.
The Intended Completion Date for the whole of the Works [Twenty Four Months]
This period includes the time period for survey, investigation and detail design as per the scope of services described at Section-8

The following documents also form part of the Contract: [2.3]
i. NBC Specification Book of Latest Edition
ii. Notice inviting bid including all corrigendum’s / addendum / additional conditions / specifications / drawings etc. if any issued at the time of invitation of bid and acceptance thereof.
iii. Bid document.
iv. Performance security

The language of the Contract documents is English [3]
The law which applies to the Contract is the laws of Union of India [3]
Limit of subcontracting 20% of the Initial Contract Price. [7.1]

Insurance requirements are as under:

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Item</th>
<th>Minimum Cover for Insurance</th>
<th>Maximum deductible for Insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Works and Plant and Materials</td>
<td>Full</td>
<td>0.45% of insured amount</td>
</tr>
<tr>
<td>(ii)</td>
<td>Loss of damage to Equipment</td>
<td>Full</td>
<td>0.45% of insured amount</td>
</tr>
<tr>
<td>(iii)</td>
<td>Other Property</td>
<td>Camp Cost</td>
<td>0.45% of insured amount</td>
</tr>
</tbody>
</table>
(iv) Personal injury or death insurance

<table>
<thead>
<tr>
<th>a) For other people;</th>
<th>Rs.1,50,000.00</th>
<th>As applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) For contractor’s Employees</td>
<td>In accordance with the statutory requirements applicable to India</td>
<td></td>
</tr>
</tbody>
</table>

The duration of insurance- up to end of defect liability period  
[13.1(A)]

The duration of insurance- up to end of completion period  
[13.1(B)]

The Site Possession Date shall be simultaneously with the notice to proceed with the work:  [21]

The Contractor shall submit a Program for the Works within 7 days of delivery of the Letter of Acceptance of tender.  
[27.1]

(This program should be in adequate detail and generally conform to the program submitted along with bid in response to ITB Clause 4.2 (K). deviations if any from that should be clearly explained and should be satisfactory to the Engineer)

The period for submission of the programme for approval of Engineer Shall be 15 days from the date of issue of Letter of Acceptance  
[27.1]

The period between Program updates shall be 30 days.  
[27.2]

The amount to be withheld for late submission of an updated Program shall be 1% of the Contract Amount  
[27.3]

The Defects Liability Period is Three Years from the date of certification of completion of work.  
[34 & 35]

The currency of the Contract is Indian Rupees.  
[43]

The rates and prices quoted by the bidder shall be fixed for the duration of the contract and shall not be subject to any adjustment  
[37]

Retention money - 5 % of gross value of the bill  
[44]

The liquidated damages - 1% of the balance work per week subject to a maximum of 10% (ten percent) of the respective Contract Price.  
[45]

**Mile Stones for Design Stage**  
[As per payment milestone in Schedule]

**Bonus Payment:**  
[46]

1% of contract Price in case of completion of work 3 months prior to completion date

Maximum 2% of contract Price in case of completion of work 6 months prior to completion date

Bonus payment for intermediate period shall be prorated as per Cl. 46.2

Advance payment  
[10% (ten percent) of the contract value]  
(Mobilisation and machinery advance)

Interest on Advance payment  
[10% (ten percent) per annum]

**Validity of Performance Security**  
- Up to the end of defect liability period [48.1]

The amount to be withheld for failing to supply “as built” drawings (duly approved by appropriate authority) by the date required is Rs.10.00 Lakh.  
[53.1]

The following events shall also be fundamental breach of contract:  
[54.2]

1. The Contractor has contravened Sub-clause 7.1 and Clause 9.0 of GCC
2. The Contractor does not adhere to the agreed construction program (Clause 27 of GCC) and also fails to take satisfactory remedial action as per agreements reached in the management meetings (Clause 30) for a period of 60 days.

The percentage to apply to the value of the work not completed representing the Employer's additional cost for completing the Works shall be - 20 % [55.1]
SECTION 5:
Technical Specification
(Enclosed Separately)
SECTION 6:
SECURITIES AND OTHER FORMS
PERFORMANCE BANK GUARANTEE#

To
The Chief Executive Officer
Rourkela Smart City Limited
Udit Nagar, Rourkela-769012

WHEREAS ____________________________ [name and address of Contractor]
(hereafter called "the Contractor") has undertaken, in pursuance of Contract No.___________
dated ____________ to execute _______________[name of Contract and brief description of
Works] (hereinafter called "the Contract").

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall
furnish you with a Bank Guarantee by a recognized Nationalized Schedule bank for the sum
specified therein as security for compliance with his obligation in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee:

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you
on behalf of the Contractor, up to a total of __________________ [amount of
guarantee]* ____________________ (in words), such sum being payable in the types and
proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon
your first written demand and without cavil or argument, any sum or sums within the limits
of______________________ [amount of guarantee] as aforesaid without your needing to prove or to show
grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the contractor before
presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the
Contract or of the Works to be performed there under or of any of the Contract documents which may
be made between your and the Contractor shall in any way release us from any liability under this
guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid until 28 days from the date of expiry of the Defect Liability
Period.

Signature and Seal of the guarantor____________________
Name of Bank _______________________________________
Address _____________________________________________
Date ________

* An amount shall be inserted by the Guarantor, representing the percentage the Contract
Price specified in the Contract including additional security for unbalanced Bids, if any and
denominated in Indian Rupees.

# In case of sole Bidder
BANK GUARANTEE FOR ADVANCE PAYMENT

To
The Chief Executive Officer
Rourkela Smart City Limited
Udit Nagar, Rourkela-769012

Gentlemen:

In accordance with the provisions of the Conditions of Contract, sub-clause 47.1 ("Advance Payment") of the above-mentioned Contract, ________________________ [name and address of Contractor] (hereinafter called "the Contractor") shall deposit with the Chief Executive Officer, Rourkela Smart City Limited [name of Employer] a bank guarantee to guarantee his proper ________________________ and faithful performance under the said Clause of the Contract in an amount of ________________________ [amount of Guarantee] * ________________________ [in words].

We, the ________________________ [bank or financial institution], as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as primary obligator and not as Surety merely, the payment to Chief Executive Officer, Rourkela Smart City Limited on his first demand without whatsoever right of obligation on our part and without his first claim to the Contractor, in the amount not exceeding ________________________ [amount of guarantee]* ________________________ [in words].

We further agree that no change or addition to or other modification of the terms of the Contractor or Works to be performed thereunder or of any of the Contract documents which may be made between Chief Executive Officer, Rourkela Smart City Limited and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until Chief Executive Officer, Rourkela Smart City Limited receives full repayment of the same amount from the Contractor.

Yours truly,

Signature and Seal: __________________________________________
Name of Bank / Financial Institution: ________________________________
Address: _______________________________________________________
Date: __________________

* An amount shall be inserted by the Bank or Financial Institution representing the amount of the Advance Payment, and denominated in Indian Rupees.
UNDERTAKING

I, the undersigned, do hereby undertake that our firm M/s…………………………………………………… Agree to abide by this bid for a period .................. days for the date fixed for receiving the same and it shall be binding on us and may be accepted at any time before the expiration of that period.

(Signed by an authorized officer of the Firm/Lead Member of JV/Consortium Firm)

Title of Officer

________________________

Name of the firm

________________________

DATE
SECTION 7

DRAWINGS

INDICATIVE SITE PLAN WITH TECHNICAL DETAILS /SPECIFICATIONS TO BE ATTACHED / PROJECT DETAILS & SCOPE OF WORK (SEPARATELY ATTACHED)
SECTION-8

TERMS OF REFERENCE & SCOPE OF WORK FOR DESIGN OF THE PROJECT

1. BRIEF TASKS TO BE CARRIED OUT AT DESIGN & EXECUTION STAGE

- Collect sub-soil data, undertake detailed survey & sub-soil investigations;
- Prepare Detailed designs and architectural drawings,
- Whenever required or necessitated by the site conditions, modify designs as well as suggest solutions to the problems come across during actual execution.
- Obtain approval of designs of each components of buildings from the Employer/Authority before execution.

2. DETAIL SCOPE OF WORK

a) Conduct necessary sub-soil investigation, wind data and earthquake data as per relevant clauses of NBC of India.

b) Carry out field surveys, soil and geo-technical investigations, and prepare plans, designs, detailed drawings, etc. as per the latest BIS and NBC guidelines.

c) Prepare detail site plan of the area using total-station etc.

d) Prepare Key map(with scale 1:50,000) showing the location of the buildings investigated and rejected and the important structures, in the vicinity. The reference to the position of the benchmark, location of the trial pits or bore-holes giving identification number for each bore connected to the datum and location of all nullahs, buildings.

e) Carryout Geotechnical Investigations and Sub-Soil Exploration at each proposed building location, and conduct all relevant laboratory and field tests on soil and rock samples. Soil bore particulars duly indicating the classification of soils within a bore log chart and soil test reports conducted in Govt. of Odisha approved soil testing laboratory on undisturbed and disturbed samples for all the geo-technical parameters like C, φ, Atterberg limits, DFS, SPT and silt factor worked out from the mean diameter of the particle size to the maximum scour level, safe bearing capacity of soils or rocks, core recovery (RQD) for rock, errodibility test for rocks, consolidation settlement parameters etc.

f) Prepare detailed designs, prepare drawings for building and approaches following the latest IS codes for design and construction of buildings and NBC specification and IS codes and obtain approval of the Director Designs, Odisha/Authority.

g) Carryout load testing on piles as per BIS guidelines and accordingly modify the designs of foundation (pile and pile cap etc.) if necessary from stability point of view.
h) Brief details of the various elements of the proposed Project are presented in the following section (to be attached).

i) The activities required for completion of the Project on a turnkey basis include

- Planning of the Facilities including functional analysis, workflow analysis etc.
- Design development including preparation of architectural brief, design concept, concept for services etc. It may be noted that the concept plans forming part of the RFP documents shall be the basis for this.
- Detailed design engineering including architectural design and construction documents, structural engineering, electrical engineering, heating ventilation and air conditioning plans, medical gases and manifold plan, plan for the central sterile services department, communication and networking plan, fire detection and protection plan etc.
- Building construction and installation of all services
- Procurement, installation, testing and commissioning of requisite equipment as per specifications provided
- Procurement and installation of furniture and fixtures
- Co-ordination with the medical equipment suppliers for installation and incorporating their requirements in the project.
- Project Management to ensure completion of Project as per the specified timelines
- Compliance with Environmental and Energy efficiency norms and obtaining at least 4 star GRIHA rating.
- Handing over of the facilities after fulfilling all the obligations under “Employer’s Requirement”

ii) The details of the various components of the Project are as follows:
(to be inserted as per requirement)

3. **TIME PERIOD FOR THE SERVICE**

The time period for the design stage is 60 days from the date of commencement. This period includes time period for all types of survey & investigation as listed at Para-2, soil exploration and laboratory testing, detail design, the draft and final design reports, drawings, technical specifications, methodology of work and all other associated reports and documents.

However, the total period of contract including Survey, Investigation, Design, and Execution will be 24 calendar months. The defect liability period shall be three years from the date of completion of the project which is included in maintenance period of 5 Years

The Contractor shall submit all designs, drawings, technical specifications and methodology to the Employer **after vetting the same from any National Institute of Repute such as Indian Institute of Technology (IIT)/NIT or**
Central Building Research Institute (CBRI) at its own cost. The Employer shall give approval on all sketches, drawings, reports and recommendations and other matters and proposals submitted for approval by the Bidder in such reasonable time as not to delay or disrupt the performance of the Contractor’s services.

4. SCHEDULE FOR COMPLETION OF TASKS

The reports have to be submitted in the following phasing in the number of copies indicated against each of them.

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Description</th>
<th>Schedule for completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Survey (Topo graphical, Geotechnical &amp; Hydrological Survey) after submission of field data, drawing &amp; approval</td>
<td>30 days from the date of commencement</td>
</tr>
<tr>
<td>4.2</td>
<td>Architectural Drawings with detail Engineering Designs and technical specifications &amp; methodology</td>
<td>45 days from the date of commencement</td>
</tr>
<tr>
<td>4.3</td>
<td>Final Architectural Drawings with detail Engineering Designs and technical specifications &amp; methodology</td>
<td>60 days from the date of commencement</td>
</tr>
<tr>
<td>4.4</td>
<td>On approval of drawing showing electrical, sanitary, ICT, Fire Fighting &amp; Landscape design</td>
<td>75 days from the date of Commencement</td>
</tr>
<tr>
<td>4.5</td>
<td>Changes during Construction</td>
<td>As and when referred by the Department</td>
</tr>
<tr>
<td>4.6</td>
<td>On Completion of Construction and submission of &quot;As built drawings&quot;</td>
<td>547 days from the date of Commencement</td>
</tr>
</tbody>
</table>

5. KEY PERSONNEL OF THE PROJECT DESIGN TEAM

The Bidder shall be required to form a multi-disciplinary team for this assignment with qualified & experienced key personal and other required supporting staff for delivering the final output of this section as per Para 7 below. The design as well as Architectural team should have the requisite experience and expertise for design of similar works as offered by the bidder and accepted by the Employer.

The CVs of the following Key Personnel would have to be got approved by the Chief Executive Officer, Rourkela Smart City Limited during contract negotiation and prior to signing of contract.

A) Project Manager:

A Graduate Degree in Civil Engineering (Civil) with 10 years of minimum experience in Design of Riverfront/Beachfront/Medium Irrigation/Minor Irrigation works and detailing of major RCC/ PSC/ STEEL-CONCRETE COMPOSITE STRUCTURE with different types of foundations including PILE FOUNDATIONS for buildings.

B) Geotechnical Engineer

A Graduate Degree in Civil Engineering in Geo-technical or Foundation Engineering having a minimum of 5 years of experience in supervising soil and geo-technical
investigations for major building works, design of foundations of all types including large diameter piles for building structures..

C) Architect

A Graduate Degree in Architect having a minimum of 10 years experience out of which at least 5 years of experience for preparation of Landscaping, Large Public Parks.

D) Electrical Engineer

A Graduate Degree in Electrical Engineering having a minimum of 5 years of experience.

6. SERVICES TO BE PROVIDED BY THE DEPARTMENT

The department will provide the following available data to the Bidder on request.

- Available details of sub-soil report and other associated data
- Available details of soil bore log and test result
- Available site plan
- Any other relevant secondary data, to the extent available in comprehensive manner

7. FINAL OUTPUTS (REPORTS, DRAWINGS etc.) required from the Bidder

7.1 Inception report 5 copies
7.2 Report with details of all Survey including laboratory test 5 copies
7.3 Draft detailed Architectural drawing and engineering designs report 5 copies
7.4 Final detailed Architectural drawing and engineering designs report 5 copies

7.5 Except inception report, all other reports as listed above shall be submitted by the Contractor to the Employer only after obtaining approval of the same from any National Institute of Repute such as Indian Institute of Technology (IIT)/NIT at Contractor’s own cost. Such approved documents need to be furnished to the Employer within the stipulated datelines as mentioned at Section-4 in the contract data.

8. PAYMENT SCHEDULE AT ARCHITECTURAL DRAWINGS AND DESIGN STAGE

The architectural drawings and design cost for the building shall be 1.5% of the Contract Price. The client shall effect payments for the design cost in accordance with the following payment schedule.

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Activity / Deliverable</th>
<th>Payment as % of Design Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Survey (Topographical, Geotechnical &amp; Hydrological Survey) after submission of field</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>data, drawing &amp; approval</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>----------------------------------------------------------------------------------------</td>
<td>---</td>
</tr>
<tr>
<td>2</td>
<td>On approval of inception report &amp; details survey and architectural drawing approved by concerned development authorities.</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>On approval of drawing showing electrical, sanitary, ICT, Fire Fighting &amp; Landscape design</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>On approval of Final Architectural drawing showing electrical and sanitary diagram and detail structural design.</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>On Completion of Construction</td>
<td>15</td>
</tr>
</tbody>
</table>
A. PROJECT EXECUTION & SUPERVISION ASPECTS

A-1. The Bidder, who shall act as contractor for the project shall be composed of qualified and experienced experts, who can carry out all the routine construction works as a fully competent and independent unit.

However, in preparing his proposal for the construction, the Bidder should allow for a suitable mechanism which will ensure thorough co-ordination of the design and execution teams, so that each team is at all times fully aware of the remedies to common problems used by the other team.

A-2. The Lead Project Engineer on behalf of the bidder (Contractor) should be named in the contract with whom day to day interactions shall be made by the Engineer for execution and supervision of works. He should be a senior Civil Engineer with at least 20 years of professional experience out of which 10 years in design and construction of building works. He should have executed at least one major building work of similar in nature as proposed by the bidder. He should be familiar with modern construction equipment and contract conditions. The candidate should have a thorough understanding and experience with IS code / NBC Guidelines relating to building construction.

A-3. The Bidder shall provide competent personnel for the project execution and supervision who shall be managed by the Lead Project Engineer at site in performing the assignment under this contract.

The Bidder’s personnel should have the required experience and expertise in conducting similar type of works with highest professional standards.

The Bidder is required to set-up the site office at the three work site and make their own arrangements for the accommodation, furniture and equipment etc.

The project execution and supervision personnel should be mobilized from the date of commencement of works by the Bidder. During the defects liability period, the Bidder would be expected to provide technical advisory services on an “as required” basis. No office set-up is expected to be provided by the Bidder.

After award of the contract, the client expects all of the proposed personnel to be available during implementation of the contract.

A-4. It is the duty of the Bidder (Contractor) to:

1. ensure that high quality of construction is achieved
2. ensure that all works are carried out in full compliance with the engineering design, technical specifications and contract documents;
3. check / conduct all necessary measurements, tests, and control the quality of various items of works and in accordance with the relevant code of Building specification with the latest edition.

B. CONTRACT MANAGEMENT FRAMEWORK

B-1. The execution of the works shall be governed by the Contract Management Framework (CMF).

The main features of CMF are described in the paragraphs that follow.

To administer the contracts under the project, the Chief Executive Officer, Rourkela Smart City Limited will be the Contractual “Employer”.

General Manager (E&T), Rourkela Smart City Limited shall be the “Engineer” of the Project and will work as the representative of the Employer. Consultant if required may be engaged, who may on proper authority, work as the representative of the employer for the purpose of supervision.

The Bidder shall be termed as Contractor for the project in accordance with Odisha PWD Code.

The Chief Executive Officer, Rourkela Smart City Limited will define the objectives of the project, and ensure that the execution is within the scope defined in the objectives.

The Chief Executive Officer, Rourkela Smart City Limited in particular to sanction variation orders, including variation in quantities and additional work items proposed by the Bidder, and all other items requiring specific approval from the Employer by following procedures as per OPWD code.

The Chief Executive Officer, Rourkela Smart City Limited shall take approval of Government in accordance with Rules of OPWD Code where ever necessary.

B-2. DUTIES AND RESPONSIBILITIES OF THE ENGINEER

The duties of the Engineer are to administer the works contract and ensure that the contractual clauses, whether related to quality or quantities of work, are respected. The duties of the Engineer include issuing of decisions; certificates and orders as specified in details in the construction contract documents. The Engineer will also coordinate the teams, to ensure that the technical policies are correctly and consistently implemented.

The principal responsibilities of the Engineer will be, but not be limited to, the following:
(a) to give the order to commence the works;
(b) to inspect Bidder’s plant and equipments and recommend augmentation/ rectification of deficiencies, if required

(c) to order special tests of materials and/or completed works, and/or order removal and substitution of improper materials and/or the works as required;

(d) approve and/or issue working drawings including variations thereof arising out of change in design as per site requirements

(e) monitor and verify the correctness of the "as-built" drawings supplied by the Bidder;

(f) to monitor the progress of the works;

(g) to review all the test result/ certificates of all construction materials and inspect sources of materials to establish their quality suitable to the required standard.

(h) to check all bituminous mix designs and concrete mix design proposed by the Bidder where ever required and in due time and suggest modifications in the mix design, laying methods, sampling and testing procedure and quality control measures, to ensure required standard and consistency in quality at the commencement of times;

(i) to check and certify the laboratory and field tests carried out by the Bidder and also carry out independent tests, if required. The report of such test shall be submitted to the Engineer-in-Charge within a period of 7 days of such tests.

(j) to issue completion certificate of part or all the works;

(k) to inspect the works during the construction period and the Defects Liability Period, and to issue Defects Liability Certificates after rectification by the Bidder of defects notified to him by the Engineer;

(l) to advise the Employer on all matter relating to execution of the works and claims from the Bidder, and to make recommendations thereon, including the possible recourse to arbitration;

(m) to approve the setting out the works;

(n) to approve materials and sources of materials;

(o) to instruct the removal from the site of materials which are not as per specifications or reconstruction of parts of the works which do not comply with the specification;

(p) to issue monthly progress reports;

(q) to issue interim payment certificates for works carried out by the Bidder, and certify completion of parts or the totality of the works (payments are to be recorded in the measurement book before issue of interim certificates);

(r) to assist the Employer in providing clarification/explanation to observations made, from time to time by the Accountant General's office/Auditors.

**B-3. ACTIONS REQUIRING SPECIFIC APPROVAL OF THE EMPLOYER**

The Engineer will be required to obtain the specific approval of the Employer before taking any of the following actions:

a) approving subcontracting of any parts of the Works;

b) certifying additional cost;

c) determining an extension of time;

d) issuing a variation order, except
i. in an emergency situation, as reasonably determined by the Engineer as per OPWD Code.
ii. when there is no financial impact;
e) fixing rates or prices;
f) approving programme for execution of works; and,
g) suspension of works

B-4. DUTIES & RESPONSIBILITIES OF THE LEAD PROJECT ENGINEER

The duties of the Lead Project Engineer of the bidder (Contractor) are, to supervise construction of the works and, to test and examine any material to be used or workmanship employed in connection with the works. The principal responsibilities of the Lead Project Engineer of the bidder (Contractor) are likely to be as follows:

1. to ensure that the construction work is accomplished in accordance with the technical specifications and Contract Condition;
2. to identify construction problems and delays and to recommend to the Engineer, actions to expedite progress
3. to ensure proper keeping of records
4. to monitor and check the day-to-day quality control and quantity measurements of the work carried out under the Contract and prepare the monthly payment certificates.
5. to prepare in consultation with the Employer, a Construction Supervision Manual outlining routine and procedures to be applied in contract management, construction supervision and administration;
6. to prepare a maintenance manual outlining the routines to be adopted in each specific reach and for the cross-drainage works and buildings;
7. to comply with his contractual obligations in executing work in all matters concerning safety and care of the works (including the erection of temporary signs) and, if required, to request the Bidder to provide any necessary lights, guards, fencing and watchmen for smooth and effective working and traffic flow.
8. to write a day-by-day project diary which shall record all events pertaining to the administration of the contract, request forms and orders given to the Bidder, and any other information which may at a later date be of assistance in resolving queries which may arise concerning execution of the works;

C) DATA, SERVICES AND FACILITIES TO BE PROVIDED BY THE EMPLOYER

Attention is drawn to the following which are not provided by the Employer and are to be arranged by the Bidder at his own cost.

- The Government of Odisha will not provide office accommodation. The Bidder shall make his own office accommodation arrangements for their office staff for each of the field supervision teams including furniture, equipment, operation and maintenance.
- The Government of Odisha will not provide project vehicles to the Bidder. The Bidder shall make his own arrangements in respect of vehicles. The Bidder shall ensure that vehicles for the team are of good makes and are of excellent working condition.
The Bidder shall be responsible for making his own arrangements for survey equipment.

The Bidder shall be responsible for making his own arrangements for communications.

**Site Laboratories:** The site laboratories (including furniture, equipment, running and maintenance) shall be provided by the Bidder, the cost of which is inclusive in this turn-key contract. The laboratory equipment shall be as specified and as required by the Engineer.

**D-1. REPORTING REQUIREMENTS**

The Lead Project Engineer of the bidder (Contractor) in charge of the building site shall prepare and submit to the Engineer five copies each of the following reports:

(i) **Monthly Reports:** The Lead Project Engineer of the bidder (Contractor) shall, no later than the 10th of each month, prepare a brief progress report summarizing the progress of the construction contract. The report shall outline any problem encountered (administrative, technical or financial) and give recommendations on how these problems may be overcome. The report should record the status of payment.

(ii) **Quarterly/Annual Reports:** The Lead Project Engineer of the bidder (Contractor) shall prepare a comprehensive report summarizing all activities annually. Such reports shall summarize the progress of the Contract, all contract variations and change orders, the status of Bidder claims, if any, brief descriptions of the technical and contractual problems encountered and Engineer's / Employer's suggestions on how to overcome those, financial status of the Contract as a whole consisting of the costs incurred and costs forecast, as well as financial plan (by the Employer) and other relevant information for the ongoing Contract.

(iii) **Sectional/Final Completion Report:** The Lead Project Engineer of the bidder (Contractor) shall prepare a comprehensive Final Completion Report for the Contract when it reaches a stage of substantial completion during the period of the services. Completion Reports must also be submitted immediately after the taking over of each Section or part of the Permanent Works. The Reports shall summarize the method of construction and supervision and recommendations for future projects of similar nature to be undertaken by the employer.

Besides the above, five copies each of Construction Supervision and Maintenance Manuals are to be submitted along with the Final Completion Report.

**D-2. DOCUMENTS PREPARED SHALL BE THE PROPERTY OF THE EMPLOYER**

All plans, drawings, specifications, designs, reports and other documents (both computer hard copies and soft copies) prepared by the Bidder in performing the works shall
become and remain the property of the Employer, and the Bidder shall, not later than upon termination or expiration of this Contract, deliver all such documents to the Client, together with a detailed inventory thereof. The Bidder may retain a copy of such documents but shall not use these documents for purposes unrelated to this Contract without the prior written approval of the Client.

E-1. PAYMENT SCHEDULE

Out of the agreement amount, the design including preparation of DPR cost shall be 1.5%, construction cost 89% & maintain ace is 9.5%. The client shall effect payments to Bidder in accordance with the following schedule.

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Particulars</th>
<th>Weightage to the contract price</th>
<th>Mode of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design &amp; Drawings</td>
<td>1.50%</td>
<td>After approval</td>
</tr>
<tr>
<td>2</td>
<td>Retaining wall along river bed</td>
<td>19.55%</td>
<td>Unit of measurement is Rmt. Payment will be made on prorate basis on completion of 10% of total quantity.</td>
</tr>
<tr>
<td>3</td>
<td>Retaining wall along in landscape area (to retain filling earth)</td>
<td>4.80%</td>
<td>Unit of measurement is Rmt. Payment will be made on prorate basis on completion of 10% of total quantity.</td>
</tr>
<tr>
<td>4</td>
<td>Hardscape (CC pavement, Paver block, grass paver, Tile surface, ramp, steps, ghaat step, planter bed, rotary, kerb stone, railing along river retaining wall, sculpture etc.)</td>
<td>18.00%</td>
<td>Unit of measurement is Sqm/Rmt/ nos depending the items. Payment will be made on prorate basis on completion of 10% of total quantity.</td>
</tr>
<tr>
<td>5</td>
<td>Landscape, shrubs, trees</td>
<td>4.50%</td>
<td>Unit of measurement is Sqm landscaping &amp; shrubs and in numbers for trees. Payment will be made on prorate basis on completion of 10% of total quantity.</td>
</tr>
<tr>
<td>6</td>
<td>Landscape furniture (dust bin, benches, signages, play equipment's)</td>
<td>0.50%</td>
<td>Unit of measurement is nos of item installed.</td>
</tr>
<tr>
<td>7</td>
<td>Buildings</td>
<td>10.00%</td>
<td>Unit of measurement is number of buildings completed.</td>
</tr>
<tr>
<td>8</td>
<td>Boundary wall, fencing &amp; gate</td>
<td>1.00%</td>
<td>Unit of measurement is Rmt. Payment will be made on prorate basis on completion of 10% of total quantity.</td>
</tr>
<tr>
<td>9</td>
<td>Stainless steel prefab toilet including all</td>
<td>2.00%</td>
<td>Payment will be made</td>
</tr>
<tr>
<td>Item no.</td>
<td>Particulars</td>
<td>Weightage to the contract price</td>
<td>Mode of measurement</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------</td>
<td>---------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>civil works</td>
<td></td>
<td>after completion in all respect.</td>
</tr>
<tr>
<td>10</td>
<td>Adventure sports</td>
<td>0.40%</td>
<td>Unit of measurement is nos of item installed.</td>
</tr>
<tr>
<td>11</td>
<td>Steel Bridge</td>
<td>5.00%</td>
<td>Payment will be made after completion in all respect.</td>
</tr>
<tr>
<td>12</td>
<td>Musical Fountain</td>
<td>2.30%</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Decorative Tower</td>
<td>1.80%</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Floating Jetty</td>
<td>0.50%</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>MS Trellies</td>
<td>0.20%</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Water Supply</td>
<td>2.70%</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Electrical</td>
<td>11.80%</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>ICT</td>
<td>0.90%</td>
<td>Unit of measurement is number of equipment’s installed.</td>
</tr>
<tr>
<td>19</td>
<td>Fire fighting equipment’s</td>
<td>0.06%</td>
<td>Unit of measurement is number of equipment’s installed.</td>
</tr>
<tr>
<td>20</td>
<td>On Completion</td>
<td>3.00%</td>
<td>Payment will be made after completion of project in all respect.</td>
</tr>
<tr>
<td>21</td>
<td>Operation &amp; Maintenance for Five years</td>
<td>9.50%</td>
<td>Payment will as per note no.2</td>
</tr>
</tbody>
</table>

Note:
1. For Item no. 2 to 19, further sub breakup can be considered with mutual consent after approval of concept design.
2. Item no. 21: Operation & Maintenance:
   1st year: 15%
   2nd year: 18%
   3rd year: 20%
   4th Year: 22%
   5th year: 25%
   Payment will be made on equal monthly basis for each year.
   In addition to this contractor will be reimbursed towards the expense of electricity bill and diesel consumption on actual basis on submission of bill and payment receipt.

E-2. PROCEDURE FOR PAYMENT
The Bidder shall submit all bills to the Engineer who will process the bills for payment after due scrutiny of work actually completed including their quality aspects as per the latest IRC/NBC/ BIS guidelines and as per Schedule of Finishes, Technical Specification.

However, in no case, the total cost of payment shall exceed the Lump Sum Contract Value for which the agreement is signed except change in scope, compensation or bonus etc. as admissible as per the contract.

Detail Project/ Work accounts will be kept by the concerned Divisional Accountant, who shall perform his duties as per rules of OPWD Code. All bills furnished by the
bidder shall be routed through the Divisional Accountant to the Executive Engineer for payment.
APPENDIX -I

FORMAT FOR POWER OF ATTORNEY FOR SIGNING OF APPLICATION

(REFER CLAUSE 4.3.5)

Know all men by these presents, We…………………………………………….. (name of the firm and address of the registered office) do hereby irrevocably constitute, nominate, appoint and authorise Mr/ Ms (name), ....................... son/daughter/wife of ........................................... and presently residing at ........................., who is presently employed with us/ the Lead Member of our Joint Venture and holding the position of ................................., as our true and lawful attorney (hereinafter referred to as the “Attorney”) to do in our name and on our behalf, all such acts, deeds and things as are necessary or required in connection with or incidental to submission of our application for qualification and submission of our bid for the [Development of Brahmani Riverfront Project] on Turnkey Project proposed or being developed by the Rourkela Smart City Limited, Rourkela through the Chief Executive Officer, Rourkela Smart City Limited, Rourkela (the “Employer”) including but not limited to signing and submission of all applications, bids and other documents and writings, participate in Pre-Applications and other conferences and providing information/ responses to the Employer, representing us in all matters before the Employer, signing and execution of all contracts including the Turnkey Project and undertakings consequent to acceptance of our bid, and generally dealing with the Employer in all matters in connection with or relating to or arising out of our bid for the said Project and/ or upon award thereof to us and/or till the entering into of the Turnkey Project with the Employer.

AND we hereby agree to ratify and confirm and do hereby ratify and confirm all acts, deeds and things done or caused to be done by our said Attorney pursuant to and in exercise of the powers conferred by this Power of Attorney and that all acts, deeds and things done by our said Attorney in exercise of the powers hereby conferred shall and shall always be deemed to have been done by us.

IN WITNESS WHEREOF WE, ................................., THE ABOVE NAMED PRINCIPAL HAVE EXECUTED THIS POWER OF ATTORNEY ON THIS ........... DAY OF ............. 2020.

For ........................................

(Signature, name, designation and address)

Witnesses:

1.

(Notarised)

2.

Appendix I

Page 2

Accepted

.................................

(Signature)
(Name, Title and Address of the Attorney)

Notes:

- The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and when it is so required, the same should be under common seal affixed in accordance with the required procedure.

- Wherever required, the Applicant should submit for verification the extract of the charter documents and documents such as a board or shareholders’ resolution/ power of attorney in favour of the person executing this Power of Attorney for the delegation of power hereunder on behalf of the Applicant.
APPENDIX II

FORMAT FOR POWER OF ATTORNEY FOR LEAD MEMBER OF JOINT VENTURE

(Refer Clause 4.3.5)

Whereas the Rourkela Smart City Limited through the Chief Executive Officer (“the Employer”) has invited applications from interested parties for the (“Development of Brahmani Riverfront Project at ABD Area of Rourkela”) on Turnkey Project (the “Project”).

Whereas, …………………….., …………………….., …………………….. and …………………….. (collectively the “Joint Venture”) being Members of the Joint Venture are interested in bidding for the Project in accordance with the terms and conditions of the Standard Bidding Document (SBD) and other connected documents in respect of the Project, and

Whereas, it is necessary for the Members of the Joint Venture to designate one of them as the Lead Member with all necessary power and authority to do for and on behalf of the Joint Venture, all acts, deeds and things as may be necessary in connection with the Joint Venture’s bid for the Project and its execution.

NOW THEREFORE KNOW ALL MEN BY THESE PRESENTS

We, …………………….. having our registered office at …………………….., M/s. …………………….. having our registered office at …………………….., M/s. …………………….. having our registered office at …………………….., and …………………….. (collectively referred to as the “Principals”) do hereby irrevocably designate, nominate, constitute, appoint and authorise M/S …………………….. having its registered office at …………………….., being one of the Members of the Joint Venture, as the Lead Member and true and lawful attorney of the Joint Venture (hereinafter referred to as the “Attorney”).

We hereby irrevocably authorise the Attorney (with power to sub-delegate) to conduct all business for and on behalf of the Joint Venture and any one of us during the bidding process and, in the event the Joint Venture is awarded the contract, during the execution of the Project and in this regard, to do on our behalf and on behalf of the Joint Venture, all acts, deeds and things as may be necessary or required or incidental to the qualification of the Joint Venture and submission of its bid for the Project, including but not limited to signing and submission of all applications, bids and other documents and writings, participate in bidders and other conferences, respond to queries, submit information/documents, sign and execute contracts and undertakings consequent to acceptance of the bid of the Joint Venture and generally to represent the Joint Venture in all its dealings with the Employer, and/ or any other Government Agency or any person, in all matters in connection with or relating to or arising out of the Joint Venture’s bid for the Project and/ or upon award thereof till the EPC Contract is entered into with the Employer.

AND hereby agree to ratify and confirm and do hereby ratify and confirm all acts, deeds and things done or caused to be done by our said Attorney pursuant to and in exercise of the powers conferred by this Power of Attorney and that all acts,

Appendix II
Page 2

deeds and things done by our said Attorney in exercise of the powers hereby conferred shall and shall always be deemed to have been done by us/ Joint Venture.
IN WITNESS WHEREOF WE THE PRINCIPALS ABOVE NAMED HAVE EXECUTED THIS POWER OF ATTORNEY ON THIS ………………….. DAY OF ………. 2020

For ………………………
   (Signature)
   ………………………
   (Name & Title)

For ………………………
   (Signature)
   ………………………
   (Name & Title)

For ………………………
   (Signature)
   ………………………
   (Name & Title)

Witnesses:
1. ……………………………
2. ……………………………
………………………………………
(Executants)
(To be executed by all the Members of the Joint Venture)

Notes:

- The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and when it is so required, the same should be under common seal affixed in accordance with the required procedure.

- Also, wherever required, the Applicant should submit for verification the extract of the charter documents and documents such as a board or shareholders’ resolution/ power of attorney in favour of the person executing this Power of Attorney for the delegation of power hereunder on behalf of the Applicant.
APPENDIX III
FORMAT FOR JOINT BIDDING AGREEMENT FOR JOINT VENTURE
(Refer Clause 4.3.6)
(To be executed on Stamp paper of appropriate value)

THIS JOINT BIDDING AGREEMENT is entered into on this the ............ day of ............
20...

AMONGST

1. {............ Limited, a company incorporated under the Companies Act, 1956/2013}
and having its registered office at ............ (hereinafter referred to as the “First Part”
which expression shall, unless repugnant to the context include its successors and
permitted assigns)

AND

2. {............ Limited, a company incorporated under the Companies Act, 1956/2013}
and having its registered office at ............ (hereinafter referred to as the “Second
Part” which expression shall, unless repugnant to the context include its successors
and permitted assigns)

WHEREAS,

(A) THE Rourkela Smart City Limited, Rourkela represented through the Chief
Executive Officer, and having its offices at Office of the Chief Executive Officer, Rourkela
Smart City Limited, Rourkela Smart City Limited, Udit Nagar, Rourkela-769012,Odisha
(hereinafter referred to as the “Employer” which expression shall, unless repugnant to the
context or meaning thereof, include its administrators, successors and assigns) has invited
applications (the “Applications”) by its Invitation for Bids (IFB) with Bid Identification No.
......................... dated ..................(the “SBD”) for qualification of bidders
(“Development of Brahmani Riverfront Project at ABD Area of Rourkela)
Turnkey Basis (the “Project”) through a Turnkey Contract.

(B) The Parties are interested in jointly bidding for the Project as members of a Joint
Venture and in accordance with the terms and conditions of the Bid document and
other bid documents in respect of the Project, and

(C) It is a necessary condition under the Bid document that the members of the Joint
Venture shall enter into a Joint Bidding Agreement and furnish a copy thereof with the
Application.

NOW IT IS HEREBY AGREED as follows:

1. Definitions and Interpretations

In this Agreement, the capitalised terms shall, unless the context otherwise requires,
have the meaning ascribed thereto under the Bid.

2. Joint Venture

2.1 The Parties do hereby irrevocably constitute a Joint Venture (the “Joint Venture”) for
the purposes of jointly participating in the Bidding Process for the Project.
2.2 The Parties hereby undertake to participate in the Bidding Process only through this Joint Venture and not individually and/or through any other Joint Venture constituted for this Project, either directly or indirectly.
Appendix III
Page 2

3. Covenants

The Parties hereby undertake that in the event the Joint Venture is declared the selected Bidder and awarded the Project, it shall enter into a Turnkey Contract with the Employer for performing all its obligations as the Contractor in terms of the Turnkey Contract for the Project.

4. Role of the Parties

The Parties hereby undertake to perform the roles and responsibilities as described below:

(a) Party of the First Part shall be the Lead member of the Joint Venture and shall have the power of attorney from all Parties for conducting all business for and on behalf of the Joint Venture during the Bidding Process and until the Appointed Date under the Turnkey Contract;

(b) Party of the Second Part shall be {the Member of the Joint Venture; and}

5. Joint and Several Liability

The Parties do hereby undertake to be jointly and severally responsible for all obligations and liabilities relating to the Project and in accordance with the terms of the Bid and the Turnkey Contract, till such time as the completion of the Project is achieved under and in accordance with the Turnkey Contract.

6. Share of work in the Project

The Parties agree that the proportion of construction in the Turnkey Contract to be allocated among the members shall be as follows:
First Party:
Second Party:
Further, the Lead Member shall itself undertake and perform at least 50 (Fifty) per cent of the total project if the Contract is allocated to the Joint Venture.

7. Representation of the Parties

Each Party represents to the other Parties as of the date of this Agreement that:

(a) Such Party is duly organised, validly existing and in good standing under the laws of its incorporation and has all requisite power and authority to enter into this Agreement;

(b) The execution, delivery and performance by such Party of this Agreement has been authorised by all necessary and appropriate corporate or governmental action and a copy of the extract of the charter documents and board resolution/ power of attorney in favour of the person executing this Agreement for the delegation of power and authority to execute this Agreement on behalf of the Joint Venture Member is annexed to this Agreement, and will not, to the best of its knowledge:

(i) require any consent or approval not already obtained;

(ii) violate any Applicable Law presently in effect and having applicability to it;
Appendix III
Page 3

(iii) violate the memorandum and articles of association, by-laws or other applicable organisational documents thereof;

(iv) violate any clearance, permit, concession, grant, license or other governmental authorisation, approval, judgment, order or decree or any mortgage agreement, indenture or any other instrument to which such Party is a party or by which such Party or any of its properties or assets are bound or that is otherwise applicable to such Party; or

(v) create or impose any liens, mortgages, pledges, claims, security interests, charges or Encumbrances or obligations to create a lien, charge, pledge, security interest, encumbrances or mortgage in or on the property of such Party, except for encumbrances that would not, individually or in the aggregate, have a material adverse effect on the financial condition or prospects or business of such Party so as to prevent such Party from fulfilling its obligations under this Agreement;

(c) this Agreement is the legal and binding obligation of such Party, enforceable in accordance with its terms against it; and

(d) there is no litigation pending or, to the best of such Party’s knowledge, threatened to which it or any of its Affiliates is a party that presently affects or which would have a material adverse effect on the financial condition or prospects or business of such Party in the fulfilment of its obligations under this Agreement.

8. Termination

This Agreement shall be effective from the date hereof and shall continue in full force and effect until Project completion (the “Defects Liability Period”) is achieved under and in accordance with the Turnkey Contract, in case the Project is awarded to the Joint Venture. However, in case the Joint Venture is either not qualified for the Project or does not get selected for award of the Project, the Agreement will stand terminated in case the Applicant is not pre-qualified or upon return of the Bid Security by the Employer to the Bidder, as the case may be.

9. Miscellaneous

9.1 This Joint Bidding Agreement shall be governed by laws of {India/ Odisha}.

9.2 The Parties acknowledge and accept that this Agreement shall not be amended by the Parties without the prior written consent of the Employer.
IN WITNESS WHEREOF THE PARTIES ABOVE NAMED HAVE EXECUTED AND DELIVERED THIS AGREEMENT AS OF THE DATE FIRST ABOVE WRITTEN.

SIGNED, SEALED AND DELIVERED

For and on behalf of

LEAD MEMBER by:

(Signature)  (Signature)
(Name)       (Name)
(Designation) (Designation)
(Address)    (Address)

In the presence of:

1. 

2. 

Notes:

1. The mode of the execution of the Joint Bidding Agreement should be in accordance with the procedure, if any, laid down by the Applicable Law and the charter documents of the executant(s) and when it is so required, the same should be under common seal affixed in accordance with the required procedure.

2. Each Joint Bidding Agreement should attach a copy of the extract of the charter documents and documents such as resolution / power of attorney in favour of the person executing this Agreement for the delegation of power and authority to execute this Agreement on behalf of the Joint Venture Member.

3. Clause Deleted.
Appendix IV
Page 1

Statement of Legal Capacity
(To be forwarded on the letterhead of the Applicant/ Lead Member of Joint Venture)

Ref. Date:
To,

Dear Sir,

We hereby confirm that we/ our members in the Joint Venture (constitution of which has been described in the application) satisfy the terms and conditions laid out in the Bidding document.

We have agreed that …………………… (insert member’s name) will act as the Lead Member of our Joint Venture.*

We have agreed that ………………….. (insert individual’s name) will act as our representative/ will act as the representative of the Joint Venture on its behalf* and has been duly authorized to submit the Bidding Document. Further, the authorised signatory is vested with requisite powers to furnish such letter and authenticate the same.

Thanking you,

Yours faithfully,

(Signature, name and designation of the authorised signatory)

For and on behalf of…………………………..

*Please strike out whichever is not applicable.
APPENDIX – V
BANK GUARANTEE FOR BID SECURITY
(Refer Clauses 16.1)

B.G. No. Dated:

1. In consideration of you, *** **, having its office at *** **, (hereinafter referred to as the “Authority”, which expression shall unless it be repugnant to the subject or context thereof include its, successors and assigns) having agreed to receive the BID of …………………… and having its registered office at ………………………… (and acting on behalf of its JV) (hereinafter referred to as the “Bidder” which expression shall unless it be repugnant to the subject or context thereof include its/their executors, administrators, successors and assigns), for the “Development of Brahmani Riverfront Project at ABD Area of Rourkela” on [Turnkey] basis (hereinafter referred to as “the Project”) pursuant to the Bid Document dated …………… issued in respect of the Project and other related documents including without limitation the draft contract Agreement (hereinafter collectively referred to as “Bidding Documents”), we (Name of the Bank) having our registered office at …………………… and one of its branches at …………………….. (hereinafter referred to as the “Bank”), at the request of the Bidder, do hereby in terms of Clause 16.1 of the Bidding Document, irrevocably, unconditionally and without reservation guarantee the due and faithful fulfilment and compliance of the terms and conditions of the Bidding Documents (including the Bidding Document) by the said Bidder and unconditionally and irrevocably undertake to pay forthwith to the Authority an amount of Rs. 40 Lakhs (Rupees forty Lakhs only) (hereinafter referred to as the “Guarantee”) as our primary obligation without any demur, reservation, recourse, contest or protest and without reference to the Bidder if the Bidder shall fail to fulfil or comply with all or any of the terms and conditions contained in the said Bidding Documents.

2. Any such written demand made by the Authority stating that the Bidder is in default of the due and faithful fulfilment and compliance with the terms and conditions contained in the Bidding Documents shall be final, conclusive and binding on the Bank.

3. We, the Bank, do hereby unconditionally undertake to pay the amounts due and payable under this Guarantee without any demur, reservation, recourse, contest or protest and without any reference to the Bidder or any other person and irrespective of whether the claim of the Authority is disputed by the Bidder or not, merely on the first demand from the Authority stating that the amount claimed is due to the Authority by reason of failure of the Bidder to fulfil and comply with the terms and conditions contained in the Bidding Documents including failure of the said Bidder to keep its BID open during the BID validity period as set forth in the said Bidding Documents for any reason whatsoever. Any such demand made on the Bank shall be conclusive as regards amount due and payable by the Bank under this Guarantee. However, our liability under this Guarantee shall be restricted to an amount not exceeding Rs. 40.00 Lakhs (Rupees forty Lakhs only).

4. This Guarantee shall be irrevocable and remain in full force for a period of 180 (one hundred and eighty) days from the BID Due Date inclusive of a claim period of 60 (sixty) days or for such extended period as may be mutually agreed between the Authority and the Bidder, and agreed to by the Bank, and shall continue to be enforceable till all amounts under this Guarantee have been paid.

5. We, the Bank, further agree that the Authority shall be the sole judge to decide as
to whether the Bidder is in default of due and faithful fulfilment and compliance with the terms and conditions contained in the Bidding Documents including, inter alia, the failure of the Bidder to keep its BID open during the BID validity period set forth in the said Bidding Documents, and the decision of the Authority that the Bidder is in default as aforesaid shall be final and binding on us, notwithstanding any differences between the Authority and the Bidder or any dispute pending before any Court, Tribunal, Arbitrator or any other Authority.

6. The Guarantee shall not be affected by any change in the constitution or winding up of the Bidder or the Bank or any absorption, merger or amalgamation of the Bidder or the Bank with any other person.

7. In order to give full effect to this Guarantee, the Authority shall be entitled to treat the Bank as the principal debtor. The Authority shall have the fullest liberty without affecting in any way the liability of the Bank under this Guarantee from time to time to vary any of the terms and conditions contained in the said Bidding Documents or to extend time for submission of the BIDs or the BID validity period or the period for conveying acceptance of Letter of Award by the Bidder or the period for fulfilment and compliance with all or any of the terms and conditions contained in the said Bidding Documents by the said Bidder or to postpone for any time and from time to time any of the powers exercisable by it against the said Bidder and either to enforce or forbear from enforcing any of the terms and conditions contained in the said Bidding Documents or the securities available to the Authority, and the Bank shall not be released from its liability under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the said Bidder or any other forbearance, act or omission on the part of the Authority or any indulgence by the Authority to the said Bidder or by any change in the constitution of the Authority or its absorption, merger or amalgamation with any other person or any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect of releasing the Bank from its such liability.

8. Any notice by way of request, demand or otherwise hereunder shall be sufficiently given or made if addressed to the Bank and sent by courier or by registered mail to the Bank at the address set forth herein.

9. We undertake to make the payment on receipt of your notice of claim on us addressed to our branch at Rourkela (address and Email of Rourkela Branch) and delivered at our above branch which shall be deemed to have been duly authorised to receive the said notice of claim & make the payment.

10. It shall not be necessary for the Authority to proceed against the said Bidder before proceeding against the Bank and the guarantee herein contained shall be enforceable against the Bank, notwithstanding any other security which the Authority may have obtained from the said Bidder or any other person and which shall, at the time when proceedings are taken against the Bank hereunder, be outstanding or unrealised.

11. We, the Bank, further undertake not to revoke this Guarantee during its currency except with the previous express consent of the Authority in writing.

12. The Bank declares that it has power to issue this Guarantee and discharge the obligations contemplated herein, the undersigned is duly authorised and has full power to execute this Guarantee for and on behalf of the Bank.
13. For the avoidance of doubt, the Bank’s liability under this Guarantee shall be restricted to Rs. 40.00 Lakhs (Rupees forty Lakhs only). The Bank shall be liable to pay the said amount or any part thereof only if the Authority serves a written claim on the Bank in accordance with paragraph 9 hereof, on or before [*** (indicate date falling 180 days after the BID Due Date)].

Signed and Delivered by ………………………. Bank

By the hand of Mr./Ms …………………….., its ………………….. and authorised official.

(Signature of the Authorised Signatory)
(Official-Seal)

Chief Executive Officer
Rourkela Smart City Limited
Power Point Presentation on Approach & Methodology of Development of Brahmani Riverfront Project

<table>
<thead>
<tr>
<th>SL No</th>
<th>Parameter</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Architectural Plan, Concept, Schedule of Finishes (Site Plan showing entry and exit, Pathway landscaping, traffic movement plan, Retaining Wall with Bank Protection, Steps, Ghats, Planter Beds Tourist Attraction creativity etc)</td>
<td>50 Marks</td>
</tr>
<tr>
<td>2</td>
<td>Service Plans</td>
<td>30 Marks</td>
</tr>
<tr>
<td></td>
<td>Information &amp; Communication Technology</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Landscaping</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fire Fighting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electrical Works including decorative lights</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water Supply &amp; Plumbing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drainage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sculpture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Horticulture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Play Equipments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other Miscellaneous Work such as Floating Jetty, Musical Fountain, Adventure Sports, Tourist Attraction creativities.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Detailed project timelines Gantt Chart Schedule using relevant project management software Indicating milestone, mobilization Schedule of human resources and Equipment and Construction Schedule</td>
<td>20 Marks</td>
</tr>
</tbody>
</table>
### APPENDIX-VII

**MINIMUM DEVELOPMENT OBLIGATION FOR BRAHMANI RIVER DEVELOPMENT PROJECT**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retaining wall along river bed including bank protection</td>
<td>625 Rm</td>
</tr>
<tr>
<td>Retaining wall along in landscape area (to retain filling earth)</td>
<td>1121 Rm</td>
</tr>
<tr>
<td><strong>Hardscape</strong></td>
<td></td>
</tr>
<tr>
<td>Cement Concrete Pavement</td>
<td>8500 Sqm</td>
</tr>
<tr>
<td>Pebble flooring</td>
<td>150 Sqm</td>
</tr>
<tr>
<td>Paver block</td>
<td>7455 Sqm</td>
</tr>
<tr>
<td>Grass paver</td>
<td>114 Sqm</td>
</tr>
<tr>
<td>Ramp</td>
<td>500 Rm</td>
</tr>
<tr>
<td>Step</td>
<td>As per tender drawing</td>
</tr>
<tr>
<td>Ghaat Step</td>
<td>As per tender drawing</td>
</tr>
<tr>
<td>Planter bed</td>
<td>As per tender drawing</td>
</tr>
<tr>
<td>Rotary</td>
<td>As per tender drawing</td>
</tr>
<tr>
<td>Cement Concrete bench with granite cladding</td>
<td>As per tender drawing</td>
</tr>
<tr>
<td>Railing along river retaining wall</td>
<td>625 Rm</td>
</tr>
<tr>
<td>Kota stone surface</td>
<td>3400 Sqm</td>
</tr>
<tr>
<td>Sculpture</td>
<td>10 Nos</td>
</tr>
<tr>
<td>MS structure for Tropiary</td>
<td>12 Nos</td>
</tr>
<tr>
<td>Drainage</td>
<td>Complete work as per approved design</td>
</tr>
<tr>
<td><strong>Landscape</strong></td>
<td></td>
</tr>
<tr>
<td>Grass</td>
<td>24600 Sqm</td>
</tr>
<tr>
<td>Shrub</td>
<td>9800 Sqm</td>
</tr>
<tr>
<td>Trees</td>
<td>2690 Nos</td>
</tr>
<tr>
<td><strong>Landscape furniture (dust bin, benches, sign ages, play equipments)</strong></td>
<td></td>
</tr>
<tr>
<td>Dust bin</td>
<td>200 nos</td>
</tr>
<tr>
<td>FRP Benches</td>
<td>50 Nos</td>
</tr>
<tr>
<td>Sign ages</td>
<td>As per drawing</td>
</tr>
<tr>
<td><strong>Buildings</strong></td>
<td></td>
</tr>
<tr>
<td>Guard room</td>
<td>1 Nos</td>
</tr>
<tr>
<td>Workshop Building</td>
<td>1 no</td>
</tr>
<tr>
<td>Shops</td>
<td>36 Nos</td>
</tr>
<tr>
<td>Ticket Counter</td>
<td>2 Nos</td>
</tr>
<tr>
<td>Gazebo</td>
<td>10 Nos</td>
</tr>
<tr>
<td><strong>Boundary wall, fencing &amp; gate</strong></td>
<td></td>
</tr>
<tr>
<td>Boundary wall</td>
<td>150 m</td>
</tr>
<tr>
<td>Particulars</td>
<td>Qty</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>Chain link fencing</td>
<td>1000 Rm</td>
</tr>
<tr>
<td>Stainless steel prefab toilet including all</td>
<td></td>
</tr>
<tr>
<td>civil works</td>
<td></td>
</tr>
<tr>
<td>Four Blocks and each block is having following</td>
<td></td>
</tr>
<tr>
<td>units</td>
<td></td>
</tr>
<tr>
<td>Male WC unit with wash basin (3 Nos).</td>
<td></td>
</tr>
<tr>
<td>Female WC unit with wash basin (3 Nos).</td>
<td></td>
</tr>
<tr>
<td>Urinal unit with 3 wash basin &amp; 4 urinal (1 Nos)</td>
<td></td>
</tr>
<tr>
<td>Adventure sports</td>
<td>As per scope</td>
</tr>
<tr>
<td>Steel Bridge</td>
<td>Complete Job</td>
</tr>
<tr>
<td>Musical Fountain</td>
<td>Complete Job</td>
</tr>
<tr>
<td>Decorative Tower</td>
<td>Complete Job - 4 nos</td>
</tr>
<tr>
<td>Floating Jetty</td>
<td>250 Sqm</td>
</tr>
<tr>
<td>MS Trellis</td>
<td>Complete job</td>
</tr>
<tr>
<td>PHE (Water supply, soak pit, sewerage )</td>
<td>Complete job as per scope</td>
</tr>
</tbody>
</table>

**Electrical Work**

<table>
<thead>
<tr>
<th>ICT</th>
<th>Complete as per scope and design criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bullet Camera - 2MP Outdoor</td>
<td>20 nos</td>
</tr>
<tr>
<td>128 Channel NVR (with 60 TB Storage 30 Days)</td>
<td>1 no</td>
</tr>
<tr>
<td>Client Workstation</td>
<td>1 no</td>
</tr>
<tr>
<td>Automatic Ticket Dispenser - 2 no</td>
<td></td>
</tr>
</tbody>
</table>

**Fire fighting equipments**

| Dry Chemical Powder Fire Extinguisher 6 Kg      | 40 nos                                    |
| capacity - 10 nos                              |                                         |
| Carbon dioxide (CO2) Fire Extinguisher 4.5 Kgs  |                                         |

**Design & Drawings**

| Complete works                                 |                                         |

**Operation & Maintenance for Five years (Fixed)**

| Complete works as per scope                    |                                         |

The above data are the minimum requirement which contractor has to provide. However the contractor has to carry out all the works as per the approved drawings. Any changes in quantity does not lead to any scope deviation.

_I/We certify that the work / equipment's offered above meet the Minimum Development Obligations as per the Scope of Work & Technical Specification provided in Vol-II._

**Signature of Authorised Signatory of**

**Bidder/**

**Venture/Consortium**

**Lead Member of Joint**
SCOPE OF WORKS & SPECIFICATIONS

For

Redevelopment of Brahmani River Front - Rourkela

OWNER: ROURKELA SMART CITY LIMITED
1.1. General

The work specified hereinabove shall be treated as an approximate assessment. The actual works as required on the basis of detailed topographical survey, Geotechnical investigation and design shall be determined by the Contractor in accordance with the Specifications and Standards and approval by employer. Any change in quantity will not be treated as deviation unless any additional work instructed by employer in writing.

The Contractor shall establish a design liaison office at site within 28 days from the Commencement Date to facilitate preparation and submission of designs, drawings, construction documents, etc., for review and approval by the Employer's Representative. The design liaison office shall preferably be located near the Employer's office to facilitate communications and frequent interactions with the Employer's Representative and the Employer. The Contractor shall provide full-time design staff and continuously maintain the design liaison office until such time as all necessary designs and Construction Documents have been completed, reviewed, and approved by the Employer's Representative. The Contractor will be fully responsible for ensuring that its designs, drawings, and construction documents satisfy all requirements for constructing Works that are complete and fully functional in all respects.

Contractor shall be responsible for making the facility fit for the intended purpose while performing all of its obligations covered under the Contract Document in its entirety. The work shall be done in accordance to the drawings approved by the statutory authorities.

Currently tender drawings and Design Criteria, Brief Technical Specifications for certain items of work are available. Scope includes further detailing, as deemed necessary (without changing the layout concept), developing required specifications, preparing Good for Construction (GFC), coordinated drawings and construct entire campus in accordance with the same. The scope shall also include preparation of as-built drawings before handing over the work to the Employer.

Maintaining the Quality assurance & Quality control (QA&QC) including control, corrective actions, reporting and arranging for regular inspections by all concerned.

The Scope of work consists of Design, Engineering & construction of Brahmani Riverfront Development Project.

The Architecture, Interiors scope includes design, detailing, demolishing of existing encroached structure as per the proposed master plan, procure, supply, construction, installation, furnishing, equipping, testing, commissioning and execution for “Redevelopment of Brahmani River Front” that includes boundary wall, entry gate, hard scape, softscape, installation of play and adventure...
equipment’s, retaining wall, erection of kiosk, food court and connecting bridge between pocket 1 and 2 along with allied services, internal road, hard-scaping and soft-scaping in accordance with the Employer’s Requirements. Design and detailing shall include:

- Appointment of consultants
- Preparation of coordinated GFC drawings
- Obtaining Employers / PMC''s approval on the GFC drawings
- Preparation of approval drawings, documents, calculations, etc, as may be necessary by the statutory authorities, at the relevant stages
- Providing material samples and mock-ups and obtaining Employers / PMC''s approval for the same
- Preparation of As-built drawings

Procurement, supply, construction, installation, furnishing, equipping, testing and commissioning shall be carried out for the following works:

- Demolishing work of existing encroached structure
- Masonry
- Plastering
- Painting
- Flooring And finishing
- GRC Works
- Fabrication works
- Specialised flooring if any other than that specified in schedule of Finishes
- Painting other than that specified in schedule of Finishes
- Good garden earth & manure
- Trees, shrubs, ground covers, lawns, terrace garden
- Irrigation system
- Fountain system
- Gates including automation

Contractor has to follow the concept layout provided in tender. Unless other wise approved by employer, contractor is not allowed to do any changes in the layout.

1.2. ARCHITECTURAL DESIGN CRITERIA

The contractor shall prepare architectural design of all the components and get it approved prior to start the detailed design of the works. The area and facility requirements have been provided below for all zones/pockets.
1.2.1. Pocket 1: 7583 sqm

1. Entry and exit gates  
2. Pedestrian bridge between pocket 1 and 2  
3. Food court  
4. Ticket facilities  
5. Gazebos  
6. Hardscape  
7. Softscape  
8. Adventure equipment's  
9. Irrigation and drainage system  
10. Lighting and electric system  
11. Fire fighting equipments  
12. Signage and FRP dustbin  
13. Retaining walls  
14. Cutting and removing un-wanted trees and shrubs  
15. Toilets and drinking water facilities Cattle catcher  
16. Water Supply  
17. Boundary wall & Chain link fencing  
18. Cutting and filling of earth as per the proposed master plan  
19. Street furniture’s like seating benches  
20. Pathway  
21. Ramp for Differently abled  
22. Plaza  
23. Graffiti walls

1.2.2. Pocket 2: 16054 sqm

1. Landscape roundabout – as per the theme of adjoining park  
2. Development of river front plaza with steps and ramps.  
3. Entry gates  
4. Hardscape  
5. Softscape  
6. Irrigation and drainage system  
7. Lighting and electric system
8. Firefighting equipments
9. Signages and FRP dustbin
10. Retaining walls
11. Cutting and removing un-wanted trees and shrubs
12. Toilet and drinking water facilities
13. Water supply
14. Cattel catcher
15. Boundary wall & chain link fencing with tall shrubs buffer.
16. Cutting and filling of earth as per the proposed master plan
17. Street furniture like seating benches
18. Roads and Pathways
19. FRP sculpture
20. Protection and treatment of earth in slope

1.2.3. Pocket 3: 19752 Sqm

1. Parking facility
2. Extended parking facility
3. Sculpture Pavilion
4. Overlooking terraces
5. Sculptures
6. Musical fountain
7. Entry gates
8. Food court
9. Gazebos
10. Hardscape
11. Softscape
12. Irrigation and drainage system
13. Lighting and electric system
14. Firefighting system
15. Signages and FRP dustbin
16. Retaining walls
17. Cutting and removing un-wanted trees and shrubs
18. Toilet and drinking water facilities Water supply
19. Cattel catcher
20. Boundary wall & Chain link fencing with tall shrubs buffer
21. Cutting and filling of earth as per the proposed master plan
22. Street furniture's; like seating benches
23. Sand pit for play area & sand sculpture court
24. Children play equipments
25. Metal pergola and trallies
26. Ramps for differently abled
27. Shops
28. Roads and pathways
29. Repairing of existing roads
30. Protection and treatment of earth in slope

1.2.4. Pocket 4: 7080 Sqm

1. Site Clearance
2. Retrofitting of existing gazebos and steps
3. Development of new Ghats
4. boating facility with floating jetty
5. Entry gates
6. Hardscape
7. Softscape
8. Irrigation and drainage system
9. Lighting and electric system
10. Signages and dustbin
11. Retaining walls
12. Water supply
13. Boundary wall & chain link fencing with tall shrubs buffer
14. Cutting and filling of earth as per the proposed master plan
15. Street furniture's; like seating FRP benches and masonry with granite cladding.
16. Protection and treatment of earth in slope

1.2.5. Pocket 5: 8966 Sqm

1. Parking facility
2. Overlooking terraces
3. Entry gates
4. Food court
5. Hardscape
6. Softscape
7. Irrigation and drainage system
8. Lighting and electric system
9. Firefighting equipments
10. Signage and dustbin
11. Retaining walls
12. Cutting and removing un-wanted trees and shrubs
13. Toilet and drinking water facilities
14. Water supply
15. Cattle catcher
16. Boundary wall & chain link fencing with tall shrubs buffer
17. Cutting and filling of earth as per the proposed master plan
18. Street furniture’s; like seating benches
19. Protection and treatment of earth in slope

1.3. SPECIAL CONDITIONS

1.3.1. Elevation:
The elevation of buildings, bridge and boundary wall is designed using pallet of material and finishes. The elevation finishes shall be a combination of natural material available in market with a combination of painted surface or expose brick work, brick jali with expose concrete and glass, natural stone cladding etc.
The contractor may come up with more options for elevation in same line in line with the original proposal and standard bid document.

1.3.2. Look & feel of the project
The Contractor shall study the drawings, visualizations, specifications, material finishes indicated in the contract document and understand all parameters of the design including the architectural look & feel intent of the design consultants. The contractor shall clarify any doubts / discrepancies during the technical discussions with RSCL /consultants.
The contractor is bound to maintain and deliver the core and shell of the building and landscaped area as per the design intent of the consultants.
The final elevation, look and feel of overall development shall merge with each other.
1.3.3. **Construction Documents**

The Contractor shall provide multiple options of the design of necessary element of the Work for the Employers Representative to review along with Employer / RSCL and shall proceed further only after its approval and sign off. Related Construction activities shall not commence prior to approval of the same. Any minor modification or alteration to one design shall not be construed as “option of the design”.

The drawings issued along with the tender are based on the applicable statutory regulations and guidelines. In due course of time the RSCL shall issue the drawings approved by the statutory authorities for “commencement of works at site”, and these shall become the basis for preparation of the GFC drawings by the contractor. All development works shall confirm to, shall be designed and constructed / executed in compliance with the applicable statutory regulations and guidelines and comments received from the concerned statutory agencies.

1.3.4. **Approval Drawings / Documents For Subsequent Approvals**

Contractor shall prepare and submit approval drawings, documents, calculations, certificates, etc, as may be necessary by the statutory authorities, at the relevant stages. The contractor shall prepare and modify the GFC drawings based on the drawings approved by the statutory authorities.

1.3.5. **Construction Drawings / Documents Approval Process**

Contractor shall submit at least following number of sets for approval of Employer’s Representative.

A. Construction Documents - 05 sets
B. Samples, datasheets etc - 05 sets

Each of the submission should clearly identify the Work, purpose of the submission, document number etc. as approved in the procedure referred above. Upon review of the said submission Employer’s Representative shall return the submission with following codes

a. Work may proceed.
b. Revise and Resubmit. Work may proceed subject to resolution of indicated comments.
c. Revise and Resubmit. Work may not proceed.
d. Review not required. Work may proceed.

Although Work may proceed on receipt of a drawing coded 2, Contractor must resolve the comments indicated, resubmit and obtain a Code 1 before release for shipment or completion of the affected Work.

Employer/ Employer’s Representative and Consultant/RSCL’s review and permission to proceed does not constitute acceptance or approval of submittals including, but not limited to, design details, calculations, analyses, test methods, construction methods, plans, certificates or materials developed or selected by Contractor and does not relieve Contractor from full compliance with the Contract requirements.
1.3.6. Technical Standards And Regulations
Contractor shall refer and implement all relevant and all applicable codes, technical standards, regulations, as amended, required for performance of Work covered under this Contract. Also, all the conditions of statutory approval already taken by the Employer need to be complied during construction stage, the same need to be complied for future approval required if any.

1.3.7. Samples
Contractor shall necessarily submit samples of all finishing materials that may affect the look and feel of the project, especially those for which basic rates are indicated in the BOQ and where generic materials are indicated. Submission of samples shall not be limited to the above, and the Employer/ Employer’s Representative and Consultant/PMC reserves the right to demand any sample of materials, as deemed necessary.

Where samples are required, they shall be submitted by and at the expense of Contractor allowing at least fourteen (14) calendar days for review by Employer/ Employer’s Representative and Consultant/PMC unless otherwise shown on the Contract Schedule. The materials represented by such samples shall not be manufactured, delivered to the Site or incorporated into the Work without Employer/ Employer’s Representative and Consultant/PMC review.

Each sample shall bear a label showing Contractor's name, Work name, Contract number, name of the item, manufacturer's name, brand name, model number, supplier's name, and reference to the appropriate drawing number, technical specification section and paragraph number, all as applicable.

Samples, which have been reviewed, may at Employer’s option, are returned to Contractor for incorporation into the Work.

1.3.8. Mock-up
As deemed necessary by the Employer/Employer’s Representative/PMC, Contractor shall execute necessary mock-ups of all items/activities related to the Work performed required under this Contract as indicated below and the cost for the same shall be deemed to be included in the Contract price.

The following mock-ups shall be executed by the contractor:
<table>
<thead>
<tr>
<th>Item</th>
<th>Extent / Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Flooring tiles</td>
<td>0.6x0.6 SQM</td>
</tr>
<tr>
<td>2. Stamped concrete</td>
<td>1.0 x 1.0 SQM</td>
</tr>
<tr>
<td>3. Waste wood flooring</td>
<td>0.6 x 0.6 SQM</td>
</tr>
<tr>
<td>4. Stone cladding, Paint, brick jali including window glazing,</td>
<td>6.0 x 6.0 SQM</td>
</tr>
<tr>
<td>aluminium louvers, flashings and interface details</td>
<td></td>
</tr>
<tr>
<td>5. All finishing items including but not limited to toilets,</td>
<td>Toilets - 01 module including all fittings,</td>
</tr>
<tr>
<td>flooring, wall cladding, doors &amp; windows, false ceiling, etc.</td>
<td>fixtures and modular partitions</td>
</tr>
<tr>
<td></td>
<td>Hard &amp; soft finishes - approx 50 sqft, including all typical interfaces and</td>
</tr>
<tr>
<td></td>
<td>details.</td>
</tr>
<tr>
<td>6. Railings and other metal fabrication works</td>
<td>Min 2.0 RM including all types of details [ turns, bends, ends, etc ]</td>
</tr>
<tr>
<td>7. Pergola</td>
<td>3.0 x 3.0 M including all interface details</td>
</tr>
<tr>
<td>8. Polycarbonate Skylights</td>
<td>3.0 x 3.0 M including all interface details</td>
</tr>
</tbody>
</table>

1.3.9. **Documents At Site**

The contractor shall maintain in a conspicuous place on the site a copy of development permission and a copy of approved drawings and specifications.

As Built drawings

Progress As-Builts / GFC drawings.

During construction, Contractor shall keep a marked-up-to-date set of progress as-built / GFC drawings and specifications on the Site as an accurate record of all deviations between Work as shown and Work as installed. These drawings and specifications shall be available to Employer for inspection at any time during regular business hours.

Final As-Builts.

A. Contractor shall at his expense and not later than thirty (30) calendar days from Taking over Certificates and before Final Payment furnish to Employer a complete set of marked-up as-built reproducible drawings and specifications with “AS-BUILT” clearly printed on each sheet and on the specification cover.
B. Contractor shall accurately and neatly transfer all deviations from progress as-built to final as-built drawings and all annotations from progress as-built to final as-built specifications.

C. Contractor will provide eight (8) copies of the as-built drawings of which one (1) is in fully editable electronic format in a form acceptable to the Employer. Employer shall provide editable electronic copy of the requisite drawings such as floor plans, to facilitate preparation of electronic as-built-drawing.

Endorsement.

Contractor shall sign each final as-built drawing and the cover of the as-built specifications and shall note thereon that the recording of deviations and annotations is complete and accurate.

Site Development & landscaping works.

The background of the Rourkela city and studies on various design considerations of a river front development are the guideline factors in preparing the layout and facilities for the development of the site. With Rourkela being developed as a Smart City it is expected to bring in a lot of positive changes for the citizens in the short as well as long term and ultimately improving the quality of Life of the citizens. The site is designed with intent to provide the proposed infrastructure in such a way that it will create a property that is aesthetically appealing, consumers and shop owners delight and eventually becomes a landmark for the entire area. The Design intents are

• To design an inclusive river front development catering to all sections of the society and integrating with smart features in consultation with RSCL as an inclusive public space.

• To develop a sustainable design with green features (as per the various norms applicable) in design, materials and product selected, limiting the disturbance to the natural conditions of earth. Design to abide by the latest National Building Code, ECBC guidelines and other code provisions of Rourkela / India.

• To design the building envelopes along with its massing and architectural detailing in such a way that it inspire the citizens and act as the new landmark.

• To correlate the built and the un-built fabric and explore the notion in the public realm of architecture so that the spatial composition of the spaces vibrates with activity for the various age groups all through the year

• To segregate and control various users inside the proposed complex with well-defined routes for all.

• To designate different entries / access for the various users

• To have a safe venue and appropriate means for disaster management at place. The entry/exit gates have guard cabin too along with CCTV monitoring.
• To design the buildings along major axis of the site. An architectural design theme to integrate the design is required to develop the buildings as iconic structure displaying the identity of a new landmark.
• To have a calm and quiet ambience
• To have all services and infrastructure of this area designed as per their respective standards and best practices followed. The detail scope of work of the individual specialization has been explained separately in the next few chapters under each subject head.
• To develop a river front development that becomes associated with the day to day life of the users

1.4. DESIGN INTENT

Concept of Landscape Design:
All the landscape has been considered focusing sustainability in layout (passive design) with human comfort and quality outdoor environment in mind. The circulation space in the open has been kept minimum by optimum placing of functions. Lighting has been done in a way to minimize the running cost by placing the light source at appropriate distance and maintaining the prescribed lux level as per the norms. The irrigation system proposed is of sprinkler type for even distribution of water and minimum wastage.

The plantation is done in a way which use the maximum irrigated water and allow less evaporation of water from ground surface. The pathway or hardscape material used at appropriate location will allow maximum permeability of water into the ground. The slope of the new terrain is proposed in a way that people walking will not feel hard to walk over. All the location / maximum location is accessible by the differently abled persons. The vegetation proposed will use minimum water and provide maximum shades.

Following list is a broad outline of features proposed
• Open food court
• Entry and exit gates in all pockets with ticket counter in pocket 1
• Pedestrian bridge between pocket 1 and 2
• Gazebos, pergola and canopy as per the master plan
• Easy to maintain Hardscape and softscape
• Provision for future proposal for Adventure sports equipment’s in pocket 1
• Irrigation and drainage system for overall development
• LED Lighting and electric system
• Firefighting system as per the standards
• Designed Signages and duel system litter-bin
• Retaining walls as per structure
- Toilet and drinking water facilities
- Design and construction of Water supply system
- Installation of Cattel catcher at strategic locations
- Designed boundary wall
- Street furniture’s; like seating benches, lamppost
- CCTV installation at strategic location

1.5. PARTICULAR SCOPE OF WORK

1.5.1. Architecture & interior

The detailed scope of work architecture includes the following components.

1.5.1.1. Construction of food court

The food court in pocket one is a complete RCC structure having kitchen and counter facility. The Minimum area of 60 sqm. The roof will be pitched roof structure. The exterior finishing of the walls along with roof to be weather proof exterior texture paint as per specs. The minimum habitable height is 3.0 m. Other facility and details should be as per drawing & finishing schedule.

1.5.1.2. Guard room and gate Complex

The guard room and gate complex should have a minimum area of 6.0 sqm guard room with counter and necessary opening like doors and windows. Separate gate for entry and exit to be provided. The gate should be of MS. Other facility and details should be as per drawing & finishing schedule.

1.5.1.3. Boundary wall

The boundary wall to be constructed with combination of RCC colum, Brick work, MS grill/GRC jail. The exterior finishing to be of texture paint. In the portion other than main road to be of chain link fencing with creepers as directed by the engineer in charge. The site is to be barricaded with tall shrubs to visually block from the surroundings.

1.5.1.4. Ticketing facility

Kiosk for ticketing facility should have minimum area of 6 sqm. with counter and necessary opening like doors and windows. This should be permanent rcc structure with kota stone flooring and paint as/specs.

1.5.1.5. Retaining walls

RCC Retaining walls to be provided where ever required as/design in line of the architectural design at locations like river edge or at places where there are level differences.

1.5.1.6. Ramps and steps

Ramps and steps to be provided as/architectural drawings and if necessary at other locations as/site requirement.

1.5.1.7. Signage
MS/SS Signage to be provided where ever necessary. The location of the signage to be as/drawing.

1.5.1.8. Dustbins
FRP dual dust bins to be provided with individual capacity of min 60 L to be provided where ever necessary. The location of the signage to be as/drawing.

1.5.1.9. Toilet
Bio toilet along with bio digester to be provided as/specs. One toilet unit will be consisting of following components per zone.
- Male WC unit with wash basin (3 Nos).
- Female WC unit with wash basin (3 Nos).
- Urinal unit with 3 wash basin & 4 urinal (1 Nos)

1.5.1.10. Drinking water facility
Water ATMs to be provided as/specifications.

1.5.1.11. Graffiti walls
The blank walls up to height 0.6 m to be painted and walls of height 0.6 m and above to be painted with graffiti(including retaining wall).

1.5.1.12. Railing & parapet walls
MS railings, parapet walls of minimum height 1.2 m required at the river edge, ramps other places where ever necessary to be provided as/drawing or as/approved by the eng in charge.

1.5.1.13. Parking facility
Open parking facility to be provided at locations as specified in the drawing. The paving should be precast paver block/grass paver confirming to IRC code. Trees, grass and shrubs to be provided in between the parking lots as/site plan.
For parking area 150mm thick WMM as base course to be provided.

1.5.1.14. Extended parking facility
The extended parking space in pocket three to be dressed, levelled, compacted and to be made fit for emergency parking and other activity like mela etc. Retaining wall with graffiti to be provided on all the four sides.

1.5.1.15. Sculpture pavilion
The sculpture pavilion in pocket three should be of minimum area 300 sqm. Out of which 100 sqm will be closed with adequate arrangement of doors and full height glazings. The building to be finished with neatly finished exposed concrete/ exposed brickwork as approved by the Engineer in charge. Other details to be as/drwing.

1.5.1.16. Shops
Permanent shops of minimum area 10.0 sqm. The total no of shops will be minimum 36 nos. If required more shops can be added to whatever provided in the drawing. The exterior finishing of
walls along with the roof to be weather proof exterior texture paint as per specs. The minimum habitable height is 3.0 m. Other facility and details should be as per drawing & finishing schedule.

1.5.1.17. Floating jetty and boating facility
Different infrastructure for boating facility like floating jetty, ticket counter to be provided. The minimum area for floating jetty to be 300 sqm or as/drawing which is higher. SS railing to be provided at the edge of the floating jetty of height 1200 mm minimum.

1.5.1.18. Steps leading to water
10 m wide RCC steps leading to the water to be constructed as/drawing.

1.5.1.19. Cable suspension Bridge
Erection of cable suspension pedestrian bridge of 75 m length and 2.0 m wide with MS/RCC staircase at both ends. Led Lighting arrangement to be provided for beautification purpose as/Specs or as directed by the Engineer in charge. For finalization of lighting scheme the contractor has to give a presentation of the scheme to the client and get it approved. The structure shall have a min ground clearance of 5 mt.

1.5.1.20. Decorative tower
Decorative tower of MS structure claded with GRC jail of minimum height 12m with 3.5 m cantilevered branches with LED lighting as/drawing and specs or as directed by the Engineer in charge.(the lighting scheme to be presented and approved by the client.)

1.5.1.21. Adventure activity equipments
Different type of adventure equipments like Burma bridge, Bamboo bridge, Balance Bridge, Horizontal Bamboo bridge, Hanging tyre bridge, Hanging Bridge, Horizontal Bridge, Knocking bridge, Pole Bridge, Plank Bridge, Stepping Bridge, Net Bridge, Zigzag Bridge, Zigzag plank Bridge, Stepping rope bridge etc to be installed as/specs.

1.5.1.22. Cattle Catchers
Cattle catchers to be installed as/drawing or site requirement or as directed by the Engineer in Charge.

1.5.1.23. Plaza
Plazas leading toward the rives to be provided as/drawing.

1.5.1.24. Bank protection
River bank protection to be provided where ever necessary using Reno/Gabion mattress ,Rip rap blanket, stone pitching where ever required as/specs or asrequired at site as/the direction of Engineer in charge.

1.5.1.25. Repairing of existing structures
Repairing works in existing structure like painting, repairing of steps, replacement of chequered tiles as required at site or as/the instruction of the Engineer in Charge.
1.5.2. Hardscape

Different type of hardscape surfaces like precast paver block, cement concrete, grass paver, polished kota stone, rough/sand blasted kota stone, stamped concrete, river pebbles, morom pathway, waste wood flooring, granite flooring to be provided where ever necessary or as directed by the engineer in charge.

1.5.3. Trees, Shrubs & Softscape

Different grasses like broadleaf grass, selection one grass, korean grass to be done as/drawing or as approved by Engineer in charge. Shrubs like Ficus long island, Golden duranta, Lantana camra, Wedelia trilobata, Tradescantia pallida, Ophiopogon, Conocarpus of minimum height 0.6 m(except conocarpus whose height to be 1.5 m minimum) to be provided as/drawing or approved by the Engineer in charge. Trees like Hibiscus rosa sinensis, Plumeria Rubra, Jacranda, Samanea saman, Largerstroemia indica, Tabernaemontana, Ficus benjamina screen, Delonix Regia, Cassia Fistula etc as/drawing or as directed by the Engineer in charge. The minimum height of the trees to be installed to be 1.5 m. Green mounds to be created using earth filling and grass as/design or as directed by the engineer in charge. Brick work/RCC planters to be constructed around all the trees which can be used for seating purpose as/drawing or as directed by the Engineer in charge.

1.5.3.1. Ficus topiary

Topiary to be created with ms frame and plants by clipping the foliage and twigs of trees, shrubs and sub shrubs to develop and maintain clearly defined shapes of live animals like elephant/bear/birds etc. The size should he minimum 4.0 m height and proportionate as/the shape of the animal as directed by the Engineer in charge.

1.5.3.2. Seating arrangements

FRP benches as/drawing to be installed in locations as specified in the drawing. Apart from FRP benches brick work with granite cladding seating benches to be installed at site as/drawing or as directed by the Engineer in charge.

1.5.3.3. Metal pergola

4.2 m wide MS pergola to be provided with suitable paint as approved by the Engineer in charge. The detail of the pergola to be as/ drawing.

1.5.3.4. Gazebo

RCC gazebos to be constructed as/drawing. The external surface to be painted with suitable colour and red oxide paint and ornamental works to be done in order to give a look and feel of natural wood.

1.5.3.5. Sandpit

300 mm deep sand pit to be provided for children play area and 600 mm deep for sand sculpture court area.

1.5.3.6. Children play equipments
Children play equipments to be provided as/specs or as directed by the Engineer in charge. Slide – 3 Nos, Double see saw – 3 Nos, Mari go round – 3 Nos, Double swing – 3 Nos.

All play equipment and Out Door Fitness Equipment shall be as per specification, of approved quality and procured from manufacturers approved by Owner.

Fiber Reinforced Plastics (FRP):

For children play equipment all the Fiber Reinforced Plastics (FRP) (minimum 4-5 mm thick) materials shall be processed by the hand laid process as follows:

1. After the preparation of the mould a layer of gel coat (tested as per IS 6746:1994) shall be applied which shall be of N.P.G duly mixed with U.V stabilized pigment to give the required colour to the product.
2. Then a coat of G.P resin tested (as per standard IS 6746: 1994) shall be applied above the surface of the gel coat after it becomes tack free.
3. The constitutive layers of C.S.M (chopped strand matt) as per IS 11551-1996, glass fiber shall be laid down along with resin to the required extent to build up the required thickness in sandwich pattern.
4. The back side coating of the resin shall be done to give a smooth finish.
5. The mould shall be kept open to dry for a specified duration for strengthened the F.R.P
6. After the mould is completely cured FRP shall be removed from the mould. Then all the corners and edges of it shall ground to make them smooth and harmless from the strands of the glass wool.

1.5.3.6.1. Double Post Swing

General:
Age Group : 4-14 Years
Product Area : 3.5 X 1.0 M
Safe Play area : 4.5 X 2.0 M

Technical Specification:
The leg support of the single post swing is made up of 100 NB while the top bar is of 50 NB powder coated G.I. pipes.
Two swings are made up of 10mm thick skid reinforced.
Seats of the single support swing are made up of 10mm thickness anti-skid rubber.
The rubber seat is suspended on 6mm thick G.I. chain.
The ball bearings are mounted inside a specially designed nylon clamp.
1.5.3.6.2. **Standard See-Saw**

General:
Age Group : 4-10 Years
Product Area : 2.5 X 0.3 M
Safe Play area : 3.5 X 1.3 M

Technical Specification:
The seats of the see saw are made from Roto moulded plastic.
The lever is made up of 15,20,25 NB G.I. pipes and is fitted on 40 NB G.I. pipe.
The bearing used is of heavy duty bush type.

1.5.3.6.3. **Slide**

General:
Age Group : 4-12 Years
Product Area: 0.5 X 3.5 M
Safe Play area: 1.5 X 5.0 M
Platform Height : 1.5 M

Technical Specification:
The slide is made up of Fibre reinforced plastic (FRP) having thickness of 3-4mm with sufficient reinforcement given to acquire proper strength to the module.
The platform is supported on vertical 80NB powder coated G.I. pipes.
The railing provided to the platform is made from LLDPE and it is supported by 20 NB G.I. pipe.
The ladder is made up of 25 NB G.I. pipe and with triangular steps of 16 SWG. Ladder to be designed in such a way it won't entrap child's foot while playing.
The 'T' support under the slide is made up of 80 NB G.I. pipe.

1.5.3.7. **Roads**

Existing roads to be repaired, new road to be constructed if required as directed by the engineer in charge as/IRC.

1.5.3.8. **Musical fountain**

Musical fountain; of minimum diameter 15.0 m; with adequate led lighting and sound to be installed as/specs or as directed by the Engineer in charge.

1.5.3.9. **Landscape Round about**
Minimum 2 Nos landscape round about to be constructed (one in pocket 2 &3 and another in pocket 5) as drawing and specs. However more numbers to be provided as/site requirement or as directed by the Engineer in charge.

1.5.3.10. Slope green Area

The slope areas which are green to be treated with geo cell system with anchor fastening system/terrain mate for protection of earth during flood. The geo cell should be as/specs or as directed by the engineer in charge.
2.1 ARCHITECTURAL WORKS

2.1.1 ITEM OF WORK

1. Concrete shall be with conformity to I.S.456.
2. Foundation shall be with conformity to I.S.1080.
3. C.R. Masonry shall be with conformity to I.S.1597.
4. Brick masonry shall be with conformity to I.S.2212.
5. Cement plastering shall be with conformity to I.S.9103 & 6925.
6. Mortar shall be with conformity to I.S.2250.
7. Mortar shall be with conformity to I.S.2250.
8. White and colour washing shall be with conformity to I.S.6278.
9. CC in foundation shall be with conformity to I.S.2571.
10. Anti-Termite Treatment shall be with conformity to I.S.6313. (Part I & Part II)
11. Painting to all surfaces shall be with conformity to I.S.2395 (Part I & Part II)
12. DPC shall be with conformity to I.S.3067.
13. Tar felt treatment shall be with conformity to I.S.1346.
14. Steel painting shall be with conformity to I.S.1477 (Part I & Part II) I.S.1661.

2.1.2 BRIEF SPECIFICATION OF ITEMS USED

It is the intent of these specifications to establish acceptable standards of quality and to provide the Contractor with complete and detailed information and subsequent instructions necessary to enable him to submit a well planned Tender, to carry out the design, where and when required, and to execute properly the work prescribed. This specification covers the general requirements for civil and architectural works comprising of masonry, flooring, skirting, dado, plastering for wall and ceilings, painting, doors, windows, ventilators, Builders hardware, ironmongery, Glass and glazing, Partition works, False ceiling works, toilet cubicles, sanitary fixtures and fittings, waterproofing, Metal sheet cladding, grills and railing works. For any items missed standard specification of Odisha Schedule of Rates (OSR) will apply and for items that are not available in OSR, Delhi Schedule of Rates may be considered.

Standards and Codes

i. The Contractor shall follow the Indian Codes and specifications for his work.
ii. All standards and codes employed or referred to shall be the latest current issue in effect at the date 28 days prior to the Tender submission date.
iii. In case of discrepancies between these Specifications and national or international standards and codes, these Specifications being only indicative in nature shall not govern, unless otherwise established by the Authority in each particular case.

2.1.3 Termite Treatment:
Providing and injecting chemical emulsion for pre-constructional ant termite treatment as per IS specification and creating a chemical barrier in bottom and sides of foundation trenches, top surface of plinth filling junction of walls and floors along with external perimeter of the building expansion joints surrounding the pipes and cables etc. complete using approved quality of chemical emulsion of requisite quantity prescribed by the manufacturer as directed by the Engineer-in-charge including cost of all materials and labour taxes etc. complete. (Indemnity bond for warranty for 10 years to be furnished)

2.1.4 Waterproofing:
Application of approved water proofing compound & continued over parapet wall as per the laying specification of the approved item, followed by a protection screed laid in requisite slope in panels of size (approximate) 2mtr x 2mtr to drain the rain water towards rain water pipe & finally filled the joint groove with Polyurethane sealant of approved make and finally finished with chequered tile all complete as per the drawing. Complete as per manufacturer specification and direction of engineer in charge. The various types of water proofing will be as per below or approved equivalent:
1. Waterproofing of sunken slab, balconies & other wet areas – Fosroc Brushbond RFX/equivalent
2. Terrace water proofing (new & old) – Fosroc Nitoproof 600 standard/equivalent
Note: cost of cleaning of existing surface is inclusive and completion of job to be as per the satisfaction of the engineer in charge.

2.1.4.1 Terrace Water Proofing:
Providing water proofing to roof top with 2.5cm thick grading concrete (1:2:2) on roof slab

2.1.5 Expansion Joint in Retaining wall:
- PVC Water Bar: fixing expansion joint with PVC water stopper of size 300 x 20mm of approved brand as per approved by engineer
• Baker Rod: Supply of Non Absorbent, rot proof, Compressible, Closed Cell polyethylene foam baker rod of 20mm core dia to be laid as per manufacturer’s specification.

• System: Polysulphide Sealant:
  ➢ Apply by brush and allow it to dry for minimum 20 minutes. Apply two coats of primer at an interval of 30 minutes. After priming is over, sealants should be filled after 30 minutes and before 90 minutes.
  ➢ Sealant: Mixing the curing agent is to be poured in the tin with the base and mixed thoroughly with a slow speed electric mixer (300 to 450 rpm) for approximately 5-6 minutes until a homogeneous and uniformly grey coloured material is obtained.
  ➢ Applying properly mixed Polysulphide based, joint sealant with in the Groove when the primer is tack free condition.
  ➢ Standards compliance
  ➢ ASTM C920-87, Type M, grade NS, Class 25.
  ➢ IS12118 (PT 1&2) – 1987
  ➢ British Standard BS:4254: 1983
• The Product should possess following Properties:
  ➢ Storage life : 12 months in original containers in dry conditions within the range room temperatures
  ➢ Solid content 100%
  ➢ Flash point 65°C
  ➢ Shore A Hardness (ASTM D 412), 16-20;
  ➢ Potlife Min 2hrs at 25°C
  ➢ Tensile Strength at break, kg/cm2 (ASTM D 412), 3 – 5;
  ➢ Elongation at break, (%) (ASTM D 412), 500 – 600;
  ➢ Adhesion / Bond Strength, Kg/2.5 cm (BS 4254), 3 – 4;
  ➢ Plastic deformation, % (BS 4254), 15;
  ➢ Staining (BS 4254), No stain;
  ➢ Movement Accommodation Factor 25 % for butt joints and 50 % for lap joints;
  ➢ Specific gravity (Mix), kg/ ltr 1.6 - 1.65;
  ➢ Setting time at 25°C (BS 4254), 18 Hrs;
  ➢ Curing Time at 25°C Min 7 days;

2.1.6 Tile Adhesive:
• Surface Preparation: Tile Adhesive can be applied directly on concrete screeds, Lean Concrete and cement or lime mortar which is admixed with water proofing compound at 200ml / Bag of
cement. Special attention must be given to new construction prior to commencing tiling. Tiles should not be placed on concrete or brickwork until all shrinkage movement has taken place.

- **System**: Providing and Applying Polymer modified tile adhesive mixed with clear potable water in the ratio 4:1 by volume (4 part powder : 1 part water). Add powder to water and mix until a uniform, lump free consistency is achieved. The total quantity of water may be slightly adjusted to achieve the required consistency. Application of adhesive should be spread on the substrate to a uniform thickness of 3mm, and then combed horizontally with a serrated trowel. Place tiles firmly into adhesive bed, ensuring good contact with a twisting motion. Only apply to areas which can be tiled in the adhesive’s open wet time (up to 1m² at a time). The adhesive Shall confirm to IS 15477 Type I & II. Supply mixing and Application shall be as per manufacturer’s Current data sheet.

- **Tile Spacer Epoxy Grout**: Providing and applying tile mate as per the manufacturers Current Data Sheet.
  - for tile size 300mm x 300mm 7mm thick, 2 mm joint filling
  - for tile size 200mm x 300mm 7mm thick, 2 mm joint filling

- **Tile Spacer white cement Grout**: Providing tile mate for filling joints in floor and wall tiles, internal/external applications of suitable colour, applied as per the manufacturers Current Data Sheet.
  - for tile size 300mm x 300mm, 3 mm joint filling
  - for tile size 200mm x 300mm, 3 mm joint filling
  - for tile size 300mm x 300mm, 4 mm joint filling
  - for tile size 200mm x 300mm, 4 mm joint filling

**2.1.7 Cement Concrete Flooring:**
Supplying, fitting and fixing in position 25mm thick cement concrete tile of Ultra category- 1/Eurocon or equivalent type of approved make, quality, colour and size in all floors at all height on 20mm thick bed of cement mortar of mix (1:4) laid in proper slope and gradient grouted with neat white cement slurry with required quantities of pigments of approved marks watering and curing for 21 days, including cost, conveyance, loading, unloading, royalties and taxes of all materials, cost of all labour, sundries, T&P required for the work complete in all respect as directed by the Engineer-in charge.

**2.1.8 Granite Flooring & cladding:**
Providing 20mm thick avg. granite flooring (as per approved sample) of approved quality, colour and size in floors, counter top, vertical cladding on seating, treads and risers on steps (single piece) at all height on minimum 25mm thick cement mortar of mix (1:1) laid in proper slope and gradient with screened and washed sharp sand for mortar and grouted with neat white cement slurry jointing the tile with neat white cement slurry mixed with required quantities of pigments of approved marks to match the shades of the
granite tile if required watering and curing for 21 days, including cost, conveyance, loading, unloading, royalties and taxes of all materials, cost of all labour, sundries, T&P required for the work including rubbing mechanically and wax polishing etc. complete in all respect as per specification and direction of Engineer-in-charge.

2.1.9 Sal Wood Frame:
Providing and fixing in position well dressed, naturally seasoned sal wood rebated frames of size 125mmx63mm to doors including two coats of hot bitumen applied to rear of frame in contact with masonry or concrete surface fixed with MS hold fast of 35x5mm embedded in cement concrete blocks 15x10x10cm of 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20mm nominal size) complete with all materials, labours, T & P including cost, conveyance, loading, sundries required for the work etc. complete in all respect as directed by the Engineer-in-charge.

2.1.10 Flush Door:
Supplying fitting and fixing in position 35mm thick flush door including lamination of Greenply/Mayur/Century/Kitply or equivalent type of approved make with teak wood beading and 1mm thick sunmica mechanically hot pressed to both side including fixing of fixtures like Godrej make Mortise lock having model no 9168, Godrej make Door closure heavy duty type having model no 8340, 125mm aluminium hinges, handle, tower bolt, stopper including cost of all materials, labour, all taxes, transportation, loading & unloading etc. complete as per specification and direction of Engineer-in-charge.

2.1.11 Aluminium Door & Window:
Providing & fixing of DOMAL - 40 or equivalent Aluminium Building Systems, made from 6063 T-6 alloy and tempered euro groove aluminium profile, in approved surface coating, mechanically mitered & joined with corrosion resistance DOMAL accessories and hardware. Glass infill, of desired thickness, shall be fixed onto using non-aging siliconized microwave treated DOMAL gaskets depending upon on the structural conditions, functions and statistical load requirements.

2.1.12 Stainless Steel Railing:
Supplying, Fitting and fixing of stainless steel of 304 grade in hand railing using 50mm dia of 2mm thick circular pipe with Balustrade of size 50mm dia of 2mm thick @ not more than 0.90mtr C/C (spaced equally as per site ) and stainless pipe bracing of size 32mm dia of 2mm thick in 3 rows in stair case all in satin finish as per approved design and specification buffing polishing etc with cost conveyance taxes of all materials labour T&P etc required for the complete in all respect and as per the direction of Engineer-in-charge.
2.1.13 Mild Steel railing
Supplying, Fitting and fixing of Mild steel in hand railing using 50mm dia of 2.9 mm thick circular pipe & 10 mm dia of 4.5 mm thickness with Balustrade of size 50mm dia of 2.9 mm thick @ not more than 0.90mtr C/C (spaced equally as per site ) and MS pipe bracing of size 50 mm dia of 2.9 mm thick in 3 rows with aluminum paint as per approved design and specification buffing polishing etc with cost conveyance taxes of all materials labour T&P etc required for the complete in all respect and as per the direction of Engineer -in-charge.

2.1.14 GRC Customized Screens casted with Power Spray methodology:
Providing and fixing Glass Reinforced Concrete (G.R.C) Screens in approved size, pattern, design, shade and thickness of 50mm on frame and design element in 30mm thick casted with layering technique Power Spray methodology have weight approximately between 3.5 – 4 Kg per Sq. Ft. and colour of M/S UniStone make or equivalent. The above weight and thickness is considering dimensions of screens up to 2133mm in height and 1219mm in width and having at least 50% void space. The screens should be made from ‘53 grade’ White Portland Cement manufactured by ‘JK Cement’ or equivalent, Fine graded Quartz & Silica Sand, Alkali Resistant Glass Fibre manufactured by ‘N.E.G JAPAN’ or equivalent, Super Plasticizers manufactured by ‘ZPXRC’ or equivalent, Polymers manufactured by ‘Dow Chemicals’ or equivalent and U.V resistant Synthetic inorganic pigments should be used for pigmentation manufactured by Lanxess / ‘BAYFERROX (Germany)’ or equivalent. The material casting should take place in FRP Moulds. The fixing of Screens should be ‘Dry fixing’ i.e. to be done with M.S Galvanized Clamps, fixtures and fasteners of Hilti / Fischer or self - tapping screws. All applicable taxes shall be charged extra, as per actual. All transportation cost shall be charged extra, at time of dispatch of material from plant premises.

2.1.15 Backlit SS Signage’s:
Design, manufacturing & installation of backlit signage’s where all the letters in Signage will be illuminated by energy efficient LEDs having a lamp life of minimum 50 - 70000 hrs and will have approximately 7 times more Light output than Conventional Signage. The signage will have very strong and uniform illumination throughout the Graphics and logo with no HOT SPOTS Visible the Illumination will be Edge to Edge. LEDs for external application shall be protected by Green Compound System, Temperature 300’ F, UV rays, Ozone & weatherproof. All wiring & connections will be of international standard with no joints between two points. LED light sources (imported Interone Led Modules & Converters) are small and unobtrusive, easy to install, and can generally be fitted out of sight. The letters will be of SS 18 gauge with 3M Vinyl face using branded ISI marked L.T wire and branded fasters for wall mounting. Colour of vinyl & light will be as per approved design & sample and to be constructed after the approved shop drawing and finished to the best standard.
2.1.16 PLASTERING FOR WALL AND CEILING

2.1.16.1 General
This specification covers the general requirements for finishing the plastered brick / concrete surfaces with Plaster of Paris and other related works forming a part of this job, which may be required to be carried out though not specifically mentioned above. The work under this specification shall consist of furnishing of all tools, plants, labour, materials and everything necessary for carrying out the work.

2.1.16.2 Applicable Codes and Standards
Work shall be carried out as per latest edition of Indian Standards and Code of Practices. List given here shall not be considered as conclusive and is for reference and guidance only. Any discrepancies/ conflict noticed shall be brought to the notice of Architect/Engineer in charge for direction / approval. However, as a general rule more stringent specification shall take precedence.
IS: 63 Whiting for paint and putty.
IS: 1200 Method of measurement of building and civil engineering works.
IS:1635 Code of practice for field slaking of building lime and preparation of putty.
IS: 2333 Plaster of Paris for ceramic industry
IS: 6932 Methods of test for building limes
IS 1661 Code of practice for application of cement and cement lime plaster finishes.

2.1.17 POP Punning Works

2.1.17.1 Materials
The plaster of Paris powder shall conform to the requirements of IS: 2333.

2.1.17.2 Workmanship
The plaster on masonry surface shall be allowed to dry before the POP punning is applied. Powder of plaster of Paris shall be mixed with water as specified by manufacturer to form a thick paste and shall be applied on the plastered surface.
The POP shall be laid and rubbed and finally trowelled to a fine uniform smooth finish. All unevenness shall be rubbed down from top to bottom in one operation to eliminate joint marks.

2.1.18 Putty Works

2.1.18.1 Materials
Water resistant white cement based putty ideal for use on concrete / mortar walls (internal and external) and ceiling.

2.1.18.2 Workmanship
Surface Preparation: All loosely adhered material shall be removed from the wall surface with the help of emery stone, putty blade or white brush and clean water. The substrate shall be clean,
free from dust, grease and loose material. Dry and absorbent surfaces shall be moistened with sufficient quantity of clean water.
Mixing of putty: Putty shall be mixed with 30-35% clean water slowly to make a paste. Mixing shall be continued for 10-15 minutes till a uniform paste is formed.
Application on prepared surface: The first coat shall be applied on already moistened wall surface from bottom to upward direction uniformly with the help of putty blade. This would ensure less wastage and proper finish. After drying of first coat of putty, the surface shall be rubbed gently with wet sponge or very gently with a putty blade in order to remove loose particles. The surface shall be allowed to dry for at least for 3 hours and then second coat of putty shall be applied. The surface shall be allowed to dry completely.
Marks if any shall be removed with the help of moist sponge or the surface shall be rubbed very gently with putty blade. The surface shall be allowed to dry completely.
Only the required quantity of putty shall be prepared at a time and shall be used within 2-3 hours of mixing of water. The total thickness of the coats should be limited to maximum 1.5 mm. If required, to remove unevenness of surface before applying any kind of paint/ distemper, walls / ceiling surface shall be leveled gently with very fine water proof emery paper of not less than 5900 number to get a glossy white surface.
Precautions during application: Utmost care shall be taken for proper and thorough mixing of putty with hand or mechanical stirrer in order to get best results. Putty shall be applied over fully cured surface. It is recommended not to rub putty strongly and harshly with rough emery paper. This breaks the film formed by putty, thus decreasing its water repellant properties. The total thickness of the coats shall be limited to maximum 1.5 mm. In case of fresh concrete/ mortar surface, it is recommended that two coats of white cement wash be done before application of putty.

2.1.18.3 Storage, Handling & Delivery
Material received at site shall be with original packing and labels. It shall be intact till issued for use of site.
Material shall be stored at properly covered dry location and shall be safe from damage.
Storage life should not exceed 6 months.

2.1.19 Cement Plastering Work
The proportions of the cement mortar for plastering shall be 1:4 (one part of cement to four parts of sand) unless otherwise specified under the respective item of work. Cement and sand shall be mixed thoroughly in dry condition and then water added to obtain a workable consistency. The quality of water and cement shall be as per relevant IS. The quality and grading of sand for plastering shall conform to IS:1542. The mixing shall be done thoroughly in a mechanical mixer
unless hand mixing is specifically permitted by the Engineer. If so desired by the Engineer sand shall be screened and washed to meet the specification requirements. The mortar thus mixed shall be used as soon as possible preferably within 30 minutes from the time water is added to cement. In case the mortar has stiffened due to evaporation of water this may be re-tempered by adding water as required to restore consistency, but this will be permitted only up to 30 minutes from the time of initial mixing of water to cement. Any mortar which is partially set shall be rejected and removed forthwith from the site. Droppings of plaster shall not be reused under any circumstances.

2.1.19.1 Workmanship

Preparation of surfaces and application of plaster finishes shall generally confirm to the requirements specified in IS:1661 and IS:2402.

Plastering operations shall not be commenced until installation of all fittings and fixtures such as door/window panels, pipes, conduits etc. are completed. All joints in masonry shall be raked as the work proceeds to a depth of 10mm/20mm for brick/stone masonry respectively with a tool made for the purpose when the mortar is still green. The masonry surface to be rendered shall be washed with clean-water to remove all dirt, loose materials, etc., Concrete surfaces to be rendered shall be roughened suitably by hacking or bush hammering for proper adhesion of plaster and the surface shall be evenly wetted to provide the correct suction. The masonry surfaces should not be too wet but only damp at the time of plastering. The dampness shall be uniform to get uniform bond between the plaster and the masonry surface.

Interior plain faced plaster - This plaster shall be laid in a single coat of 13mm thickness. The mortar shall be dashed against the prepared surface with a trowel. The dashing of the coat shall be done using a strong whipping motion at right angles to the face of the wall or it may be applied with a plaster machine. The coat shall be trowelled hard and tight forcing it to surface depressions to obtain a permanent bond and finished to smooth surface. Interior plaster shall be carried out on jambs, lintel and sill faces, etc. as shown in the drawing and as directed by the ENGINEER. Rate quoted for plaster work shall be deemed to include for plastering of all these surfaces.

Plain Faced Ceiling plaster - This plaster shall be applied in a single coat of 6mm thickness. The proportion of cement mortar shall be 1:3.

Exterior plain faced plaster - This plaster shall be applied in 2 coats. The first coat or the rendering coat shall be approximately 14mm thick. The rendering coat shall be applied as stipulated as mentioned, except finishing it to a true and even surface and then lightly roughened by cross scratch lines to provide bond for the finishing coat. The rendering coat shall be cured for at least two days and then allowed to dry. The second coat or finishing coat shall be 6 mm thick
with approved water proofing admixture, if so specified in the item description. Before application of the second coat, the rendering coat shall be evenly damped. The second coat shall be applied from top to bottom in one operation without joints and shall be finished leaving an even and uniform surface. The mortar proportions for the coats shall be as specified in the respective item of work. The finished plastering work shall be cured for atleast 7 days.

Interior plain faced plaster 20mm thick if specified for uneven faces of brick walls or for random/coursed rubble masonry walls shall be executed in 2 coats. Where specified in the drawings, rectangular grooves of the dimensions indicated shall be provided in external plaster by means of timber battens when the plaster is still in green condition. Battens shall be carefully removed after the initial set of plaster and the broken edges and corners made good. All grooves shall be uniform in width and depth and shall be true to the lines and levels as per the drawings. Curing of plaster shall be started as soon as the applied plaster has hardened sufficiently so as not to be damaged when watered. Curing shall be done by continuously applying water in a fine spray and shall be carried out for atleast 7 days.

When the specification items of work calls for waterproofing plaster, the CONTRACTOR shall provide the waterproofing compound as specified while preparing the cement mortar. Payment for waterproofing compound will be made separately if it is not included as a combined item of work.

For external plaster, the plastering operations shall be commenced from the top floor and carried downwards. For internal plaster, the plastering operations for the walls shall commence at the top and carried downwards. Plastering shall be carried out to the full length of the wall or to natural breaking points like doors/windows etc.

The finished plaster surface shall not show any deviation more than 4mm when checked with a straight edge of 2m length placed against the surface. To overcome the possibility of development of cracks in the plastering work following measures shall be adapted. Plastering work shall be deferred as much as possible so that fairly complete drying shrinkage in concrete and masonry works takes place. Steel wire fabric shall be provided at the junction of brick masonry and concrete to overcome reasonably the differential drying shrinkage/thermal movement. This steel item shall be measured and paid for separately. Ceiling plaster shall be done, with a trowel cut at its junction with wall plaster. Similarly trowel cut shall be adopted between adjacent surfaces where discontinuity of the background exists.

2.1.20 PAINTING WORKS

2.1.20.1 General

This specification covers the general requirements for painting of interior and exterior plastered brick / concrete surfaces and partition walls with suitable paints and other related works forming a
part of this job, which may be required to be carried out though not specifically mentioned above. The work under this specification shall consist of furnishing of all tools, labour, materials and everything necessary for carrying out the work.

2.1.20.2 Applicable Codes and Standards

Work shall be carried out as per latest edition of Indian Standards and Code of Practices. List given here shall not be considered as conclusive and is for reference and guidance only. Any discrepancies/conflict noticed shall be brought to the notice of Architect/Engineer in charge for direction/approval. However, as a general rule more stringent specification shall take precedence.

IS: 77 Linseed oil, boiled, for paints
IS: 103 Ready mixed paint, brushing, white lead for priming and general purposes
IS: 133 Enamel, interior (a) under coating (b) finishing
IS: 137 Ready mixed paint, brushing, bituminous, black lead-free acid alkali water and heat resisting.
IS: 168 Ready mixed paint, air drying for general purposes.
IS: 337 Varnish, finishing interior
IS: 348 French polish
IS: 427 Distemper, dry, colour as required
IS: 428 Distemper, oil emulsion, colour as required
IS: 524 Varnish, finishing exterior, synthetic
IS: 525 Varnish, finishing exterior and general purposes
IS: 712 Specification for building limes
IS: 1200 Part x Ceilings and Linings
IS: 1200 Part xiii White washing, Colour washing, distempering and other finishes
IS: 2074 Ready mixed paint, air drying, red oxide-zinc chrome, priming
IS: 2338 Code of practice for finishing of wood and wood-based materials
IS: 2395 Code of practice for painting concrete, masonry and plaster surfaces
IS: 2932 Specification for enamel, synthetic, exterior type (a) undercoating, (b) finishing
IS: 2933 Enamel exterior type (a) undercoating, (b) finishing
IS: 3536 Specification for ready mixed paint, brushing, wood primer, pink
IS: 5410 Cement paint, colour as required
IS: 5411 Specification for plastic emulsion paint (Parts 1 & 2) for interior
IS: 6278 Code of practice for white washing &colour washing
IS: 9862 Specification for ready mixed paint, brushing, bituminous, black, lead-free, acid, alkali, water and chlorine resisting
IS: 384 Brushes for painting
IS: 1477 Code of practice for painting

2.1.20.3 Painting of Concrete Masonry, Plastered Surfaces & Partition Walls

2.1.20.3.1 Materials

All paint products shall have no added lead, mercury, chromium, arsenic and antimony content.

- Cement paint shall conform to IS: 5410. The primer shall be a thinned coat of cement paint.
- Acrylic emulsion paint shall be of an approved manufacture.
- Plastic emulsion paint shall conform to IS: 5411.

All paints shall have low VOC with VOC for non-flat (gloss finish) paints shall be 150g/l and VOC for flat (mat finish) paint shall be 50 g/l.

White wash shall be made from good quality fat lime conforming to IS: 712. It shall be slaked at site and mixed with water in the proportion of 5 litres of water to 1 kg of un-slaked lime stirred well to make a thin cream. This shall be allowed to stand for a minimum period of one day and strained through a clean coarse cloth. Four kg of gum dissolved in hot water shall be added to each cu.m of cream. 1.30 kg of sodium chloride dissolved in hot water shall then be added per 10 kg of lime used for the white wash to be ready for application.

Colour wash shall be made by addition of a suitable quantity of mineral pigment, not affected by lime, to the prepared white wash to obtain the shade/tint as approved by the Engineer.

All the materials shall be of the best quality from an approved manufacturer. Contractor shall obtain prior approval of the Engineer for the brand of manufacture and the colour/shade. All materials shall be brought to the site of works in sealed containers.

2.1.20.3.2 Workmanship

Contractor shall obtain the approval of the Engineer regarding the readiness of the surfaces to receive the specified finish, before commencing the work on painting. Painting of new surfaces shall be deferred as much as possible to allow for thorough drying of the sub-strata.

The surfaces to be treated shall be prepared by thoroughly brushing them free from dirt, mortar droppings and any loose foreign materials. Surfaces shall be free from oil, grease and efflorescence. Efflorescence shall be removed only by dry brushing of the growth. Cracks shall be filled with Gypsum. Workmanship of painting shall generally conform to IS: 2395.

Surfaces of doors, windows etc. shall be protected suitably to prevent paint finishes from splashing on them.

White Wash - The prepared surfaces shall be wetted and the finish applied by brushing. The operation for each coat shall consist of a stroke of the brush first given horizontally from the right and the other from the left and similarly, the subsequent stroke from bottom upwards and the other from top downwards, before the first coat dries. Each coat shall be allowed to dry before the next coat is applied. Minimum of 2 coats shall be applied unless otherwise specified in the item of work. The dry surface shall present a uniform finish without any brush marks.
Colour Wash - Colour wash shall be applied in the same way as for white wash. A minimum of 2 coats shall be applied unless otherwise specified in the item of work. The surface shall present a smooth and uniform finish without any streaks. The finished dry surface shall not show any signs of peeling/powdery and come off readily on the hand when rubbed.

Acrylic Emulsion Paint - The prepared surface shall be dry and provided with one coat of primer which shall be a thinned coat of emulsion paint. The quantity of thinner shall be as per manufacturer's instructions. The paint shall be laid an evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing lightly in a direction at right angles. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off constitutes one coat. The next coat shall be applied only after the first coat has dried and sufficiently become hard which normally takes about 2 to 3 hours. A minimum of 2 finishing coats over one coat of primer shall be provided unless otherwise specified in the item of work. Paint may also be applied using rollers. The surface on finishing shall present a flat velvety smooth finish and uniform in shade without any patches.

Cement Paint - The prepared surfaces shall be wetted to control surface suction and to provide moisture to aid in proper curing of the paint. Cement paint shall be applied with a brush with stiff bristles. The primer coat shall be a thinned coat of cement paint. The quantity of thinner shall be as per manufacturer's instructions. The coats shall be vigorously scrubbed to work the paint into any voids for providing a continuous paint film free from pinholes for effective water-proofing in addition to decoration. Cement paint shall be brushed in uniform thickness and the covering capacity for two coats on plastered surfaces shall be 3 to 4 kg/sq.m. A minimum of 2 coats of the same colour shall be applied unless otherwise specified in the item of work. At least 24 hours shall be left after the first coat to become sufficiently hard before the second coat is applied. The painted surfaces shall be thoroughly cured by sprinkling with water using a fog spray at least 2 to 3 times a day. Curing shall commence after about 12 hours when the paint hardens. Curing shall be continued for at least 2 days after the application of final coat. Paint may also be applied using rollers.

2.1.20.4 Painting and Polishing of Woodwork

2.1.20.4.1 Materials

Wood primer shall conform to IS: 3536E.
Varnish shall conform to IS: 337.
French polish shall conform to IS: 348.
Synthetic enamel paint shall conform to IS: 2932.
All the materials shall be of the best quality from an approved manufacturer. Contractor shall obtain prior approval of the Engineer for the brand of manufacture and the colour/shade. All materials shall be brought to the site of works in sealed containers.

2.1.20.4.2 Workmanship

The type of finish to be provided for woodwork, either for painting or polishing, the number of coats, etc. shall be as specified in the respective items of work.

Primer and finish paint shall be compatible with each other to avoid cracking and wrinkling.

Primer and finish paint shall be from the same manufacturer.

Painting shall be either by brushing or spraying. Contractor shall procure the appropriate quality of paint for this purpose as recommended by the manufacturer. The workmanship shall generally conform to the requirements of IS: 2338 (Part I).

All the wood surfaces to be painted shall be thoroughly dry and free from any foreign matter. Surfaces shall be smoothened with abrasive paper using it across the grains and dusted off. Wood primer coat shall then be applied uniformly by brushing. The number of primer coats shall be as specified in the item of work. Stopping as per IS 426 shall be used to fill up large holes & cracks on the surface. For small holes or minor cracks, fillers as per IS 110 should be used. Any slight irregularities of the surface shall then be made up by applying an optimum coat of filler conforming to IS: 110 and rubbed down with an abrasive paper for obtaining a smooth surface for the undercoat of synthetic enamel paint conforming to IS: 2932.

Paint shall be applied by brushing evenly and smoothly by means of crossing and laying off in the direction of the grain of wood. After drying, the coat shall be carefully rubbed down using very fine grade of sand paper and wiped clean before the next coat of finishing is applied. At least 24 hours shall elapse between the applications of successive coats. Each coat shall vary slightly in shade and this shall be got approved by the Engineer. The number of coats of paint to be applied shall be as specified in the item of work.

All the wood surfaces to be provided with clear finishes shall be thoroughly dry and free from any foreign matter. Surfaces shall be smoothened with abrasive paper using it in the direction of the grains and dusted off.

Any slight irregularities of the surface shall be made up by applying an optimum coat of transparent liquid filler conforming to IS 345. The surface when hard shall be rubbed down with fine abrasive paper. All dust and dirt shall be cleaned and on this surface water or spirit stains shall be applied to enhance the natural grain or figuring effect of wood.

After the surface is dry, a suitable sealer shall be applied to prevent bleeding of stain and filler into the finish coat. The surface shall be rubbed down lightly, wiped off and allowed to dry.

Over this prepared surface, varnish conforming to IS: 337 shall be applied by brushing. Varnish should not be retouched once it has begun to set. Staining if required shall be provided as
directed by the Engineer. When two coats of varnish are specified, the first coat should be a hard-drying undercoat or flatting varnish which shall be allowed to dry hard before applying the finishing coat. The number of coats to be applied shall be as per the item of work

2.1.20.5 Mock-Up
The contractor shall prepare and install mock-up samples as per approved shop drawings. Mock-up samples shall be of full size and shall be true representation of actual works to be carried out at site. Mock-ups may be part of completed work if undisturbed.

2.1.21 Storage, Handling & Delivery
Material received at site shall be with original packing and labels. It shall be intact till issued for use of site.
Material shall be stored at properly covered dry location and shall be safe from damage.
Paints shall always be kept covered and mixing shall be done in suitable containers.
All necessary precautions shall be taken against fire hazards.

2.1.22 GRILLS AND RAILING WORKS
2.1.22.1 General
This specification covers the general requirements regarding materials and details of fabrication and erection of Steel Handrails. The contractor shall design, engineer, document, test, manufacture, deliver, install, protect and commission SS Railing complete with all necessary accessories, fixings, finishes, flashings, sealants and the like in accordance with the Contract Documents. The scope of this Section is performance based, and shall be developed, tested and warranted to comply with:
The design intentions indicated on the Drawings,
Specified performance criteria and requirements,
Relevant statutory and project requirements.

2.1.22.2 Applicable Codes and Standards
Work shall be carried out as per latest edition of Indian Standards and Code of Practices. List given here shall not be considered as conclusive and is for reference and guidance only. Any discrepancies/conflict noticed shall be brought to the notice of Architect/Engineer in charge for direction/approval. However, as a general rule more stringent specification shall take precedence.

INDIAN STANDARDS:
NBC 2005 Bureau of Indian Standards, the National Building Code of India,
IS: 806 Code of Practice for Use of Steel Tubes in General Building Construction.
IS: 2835 Specification for flat transparent sheet glass (third revision)
IS: 4912 Safety Requirements for Floor and Wall Openings, Railings and Toe Boards
M.S. Grills & Handrailings

2.1.22.3.1 Materials

2.1.22.3.2 Workmanship

Contractor shall install a full-scale mock up for a length of 7.5m of typical detailing treatment at locations to be confirmed by the Architect.

The visual mock-up for the assembly will be required to be accepted and endorsed by the Architect with respect to appearance of colour.
2.1.23 MISCELLANEOUS

2.1.23.1 General
This part of the specification covers miscellaneous items such as Inserts, bolts, cutouts, metal lath and wire fabric.

2.1.23.2 Applicable Codes and Standards
IS:412 - Expanded metal steel sheets for general purposes.

2.1.23.3 Inserts, Bolts, Cutouts, etc.

2.1.23.3.1 Workmanship
All the miscellaneous inserts such as bolts, pipes, plate embedments etc. either supplied free by the Owner or to be furnished by the Contractor shall be accurately installed in the building works at the correct locations and levels, all as detailed in the construction drawings. Contractor shall prepare and use templates for this purpose, if so directed by the Engineer. In the event, any of the inserts are improperly installed, Contractor shall make necessary arrangements to remove and re-install at the correct locations/levels, all as directed by the Engineer without any extra cost to the Owner.
The rate quoted by the Bidder for concrete works shall hold good for accurately fixing the inserts at the correct levels/alignment and shall include the cost of any temporary supports/anchors such as bars including cutting, bending, welding, etc. as required.
Steel templates shall be used by the Contractor to locate and very accurately position bolts, groups of bolts, inserts, embedded parts, etc. at his cost. Such templates shall be got previously approved by the Engineer. Templates shall invariably be supported such that the same is not disturbed due to vibration, movement of labourers, materials, shuttering work, reinforcement, etc. while concreting. The Contractor will have to suitably bend, cut or otherwise adjust the reinforcement in concrete at the location of inserts, as directed by the Engineer. If the Engineer so directs, the inserts will have to be welded to reinforcement to keep these in place. The Contractor shall be responsible for the accuracy of dimensions, levels, alignments and centre lines of the inserts in accordance with the drawings and for maintenance of the same until the erection of equipment/structure or final acceptance by the Owner.
The Contractor shall ensure proper protection of all bolts, inserts, etc. from weather by greasing or other approved means such as applying white lead putty and wrapping them with gunny bags or canvas or by other means as directed by the Engineer to avoid damage due to movement of his labourers, materials, equipment, etc. No extra claim from the Contractor on this account shall be entertained. The Contractor shall be solely responsible for all damage caused to bolts, inserts, etc. due to his negligence and in case damage does occur, they shall be rectified to the satisfaction of the Engineer at the Contractor’s cost.
Cut outs, chamfers, pockets, etc. shall be left as indicated in the drawings and no extra cost shall be payable for providing these at their correct locations. The Contractor shall take all necessary precautions to protect the cut outs from accidentally getting filled up or the edges getting broken.

### 2.1.23.4 Wooden/Bamboo/MS railing (Deck)
Providing and fixing wooden 100mm x 60mm rounded hand rails in straight lengths complete. With 1st class Teak wood / Sissu wood (0.9m high)

### 2.1.23.5 TECHNICAL SPECIFICATION CHILDREN PLAY AREA

#### 2.1.23.5.1 Scope of works
The scope of works under this contract includes supply and installation of playground equipment’s.

Type of playground equipment’s:
- Elephant Slide

#### 2.1.23.5.2 General specification:
- The design of the playground as an area will be aesthetical, and shall not distort with the local surroundings, neighbourhood architecture and community heritage.
- The design of the playground area has to consider the accessibility for children with any sort of impairment.
- The different components of each play area will be coherent among the terms of materials, colours, sizes, finishing and qualities.
- Bidder must visit the site to be aware about the location and the conditions of the park.
- Bidders must submit valid and updated Product Certificate issued by TUV Product Service or equivalent test agency for each reference. Such documents certify those products and processes comply with a set of standards pertaining to child safety, both in their design and in the materials used to make them, in accordance with standard EN 1176.
- The Contractor shall supply and fix all materials which shall be new and in a good condition. The Contractor shall supply all the necessary skilled and nonskilled manpower to complete the works in accordance with the programmer.
- The contractor will be responsible for all civil and machinery works for playground equipment’s and rubber surfaces including, site preparation, excavation, removing the debris, backfilling, levelling, compacting, Contractor shall clean the jobsite of excess materials, including post hole excavations.
- Play equipment design should be creative and preferring new models.
- Catalogues must be attached, and the selected equipment must be identified by the number of the page, code number, type etc.
• Samples of the Main Materials Specifications corresponding to the play equipment’s and rubber surfaces which specified in tenderer offer must be provided by the bidder board. Samples must contain a clear an explanatory description.

• The play equipment’s must be suitable for children use for ages (5-12) Play equipment’s safety regulations in particular the norms of EN 1176 and EN 1177.

• Contractor to prepare shop drawings with proposed layout & details for playground equipment’s which to be submitting to the MM. engineers for approval prior to placing any order.

• All materials used to be with a record of durability in outdoor setting withstanding harsh weather conditions and a temperature that rises above 40 degrees Celsius and durability to resists local weather. Moreover, all metals shall be hot-dip galvanized only after steel manufacturing including welding points, and powder coated to prevent rust as per below Main Material specifications.

• Colors& finishes are up to the client’s /PMC approval.

• Sites to be kept clean and put back to its original state as handed over to the contractor by Engineer.

• Contractor must fix in each game a plate showing manufacturer, and supplier information.

• All accessible edges shell is machined to a rounded finish. All welds shall be watertight, buffed smoother, or polished to a non-visible finish and factory pressure tested. All games must be a completely safe play environment with no pinch points, head entrapments or protrusion hazard.

2.1.23.5.3 Warranty:

• Minimum of five years against failure due to material or production defects on all galvanized and other non-coated steel and metal parts, solid plastic and HPL or HDPE panels and machined timber. Also, against failure due to material or production defects on springs, coated metal parts, plastic parts and net constructions. Against functional errors due to material or production defects.

• The warranty covers also the wooden materials.

• Any warranty extension provided by bidder companies shall be considered as an added value by the engineer committee.

2.1.23.5.4 Quality & standards:

• The companies must provide ISO 9001 and ISO 14001 (Quality & Environmental management systems) certified from the main factory.

2.1.23.5.5 Shop drawings:

• The Contractor after completing all contractual obligations shall prepare all the required shop drawings in a scale of 1: 50 for Plans, 1: 10 for Details.

• Drawings and instruction: product drawing and installation manuals shall be supplied by the manufacturer for ease of installation

2.1.23.5.6 Play equipment specifications

Main material specification:
2.1.23.5.7 Metal:

- All metallic components shall be of class or grade according to norm UNE-EN 10204:2006. Main metallic parts refer to equipment structural posts, walkways, swing crossbeam and equivalents.
- Main metallic parts shall be in hot dip galvanized steel after manufacturing and powder coated, free of lead and high resistance to weather deterioration.
- Steel welding pints and any direct junction/connection between poles shall be treated with a hot-dip galvanized treatment after its manufacture in order to avoid corrosion.
- Main metallic parts shall optionally by an aluminium with a square profile of 95mm x 95mm and 3mm thick, with internal nerves of also 3mm and dust powder coated, free of lead and high resistance to weather deterioration.
- Metallic accessories refer to those components which are highly exposed to wear like slide sheets, tunnels, swing lintels, sliding poles, bar slides, screws, pads and swing chains, punctured sheets, brackets, bars and steps, among others.
- All metallic accessories shall have stainless steel quality AISI304 or AISI316 highly resistant to extreme weather conditions like beach humidity, salty water, sandy wind, etc.
- Metallic accessories like brackets, handle bars and climbing, ladder steps which are not for slide purposes shall be optionally made in anodized aluminium.
- Metallic clamps refer to brides, flanges any other tool connecting structural poles to main decks and floors.
- All metallic clamps shall be made of casted aluminium with a high resistance to exhaustion.
- Metallic anchoring shoes refers to fixing method of equipment in surface.
- All metallic anchoring shoes shall be made of hot dip galvanized steel. Dimensions as per manufacturers drawings corresponding to equipment.
- All metallic anchoring shall isolate wooden structures from the humidity of the floor.
- All metallic anchoring shall be adjustable(prefer), allowing expansion due to dilation and sample surface in contact with ground.
- All metallic anchoring shall be of an easy installation and substitution of components without the need to disassemble the whole element.

2.1.23.5.8 Wood:

- Wood class or grade according to norm UNE EN -335-1.
- Wooden structural parts refer to tower poles and crossbeams.
- Wooden structural parts shall be made of laminated pine or equivalent, with a water-based coat finishing not affected by local weather conditions.
- Wooden structural parts shall be autoclaved treatment risk IV or superior and minimum dimension of 95mmx95mm.
- Wooden structural parts shall count with PEFC and FSC certification.
- Wooden structural parts shall be planned and rounded at the edges and all screws and bolts are either countersunk or plastic cap covered.
- Wooden structural parts shall be resistant of fungus, rotting, humidity, fire and insects such as termites.
- Wooden structural parts shall be resistant to humidity, salty water and sandy wind.
- All tops of the wooden structural parts should be covered by injected plastic piece cover or equivalent.

2.1.23.5.9 Rope:
- Rope refers to cord material in climbing wall parts excluding frame, rope bridges, basket swings and any other component composed by climb and tread cord.
- All rope components must be plaited cable including a fibre or steel core, depending on resistance and structural demands of the play set.
- All rope component must have a polyamide coating
- All rope shall have a minimum diameter of 16 mm, and maximum of 20 mm.
- All structural climbing walls shall include plastic pieces strengthening the protection from wear and a low maintenance.

2.1.23.5.10 Plastics
- Plastics pieces refer to joints and tubes’ endpoints, handles, interactive movable pieces, rope end sections, rope step protectors, nut and hardware cover.
- All plastic pieces shall be injected plastic elements made of polyamides and polypropylene, depending on each piece’s use requirements.
- All plastic pieces shall include a filter against degradation and discoloration caused by UV rays, and also complies with playground standard related to dangerous and toxic substances.
- Highly resistant to wear and weather conditions and retain their properties among the temperatures of 30° and 60°.

2.1.23.6 GARDEN FURNITURE & DUSTBINS.
The bidder shall have to submit the garden furniture like sitting benches and dustbins etc. The layout and design shall be submitted to PMC for Approval.
Cast in situ furniture/ sitting around the existing big trees are proposed in wood.
Supply & Installation of garbage Litter Bins, 60 litres, 100% Virgin HDPE, UV resistant & crack resistant, Reinforced Lids with Ergonomic design
Quality, make, colour, material shall be approved by the client/ PMC of all the garden furniture.
Bidder needs to submit the catalog and detail specification of the furniture and garbage bins.
2.1.23.7 ARTIFICIAL ROCK, ISLAND, ANIMAL & BIRDS & OTHER TOPIARY STRUCTURE

The build the rock wall along the entrance boundary wall and create the entry gate for using guard room / Ticket counter etc. to give the jungle theme for the entry gate.

The bidder shall design, build, install and maintain the artificial stone Actual size of Animal &Birds structure of minimum height 4 meter. The bidder shall submit the design & layout concept of Sculptures in stone, wood, metal, green wall etc. Artificial rock in high quality fiber reinforced - Making of artificial hill with a base structure of Ferro-cement, with 100% water proof as per detailed drawing. Bidder to submit the detail and drawings and take the approvals from client/PMC before execution of work.

The topiaries to be constructed in MS bars (minimum dia 8 mm) in the desired shape of the animal fixed on PCC base and required shrubs to fill it.

2.1.23.8 TOILETS

The bidder shall to design, built, install and maintain Public utilities /Toilets etc. The bidder shall to provide adequate facilities of Public utilities /Toilets/ Guard Rooms etc. in all sense with good industrial practice. The bidder shall to submit the detail drawings of all the components which includes sanitation, plumbing, electrical civil, HVAC etc. The bidder shall also provide the adequate water storage for toilets and drinking water cooler, power back up for emergency light, etc. The bidder shall have to maintain the Public utilities /Toilets/ Guard Rooms etc. areas and fixture for one year and replace the fixtures which are not working during maintenance period.

All the toilets to be bio toilet with adequate bio digester. The detailed spces as follows.

2.1.23.8.1 Urinal Unit

<table>
<thead>
<tr>
<th>Sr.no</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mild steel frame</td>
<td>Mild steel frame as per is 4923 apollo/jindal or Similar 38 mm square tubing atleast 2mm thick</td>
</tr>
<tr>
<td>2.</td>
<td>Galvanized steel Paneling</td>
<td>Galvanized steel panelling as per is 277 Tata/essar/jindal or similar atleast 22 gauge</td>
</tr>
<tr>
<td>3.</td>
<td>Flooring</td>
<td>Stainless steel 304 14/16 gauge Jindal make atleast 16 gauge</td>
</tr>
<tr>
<td>4.</td>
<td>PAN</td>
<td>Stainless steel 304 heavy duty silvershine or Similar make atleast 18 gauge oval type gents urinal</td>
</tr>
<tr>
<td>5.</td>
<td>Paint</td>
<td>Zinc rich epoxy based primer, epoxy based main coat, polyurethane based final glossy coat, dual Tone color as desired by authority atleast 16 micron each layer Berger make or similar</td>
</tr>
</tbody>
</table>
6. **Plumbing** | Finolex make or similar schedule-40
9. **Wash basin** | STAINLESS STEEL MAKE at least 20 gauge
10. **Electrical wiring** | ISI make anchor or similar
11. **Water tank** | Plasto make or similar should be overhead
12. **Exhaust fan** | Crompton/ Havells or similar
13. **Roofing** | Heavy duty roofing sandwich type panel at least 22 gauge
| Load bearing capacity of at least 500 kg
14. **Heat insulation** | Puff type with density of 40kg/m³ at least 35 mm thick

**Partition**

<table>
<thead>
<tr>
<th>Sr.no</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mild steel frame</td>
<td>MILD STEEL FRAME AS PER IS 4923 APOLLO/JINDAL OR SIMILAR 38 MM SQUARE TUBING AT LEAST 2MM THICK</td>
</tr>
<tr>
<td>2.</td>
<td>Galvanized steel paneling</td>
<td>GALVANIZED STEEL PANELLING AS PER IS 277 TATA/ESSAR/JINDAL OR SIMILAR ATLEAST 22 GAUGE</td>
</tr>
<tr>
<td>3.</td>
<td>Flooring</td>
<td>STAINLESS STEEL 304 14/16 GAUGE JINDAL MAKE ATLEAST 16 GAUGE</td>
</tr>
<tr>
<td>4.</td>
<td>PAN</td>
<td>STAINLESS STEEL 304 HEAVY DUTY SILVERSHINE OR SIMILAR MAKE ATLEAST 18 GAUGE OVAL TYPE GENTS URINAL WESTERN TYPE FOR HANDICAPPED STAINLESS STEEL 304 MAKE.</td>
</tr>
<tr>
<td>5.</td>
<td>Paint</td>
<td>ZINC RICH EPOXY BASED PRIMER, EPOXY BASED MAIN COAT, POLYURETHANE BASED FINAL GLOSSY COAT, DUAL TONE COLOR as desired by authority at least 16 micron each layer BERGER MAKE OR SIMILAR</td>
</tr>
<tr>
<td>6.</td>
<td>Plumbing</td>
<td>FINOLEX MAKE OR SIMILAR SCHEDULE-40</td>
</tr>
<tr>
<td>8.</td>
<td>Transportation</td>
<td>INCLUDED</td>
</tr>
<tr>
<td>9.</td>
<td>Wash basin</td>
<td>STAINLESS STEEL MAKE AT LEAST 20 GAUGE</td>
</tr>
<tr>
<td>10.</td>
<td>Electrical wiring</td>
<td>ISI MAKE ANCHOR OR SIMILAR</td>
</tr>
<tr>
<td>11.</td>
<td>Water tank</td>
<td>Plasto make or similar should be overhead</td>
</tr>
<tr>
<td>12.</td>
<td>Exhaust fan</td>
<td>Crompton/ Havells or similar</td>
</tr>
</tbody>
</table>
13. **Roofing**  
Heavy duty roofing sandwich type panel atleast 22 gauge load bearing capacity of atleast 500 kg

14. **Heat insulation**  
Puff type with density of 40kg/m³ atleast 35 mm thick partition

---

**2.1.23.9 TRELLIS AND PERGOLA**

The bidder shall to design, built, install and maintain Trellis and Pergola in Mild steel section as/drawing. The bidder submits the design & layout concept of steel Trellis and Pergola. The wooden Trellis and Pergola shall be design for shade view and vista. Bidder shall submit the detail and drawings of sculpture and take the approvals from client/PMC before execution of work.

**2.1.23.10 Exterior/Recycled Wood Flooring**

Seasoned/recycled wooden planks of size 1500 mm x 300 m x 20 mm to be installed at a spacing of 600 mm c/c over well compacted soil as approved by the engineer in charge.

**2.1.23.11 Chain link fencing**

Providing and fixing PVC quoted GI chain link fencing of wire thickness 3mm and fencing opening of 2" of 8 feet high including MS angle section 50 mm x 50 mm x 5 mm of mild steel spaced 10 feet apart on all four sides of the court.

The Other miscellaneous items like Information desk, Display Panels, sofa, Book shelf, Storage racks, storage for souvenirs, standing Binoculars for building deck and standing binoculars for viewing deck etc. the bidder to submit the detail and drawings and take the approvals from client/PMC before execution of work. Bidder to select all the above items as per good market brand and submit the sample and take prior approval form from client/PMC.

**2.1.23.12 Floating jetty**

Supply and installation of HDPE pontoons of size 500 mm x 500 mm x 400 mm and thickness 6 mm minimum made up of pure virgin grade MBM of haldia petrochemical/Indian oil.SS railing to be provided on both side height up to 1 m. The product to be approved by Cipet.

**2.1.23.13 Geo cell**

Geo cell is a light weight 3D honey comb like cellular confinement system, which offer eco-friendly solution for various civil engineering challenges. Engineered for diversity.

It should have following properties. The Geo cell has to be fixed to the ground using minimum 600 mm fastener as/vendor specs.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polymer density</td>
<td>g/cm³</td>
</tr>
<tr>
<td>Environmental Stress Cracking</td>
<td>Hrs</td>
</tr>
<tr>
<td>Resistance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.935-0.965</td>
</tr>
<tr>
<td></td>
<td>&gt;5000</td>
</tr>
<tr>
<td>Carbon Black Content</td>
<td>%</td>
</tr>
<tr>
<td>----------------------</td>
<td>---</td>
</tr>
<tr>
<td>Material</td>
<td>Blend of various Polyethylene and additives</td>
</tr>
<tr>
<td>Texture</td>
<td>Polyethylene strip consists of a multiple indentations over the entire strip area on both sides of strip.</td>
</tr>
<tr>
<td>Perforations</td>
<td>Polyethylene strip is perforated with horizontal rows of maximum 10mm diameter holes. Cell perforations area is less than 12% of cell surface area.</td>
</tr>
<tr>
<td>Strip Thickness</td>
<td>1.2 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cell / Section properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property</td>
</tr>
<tr>
<td>Weld Spacing (+/-3%)</td>
</tr>
<tr>
<td>Cell Depth (+/-3%)</td>
</tr>
<tr>
<td>Expanded Cell Dimensions (+/-3%)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Expanded Cell Area (+/-3%)</td>
</tr>
<tr>
<td>Nominal Expanded Section Dimension (+/-3%)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Nominal Expanded Section Area</td>
</tr>
<tr>
<td>Seam Peel Strength</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
2.1.23.14 Rolling Shutter

2.1.23.14.1 Materials

Metal Rolling Shutters should conform to IS:6248. The rolling shutter accessories should be as specified and approved should be suitable for fixing in position as specified i.e. outside or inside; on or below lintel or between jambs of the opening.

Rolling shutter to be hand operated of push and pull type. The shutter consist of 80 mm wide MS laths 1.25 mm thick or gauge as specified of mild steel sheet machine rolled. Laths are inter-locked together throughout its entire length and jointed together at the end with end locks. These are mounted on specially designed pipe shaft.

2.1.23.14.2 Cold Rolled Steel Strips

Cold Rolled Steel Strips used for rolling shutter lath sections shall conform to temper No. 5, Dead soft quality of IS:4030.

2.1.23.14.3 GI Sections

GI Sheets and Plates used for manufacturing the guide channels, brackets and lock plate should be of hot rolled steel of thickness not less than 18 gauge conforming to IS:5986. These shall be free from surface defects and the edges shall be cleanly sheared. All components of rolling shutter to be hot dip galvanised with a zinc coating containing not less than 97.5% pure zinc. The minimum weight of zinc coating to be 230 g/sq.m.. The coating shall be free from flaking/peeling.

2.1.23.14.4 Steel Pipe

GI Pipes used for the suspension shaft of the roller should be heavy duty pipe suitable for mechanical purposes and shall conform to IS:1161.

2.1.23.14.5 Springs

The springs used in the roller for counter balancing the rolling shutter should be made either from high tensile spring steel wire or flat spring steel strip. The spring steel wire used or helical spring should conform to Grade 2 of IS:4454. Flat spring steel strip used for spiral spring shall be from 0.8 to 1.0 percent carbon steel strip especially hardened and tempered.

Both the side guides and bottom rails are jointless and of single piece of pressed steel of minimum 16 gauge thickness. The top cover of shaft, spring etc. should be of the same materials as that of lath. Hood, brackets etc. are required to cover the shaft etc. The reduction gear arrangement operated by the mechanical device should be of the best quality and easy in operation.
2.1.23.14.6 Fixing of Rolling Shutter

First the brackets are fixed on the lintel/beam or under the lintel/beam as required with rawl plugs and screws, bolts, washers etc. The shafts along with the spring are then fixed on the brackets. The lath portion (shutters) is laid on ground and the side guide channels are bound with it. The shutter is then placed in position. The side guide channels are fixed to the wall through the plates welded to the guides. These plates and brackets should be fixed by means of steel screws, bolts and rawl plugs drilled into the wall.

The plates and screws, bolts shall be concealed in plaster to make their locations invisible. Fixing should be done accurately so that the operation of the shutter is easy and smooth. The smooth and easy working of shutters are ensured. To prevent rusting of shutters, it is cleaned off dust, scales, rust etc. and priming with a coat of red oxide paint is done before fixing the shutter in position and then it is painted with two coats of flat/synthetic enamel paint.

2.1.23.15 Musical Fountain

Supply, installation, Testing & Commissioning of complete musical fountain with complete electro mechanical features including all lightings and nozzles and electric panels.

The Specification as follows.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description</th>
<th>Qty.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Supply, installation, Testing &amp; Commissioning of stream jet nozzle made of Brass with ball valve and fittings for UFA fountain, 1.0inch connection(fountain Height 30-40ft)</td>
<td>50</td>
<td>NOS</td>
</tr>
<tr>
<td>2</td>
<td>Supply, installation, Testing &amp; Commissioning of 6 arm revolving nozzle with ball valve and fittings</td>
<td>5</td>
<td>NOS</td>
</tr>
<tr>
<td>3</td>
<td>Supply, installation, Testing &amp; Commissioning of high shooter nozzle made of brass with ball valves and fittings. 1.0 inch connection(fountain Height 30-40ft)</td>
<td>5</td>
<td>NOS</td>
</tr>
<tr>
<td>4</td>
<td>Supply, installation, Testing &amp; Commissioning of sunburst nozzle assembly with ball valves and fittings</td>
<td>1</td>
<td>NOS</td>
</tr>
<tr>
<td>5</td>
<td>Supply, installation, Testing &amp; Commissioning of aerator nozzle for corner jet made of brass with ball valves and fittings, 1.0 inch connection(fountain Height 15-20ft)</td>
<td>4</td>
<td>NOS</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Quantity</td>
<td>Unit</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------------------------------------</td>
<td>----------</td>
<td>------</td>
</tr>
<tr>
<td>6</td>
<td>Supply, installation, Testing &amp; Commissioning of 6ft inner ss ring with 18 nozzle (1/2 inch) set with ball valve and fittings (fountain Height 15-20ft)</td>
<td>2</td>
<td>NOS</td>
</tr>
<tr>
<td>7</td>
<td>Supply, installation, Testing &amp; Commissioning of 2D nozzle assembly (fountain Height 25-30ft)</td>
<td>5</td>
<td>NOS</td>
</tr>
<tr>
<td>8</td>
<td>Supply, installation, Testing &amp; Commissioning of IP68, Brass / SS 304 Body, 24VDC, solenoid valve 1.0&quot; connection with required accessories, U-flow</td>
<td>48</td>
<td>NOS</td>
</tr>
<tr>
<td>9</td>
<td>Supply, installation, Testing &amp; Commissioning of IP68, Brass / SS 304 Body, 24VDC, solenoid valve 1.5&quot; connection with required accessories, U-flow</td>
<td>10</td>
<td>NOS</td>
</tr>
<tr>
<td>10</td>
<td>Supply, installation, Testing &amp; Commissioning of IP68, Brass / SS 304 Body, 24VDC, solenoid valve 2.0&quot; connection with required accessories, U-flow</td>
<td>8</td>
<td>NOS</td>
</tr>
<tr>
<td>11</td>
<td>Supply, installation, Testing &amp; Commissioning of IP68, Brass / SS 304 Body, 24VDC, solenoid valve 2.5&quot; connection with required accessories, U-flow</td>
<td>4</td>
<td>NOS</td>
</tr>
<tr>
<td>12</td>
<td>Supply, installation, Testing &amp; Commissioning of 54W LED nozzle mounted Light 24VDC</td>
<td>5</td>
<td>NOS</td>
</tr>
<tr>
<td>13</td>
<td>Supply, installation, Testing &amp; Commissioning of 36W LED nozzle mounted Light 24VDC</td>
<td>91</td>
<td>NOS</td>
</tr>
<tr>
<td>14</td>
<td>Supply, installation, Testing &amp; Commissioning of 36W LED Light 24VDC</td>
<td>20</td>
<td>NOS</td>
</tr>
<tr>
<td>15</td>
<td>Supply, installation, Testing &amp; Commissioning of 18W LED Light nozzle mounted 24VDC</td>
<td>11</td>
<td>NOS</td>
</tr>
<tr>
<td>16</td>
<td>Supply, laying, testing and commissioning of PVC insulated sheathed copper conductor 1100 V grade unarmoured cable. of following Size</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Make: Deep Cable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>3sqmm 4core wire 100meter</td>
<td>8</td>
<td>NOS</td>
</tr>
<tr>
<td>b</td>
<td>2.5sqmm 4core wire 100meter</td>
<td>2</td>
<td>NOS</td>
</tr>
<tr>
<td>c</td>
<td>1.75sqmm 2core wire 100meter</td>
<td>2</td>
<td>NOS</td>
</tr>
<tr>
<td>d</td>
<td>1.5sqmm 2 core wire 100 meter</td>
<td>1</td>
<td>NOS</td>
</tr>
<tr>
<td>e</td>
<td>1.0sqmm 2 core wire 100meter</td>
<td>1</td>
<td>NOS</td>
</tr>
<tr>
<td>f</td>
<td>0.5sqmm 25core shield wire 100meter</td>
<td>3</td>
<td>NOS</td>
</tr>
</tbody>
</table>
17. Supply, laying, testing and commissioning of PVC insulated sheathed copper conductor 1100 V grade unarmoured/armoured cable for Submersible Pump

18. Supply, laying, testing and commissioning of following size PVC electrical conduit complete as required.

19. Supply, installation, Testing & Commissioning of Stainless Steel 304 Grade header for fountain

20. Supply, installation, Testing & Commissioning of 2d nozzle controller and driver

21. Supply, installation, Testing & Commissioning of PLC for 2D

22. Supply, installation, Testing & Commissioning of 50CH PLC

23. 1000W ,24V Power Supply and controllers for lights and solenoid valves


25. Supply of Single stage High speed horizontal centrifugal monobloc with volute type delivery casing, Open Well Submersible pump, delivery casing & Motor body in CI, Motorshafts in carbon steel, impeller in CI with motor 35HP (1 Working + 1 Standby)

26. Supply, installation, Testing & Commissioning of 8CH musical Console

27. Supply, installation, Testing & Commissioning of 500W sound system with 250W 2.speakers

28. Supply, installation, testing and commissioning of 240/415 V, 1 / 3 Phase and 50 Hz motor. The switchboard cubical indoor type made of 16 SWG CRCA Sheet Painted with powder coated paint of Siemens grey shade. The cubical is wall mounted with dust & vermin Proof construction with inter connection. It comprise MCB, SPP, Relay, Digital Voltmeter, Digital Ammeter, phase indicating lamp, Etc.

29. UPVC pipe and Fittings (Sch 40) complete

2.1.23.16 Adventure Games
Supply, installation of adventure games as follows.
<table>
<thead>
<tr>
<th>SR NO</th>
<th>IMAGE</th>
<th>SPECIFICATION</th>
</tr>
</thead>
</table>
| 01    | ![Burma Bridge Image](image1.png) | NAME- BURMA BRIDGE  
SPECIFICATION-  
Bridge length - Distance Between Two Tree Approx. 50 meter  
Platform – 5 X 5 ft  
12 Mm / 16 Mm Wire Rope  
Material-Wire Rope, Static Rope, U Clamp, CPVC Pipe, Wood Plank, Fibre Material, Iron Material  
Indian Safety Equipment Will Be Provided. (1 Bridge-1 Set{(Helmet, Harness, Carabineer, Sealing, Belay Pulley)}) |
| 02    | ![Bamboo Bridge Image](image2.png) | NAME- BAMBOO BRIDGE  
SPECIFICATION-  
Bridge length - Distance Between Two Tree Approx. 50 meter  
Platform – 5 X 5 ft  
12 Mm / 16 Mm Wire Rope  
Material-Wire Rope, Static Rope, U Clamp, CPVC Pipe, Wood Plank, Fibre Material, Iron Material  
Indian Safety Equipment Will Be Provided. (1 Bridge-1 Set{(Helmet, Harness, Carabineer, Sealing, Belay Pulley)}) |
| 03    | ![Balance Bridge Image](image3.png) | NAME- BALANCE BRIDGE  
SPECIFICATION- |
Bridge length - Distance Between Two Tree Approx. 50 meter
Platform – 5 X 5 ft
12 Mm / 16 Mm Wire Rope
Material: Wire Rope, Static Rope, U Clamp, CPVC Pipe,
Wood Plank, Fibre Material, Iron Material
Indian Safety Equipment Will Be Provided.
(1 Bridge-1 Set{(Helmet, Harness, Carabineer, Sealing, Belay Pulley)})

04

NAME: HORIZONTAL BAMBOO BRIDGE
SPECIFICATION:
Bridge length - Distance Between Two Tree Approx. 50 meter
Platform – 5 X 5 ft
12 Mm / 16 Mm Wire Rope
Material: Wire Rope, Static Rope, U Clamp, CPVC Pipe,
Wood Plank, Fibre Material, Iron Material
Indian Safety Equipment Will Be Provided.
(1 Bridge-1 Set{(Helmet, Harness, Carabineer, Sealing, Belay Pulley)})
NAME- HANGING TYRE BRIDGE

SPECIFICATION-
Bridge length -Distance Between Two Tree Approx. 50 meter
Platform – 5 X 5 ft
12 Mm / 16 Mm Wire Rope
Material-Wire Rope, Static Rope, U Clamp, CPVC Pipe,
Wood Plank, Fibre Material, Iron Material
Indian Safety Equipment Will Be Provided.
( 1 Bridge-1 Set{(Helmet, Harness, Carabineer, Sealing, Belay Pulley)})

NAME- HANGING BRIDGE SPECIFICATION-
Bridge length -Distance Between Two Tree Approx. 50 meter
Platform – 5 X 5 ft
12 Mm / 16 Mm Wire Rope
Material-Wire Rope, Static Rope, U Clamp, CPVC Pipe,
Wood Plank, Fibre Material, Iron Material
Indian Safety Equipment Will Be Provided.
( 1 Bridge-1 Set{(Helmet, Harness, Carabineer, Sealing, Belay Pulley)})
<table>
<thead>
<tr>
<th>NAME</th>
<th>Horizontal bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIFICATION</td>
<td>Bridge length - Distance Between Two Tree Approx. 50 meter</td>
</tr>
<tr>
<td></td>
<td>Platform - 5 X 5 ft</td>
</tr>
<tr>
<td></td>
<td>12 Mm / 16 Mm Wire Rope</td>
</tr>
<tr>
<td>Material</td>
<td>Wire Rope, Static Rope, U Clamp, CPVC Pipe, Wood Plank, Fibre Material, Iron Material</td>
</tr>
<tr>
<td>Indian Safety Equipment Will Be Provided.</td>
<td></td>
</tr>
<tr>
<td>(1 Bridge-1 Set{(Helmet, Harness, Carabineer, Sealing, Belay Pulley)})</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NAME</th>
<th>Knocking Bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIFICATION</td>
<td>Bridge length - Distance Between Two Tree Approx. 50 meter</td>
</tr>
<tr>
<td></td>
<td>Platform - 5 X 5 ft</td>
</tr>
<tr>
<td></td>
<td>12 Mm / 16 Mm Wire Rope</td>
</tr>
<tr>
<td>Material</td>
<td>Wire Rope, Static Rope, U Clamp, CPVC Pipe, Wood Plank, Fibre Material, Iron Material</td>
</tr>
<tr>
<td>Indian Safety Equipment Will Be Provided.</td>
<td></td>
</tr>
<tr>
<td>(1 Bridge-1 Set{(Helmet, Harness, Carabineer, Sealing, Belay Pulley)})</td>
<td></td>
</tr>
</tbody>
</table>
| 09 | NAME- POLE BRIDGE  
SPECIFICATION-  
Bridge length - Distance Between Two Tree Approx. 50 meter  
Platform – 5 X 5 ft  
12 Mm / 16 Mm Wire Rope  
Material-Wire Rope, Static Rope, U Clamp, CPVC Pipe, Wood Plank, Fibre Material, Iron Material  
Indian Safety Equipment Will Be Provided.  
(1 Bridge-1 Set{(Helmet, Harness, Carabineer, Sealing, Belay Pulley)}) |
|----|---|
| 10 | NAME- PLANK BRIDGE  
SPECIFICATION-  
Bridge length - Distance Between Two Tree Approx. 50 meter  
Platform – 5 X 5 ft  
12 Mm / 16 Mm Wire Rope  
Material-Wire Rope, Static Rope, U Clamp, CPVC Pipe, Wood Plank, Fibre Material, Iron Material  
Indian Safety Equipment Will Be Provided.  
(1 Bridge-1 Set{(Helmet, Harness, Carabineer, Sealing, Belay Pulley)}) |
NAME - STEPPING BRIDGE
SPECIFICATION -
Bridge length - Distance Between Two Tree Approx. 50 meter
Platform – 5 X 5 ft
12 Mm / 16 Mm Wire Rope
Material - Wire Rope, Static Rope, U Clamp, CPVC Pipe,
Wood Plank, Fibre Material, Iron
Material
Indian Safety Equipment Will Be Provided.
(1 Bridge-1 Set{(Helmet, Harness, Carabineer, Sealing, Belay Pulley)})

NAME - NET BRIDGE
SPECIFICATION -
Bridge length - Distance Between Two Tree Approx. 50 meter
Platform – 5 X 5 ft
12 Mm / 16 Mm Wire Rope
Material - Wire Rope, Static Rope, U Clamp, CPVC Pipe,
Wood Plank, Fibre Material, Iron
Material
Indian Safety Equipment Will Be Provided.
(1 Bridge-1 Set{(Helmet, Harness, Carabineer, Sealing, Belay Pulley)})
| 13 | NAME- ZIG ZAG BRIDGE SPECIFICATION-  
|    | Bridge length -Distance Between Two Tree Approx. 50 meter  
|    | Platform – 5 X 5 ft  
|    | 12 Mm / 16 Mm Wire Rope  
|    | Material-Wire Rope, Static Rope, U Clamp, CPVC Pipe, Wood Plank, Fibre Material, Iron Material |
| 14 | NAME- ZIG ZAG PLANK BRIDGE SPECIFICATION-  
|    | Bridge length -Distance Between Two Tree Approx. 50 meter  
|    | Platform – 5 X 5 ft  
|    | 12 Mm / 16 Mm Wire Rope  
|    | Material-Wire Rope, Static Rope, U Clamp, CPVC Pipe, Wood Plank, Fibre Material, Iron Material  
|    | Indian Safety Equipment Will Be Provided.  
|    | (1 Bridge-1 Set{(Helmet, Harness, Carabineer, Sealing, Belay Pulley)}) |
2.1.23.17 RCC garden benches

**Description:** This item shall govern the Provision of supply, erecting & installation of the precast concrete reinforced benches with back rest.

**General Requirement:** The precast concrete reinforced benches shall be manufactured in accordance with the design requirement and details shown in the plan and in conformity with the requirements.

**Material and construction methods:** The material materials and construction of precast concrete reinforced benches will be as follows:

**Concrete Mix Design:** The benches shall be cast using M-30 grade concrete mix in accordance with IS:10269:2009(with latest amendment).

In gray cement by using vibro- compaction Technique and with reinforcement as detail in the specification. The manufacturer shall be responsible to design a mix which achieves both the strength and the surface finished required for both installation & application. Compressive strength shall not be less then the 30Mpa at 28 days.

**Reinforced Steel:** T MT Reinforcement bars confirming to is :1786:2008 of dia 10mm shall be used as main reinforcement bar and 4mm dia. Mild steel bars shall be used as stirrups as per the reinforcement Diagram.
**Connections:** 12mm dia x 65mm long galvanized steel CSK (countersunk) bolts with EVA (Ethylene Vinyl Acetate) wash for connecting sitting plank with leg and half threaded carriage bolts & nuts with VA ang steel washes of shized 135mm length x 8mm dia .for connecting back rest plank with leg .Threaded steel fastener shall confirm to IS:1367 with latest amendments.

**Paint:** Red colour Acrylic based paint (othet colour may be used ,if decided by Engineer-in-charge) conforming to IS:15489should be used.

**Details of memberof precast concrete reinforced benches :**

a. **Rcc Base Supports:** two numbers of legs manufactured using M-30 grade gray cement concrete of back height 1000mm, front height 450mm, bottom width 620mm with 100mm thickness. Each leg shall be reinforced with 4nos. Of 10mm dia TMT bars distributed uniformly along the section and periphery of the legs and tied with 4mm dia mild steel stirrups as per detailed given in drawing. Each leg will have 3 nos 12mm dia 65 mmlength galvanised coupling nuts ,m welded suitably to the main reinforcement at appropriate locations on the seating to receive concrete planks on thr legs and 3 holes to receive carriage bolts for fixing back rest planks.

b. **Planks :** five RCC planks of sizes 1500mmx100mmx50mm shall be cast using M-30 grey cement mixed with 3 % redpigment ( other colour may be used , if decided by Engineer) and each planks reinforced with 2 nos.10mm dia TMTbars along the length of 10nos.4 mm dia mild steel bar along width and having 2 holred of 14 mm dia at approach location to receive 12 mm dauia galvanised bolts for fixing these planks on the legs. One RCC planck of sizes 1500mmx200mm x50mm shall be cat using M-30 grade gray cement concrete with mix with 3% red pigment ( Other colour may be used , if decided by Engineer) and shall be reinforced with 3 nos 10mm dia TMT bars along the length as per drawing and 10 nos 4mm dia mild steel bar along width and having two holes of 14mm dia at appropriate loction so as to receive 12 mm dia galvanied bolts for fixing on the legs.

5. **Finish :** Finish of concrete bench shall be generally equal to the approve sample .Exposed surface should exibite a typically uniformly smooth texture with ni bugs hole and smooth mold seams

6. **Tolerance :** All dimensions should be as per drawing +_ 3mm.

7. **Product delivery , Handling and storage**

a. Deliver material to site , ready for used in accepted manufacturers orginal and unopened containers and packaging , bearing levels as type of materials , brand / manufacture’s name.

b. Store materials under cover in a dry and clean location , of the ground .Removed delivered materials which are damage or otherwise not suitable for installation from job site, and replace with acceptable materials are directed by Engineer.

8 **Installation of RCC bench:** Each seating plank ( bottom) of bench will be bolted with leg with help of 12mm dia x 65 mm length galvanized steel CSK (countersunk) bolts with EVA (Ethylene vinyl
acetate) washer. Back the rest planks will be fitted with half threaded carriage bolts and nuts with EVA and steel washer of size 165mm length x 5m dia.

After assembly of klegs and planks at site, the hole visible at the back site of the bench will be sealed with cement mortar to prevent pilferage and plank will be painted with red color acrylic based paint (other color may be used if decided by tendering authority). Head of bolts shall be grouted with epoxy resins like Araldite.
2.2 HARDSCAPE

2.2.1 General
This specification covers the general requirements for external development works comprising of flooring, skirting, dado, plastering for wall and ceilings, painting, water proofing, Metal sheet cladding, grills and railing works.
The works under this specification shall consist of furnishing of all tools, plants, labour, materials, and everything necessary for execution.

2.2.2 FLOORING & PAVING

<table>
<thead>
<tr>
<th>FLOORING</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS 1200 (Part-XI)</td>
<td>Method of measurement of Building and Civil Engineering work (Part 11) paving, floor finishes, dado and skirting</td>
</tr>
<tr>
<td>IS 1237-Edition 2.3</td>
<td>Specification for cement concrete flooring tiles</td>
</tr>
<tr>
<td>IS 1443</td>
<td>Code of practice for laying and finishing of cement concrete flooring tiles</td>
</tr>
<tr>
<td>IS 2114</td>
<td>Code of practice for laying in-situ terrazzo floor finish</td>
</tr>
<tr>
<td>IS 3622</td>
<td>Specification for sand stone (Slab &amp; Tiles)</td>
</tr>
<tr>
<td>IS 4457</td>
<td>Acid and / or alkali Resistant tiles</td>
</tr>
<tr>
<td>IS 5318</td>
<td>Code of practice for laying of hard wood parquet and wood block floors</td>
</tr>
<tr>
<td>IS 5766</td>
<td>Code of practice for laying of burnt clay brick floor</td>
</tr>
<tr>
<td>IS 13630 (Part-1 to 15)</td>
<td>Methods of Testing for ceramic tiles</td>
</tr>
<tr>
<td>IS 13712</td>
<td>Specification for ceramic tiles, definition, classification characteristic and marking</td>
</tr>
<tr>
<td>IS 15622</td>
<td>Specification for pressed ceramic tile.</td>
</tr>
</tbody>
</table>

2.2.3 CEMENT CONCRETE FLOORING

2.2.3.1 Materials:
The specifications for materials, grading, mixing and the quantity of water to be added shall generally conform to their relevant specifications described under plain and reinforced concrete. The maximum size of coarse aggregate shall be 10 mm. The fine aggregate shall consist of properly graded sand. Concrete shall be mixed preferably by machine, and hand mixing shall be avoided as far as practicable.

2.2.3.2 Preparation of Base:
The base concrete surface shall be thoroughly chipped to remove laitance, caked mortar, loose sand, dirt etc. cleaned with wire brush and washed clean and watered until no more water is
absorbed. Where the base concrete has hardened so much that roughening the surface by wire brushes is not possible, the same shall be roughened by chipping or hacking at close intervals. The surface shall be soaked with water for at least 12 hours and surface water removed and dried before laying the topping. Before laying the concrete, cement slurry at 2.75 kg./sqm. of surface shall be applied for better bond. Concrete flooring shall then be laid in alternate bays in pattern and joints, wide/flush as per drawing. The edge of each panel into which the floor is divided shall be supported by wooden or metal strips duly oiled to prevent sticking. The panels shall be of uniform size and, unless otherwise specified, no dimension of panel shall exceed 2 m. and the area of a panel shall not be more than 2 sqm. However, the exact size of panel shall be decided by the Engineer-in-Charge to suit the size of the room. The joints in the floor finish shall extend through the borders and skirting/dado. The border shall have mitred joints at the corners of the room. Where glass/aluminium dividing strips are proposed to be provided, the same shall be fixed in cement mortar 1:2 @ 600 mm. centers or as specified in the schedule for full depth of the finished floor. The depth of dividing strips shall be the thickness as proposed for the finished floor in the item. In the case of flush joins, alternate panels only may be cast on same day. At least 48 hours shall elapse before the concreting of adjacent bay is commenced.

2.2.3.3 Mixing

The topping concrete shall be of mix of one part of cement, two parts of sand and 4 parts of well graded stone chips of 10 mm. maximum size. The ingredients shall be thoroughly mixed with just enough water to the required plasticity, having water cement ratio not more than 0.4.

2.2.3.4 Laying:

The free water on the surface of the base shall be removed and a coat of cement slurry to the consistency of thick cream shall be brushed on the surface. On this fresh grouted base, the prepared cement concrete shall be laid immediately after mixing. The concrete shall be spread evenly and laid immediately after mixing. The concrete shall be spread and levelled carefully. The concrete shall be completed and brought to the specified levels by means of a heavy straight edge resting on the side forms and down ahead with a sawing motion in combination with a series of lifts and drops alternatively with small lateral shifts, either mechanically or manually as directed by the Engineer-in-Charge. While concreting the adjacent bays, care shall be taken to ensure that the edges of the previously laid bays are not broken by carelessness or hand tamping. Immediately after laying the concrete, the surface shall be inspected for high or low spots and any needed correction made up by adding or removing the concrete and whole surface is again levelled. When the layer is made even, the surface shall be completed by ramming or beating and then screed to a uniform line and level. Before the initial set commences, the surface shall be trowelled to smooth and even surface free from defects and blemishes and tested with straight edges. No dry cement or mixture of dry cement
and sand shall be sprinkled directly, or empty gunny bags spread over the surface of the concrete to absorb excess water coming on top due to floating.

2.2.3.5 Finishing the Surface:
After the concrete has been fully compacted, it shall be finished by trowelling or floating. Finishing operations shall start shortly after the compaction of concrete and shall be spread over a period of one to six hours depending upon the temperature and atmospheric conditions. The surface shall be trowelled intermittently at intervals for several times so as to produce a uniform and hard surface. The satisfactory resistance of floor to wear depends largely upon the care with which trowelling is carried out. The objective of trowelling is to produce as hard and close knit a surface as possible. The time interval allowed between successive trowelling is very important. Immediately after laying only just sufficient trowelling shall be done to give a level surface. Excessive trowelling in the earlier stages shall be avoided as this tends to work a layer rich in cement to the surface, some time. After the first trowelling, the duration depending upon the temperature, atmospheric conditions and the rate of setting of cement used, the surface shall be re-trowelled many times at intervals to close any pores in the surface, and to bring to surface and scrap off any excess water in concrete or laitance (it shall not be trowelled back into the topping).

The final trowelling shall be done well before the concrete has become too hard but at such a time that considerable pressure is required to make any impression on the surface. Trowelling of rich mix of dry cement and fine aggregate on to the surface shall not be permitted. Trowel marks should not be seen on the finished surface. Where broom finish is specified, after the concrete has been thoroughly compacted, and when most of the surface water has disappeared, the surface shall be given broom finish with an approved type of brass or M.S. fiber. The broom shall be pulled gently over the surface from edge to edge in such a manner that corrugation shall be uniform in width and depth, the depth shall be not more than 1.5 mm. Brooming shall be done when the concrete is in such a condition that the surface will not be torn or unduly roughened by the operation. Coarse or long bristles which cause irregularities or deep corrugation shall be trimmed out. Brooms which are worn or otherwise unsatisfactory shall be discarded.

After the concrete in the bays has set, the joints of the panels should be filled with cement cream and neatly floated smooth or jointed. Care should be taken that just the minimum quantity of cream for joint is used and excess spilling over the already finished surface shall be removed when the cream is still green. In case of wide joints, the same shall be filled with pigmented cement concrete (1:2:4) using approved pigment and the joint shall be finished in perfectly straight line.

2.2.3.6 Steel Trowel Finish:
Areas where Marblex tiles are proposed to be used are required to have base concrete finished smooth by steel trowel.
2.2.3.7 Curing:
The completed flooring shall be protected from sun, wind and rain for the first two days and movement of persons over the floor is prohibited during this period. The finished surface shall be covered and cured continuously form the next day after finishing, at least for a period of 7 days. Bunding with murrum for curing is prohibited as it will leave permanent stain on the finished floor. Curing shall be done by spreading sand and kept damp throughout the curing period of seven days minimum. The surface shall be protected from any damage to it whatsoever. The surface shall then be allowed to dry slowly. All corners, junctions of floor with plastered wall surface shall be rounded off when required at no extra cost.

2.2.4 KOTA STONE FLOORING/ SKIRTING/ FACIA / SHELVES:

2.2.4.1 Materials
The stone shall be hard, sound, durable, homogeneous in texture and resistant to wear. These shall be without any soft veins, cracks or flaws and shall have uniform colour. They shall have natural surface free from broken flakes on top. Hand cut/ machine cut for exposed edges and machine polished. Kotah stone shall be of the best quality and of the specified thickness, size and the shade, which shall be got approved by the Engineer-in-charge. The slabs / tiles shall be rectangular or square in shape or as per pattern shown in drawing and as directed by the Engineer-in-charge. The sizes given in schedule of quantities are tentative and can vary only slightly as per the availability in the market. The thickness of the slab after it is dressed shall be 20, 25, 30 or 40 mm as specified in the item. Tolerance of (+/-) 2 mm shall be allowed for the thickness. In respect of length &width, tolerance in length & width shall be permissible upto (+/-) 5 mm for hand cut slabs & (+/-) 2 mm for machine cut slabs. At its thinnest, no stone shall be thinner than the specified thickness.

Uniformity of size and colour / shade shall generally be maintained for the stones used in any one room. The exposed surface shall be machine polished to a smooth, even and true plane and the edges hand cut and dressed true and squares. The evenness of the surface of slabs and edges of the slab shall not be marred by careless dressing or handling, and no patching up shall be allowed for the slab. The edges shall be quite straight. The under face may be left as required or rough dressed. Before taking up the work, samples of stone slabs to be used and their dressing and polishing shall be got approved by the Engineer-in-charge and kept in his office as approved sample and the stone slabs to be used shall conform to the same.

2.2.4.2 Bedding/ Backing Coat
Kota Stone floorings when laid on ground floor, a base course of lean concrete mixCement Mortar 1:4:8 (Cement, Course Sand, Stone Aggregate 40mm nominal size) is to be provided between flooring and well compacted sub-base. The minimum thickness of Base-Course will be 100 mm for floors of buildings/ Platform/Concourse/Pathway etc.
2.2.4.3 Construction Details
Cement mortar as specified for bedding shall be uniformly mixed. The amount of water added shall be the minimum necessary to give just sufficient plasticity for laying and satisfactory bedding. Care shall be taken in preparing the mortar to ensure that there are no hard lumps that would interfere with the even bedding of the stones. Before spreading the mortar, the sub-floor or base shall be cleaned of all dirt, set mortar scum or laitance and of loose materials by hacking and brought to original levels and then well wetted without forming pool of water on surfaces.

2.2.4.4 Fixing the stone slab/ tile:
Before laying, the stone shall be thoroughly wetted with clean water, neat cement grout (2.75 kg/sqm.) of honey like consistency shall be spread on the mortar bed over as much areas as could be covered with the slabs within half an hour. The specified type of stone shall be laid on the neat cement float and shall be evenly and firmly bedded to the required level and slope in the mortar bed. Each stone shall be gently tapped with wooden mallet till it is firmly and properly bedded. There shall be no hollows left. If there is a hollow sound on gently tapping off the slab, such slab shall be removed and reset properly. The joints shall be grouted with matching cement slurry. Approved pigment shall be used in cement slurry to match with shade of stone. Pigment required to match the shade of stone shall be supplied by the contractor at no extra cost. The stone adjoining the wall shall go about 12mm. under the plaster, skirting or dado for the wall. All stone slabs, tiles shall be so laid as to have continuous lines from various rooms to the corridors. No change of lines shall be permitted at junction between rooms and corridors. Only one piece machine cut, Kotah stone shall be used for treads and risers, unless otherwise specified in the tender schedule.

2.2.4.5 Curing
The work shall be kept well wetted with damp sand or water for seven days.

2.2.4.6 Polishing and cleaning
When the bedding and joints have completely set and attained required strength, the surface shall be machine polished to give smooth, even and true plane to the flooring. All flooring shall be thoroughly cleaned and handed over free from any mortar stains etc. Polishing shall be done as per relevant IS and IS-14223 (Specification for polished building stones).

2.2.5 Skirting and Dado/ Facia
The quality and type of stone shall be same as mentioned for flooring except of their height and thickness or backing coat which shall be as mentioned in item schedule. The backing shall conform to the specifications for cement mortar specified for item of terrazzo tiles. Contractor should take into consideration the fact that touching up of the plaster at the junction of skirting / dado is invariably done after the skirting/ dado/ facia work is completed and quote rates accordingly. Nothing extra for the same shall be entertained.
Fixing, curing, polishing and cleaning shall be as specified herein before under cement/ terrazzo tile skirting. Polishing may be done by hand, but a smooth surface and fine polishing shall be obtained. Joints shall be finished in neat matching cement slurry. The junction of plaster and the upper edges of the dad o/ skirting shall be finished smoothly as directed by the Engineer-in-charge without any extra cost.

2.2.6 Paver Blocks / Interlocking Concrete Block Pavement:

Shall confirm to IRC 63

Providing and fixing pre-cast Rubber Dye inter locking concrete block 60mm thick with grade of concrete M-30 compressed by mechanically pressed and as per approved design including 50 mm Sand layer for levelling and filling the joint with sand in proper line and level etc complete.

The scope of work includes supplying and lying of precast paver blocks at site, as mentioned in the Item. All relevant provisions of IS 15658:2006 shall apply. Laying of paver blocks at site as per requirement in technical specification, within shortest possible time. The work shall be executed in perfect line and level as per instructions of Engineer in charge. Colored concrete paver blocks shall be manufactured as per specifications using approved color pigment. The color shade shall be as selected by employer before commencement of the work. The contractor shall guarantee that all material and components designed, fabricated, supplied and laid by him shall be free from any type of defect due to faulty material and/Workmanship/erection For a period of One year from the date of completion of work.

For motorable area a base course of Wet Mix Macadam of 150 mm thick and in non motorable area granular sub base to be provided for 150mm thick.

2.2.7 Bedding Sand Course

The bedding sand shall consist of a clean well graded sand passing through 4.75mm sieve and suitable for concrete. The bedding should be from either a single source or blended to achieve the following grading.

Bedding Sand Requirement

<table>
<thead>
<tr>
<th>In Sieve Size</th>
<th>% Passed</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.52mm</td>
<td>100</td>
</tr>
<tr>
<td>4.75mm</td>
<td>95-100</td>
</tr>
<tr>
<td>2.36mm</td>
<td>80-100</td>
</tr>
<tr>
<td>1.18mm</td>
<td>60-100</td>
</tr>
<tr>
<td>600 Microns</td>
<td>25-60</td>
</tr>
<tr>
<td>300 Microns</td>
<td>10-30</td>
</tr>
<tr>
<td>150 Microns</td>
<td>5-15</td>
</tr>
<tr>
<td>75 Microns</td>
<td>0-10</td>
</tr>
</tbody>
</table>

- Contractor shall be responsible to ensure that single-sized, gap-graded sands or sands containing an excessive amount of fines or plastic fines are not used. The sand particles should preferably be sharp not rounded as sharp sand possess higher strength and resist the migration
of sand from under the block to less frequently areas even though sharp sands are relatively more difficult to compact than rounded sands, the use of sharp sands is preferred for the more heavily trafficked driveways. The sand use for bedding shall be free of any deleterious soluble salts or other contaminants likely to cause efflorescence.

- The sand shall be of uniform moisture content and within 4% - 8% when spread and shall be protected against rain when stock piled prior to spreading. Saturated sand shall not be used. The bedding sand shall be spread loose in a uniform layer as per drawing. The compacted uniform thickness shall be of 45mm and within +/- 5mm thickness variation shall not be used to correct irregularities in the base course surface.
- The spread sand shall be carefully maintained in a loose dry condition and protected against pre-compaction both prior to and following screeding. Any pre-compacted sand or screeded sand left overnight shall be loosened before further laying of paving blocks take place.
- Sand shall be slightly screeded in a loose condition to the predetermined depth only slightly ahead of the laying of paving unit.

2.2.8 Grass Paver:
- The grass pavers should have perpendiculars after release from the mould and the same should be retained until the laying. The surface should be of anti-skid and anti-glare type. The grass pavers should have minimum 50% opening for grass, uniform chamfers to facilitate easy drainage of surface run off. The pavers should have uniform interlocking space of 2mm to 3mm to ensure compacted sand filling after vibration on the paver surface.
- The concrete mix design should be followed for each batch of materials separately and automatic batching plant is to be used to achieve uniformity in strength and quality.
- The pavers shall be manufactured in single layer only.
- Skilled labour should be employed for laying blocks to ensure line and level for laying, desired shape of the surface and adequate compaction of the sand in the joints.
- The pavers are to be skirted all round with kerbing using solid concrete blocks of size 100mm x 200mm x 400mm or as directed by the Engineer. The kerbingshould be embedded for 100mm depth. The concrete used for kerbing shall be cured properly for 7 days minimum.

2.2.9 Granular Sub Base

Construction of granular sub-base by providing close graded granular sub-base Grading-III material as per table 400-1, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC and compacting with vibratory roller to achieve the desired density complete as per Clause 401 of MoSRT&H Specifications for Road & Bridge works (5th Revision).
2.2.10 Wet Mix Macadam

Providing, laying, spreading and compacting graded stone aggregate to Wet Mix Macadam specification including premixing the materials with water at OMC in mechanical mix plant, carriage of mixed material by tipper to site, laying in uniform layers with paver in sub-base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density as per Clause 406 of MoSRT&H Specifications for Road & Bridge works (4th Revision.)

2.2.11 Stamped Concrete flooring

2.2.11.1 Materials:
Providing, Applying and finishing the top surface of concrete, in accordance with sprinkling of Uni Stone/Ultratech color hardener. Floating the surface with different types of floaters, application of release agent, stamping the concrete with stamping tools, cleaning the surface with water and application of acrylic based sealer for finishing. Complete for plaza and gazebo, pathway area, External roads etc.

2.2.11.2 Preparation of Base:
The base concrete surface shall be thoroughly chipped to remove laitance, caked mortar, loose sand, dirt etc. cleaned with wire brush and washed clean and watered until no more water is absorbed. Where the base concrete has hardened so much that roughening the surface by wire brushes is not possible, the same shall be roughened by chipping or hacking at close intervals. The surface shall be soaked with water for at least 12 hours and surface water removed and dried before laying the topping. Before laying the concrete, cement slurry at 2.75 kg./sqm. of surface shall be applied for better bond. Concrete flooring shall then be laid in alternate bays in pattern and joints, wide/ flush as per drawing. The edge of each panel into which the floor is divided shall be supported by wooden or metal strips duly oiled to prevent sticking. The panels shall be of uniform size and, unless otherwise specified, no dimension of panel shall exceed 2 m. and the area of a panel shall not be more than 2 sqm. However, the exact size of panel shall be decided by the Engineer-in-Charge to suit the size of the room. The joints in the floor finish shall extend through the borders and skirting/dado. The border shall have mitred joints at the corners of the room. Where glass/ aluminium dividing strips are proposed to be provided, the same shall be fixed in cement mortar 1:2 @ 600 mm. centers or as specified in the schedule for full depth of the finished floor. The depth of dividing strips shall be the thickness as proposed for the finished floor in the item. In the case of flush joins, alternate panels only may be cast on same day. At least 48 hours shall elapse before the concreting of adjacent bay is commenced.

2.2.11.3 Laying & finishing of the finished surface:
Providing, Applying and finishing the top surface of concrete, in accordance with sprinkling of Uni Stone/Ultratech color hardener at the rate of 0.390 kg. /sq. ft., Floating the surface with different types of floaters, application of release agent at the rate of 0.013 kg. /sq. ft., stamping the
concrete with stamping tools, cleaning the surface with water and application of acrylic based sealer for finishing. Complete for plaza and gazebo, pathway area, External roads etc.

2.2.11.4 Curing:
The completed flooring shall be protected from sun, wind and rain for the first two days and movement of persons over the floor is prohibited during this period. The finished surface shall be covered and cured continuously form the next day after finishing, at least for a period of 7 days. Bunding with murrum for curing is prohibited as it will leave permanent stain on the finished floor. Curing shall be done by spreading sand and kept damp throughout the curing period of seven days minimum. The surface shall be protected from any damage to it whatsoever. The surface shall then be allowed to dry slowly. All corners, junctions of floor with plastered wall surface shall be rounded off when required at no extra cost.

2.2.12 Pebble flooring
Supply, providing and laying natural unpolished mixed colour Pebbles of Diameter size 10 mm to 30mm (Laid in 50mm THK layer) over 50 mm thick IPS flooring bed (1:2:4). Below IPS bed there will be a 150 mm thick pcc(1:4:8) over a compacted soil.

2.2.13 Murram Pathway
Supplying and spreading of coarse sand & murrum admixtures (1:2) on finished surface on slopes & bed complete as per direction of engineer in charge over a layer of compacted Soil.
2.3 SOFTSCAPE

2.3.1 Site Dressing and Land Modulation

2.3.1.1 Scope

The Scope consists of clearance of the Site of Works and preparation of the same to commence the proposed landscape execution activities. Wherever applicable, this is deemed to include all preliminary works like Dismantling/Demolition, Site Clearance, and General Leveling etc.

The drawings shall be read in conjunction with the specifications and matters referred to, shown or described in one are not necessarily repeated in the other.

In the event of any element of specification not available in any of the documents the instructions of the Engineer-in-Charge in writing shall be followed by the Contractor.

All the drawings and designs shall be submitted to PMC/ client for approval before execution.

The work shall be executed and measured as per metric dimensions given in the Schedule of Quantities, drawings etc.

General Items

The more important Codes, Standards and publications applicable to this section are listed hereinafter.

National Building Code (NBC) – Landscape Work (Hardscape & Softscape)

APWD – Landscape Work (Hardscape & Softscape)

CPWD - Landscape Work (Hardscape & Softscape)

2.3.2 Setting out the works

- The Contractor shall supply without additional charges the requisite number of persons with the means and material necessary for the purpose of setting out works and checking, weighing and assisting in the measurement or examination at any time and from time to time, of the work or the materials. Failing this, the same may be provided by the client’s designated representative In-charge at the expense of the Contractor and the expenses shall be deducted from any money due to the Contractor under the contract or from his security deposit.

- The Contractor shall arrange for a qualified surveyor to set out the works and obtain certification of its accuracy from the surveyor. The Contractor shall then set out the works and shall be responsible for the true and perfect setting out of the same and for the correctness of the positions, levels, dimensions, and alignment of all parts thereof and for provision of all necessary instruments, appliances and labour in connection therewith. The Contractor shall submit to the client and the Landscape Architects, margins and the verifications of layout within seven days from the date of getting site layout from Landscape Architects / client.

- Mark the layout on the site. All bench marks, levels should be properly established and preserved for future use.
• Clearly check the surveyed map provided by the client and mark all drainage lines, water pipe lines, electrical lines, etc. It needs to be checked by Contractor to satisfy him / herself from safety point of view before starting of work.

• The checking of any setting out or of any line or level by the Landscape Architects and CLIENT’s representative or their representative shall not in any way relieve the Contractor of his responsibilities, for the correctness thereof. The Contractor shall carefully protect and reserve all benchmarks and other things used in setting out of the work.

2.3.3 Site Clearing / Excavation / Site Grading

• Light irrigation, by flooding the whole site with water. The water should penetrate up to depth of 15-20 cm only so that the weeds can germinate. Remove all grasses, small shrubs/weeds etc. with roots. Excavating the site as marked on the drawing/as instructed at the site, up to any lead and lift.

• Verify the levels and bench-marks from the up-dated surveyed drawing made available by the client. If there are any discrepancies between the site and the survey drawing, the same are to be brought to the client’s notice by addressing a letter to the client and copy marked to the Landscape Architects.

• Grading and levelling of site as shown in drawing / specified on site by Landscape Architects. This will include spreading manually or by help of soil unloaded at different working areas in the site so as to obtain basic datum levels and grades.

• Excavated material shall be stacked off in the manner indicated at the site including stacking of excavated material up to any lead and lift. The rate shall only cover the cost of excavation, stacking and/or spreading of the material, if required at the site.

• Clearing the area of unwanted materials including the weeds, stones, masonry pieces etc. and all such matter that may cause damage to growth of the plant materials immediately or in future.

2.3.4 Topographic Survey & Geotechnical investigation

- Contractor to conduct detail topographical site survey and Geotechnical investigation before execution of work and submit the same to the Engineer in charge for approval.

2.3.5 Earth Works

- Earthworks shall involve the grading of soil for earth mounding, the excavation of trenches and soil for formation levels of pathways and foundations, and the fine grading of earth banks and landscape areas roughly graded by others.

- Excavation shall be carried out to the depth shown on or implied in the drawings or to such greater or lesser depths as the Landscape Architect may direct. The Contractor shall supply and fit all shoring, sheeting, strutting and walling required to maintain the sides of excavations as long as
necessary and to remove them as required. The Contractor is to allow for making all necessary adjustments to existing manholes in accordance to bring them to the same level as the required profiled grades. No claim shall be entertained for either bulking or compacting and all other quantities shall be measured net from the drawings.

- The stripping and replacement of the subsoil shall only be done in dry weather and ground conditions unless in exceptional circumstances the Landscape Architect authorizes otherwise. Subsoil in heaps or dumps shall not be sited so as to damage or impede water courses or other drainage so long as they are capable of remaining in operation. Any weeds which may grow on the heaps of subsoil shall be sprayed with an approved selective weed-killer to prevent seeding.

- Notwithstanding the general description for the type of material to be excavated, if original bed rock is encountered during these operations which can only be removed by blasting or compressed air tools this work will be paid for separately as an extra over item for that given for normal excavation. This work shall only be undertaken when authorized in writing by the Landscape Architect.

- During excavation it is expected that the Contractor will take every prudent step or precautions such as tests or borings in order to prove the nature or type of material underneath or the ground bearing capacity in order to protect his workmen, plant or machinery employed in these operations.

- In the event of the Contractor excavating below the proper levels or otherwise in excess of the dimension given, he shall at his own expenses, remove all loose excavated material and replace the soil excavated in error.

- If, in the opinion of the Landscape Architect the bottoms of any excavation or any material to be excavated become unsuitable due to the Contractor’s operations, the Contractor shall, at his own expenses, carry out any necessary excavation and make up in a similar manner to the above.

- If, in the opinion of the Landscape Architect the weather conditions are such as to preclude the satisfactory completion of any operation or cause unnecessary nuisance or disturbance to other parties, the Contractor shall, on receiving directions from the Landscape Architect suspend operations on that particular portion of the work until the Landscape Architect considers that weather conditions are satisfactory or issues a direction to re-commence operations. The absence of such a direction shall in no way constitute the basis of a claim for delay or remedial work to a formation which is unsuitable.

2.3.6 Major Grading

- Site shall be complete with rough dressing including the base levels by civil contractor before handed over to landscape contractor for execution.

- Role of Landscape contractor involves major grading forming earth mounds / hillocks from imported fill materials where specified, or from the site debris and soil generated by excavations. The soil shall be graded using suitable earth moving machinery to the contoured earth forms indicated on the drawings. Soil, when in a dry enough state for easy working, shall be distributed to the correct
areas and laid in layers not exceeding 100mm thick and compacted by at least 2 passes of the earth moving machine in each direction for each 100mm layer.

- Earth slopes are to be formed from the compacted mounds to the gradients and levels shown on the drawings, accounting for the topsoil depths to be included after subsoil formation is complete. If insufficient fill is available to complete the levels shown, additional suitable subsoil is to be imported to make up the required quantities. Importation of additional fill shall only be carried out with written permission of the Landscape Architect.

- Earthworks levels are to be carried out to the contours shown on the drawings to a maximum tolerance of 150mm measured vertically, and to a maximum gradient of 1:2. All subsoil levels are to account for the later additional of specified depths of topsoil.

- The Contractor shall be responsible for protection of completed subsoil mounds and shall take preventative measures to control erosion and siltation restore or replace any portion of the earthwork areas which erodes, slumps, silts or is otherwise damaged by the out-washing of soil.

2.3.7 Excavation for Formation Levels and Trenches

- For paving areas, excavate subsoil to create a smooth formation for taking the sub-base for the paved area, to levels shown on the drawings accounting for the depth of the paving build up.

- Firmly compact sub-grade with a smooth wheeled vibratory roller to achieve an even level. Finished sub-grade is to be protected until the path sub-base or other construction such as pool sub-base is laid. If sub-grade is too dry to be compacted, water shall be added until suitable texture is achieved. If sub-grade is too wet, the material shall be left to dry out until workable.

- A completed sub-grade/formation on which there is standing water, soft spots or slurry shall be deemed to be unsuitable and shall be rectified at the Contractor’s expense including making up of additional material as required to bring the formation to line and level again.

- Where soft or wet ground is encountered prior to preparation of the sub-grade and this soft or wet ground cannot satisfactorily be compacted, the Contractor shall submit a written request for this to be inspected and the area to be dug out and replaced with suitable material shall be evaluated by the Landscape Architect and directed accordingly.

- Surplus material resulting from excavations for path formation or drainage trenches shall be taken off site at Contractor’s own expense unless otherwise directed by the Landscape Architect in writing.

- Excavation of drainage or formation trenches shall be carried out after the major grading has been completed and approved. Trenches shall be cut to lines and gradients shown on the drawings. Planking and strutting shall be carried out as required to make the sides of the trenches safe. The Contractor will be responsible for ensuring that drainage trenches are kept free from mud and water and side slippage.
2.3.8  Fine Grading and Shaping
- Slight unevenness, ups and downs and shallow depressions shall be removed by fine dressing the surface to the formation levels of the adjoining land, as directed by Landscape consultant and adding suitable quantities of Good earth, brought from approved source, if necessary.
- Fine grading shall be carried out using small sized earth moving equipment or by hand and shall involve final modeling of the earth contours produced by the major grading exercise. The shaping will follow the contours shown on the plans in general terms, but the final forms will be developed by eye to create smoothly flowing and pleasing contours.
- The Fine Grading will provide the detailed earth contouring prior to cultivation of soil. Soil cultivation and the application of topsoil mixes shall not take place until the Fine Grading is completed.

2.3.9  Drainage
The bidder shall have to design the Natural grading and drainage slope towards the beel side. The drawings of the drainage shall be submitted to PMC for approval before execution at site.

2.3.10  Trenching in Ordinary Soil
- Trenching is done in order to loosen the soil, turn over the top layer containing weeds etc. and to bring up the lower layer of good earth to form a proper medium for grassing, re-grassing, hedging and shrubbery. Trenching shall be done to the depth ordered by the Engineer-in-charge. The depth is generally 30 cm for grassing and 60 cm for re-grassing in good soil.
- The trenched ground shall, after rough dress, be flooded with water by making small kiaries to enable the soil to settle down. Any local depression unevenness etc. shall be made good by dressing and/or filling with good soil.
- Weeds or other vegetation which appear on the ground are then uprooted and removed and disposed off and paid.

Trenching: Trenching shall consist of the following operations:
✓ The whole plot shall be divided into narrow rectangular strips of about 1.5 m width or as directed by the Engineer-in-Charge.
✓ These strips shall be sub-divided lengthwise into about 1 m long sections. Such sections shall be excavated serially, and excavated soil deposited in the adjacent section preceding it.
✓ In excavating and depositing care shall be taken that the top soil with all previous plant growth including roots, get buried in the bottom layer of trenched area, the dead plants so buried incidentally being formed into humus.
✓ The excavated soil shall be straight away dumped into the adjoining sections so that double handling otherwise involved in dumping the excavated stuff outside and in back filling in the trenches with leads is practically eliminated.
• Measurements: Length and breadth of the plot shall be taken correct to 0.1 m and depths correct to cm. Cubical contents shall be calculated in cubic meters, correct to two places of decimal. No deduction shall be made nor extra paid for removing stones, brick bats and other foreign matter met with during excavation upto initial lead of 50 m and stacking the same.

• Rate: The rate shall include the cost of all labour and material involved in the operations described above, including cost of all precautionary measures to be taken for protections and supporting all services etc. met with during trenching. It does not include the cost of mixing of earth, sludge/manure.

2.3.11 Good Earth

• The earth shall be stacked at site in stacks not less than 50 cm high and of volume not less than 3.0 cum.

• Measurements: Length, breadth and height of stacks shall be measured correct to a cm. The volume of the stacks shall be reduced by 20% for voids before payment, unless otherwise described.

• Rate: The rate shall include the cost of excavating the earth from areas lying at distance not exceeding one km. from the site, transporting the same at site breaking of clods and stacking at places indicated. The rate shall also include royalty if payable.

2.3.12 Oil Cake

• Neem /Castor: The cake shall be free from grit and any other foreign matter. It should be un-decorticated and pulverized. The material shall be packed in old serviceable gunny bags of 50 kgs capacity approximately. The weight of gunny bag shall be deducted @1 kg per bag and payment shall be made for net quantity. The quality of cake should be got approved by the Engineer-in-charge before supply.

• Measurements: The arrangement for weighing shall be made at site of work by the department. The gunny bags shall be the property of the government.

• Rate: The rate shall include the cost of labour and material involved in all operations described above, including carriage up to site of work with all lead and lifts, weighing etc.

2.3.13 Supply and Stacking of Manure

• Farmyard Manure: It shall be transported to the site in lorries with efficient arrangement to prevent spilling en route. It shall be stacked at site. Each stack shall not be less than 50 cm height and volume not less than 3 cum.
• Measurements: Length, breadth and depth of stacks shall be measured correct to a cm. The volume of the stack shall be reduced by 8% for looseness in stacking and to arrive at the net quantity for payment.

• Rate: The rate shall include the cost of labour and material involved in all operations described above, including carriage up to one km. The rate shall also include royalty if payable.

2.3.14 Rough Dressing of the Trenched Ground
• Rough dressing of the area shall include making kiaries for flooding.
• The trenched ground shall be levelled and rough dressed and if there are any hollows and depressions resulting from subsidence which cannot be so levelled, these shall be filled properly with earth brought from outside to bring the depressed surface to the level of the adjoining land and to remove discontinuity of slope and then rough dressed again. The supply and spreading of soil in such depressions is payable separately. In rough dressing, the soil at the surface and for 75 mm depth below shall be broken down to particle size not more than 10 mm in any direction.
• Measurements: Length, breadth of superficial area shall be measured correct to 0.1 metre. The area shall be calculated in sqm correct to two places of decimal.
• Rate: The rate shall include the cost of all the labour and material involved in all the operations described above.

2.3.15 Mixing of Good Earth and Sludge / Manure
• The stacked earth shall, before mixing be broken down to particle of sizes not exceeding 6mm in any direction. Good earth shall be thoroughly mixed with sludge or manure in specified proportion as described in the item or as directed by the Engineer-in-charge.
• Measurements: The quantity of good earth and sludge or manure mixed shall be determined by the difference in the volume of good earth, sludge or manure in stack, before and after spreading duly accounted for voids and looseness in stack.
• Rate: The rate shall include the cost of all labour and materials involved in all the operations described above, but does not include the cost of good earth sludge or manure which shall be paid for separately, unless otherwise described in the item.

2.3.16 Grassing with select Grass
• The area from where the grass roots are to be obtained shall be specified by the Engineer in-Charge at the time of execution of the work and no royalty shall be charged on this account from the contractor. Grass is to be arranged by contractor (cost of grass to be paid separately).
• The soil shall be suitably moistened and then the operation of planting grass shall be commenced. The grass shall be dibbled at 10 cm, 7.5 cm, 5 cm apart in any direction or other spacing as
described in the item. Dead grass and weeded shall not be planted. The contractor shall be responsible for watering and maintenance of levels and the lawn for 30 days or till the grass forms a thick lawn free from weeded and fit for moving whichever is later. Generally planting in other direction at 15 cm, 10 cm, spacing is done in the case of large open spaces, at 7.5 cm spacing in residential lawn and at 5cm spacing for Tennis Court and sports ground lawn. Rates are including cost of labour and material (grass shall be paid separately.)

- During the maintenance period, any irregularities arising in ground levels due to watering or due to trampling by labour, or due to cattle straying thereon, shall be constantly made up to the proper levels with earth as available or brought from outside as necessary, Constant watch shall be maintained to ensure that dead patches are replanted, and weeds are removed.

- Measurements: Length, breadth of the lawn grassed shall be measured correct to 0.1 meter and the area shall be calculated in sqm correct to two places of decimal.

- Rate: The rate shall include of all the labour and material involved in all the operations described above, excluding supply of the requisite quantity of good earth and grass so needed for properly maintaining the levels of the lawns. (payment of grass to be paid separately).

2.3.17 Uprooting Rank Vegetation and Weeds and preparing the ground for planting

- Initially the area shall be dug up to a depth of 30 cm. and weeds and rank vegetarian with roots removed thereon by repeated forking. The whole area then shall be retrenched to a depth of 60 cm in the same manner as described in 2.1. Clods of excavated earth shall then be broken upto the size not more than 75 mm in any direction. The area shall then be flooded with water and after 10 days and within 15 days of flooding, weeds shall be uprooted carefully. The rubbish arising from the above operations shall be removed and disposed off in a manner directed by the Engineer-in-charge, away from the site. The earth shall then be rough dressed and fine dressed as described in 2.6 & 2.8.

- Measurements: Length, breadth of uprooted area shall be measured correct to 0.1 meter and the area shall be calculated in sqm correct to two places of decimal.

- Rate: The rate shall include the cost of all the labour and material involved in all the operations described above.

2.3.18 Excavation and Trenching for preparation of beds for hedge and shrubbery

- Beds for hedges and shrubbery are generally prepared to width of 60 cm. to 125 cm and 2 to 4 meters respectively.

- Beds for hedges and shrubbery shall be prepared in the following manner. The beds shall first be excavated to a depth of 60 cm. and the excavated soil shall be stacked on the sides of the beds. The surface of the excavated bed shall then be trenched to a further depth of 30 cm, in order to loosen the soil, in the manner described in 2.1. No flooding will be done at this stage but the top
surface shall be rough dressed and levelled. The excavated soil from the top 60 cm depth of the bed stacked at the site shall then be thoroughly mixed with sludge over manner in the proportion 8:1 by ratio or other proportion described in the item. The mixed earth and manure shall be refilled over the trenched bed, levelled neatly and profusely flooded so that the water reaches even the bottom most layers of the trenched depth of the bed. The surface after full subsidence shall again be refilled with the earth and manure mixture, watered and allowed to settle and finally fine dressed to the level of 50 mm to 75 mm below the adjoining ground or as directed by the Engineer-in-Charge. Surplus earth if any, shall be disposed off as directed by the Engineer-in-charge. Any surplus earth if removed beyond initially lead shall be paid separately. Stones, bricks bats and other foreign matter if met with during excavation or trenching shall be removed and stacked within initially lead & lift, such material as is declared unserviceable by the Engineer-in-charge shall be disposed by spreading and levelling at places ordered by him. If disposed outside the initial lead & lift, then the transport for the extra leads will be paid for separately. If a large proportion of material unsuitable for the hedging and shrubbery operations is met with and earth from outsides is required to be brought in for mixing with manure and filling, the supply and stacking of such earth will be paid for separately.

- Measurements: Length, breadth and depth of the pit excavated and trenched shall be measured correct to a cm. The cubical contents shall be calculated in cubic meter correct to two places of decimal.
- Rate: The rate shall include the cost of all the labour and material involved in all the operations described above. The rate shall not include the cost of supply & stacking of the manure unless the same is specifically included in the description of the item.

2.3.19 Digging holes for planting trees

- In ordinary soil, including refilling earth after mixing with oil cake, manure and watering.
- Holes of circular shape in ordinary soil shall be excavated to the dimensions described in the items and excavate soil broken to clods of size not exceeding 75 mm in any direction, shall be stacked outside the hole, stones, brick bats, unsuitable earth and other rubbish, all roots and other undesirable growth met with during excavation shall be separated out and unserviceable material removed from the size as directed. Useful material, if any, shall be stacked properly and separately. Good earth in quantities as required to replace such discarded stuff shall be brought and stacked at site by the contractor which shall be paid for separately. The tree holes shall be manured with powdered Neam/castor oil cake at the specified rate along with farm yard manure over sludge shall be uniformly mixed with the excavated soil after the manure has been broken down to powder, (size of particle not be exceeded 6 mm in any direction) in the specified proportion, the mixture shall be filled in to the hole up to the level of adjoining ground and then profusely watered and
enable the soil to subside the refilled soil shall then be dressed evenly with its surface about 50 to 75 mm below the adjoining ground level or as directed by the Engineer-in-charge.

- Measurements: Holes shall be enumerated.
- Rate: The rate shall include the cost of all the labour and material involved in all the operations described above, excluding the cost of supply and stacking the requisite quantity of manure/sludge and oil cake.

2.3.20 Filling Mixture of Earth and Sludge over Manure

- The separately specified earth and sludge shall be broken down to particles of size not exceeding 6 mm in any directions before mixing. Good earth shall be thoroughly mixed with sludge over manure in specified proportions as directed by Officer-in-Charge. During the process of preparing the mixture as above, trenches shall be flooded with water and levelled.
- Measurements: Measurement shall be made in (Length, breadth and height of stacks) cubic meter. The cubical contents shall be worked out to the nearest two places of decimal in cubic meter.
- Rate: The rate shall include the cost of all the labour and material involved in all the operations described above, but do not include the good earth, sludge or manure which will be paid separately.

2.3.21 Specifications of Plants

The plants included should be as per following specifications:

- The plants should be full of fresh and healthy foliage.
- The plants should be free from insect, pest and disease.
- Plant should be healthy and vigorous growth
- The height of the plants will be measured from top of the pots.
- The plants should be well settled and should not be newly shifted.
- The plants should be true to the variety and named Variety should be tagged.
- Moss stick used should be made on plastic pipe.
- Moss stick should be straight and properly fixed in the pot.
- The rejected plants materials should be removed from the site immediately.
- Moss stick should be covered with the plants in case of plants supplied with moss stick.
- The Plant should be well established and good spread.
- Good earth and manure used for filling the pot/poly bag free from any inert material and mixed to proper ratio.
- Pot/ Poly bag used for filling the plants should be proper size good quality not damaged.
- There should be proper drainage in pots for plants.
- The flowering plants should also have proper flowering and should be true to the variety.
- All plant should have the tendency of growth and should not be stunted type.

There should be no stagnation of water in the pots
2.4 HORTICULTURE WORKS

2.4.1 Scope

The bidder shall develop low maintenance grass, ground covers, planters and stepping stones in lawn etc. the bidder needs to retain and care of existing trees and plants, remove the dead plants and shrubs as per proposed plan. Bidder to submit the details and drawings and take the approvals from client/PMC before execution of work.

The scope of services covers all horticultural operations and services including, labour, equipment, services and transport for all plant materials, Good earth, top soil conservation, manures, pesticides etc. completing the entire work within the scheduled time, maintaining the entire Soft scaping work for One year after virtual completion of the work.

The Contractor shall refer to Specifications provided in this document for relating to formation levels, sub-bases, concrete footings, foundations and all associated works.

Vendors’ shop drawings shall be submitted for all such items where the Contractor will procure and install items from/by a reputed vendor. Execution of all such items shall be done after such drawings are approved by the Employer/ Employer’s representative.

Contractor shall prepare and issue all required working drawings and get them approved by Employer/ Employer’s representative with required number of revisions till the details provided satisfy the Employer/ Employer’s representative.

Defect Liability Period shall be of one year after completion of Landscape Execution. The Contractor will be responsible for maintenance of the entire landscape development area for a period of One year after completion of all above works as certified by the Employer/ Employer’s Representative.

2.4.2 Special Condition

The Contractor will have to provide the following items at no extra cost to Employer:

a. The Contractor will supply and install 2.0 metres high barricades for safeguarding landscape development area and works, as indicated in the drawing. He may also install the barricades in the landscape development area according to his own understanding if he feels that any part of the landscape area is bound to be damaged for any reason, after taking prior permission from the Employer/ Employer’s Representative.

b. The Contractor will supply, install and maintain at his own cost, the most modern, automated watering system for the landscape, which will take care of the requirement for particular plants, save water and does not waste water, including any requirements specified by the Landscape Architect appointed by contractor. He will give full details of the layout, size of the pipe, size of the sprinklers, bubblers, etc. and their warranty period. All equipment must conform to international standards and/or Indian Standards if available. The design of the irrigation system has to be approved by Employer/ Employer’s representative.
c. All equipment required for development shall be made available by Contractor, and its maintenance shall be his responsibility. This includes Tagara, Phawdas, Hose Pipes, Ground Roller, Manual and/or Electric lawn Mowers, Sprinklers, etc.

d. Contractor will ensure that all plants remain free of diseases, pests, etc. during development and maintenance periods. The contractor shall, without any additional charge renew any dead or defective plant material and shall fully maintain including watering, de-weeding etc. of the whole landscape as mentioned above.

e. Contractor shall follow pre-construction and during construction soil erosion control measures as per the NBC Part 10, section 1, Chapter 4 – Protection of Landscape during Construction.

f. The contractor in co-ordination with the Employer as applicable shall ensure conservation and storage of top soil: Topsoil shall be stripped to a depth of 200 mm from areas proposed to be occupied by buildings, roads, paved areas and external services. It shall be stockpiled to a height of 400 mm in designated areas and shall be re-applied to site during plantation of the proposed vegetation. Topsoil shall be separated from sub-soil debris and stones larger than 50 mm diameter. The stored topsoil may be used as finished grade for planting areas. It is the landscape contractor’s responsibility to conserve top soil that is not disturbed by the civil contractor.

g. The Contractor shall:
   I. Furnish the source of top soil to Employer/ Employer’s Representative.
   II. Contractor to carry out a detail soil report, providing soil details such as pH, alkalinity, total soluble salts, porosity, sodium content and organic matter and submit the same to Engineer in charge for approval.
   III. Use the restored soil at site for landscape purpose, manure mixture, Neemcake, weedicide shall be added if required.
   IV. Not consider any external soil source unless the existing soil conserved from site is lacking in quality and/or quantity.
2.4.3 Soil Analysis for Top Soil fertility determination

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<table>
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<tr>
<td>• To determine the fertility of top soil for conservation, soil investigation shall be carried out by an NABL accredited laboratory.</td>
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<td>• Adequate number of test samples of soil from a depth of 10-200mm below ground level shall be collected from at least 5 representative locations from site, preserved and transported (as per standard procedures specified by the laboratory) carefully to the laboratory for carrying out necessary tests.</td>
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<td>• All relevant Indian Standards for sampling and conducting laboratory tests shall be followed.</td>
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<td>• This soil samples shall be analyzed to determine soil type, texture, total organic content, pH, extractable nutrients such as nitrogen, phosphorus, potassium, salinity, cation exchange capacity, % base saturation and extractable heavy metals.</td>
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<tr>
<td>• The soil analysis report from the laboratory shall also include a statement on the fertility and suitability of the soil for plant growth based on the analysis, in addition to the test results.</td>
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2.4.4 Top Soil conservation

- Topsoil shall be removed for conservation to a depth of 200 mm (not more than 400 mm) and shall be separated from subsoil debris and stones larger than 50 mm diameter.
- It shall be stockpiled to a height of 400 mm in designated areas. The stockpiled topsoil shall be protected from erosion during storage by installing earthen berms/solid walls, temporary seeding (using native grass), covering with mulch or plastic, etc.
- The topsoil shall be protected with sand bags/solid walled enclosures (2 feet high) on all sides for containment.
- Appropriate drainage channels shall be dug around the storage area to prevent flooding of the top soil storage area.
- The top soil shall be reapplied to site during plantation of the proposed vegetation as finished grade for planting areas.
- Seeding will take place immediately after respreading topsoil and decompacting, unless timing is inappropriate (for e.g., not in mid-summer).

h. The contractor to identify erosion prone areas on site and protect them from construction activities throughout the construction period. Prevent / mitigate the disturbances caused to site due to construction activity.

i. The contractor shall execute a sedimentation and erosion control plan that conforms to the best management practices highlighted in the National Building Codes of India (NBC) Part 10, section 1, Chapter 4 – Protection of Landscape during Construction. This standard describes two types of measures that can be used to control sedimentation and erosion. Stabilization measures include temporary seeding, permanent seeding and mulching. Structural control measures include earth dikes, silt fence, sediment trap, and sediment basin. All of these measures are intended to stabilize the soil to prevent erosion.

j. The erosion and sedimentation control plan must be approved by Employer/ Employer’s Representative and the erosion sedimentation control plan must be maintained throughout the execution period.

k. The contractor shall execute measures of protection and preservation of existing landscape on site during entire construction time.

l. Design, execute and maintain a temporary storm water management layout for the duration of construction activity. The storm water management layout should conform to National Building Codes of India (NBC) Part 10, section 1, chapter 4 – Protection of Landscape during Construction.

i. Contractor should take measures to prevent entry of any soluble/ insoluble construction waste to enter the water table/ water ways/ ravines on site.
2.4.5 Plantation Work

2.4.5.1 Provision of Site Utilities

The Contractor is to allow for the provision at his own cost of all site utilities for the duration of the contract including but not limited to water, electricity and telephone.

a. Landscape Development Technique

i. The contractor will not be allowed to use different techniques or quality criteria or materials unless his alternative system has been confirmed in writing by the Employer/Employers representative.

ii. No cost increases for alternative specifications will be entertained unless formally submitted in writing as an improvement in the quality of a product and accepted in writing, following Employer/Employer’s Representative approval, by the Employer/Employers representative.

b. Quality of Workmanship and Materials

i. All materials and workmanship shall be of the high standards and quality demanded by this specification. Sub-standard work and materials identified by the Employer/Employer’s representative will be rejected and will be required to be rebuilt or replaced at the Contractor’s costs.

ii. All plant material shall be of the genus, species and variety specified and substitutions will not be permitted unless authorized in writing by the Employer/Employer’s representative. The sizes and plant description set out in the section headed Plant Material.

iii. All trees and shrubs supplied for the contract shall be free of pest, disease, discolouration and damage. Plants shall be well branched with vigorous shoots. The root system of each plant shall contain a good proportion of fibrous roots.

iv. All materials are to be approved by the Employer/Employer’s representative prior to use on site. Materials shall be obtained from approved sources/manufacturers and/or suppliers. All guarantees and warranties shall be copied and submitted to the Employer/Employer’s representative prior to requests for approval.

v. Where particular products are specified, the Main contractor’s specialists subcontractors if he wishes to use similar products from other manufacturers must seek prior confirmation from the Employer/Employer’s representative.

c. Site Responsibilities

From the commencement of the works until the Certificate of virtual Completion has been issued by the Employer/Employer’s representative, the Main contractors specialists subcontractors shall, in respect of all areas of soft landscape works, adjacent areas and parts of the site used by him, be responsible as follows:
- For adequate protection to grassed areas, planted areas and trees and for making good Softscape works on removal of any protective measures at completion.
- For any damage to existing works and features and any necessary rectification work required to obtain approval from Employer/Employer’s Representative.
- For keeping all paved surfaces used by him in a clean and tidy condition.
- For periodic removal of all surplus excavations and waste matter produced by his operations to a Local Authority registered tip off site, to be found by the Main contractors specialists subcontractors.
- For keeping all Softscape areas in a weed-free and tidy condition and adequately watered.

- The Main contractor’s specialist subcontractors shall make appropriate allowance for these requirements in his rates.

- The Main contractor’s specialist subcontractors shall, within 24 hours of notification and as directed by the Employer/Employer’s representative, undertake at his own expense any remedial works arising from the stated requirements.

d. Tree conservation:
   - All trees to be conserved shall be protected with a 3-4 foot high enclosure constructed using brick/fencing (with an access gate for tree maintenance).
   - This tree enclosure shall be erected before demolition, grading, or construction begins and remain until final inspection of the project. A ‘Warning” sign of size 8.5”x 11” shall be prominently displayed on each protective enclosure to state the following:
   - The following activities are prohibited within and in the vicinity of the tree protection zone throughout the entire duration of the construction project:
     - Cutting of tree roots by utility trenching, foundation digging, placement of curbs and trenches, or other miscellaneous excavations
     - soil disturbance or grade change
     - drainage changes
     - storage of material, topsoil, vehicles, or equipment
     - Activity including but not limited to compaction, grading, construction etc.
     - dumping of any material including but not limited to paint, petroleum products, concrete, mortar, dirty water, waste
     - use of the tree trunks as a backstop, support or anchorage as
     - a temporary power pole, signpost or other similar function
   - The following activities are permitted or required within the Tree Protective Zone with approval from Landscape Architect:
• Mulching with wood chips (unpainted/untreated) or approved material to a four to six inch depth, leaving the trunk clear of mulch to prevent inadvertent soil compaction and moisture loss.
• Irrigation, Aeration, fertilization indicated by Landscape Architect for the healthy growth/maintenance of the tree
• if tree is adjacent to or in the immediate proximity to a grade slope of 8% or more, erosion control measures shall be installed outside the Tree Protection Zone to prevent siltation and/or erosion within the zone.

e. Plant Protection
• All plant material is to be carefully protected and if necessary wrapped in the nursery during lifting, awaiting transportation, during transportation, unloading and during storage on site.
• Any evidence of unsatisfactory protection to roots, stems, branches and leaves will result in plants being rejected.
• Unprotected plants must not be transported during very hot weather, and all plants must be kept moist during transportation and storage. No plant material shall be left on site unplanted for more than two days.

f. Work by Machine or Hand
• All operations herein described shall be carried out by suitable approved machines or by hand.
• Any work around the base of existing trees, in confined spaces or which is impractical to carry out by machine for any reason shall executed by hand and the contractor shall include for this in his rates.

g. Notice of Intentions
• The contractor shall give forty-eight hours written notice to the Employer/Employer’s representative of his intention to commence any of the following operations:
• Setting out, Planting, Topsoiling, Turfing, Sprigging, Maintenance visits, etc.

h. Heavy Machinery
• Heavy machinery, which would excessively consolidate the sub-soil, shall not be used during any operations nor shall heavy machinery be taken over areas prepared for planting or grassing.

i. Substitutions
• If the Main contractor’s specialist subcontractor is unable to supply a particular species of plant, he is to notify the Employer/Employer’s representative in advance of his intention to make a substitution. No substitution will be allowed without prior written agreement of the Employer/Employer’s representative.
ii. Notices of substitutions are to be made sufficiently for in advance of installation to ensure that the substituted material conforms to specifications. Substitutions requested by the Main contractor’s specialist subcontractor after work has started on site will not be entertained.

j. Setting Out
i. The Contractor shall be responsible for accurately setting out all the works prior to the commencement of the works and shall rectify errors in setting out at his own expense.
ii. Any discrepancy in site area between that shown on the drawings by Landscape Architect appointed by contractor and the actual area on the ground shall be notified to the Employer/ Employer’s representative.
iii. The Contractor shall supply all necessary materials, equipment and labour to enable the Landscape Architect to check the setting out, levels and dimensions on the site along with the Employer/ Employer’s representative.

k. Tools and Equipment
i. The Contractor shall use proper tools and equipment for the carrying out of the works and is to ensure that the work force is fully and properly equipped with the correct equipment and experience for the job at hand.

l. Failures of Plants (Pre-practical completion)

i. Any trees, shrubs, grass or other plants (other than those found to be missing or not in accordance with the Contract Documents as a result of theft or malicious damage and which shall be replaced), which are dead, dying, missing or found not to be have been in accordance with the Contract Documents at practical completion of the Works shall be replaced by the Contractor entirely at his own cost unless the Contract Administrator shall otherwise instruct.

ii. The Contract Administrator shall certify the dates when in his opinion the Contractor’s obligations under this clause have been discharged.

m. Plants Defects Liability and Post Practical Completion Care by Contractor

i. Any grass which is found to be defective within 12 months, any shrubs, ordinary nursery stock trees or other plants found to be defective within 12 months and any semi-mature, advanced or extra-large nursery stock trees found to be defective within 12 months of the date of virtual completion due to materials or workmanship not in accordance with the Contract Documents shall be replaced by the Contractor entirely at his own cost unless the Contract Administrator shall otherwise instruct.

ii. The Contract Administrator shall certify the dates when in his opinion the Contractor’s obligations under this clause have been discharged.
iii. Malicious Damage or Theft (Before Practical Completion): All loss or damage arising from any theft or malicious damage prior to practical completion shall be made good by the Contractor at his own expense.

n. Submittals
i. The Contractor shall submit for review drawings by Landscape Architect appointed by contractor completely dimensioned, indicating any pattern layouts, special installation procedure, cutting, fitting, sinking and adjacent equipment materials for coordination.

ii. The Contractor shall submit samples of all materials and samples of workmanship for approval by Employer/Employer’s representative.

iii. The Contractor shall be responsible for producing and submitting for comment and approval to the Employer/Employer’s representative the shop drawings and samples of all elements indicated in this section. All should be based on the drawings provided by Landscape Architect appointed by contractor. All submissions should be reviewed, approved and endorsed by the Contractor.

o. Handling, Storage And Delivery
i. The Contractor shall:
   - Coordinate delivery with suppliers, to minimize handling.
   - Handle and store equipment and materials in such a manner that no damage will be done to the materials or the work of other trades.
   - Store packaged materials, undamaged in their original wrappings, or containers with manufacturer’s labels and seals intact.
   - Stack equipment and materials on wooden platforms at least 150mm clear of the ground and protect with weatherproof covers.
   - Damaged equipment, material or works will be rejected by the Employer/Employer’s representative whether built-in or not.
   - For equipment, materials and work, covering shall be of suitable material containing nothing that may injure or stain the materials.

p. Protection of Work
i. The Contractor shall protect all equipment, materials and completed work from damage until final completion of the work.

ii. The Contractor shall remove and replace damaged work at no extra cost.

q. Reference Standards
i. The Contractor shall comply with all relevant Indian Standards, ASTM, NBC, British Standard Code of Practice, Draft BS or DIN Standard applicable to elements indicated in this section, the recommendations and requirements of such documents shall be
considered a minimum standard of such work described and must be complied with.

ii. Nothing shall relieve the Contractor of his responsibility for providing a higher standard than the relevant Code or Standard where it is required to comply with other sections of the Specification.

2.4.6 Plant Materials and Planting Operations

The following plant descriptions cover the different categories of plant material to be used on the site. These descriptions and their accompanying drawings requirements must be studied carefully and adhered to.

Plants that do not reach the specified dimension or quality, characteristics in this section or in the sizes and descriptions set out in the Bill of Quantities will be rejected and will have to be replaced at the Contractor’s cost.

Trees and palms and large feature plants that are growing in open ground are to be prepared for transplanting at least 2 months before moving, either to containers in the nursery or direct to the site. Preparation of in-ground trees and palms shall be by root pruning to the stated rootball dimensions.

Trenching around the outer edge of the rootball using pruning and a sharp spade shall be done in four separate stages trenching in quarters, with one quarter of the tree roots being cut and backfilled each week, the next quarter the following week, with all of the ball being cut in one month.

If roots over 25mm are encountered these are to be cleanly cut with large secateurs or pruning saw.

For trees and palms that are to be containerised or root wrapped, the lifting and placing in containers or being wrapped is to be done immediately after the root trenching operation is complete.

Rootballs are to be wrapped and tied with Gunny sack or hessian sacking if not containerized. Exposed trunks are to be wrapped in rice straw including the lower parts of the branch system. Damaged trees will automatically be rejected on arrival at site.

All trees and palms are to be purchased, stored and grown on in suitable nursery conditions within one month of the contract and made ready for direction by the Landscape Architect appointed by Contractor.

Failure to procure within this time and to reveal the source of supply and location will result in the Employer/Employer’s representative sourcing the plant materials for the Contractor, and the cost of this sourcing operation will be deducted from the Contractor’s payments.
All dimensions shown with tolerances (that is 120 - 150mm) refer to maximum and minimum dimensions that will be accepted. Measurement of all plants of one species shall, as a minimum, average between the upper and lower figures (that is in the above case 135mm).

All trees and palms specified for containerising or root wrapping after root pruning operations are to be well furnished with leaves over the crown of the tree. Thinning of leaves to reduce transpiration to give a 50% cover is permissible providing due notification is given that thinning is required to ensure that the trees can be inspected before thinning work is done. Bare crowned trees will not be permitted.

2.4.7 Trees

These are nursery grown trees pruned during growth to produce a tight well rounded head, and a straight stem clear of leaves or twigs.

Trees shall be 100 - 120mm circumference stem when measured 0.9m from ground level and shall have a clear straight stem of minimum 1.5mm.

The head shall be well balanced and rounded and contain at least four main branches with a well developed secondary branch system and a defined central leader that has not been pruned, giving an overall height of 2.5 -3.0m at the time of planting.

Pruning at the time of removal from the nursery will not be permitted.

In dry weather conditions, trees are to be sprayed with approved Anti-transpirant.

Rootball dimensions: diameter 500mm (1.6") x 300mm (1’) deep minimum. Branching/leaf spread shall be of 1.5 - 1.8m diameter.

2.4.8 Shrubs

These are woody perennials of generally multi stemmed and bushy habit ranging from 3 - 4.5m down to 500mm height.

Shrubs shall have no less than three main stems and shall be well balanced and bushy, with strongly developed fibrous root systems, and shall be pruned in advance as required to achieve the specified height tolerances.

Branches shall break from the base of the plant just above the root collar and shall be well furnished with leaves right down to ground level.

All plants are to be container grown in containers of suitable dimensions for the species.

2.4.9 Herbaceous Plants

These are non-woody perennials usually of a clump forming habit.

Plants shall have a well developed main stem or stems with good symmetry, a healthy root system, free from pest or disease.

Clumps of herbaceous plants shall include rhizomes, corns, tubers or roots and soil undisturbed by lifting with evidence of growing shoots emerging above soil level.
All herbaceous plants are to be grown in containers unless specified as being produced by alternative method.

2.4.10 Groundcover plants

These are low growing, 500mm or less, or prostrate shrubs or herbaceous plants whose habit is to totally cover the soil.

All groundcover species shall be evenly balanced to allow equal growth in all directions.

Plants shall have fully developed roots and leaves.

Rooted cuttings will not be accepted. All plants to be container grown.

Rooted shoots of certain spreading ground cover plants shall be used only where specified, planted as ‘sprigs’ as opposed to established plants in soil.

Plants shall be rooted shoots and shall have at least one and evidence of vigorous root growth. Recent cuttings with no root development shall not be acceptable.

2.4.11 Climbers

Climbers are plants whose growth habit is to climb upwards by means of twinning stems, tendrils or clinging roots.

Plants shall be grown to reach the recommended size using stocks no less than one year old, and no more than five years old at the time of the start of the contract.

Plants shall have at least two leader shoots up to the recommended height and a vigorous root system. All plants to be container grown.

2.4.12 Hedging Plants

Hedging Plants shall be shrubs such as Lawsonia, Ixoras, etc as per design requirements of Landscape Architect appointed by contractor as suited to regular clipping, previously prepared to establish a uniform height and complete foliage cover to the stem from ground level upwards.

Plants shall be a minimum overall height of 500mm with a minimum of 4 branches arising from ground level and a strongly developed fibrous root system.

Branches shall be well clothed in leaves down to ground level. All plants to be container grown in suitably sized containers.

Hedging plants shall be prepared by root and branch pruning to achieve the ‘box’ shape shown, at least 3 months before transplanting.

2.4.13 Planting Techniques and Accessories

All plants shall be planted to accommodate the spreading root system of the plant to the same soil depth as in the nursery and shall be well watered before removing them from containers. Plants are to be positioned upright and the soil firmed around the roots.

Planting shall be carried out in accordance with the schedule of plants and drawings supplied by Landscape Architect appointed by contractor. The number of each species and variety shall be
evenly distributed over the area as indicated on the drawings by Landscape Architect appointed by contractor.

For large areas the outer rows are to be set out first to ensure the correct shape to the bed is established. The remaining plants are then to be evenly distributed to cover the planting area. The Landscape Architect is to be notified in advance if there are too many or too few plants to fill the area required and an assessment of setting out adjustments will be directed accordingly.

Setting out of plants is to be completed and approved by Landscape Architect appointed by contractor before planting into the soil bed can commence.

2.4.14 Staking and Supports

Stakes shall always be used when planting instant trees, standards and single stem palms and for tall shrubs when directed by the Landscape Architect appointed by Contractor.

Stakes shall be in sawn timber of an approved type and be carried out according to the size of plant to be supported. The types of approved staking methods are:

a. Tripod or Quadropod staking for large trees or palms

Three or four stakes each 50 x 50mm section shall be positioned equidistantly around the tree and firmly driven into the ground at angles of between 30 - 40 degrees.

The inner ends of the stakes shall extend beyond the tree stem by not more than 150mm and shall not be higher than 300mm below the lowest branch.

The tree stem shall be wrapped in hessian or gunny sacking at the point where the tree stakes are to be fastened in order to prevent bark damage.

The stakes shall be neatly and firmly fastened to the tree stem using rubber hose or cord; String are not be used.

The stakes are to be adjusted and the position of the protective wrapping is to be altered up or down every month.

The hessian wrapping is to be sprayed with an approved horticultural pesticide.

2.4.15 Turfing: Fine Turf

Fine Turf shall consist of fine bladed rhizomatous grass such as Bermuda grass or cultivar specified by Landscape Architects appointed by the Contractor.

Fine Turf shall be a live grass sod or mat at least 300mm square with a well developed root system growing in a minimum of 25mm soil bed, free from stones or extraneous roots, cut mechanically or by hand to give an even thickness and texture.

A sample of one square metre of Fine Turf or both types shall be submitted to the Employer/Employer’s representative for approval before fine Turf is brought in for use on site. The source of the material shall be stated by the Contractor.
Fine Turf shall be free from weeds, fungus, pest or disease and contaminants or pollutants. Fine Turf sods shall be kept moist and in shade and shall be planted within 24 hours after lifting.

a. Fine Turfing Operations
Subsoil mix shall be hand raked to provide an even and fine tilth to an even and accurate level matching kerb edge levels. Any lumps or stones over 25mm in diameter brought up in this operation shall be removed from site.

Soil areas shall be lightly sprinkled with water to moisten surface in dry weather before laying turf. Pre-Turfing fertilizer shall be applied to all areas to be turfed prior to turfing at the rate of 40gm per square metre evenly spread over the whole area and lightly worked into the soil. The turves shall be laid on the prepared soil bed and firmed into position in consecutive rows with broken joints, closely butted and to the correct levels. The turf shall be laid off planks working over turves previously laid.

Where necessary, the turves shall be lightly and evenly firmed with wooden beaters, the bottom of the beaters being frequently scraped clean of accumulated soil and mud.

A dressing of finely sifted topsoil/sand/compost mix shall be applied and well brushed into the joints to give an overall even surface.

Watering shall take place over the area that has been turfed immediately after planting. Watering shall be undertaken by use of a fine spray to avoid disturbance of soil particles.

Fine turfing shall only be accepted as complete when new growth has caused turves to knit together and adhere by rooting to the soil bed. Any areas not covered by green healthy grass to the satisfaction of the Landscape Architect within 28 days after fine turfing shall be re-laid as specified at the Contractor’s own expense.

If shrinkage occurs or the joints open, finely sifted topsoil/sand/compost mix shall be brushed into the gaps and shall be watered in.

Any inequalities in finished levels owing to variation in turf thickness or uneven consolidation of soil shall be adjusted by lifting turves and by re-spreading fine soil mix to correct levels and relaying turves as specified.

The finished level of the Fine Turf shall be 25mm above adjoining paved surfaces or other hard edges after allowing for final settlement.

Turf edges and margins shall be laid with whole turves and uneven edges trimmed to give an even line.

b. Maintenance of Fine Turfing before Completion
Watering shall be carried out as often as necessary before completion to allow a satisfactory green sward to develop over the whole fine turfed area.

Cutting before completion shall be carried out as necessary to keep the grass to a maximum height of 25mm.
One extra fertilizer application is to be allowed for before completion, to be used if directed by the Landscape Architect appointed by Contractor.

Completed fine turfed areas are to be kept in a weed free inset free, fungus free and tidy condition until completion (that is start of maintenance period).

Edge cutting shall be carried out as required along edges of paths, plant beds or other junctions with other materials. Only sharp edge cutting tools are to be used for this operation.

Over cutting or ragged edges will require the relaying of the turf edge strip as specified (that is 300mm wide).

c. Specification for Sourcing of Turf Types

Fine Turf is to be specially prepared horticultural turf, re-lawn or turf-carpet, mechanically cut to specified tolerances.

2.4.16 Slope retention work with Coir Mat Turfing

a. Site Preparation

Sub-grade shall be excavated to proper lines and grades based on construction plans.

The sub-grade shall be fairly smooth and free of sharp objects and debris that may damage the Coir Mat. The soils should be proof rolled prior to Coir Mat and backfill placement.

The soils should be compacted to 95 Percent of the relative density based on the Site Engineer’s recommendations.

Above the compacted soil, Top soil mix ‘A’ to be laid upto 150 mm thick layer for planting turf.

Coir mat to be laid first and then planting operation should take place.

b. Laying of Coir Mat

Coir Mat should be placed in correct orientation as shown on the construction plans and approved by the Engineer.

The Contractor should verify the orientation. The orientation of the Coir Mat should be such that it is rolled in the direction of the slope – not perpendicular to it.

The Coir Mat should be cut to length based on construction plans using an Engineer approved cutting tool.

Each sheet of Coir Mat should be pulled taut by hand to get rid of any wrinkles.

Adjacent sheets should be overlapped for minimum width of 0.30 M.

Each sheet may be secured in place using staples, pins, sandbags, backfill, or by other Engineer approved methods to help prevent disruption during the installation of adjacent sheets.

Turfing should be done as per procedures mentioned above once Coir mat is installed.

2.4.17 Watering of all Plants

After planting all plants are to be thoroughly watered to soak the ground all around the rootball.
After watering and the water has percolated away leaving the surface relatively dry the soil is to be lightly cultivated to give an even soil tilth.

2.4.18 Mulching
After completion of planting and watering and light cultivation operations a 50mm deep layer of approved mulch shall be spread and forked in overall cultivated planting areas. Around each tree and palm and around the base of each climber, additional mulch is to be applied to a 50mm depth to a diameter of 600mm.
Mulching is to be done within 2 days of completing planting and watering in.

2.4.19 Fertilizing
After a period of settling in of at least one month, all pit planted materials shall be fertilized with an approved slow release fertilizer at the rate of:
- Trees: 250gm per tree
- Shrubs/climbers: 50gm per plant
- Ground Cover/Herbaceous: 100gm per square meter spread
- Rooted Shoots: around the base of the plants - 40gm per square meter
All fertilized areas are to be watered immediately after fertilizer application.

2.4.20 Disease Control
The Contractor shall take all necessary precautions to prevent or eradicate any outbreak of disease or insect attack.

2.4.21 Planting into Turf Areas
Where planting is to be carried out in areas of turf, the turf shall be carefully cut to the size of the tree or shrub pit, rolled and stored for re-use, being kept moist and in shade. After planting is complete stored turf shall be re-laid around the base of the plant.
The Contractor shall replace at his own expense, any turf which is damaged during planting operations.

2.4.22 Protection of Planted Areas
The contractor shall be responsible for protecting all planted areas.
If it is necessary for the Contractor to erect protective fencing, the Contractor shall be responsible for keeping the fencing in position and in good repair until the end of the maintenance period.
Fencing proposals shall be submitted to the Employer/Employer’s representative for approval.
Post and string fences shall not be acceptable.

2.4.23 Maintenance prior to Completion
After planting and prior to the onset of the maintenance period, the Contractor shall be responsible for carrying out all necessary measures to ensure that the plant material thrives and becomes established and that the landscape areas are kept in a clean and tidy condition.
The Contractor shall allow for carrying out the following maintenance operations when necessary prior to the onset maintenance period.

The Contractor shall be responsible for replacing any plants which fail to survive as a result of inadequate maintenance operations, poor workmanship or poor quality of plant material prior to completion.

The Virtual Completion Certificate will not be issued until all plants scheduled on the Drawings and Schedule of Works are installed in a healthy condition in the manner specified.

2.5 SIGNAGES

2.5.1 Scope of Work and Services
Contractor to design, fabricate and install of exterior signages in stone which consist building/area identification signs, regulatory signs and direction always finding signs information and History about place & DeeporBeel wildlife sanctuary). The design shall be approved by Landscape architect and client. Contractor has to submit drawings of the same and take the approval before execution of the work.

2.5.2 Design Requirements
The following are the design requirements:

1. The signs shall be attractive and exhibit a professional quality of workmanship, which will reflect positively on DeeporBeel wildlife sanctuary.
2. Signage should incorporate client's branding standards, as appropriate.
3. Signage should leverage the spatial organization of the facility and utilize architectural design features, destinations zones, landmarks, shape, color, lighting, etc.
4. Signage should be easy to recognize, consistent, clear, distinctive, and easy to read.
5. Signage shall be compliant with CPWD Standards or relevant norm for signages design.

2.5.3 Considerations - Services and Products

1. Perform a site review to verify locations, determine available areas for signage, confirm dimensions and identify potential conflicts with architecture or landscape designs.
2. Finalize all elements of the sign system design including materials, fabrication specifications, graphic design and installation details.
3. Prepare sign lay outs based on actual sign messages to determine sign and letter sizes and to determine the need for variations to the way finding/signage program.
4. Provide final fabrication submittals based on approved design.
5. Be responsible for fabricating the exterior signage program in accordance with the approved design.
6. Develop an installation schedule to assure timely, accurate and code compliant installation.
7. Be responsible for the installation of the exterior signage program in accordance with the design intent of the approved program.

2.5.4 Drawings to be prepared By Contractor

A. SOFTSCAPE WORKS

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Drawing title</th>
<th>Sheet/Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Site Grading with levels Plan</td>
<td>A1 sheet/1:200</td>
</tr>
<tr>
<td>2</td>
<td>Landscape Master Plan</td>
<td>A1 sheet/1:200</td>
</tr>
<tr>
<td>3</td>
<td>Plantation Plan for Trees</td>
<td>A1 sheet/1:100/50</td>
</tr>
<tr>
<td>4</td>
<td>Plantation Plan for Shrubs, Groundcovers and Lawn</td>
<td>A1 sheet/1:100/50</td>
</tr>
<tr>
<td>5</td>
<td>Blow-up Plans</td>
<td>A1 sheet/1:50</td>
</tr>
<tr>
<td>6</td>
<td>Site sections</td>
<td>A1 sheet/1:100/50</td>
</tr>
<tr>
<td>7</td>
<td>Typical Details</td>
<td>A1/A2 sheet/1:25</td>
</tr>
</tbody>
</table>

1.1 List of Hardscape Drawings to be prepared By Contractor

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Drawing Title</th>
<th>Sheet/Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General Layout / Dimension plan</td>
<td>A1 sheet/1:200</td>
</tr>
<tr>
<td>2</td>
<td>Grading &amp; Drainage Plan</td>
<td>A1 sheet/1:200</td>
</tr>
<tr>
<td>3</td>
<td>Material/ Hardscape plan and Flooring Details</td>
<td>A1 sheet/1:200</td>
</tr>
<tr>
<td></td>
<td>(cover all the areas and material)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Softscape/ planting plan</td>
<td>A1 sheet/1:200</td>
</tr>
<tr>
<td>5</td>
<td>Mock-Up Drawings</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Site Sections and Blow up sections</td>
<td>A1 sheet/1:100</td>
</tr>
<tr>
<td>7</td>
<td>Lighting plan &amp; Detail</td>
<td>A1 sheet/1:100</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Scale</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>8</td>
<td>Plan, Elevation Section for Watch Tower, Ticket Counter, Guard Room, Electrical room, Shops, Gate, Toilet, Pavilion, Bamboo Walk Way, viewing deck, Walk Way, etc.</td>
<td>A1 sheet/1:100/50</td>
</tr>
<tr>
<td>9</td>
<td>Sculpture detail and layout</td>
<td>A1 sheet/1:100/50</td>
</tr>
<tr>
<td>10</td>
<td>Details of Gazebo and Pergola</td>
<td>A1 sheet/1:100/50</td>
</tr>
<tr>
<td>11</td>
<td>Details of Play Equipments</td>
<td>A1 sheet/1:100/50</td>
</tr>
<tr>
<td>12</td>
<td>Layout and Details of Garden furniture &amp; Dustbins.</td>
<td>A1 sheet/1:100/50</td>
</tr>
<tr>
<td>13</td>
<td>Typical Details</td>
<td>A1/A2 sheet/ 1:25</td>
</tr>
</tbody>
</table>

Note: These are the tentative drawings list but not limited to these. The bidder shall have to furnish all the working drawings covering each and every element of landscape works.

**As Built drawings**
The bidder shall have to furnish the as built drawings of all the component of entire development after completion of the site work.
The drawings shall be submitted in the form of softcopy in Auto Cad and PDF format and Hardcopy (6 set) in A1/A2 size.
LIST OF APPROVED MAKES/BRANDS OF MATERIALS
Following list of approved vendors are provided for different materials. However contractor may procure from other equivalent vendors after approval from employer.

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Details of Materials / Equipment</th>
<th>Manufacturer’s Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Erosion control mats (for slope retention-Geo cell &amp; Terrian mat)</td>
<td>Terrain infratech Or Approved Equivalent</td>
</tr>
<tr>
<td>2.</td>
<td>Plant material</td>
<td>Reputed Nursery or nurseries (Shall be approved by Landscape architect &amp; PMC)</td>
</tr>
<tr>
<td>3.</td>
<td>Tiles</td>
<td>Kajaria, somany, Jhonson or equivalent as approved by the PMC</td>
</tr>
<tr>
<td>4.</td>
<td>Ordinary Portland Cement</td>
<td>L &amp; T, Konark, ACC, UltraTech</td>
</tr>
<tr>
<td>5.</td>
<td>White Cement</td>
<td>Birla, J.K</td>
</tr>
<tr>
<td>6.</td>
<td>Coarse Sand</td>
<td>As Per IS 383(Latest Edition) From Approved Quality</td>
</tr>
<tr>
<td>7.</td>
<td>Fine Sand</td>
<td>As Per IS 383(Latest Edition) From Approved Quality</td>
</tr>
<tr>
<td>8.</td>
<td>Stone Aggregate</td>
<td>As Per IS 383(Latest Edition) From Approved Quality</td>
</tr>
<tr>
<td>9.</td>
<td>Water Proofing</td>
<td>Pidilite, FOSROC, Soprema, Sikka</td>
</tr>
<tr>
<td>10.</td>
<td>Reinforcement Steel - T.M.T.</td>
<td>TATA steel, Sail, RINL</td>
</tr>
<tr>
<td>11.</td>
<td>Structural Steel</td>
<td>TATA steel, Sail Or Approved Equivalent</td>
</tr>
<tr>
<td>12.</td>
<td>Stainless Steel Sections</td>
<td>Jindal Steel Or Approved Equivalent</td>
</tr>
<tr>
<td>13.</td>
<td>Anchor Fasteners/ Couplers</td>
<td>Hilti, Canon</td>
</tr>
<tr>
<td>15.</td>
<td>Epoxy</td>
<td>Fosroc Or Approved Equivalent</td>
</tr>
<tr>
<td>16.</td>
<td>Epoxy Grout</td>
<td>BAL(6407272) Or Approved Equivalent</td>
</tr>
<tr>
<td>17</td>
<td>Penetrating Sealer (Aquamix)</td>
<td>Pristine (6405480) Or Approved Equivalent</td>
</tr>
<tr>
<td>----</td>
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<td>-----------------------------------------</td>
</tr>
<tr>
<td>18</td>
<td>Polish Protector (Aquamix)</td>
<td>Pristine (6405480) Or Approved Equivalent</td>
</tr>
<tr>
<td>19</td>
<td>Putty</td>
<td>Shalimar Or Approved Equivalent</td>
</tr>
<tr>
<td>20</td>
<td>Fire Sealent</td>
<td>Navair (6491167) Or Approved Equivalent</td>
</tr>
<tr>
<td>21</td>
<td>Paints/Polish</td>
<td>ICI, Berger, Asian</td>
</tr>
<tr>
<td>22</td>
<td>Textured Paint</td>
<td>Spectrum (6836587), Heritage, Asian, Nerolac.</td>
</tr>
<tr>
<td>23</td>
<td>Pigment</td>
<td>Sudershon Chemicals, TATA Pigments</td>
</tr>
<tr>
<td>24</td>
<td>Mirror</td>
<td>Modiguard, Goldplus</td>
</tr>
<tr>
<td>25</td>
<td>Integral Water Proofing</td>
<td>Pidilite Or Approved Equivalent</td>
</tr>
<tr>
<td>26</td>
<td>Bio Toilet</td>
<td>Suvidha, Tata Nestin</td>
</tr>
<tr>
<td>27</td>
<td>Taps and other accessories</td>
<td>Jaquar, Hindware, Kohler</td>
</tr>
<tr>
<td>28</td>
<td>Stamped Concrete</td>
<td>Unistone, UltraTech, Prism</td>
</tr>
<tr>
<td>29</td>
<td>Floating Jetty</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>GRC</td>
<td>Unistone, Birla White</td>
</tr>
</tbody>
</table>

Note: The contractor shall produce all samples including natural stones, before procurement of the materials, for approval of the Architects/Project Manager, PMC/ Client.
<table>
<thead>
<tr>
<th>SR NO</th>
<th>FLOOR DETAIL DISCRIPTION</th>
<th>FLOORING</th>
<th>CLADDING / WALL FINISH</th>
<th>DOOR / WINDOW</th>
<th>CEILING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GHAZEB0</td>
<td>Stamped Concrete</td>
<td>As per Site</td>
<td>CC</td>
<td>Acrylic Emulsion Paint</td>
</tr>
<tr>
<td>2</td>
<td>GATE CABIN</td>
<td>Kota Stone Polished</td>
<td>300X300</td>
<td>Kota Stone</td>
<td>Acrylic Emulsion Paint</td>
</tr>
<tr>
<td>3</td>
<td>KIOSK</td>
<td>Kota Stone Rough</td>
<td>300X300</td>
<td>Kota Stone</td>
<td>White Wash</td>
</tr>
<tr>
<td>4</td>
<td>WORKSHOP</td>
<td>CC Finish</td>
<td>As per Site</td>
<td>CC</td>
<td>Acrylic Emulsion Paint</td>
</tr>
<tr>
<td>5</td>
<td>STAIRCASE</td>
<td>Kota Stone Rough</td>
<td>As per Site</td>
<td>Kota Stone</td>
<td>Acrylic Emulsion Paint</td>
</tr>
<tr>
<td>6</td>
<td>KITCHEN</td>
<td>Kota Stone Polished</td>
<td>300 X 300</td>
<td>Kota Stone</td>
<td>Acrylic Emulsion Paint</td>
</tr>
</tbody>
</table>
1. **Scope of Work- Civil and Structural.**

1.1. **General**

The work specified hereinabove shall be treated as an approximate assessment. The actual works as required on the basis of detailed topographical survey, Geotechnical investigation and design shall be determined by the Contractor in accordance with the Specifications and Standards.

The Contractor shall establish a design liaison office at site within 28 days from the Commencement Date to facilitate preparation and submission of designs, drawings, construction documents, etc., for review and approval by the Employer's Representative. The design liaison office shall preferably be located near the Employer's office to facilitate communications and frequent interactions with the Employer's Representative and the Employer. The Contractor shall provide full-time design staff and continuously maintain the design liaison office until such time as all necessary designs and Construction Documents have been completed, reviewed, and approved by the Employer's Representative. The Contractor will be fully responsible for ensuring that its designs, drawings, and construction documents satisfy all requirements for construction Works that are complete and fully functional in all respects.

Contractor shall be responsible for making the facility fit for the intended purpose while performing all of its obligations covered under the Contract Document in its entirety. The work shall be done in accordance to the drawings approved by the statutory authorities.

Scope includes Analysis, design and detailing of each structural members based on relevant IS codes, as deemed necessary (without changing the footprint of the proposed “buildings and space planning”, design intent), developing required specifications, preparing Good for Construction (GFC), coordinated drawings and construct entire campus in accordance with the same. The scope shall also include preparation of as built drawings before handing over the work to the Employer, maintaining the Quality assurance & Quality control (QA&QC) including control, corrective actions, reporting and arranging for regular inspections by all concerned.

The Scope of work consists of Design, Engineering & construction of Brahmani Riverfornt Development Project.

Design and detailing shall include:

1. Appointment of consultants
2. Preparation of coordinated GFC drawings
3. Obtaining Employers / PMC''s approval on the GFC drawings
4. Preparation of approval drawings, documents, calculations, etc, as may be necessary by the statutory authorities, at the relevant stages
5. Providing material samples and mock-ups and obtaining Employers / PMC”s approval for the same
6. Preparation of As-built drawings
Scope of Work

Procurement, supply, construction, installation, furnishing, equipping, testing and commissioning shall be carried out for the following works:

1. Demolishing work of existing encroached structure
2. RCC
3. Steel structures
4. Masonry
5. Plastering
6. Painting
7. Fabrication and installation works
8. Suspension cables
9. Painting

Particular Scope of Work

1.1.1.1. Civil and Structural

The detailed scope of work and the basic design criteria for each Building includes are as follows

1.1.1.1.1. Topographic Survey & Geotechnical investigation

Contractor to conduct detail topographical site survey and Geotechnical investigation before execution of work and submit the same to the Engineer in charge for approval.

1.1.1.1.2. Construction of food court

The food court in pocket one is a complete RCC structure. All the load i.e. permanent (Dead load), Live load and seismic load combinations to be considered. The design and Analysis shall be carried by the reputed software STAADPro for critical load combinations. Each element should be designed as per relevant IS codes.

1.1.1.1.3. Guard room and gate Complex

The guard room and gate complex should have a minimum area of 6.0 sqm guard room with counter and necessary opening like doors and windows. Separate gate for entry and exit to be provided. The gate should be of MS. All the load i.e. permanent (Dead load), Live load, seismic load and Wind load to be considered. The design and Analysis shall be carried by the reputed software STAADPRO for Critical load combinations. Each element should be designed as per relevant IS codes.
1.1.1.1.4. **Boundary wall**  
The boundary wall to be constructed with combination of RCC column, Brick work, MS grill/GRC jali. All the load i.e. permanent (Dead load), Live load, seismic load and Wind load to be considered. The design and Analysis shall be carried by the reputed software STAADPRO for critical load combination. Each element should be designed as per relevant IS codes.

1.1.1.1.5. **Ticketing facility**  
Kiosk for ticketing facility should have minimum area of 6 sqm. with counter and necessary opening like doors and windows. This should be permanent RCC structure with kota stone flooring and paint as/specs. The design and Analysis shall be carried by the reputed software STAADPRO. Each element should be designed as per IS codes.

1.1.1.1.6. **Retaining walls**  
RCC Retaining walls to be provided where ever required as/design in line of the architectural design at locations like river edge or at places where there are level differences. IS 456 and SP -16 codes to be followed. SBC of soil to be considered to fix the size of the retaining wall. The retaining wall to be designed for the lateral loads so, has to be designed to have the Stability against sliding and Overturning Moment. The foundation design shall be suitable for the Seismic requirement of Rourkela as per latest IS code. The design shall be consider the maximum wind speed of Rourkela as per IS 875. As foundation may encounter the river water in rainy season, hence Grade of concrete to be used shall not be less than design Mix M30 and grade of reinforcement steel shall be Fe 500. Stability against Overturning Moment and sliding should not be less than 1.55. If there is a space restriction to increase the area of Retaining wall to satisfy the sliding and overturning criteria then the shear key should be provided. Factor of safety = Resisting force/ Sliding force. Density of soil governs to calculate the depth of the founding level. The Base slab thickness should be fixed minimum (H/12)  
H= Height of the Retaining wall above GL+ the height of the founding level below GL  
Structural Strength of the wall to be satisfied. It is usual to assume for free-standing retaining walls that sufficient outward movement occurs to allow active (minimum) earth pressures to develop.
The designer must ensure that sufficient movement can take place without affecting the serviceability or appearance of the wall.

Basic Loading:
Normal Loading = static earth pressure + water pressure + pressure due to live loads or surcharge. The possible occurrence of other design cases, or variation of the one above, caused by construction sequence or future development of surrounding areas should also be considered. For instances, additional surcharges may need to be considered and allowance made for any possible future removal of ground in front of the wall in connection with services, particularly if the passive resistance of this material is included in the stability calculations. The effect of excavation on the wall bearing capacity may also need to be considered.
Expansion joint to be provided for the continuous RCC wall as per IS codes.
For the determination of earth pressure, it is usual to consider a unit length of the cross-section of the wall and retained soil. A unit length is also used in the structural design of cantilever walls and other walls with a uniform cross-section.
Base slab width can be 0.6H where H= Total height of the wall/stem.
Toe projection can be B/3 where B= Base slab width.
No tension is allowed, QMAX and QMIN should be less than the Safe bearing capacity of soil obtained from the Geotechnical Report.
RCC retaining wall should be checked for ultimate shear and ultimate moment . The Actual shear stress calculated should be less than the permissible shear stress from IS 456- Table 19.
The minimum Area of steel to be considered for the design should not be less than 0.12% of the gross sectional area.
The Analysis, Design and Drawings for complicated Retaining wall (along or inside the river area) need to be approved by Indian Institute of Technology before submitting for the RSCL approval.

1.1.1.1.7. Railing & parapet walls
MS railings, parapet walls of minimum height 1.2 m required at the river edge, ramps at other places wherever necessary to be provided. The design should be done as per relevant IS codes.

1.1.1.8. Shops
Permanent shops of minimum area 10.0 sqm. The total no of shops will be minimum 36 nos. The design and Analysis shall be carried by the reputed software STAADPRO. Each element should be designed as per IS codes.

1.1.1.9. Steps leading to water
10 m wide RCC steps leading inside the water to be constructed & should be designed as per IS456 code.

1.1.1.1.10. **Cable suspension Bridge**

Erection of cable suspension pedestrian bridge of 75 m length and 2.0 m wide with MS/RCC staircase at both ends. Analysis shall be carried by the reputed software STAADPRO. Each element should be designed as per relevant IS codes.

A suspension bridge is a type of bridge in which the deck (the load-bearing portion) is hung below suspension cables on vertical suspenders. The design of modern suspension bridges allows them to cover longer distances than other types of bridges. The main element of a cable suspended bridge is the cable system. The main forces in a suspension bridge of any type are tension in the cables and compression in the pillars. Since almost all the force on the pillars is vertically downwards, and the bridge is also stabilized by the main cables, the pillars can be made quite slender. The weight is transferred by the cables to the towers, which in turn transfer the weight to the ground.

The basic structural components of a suspension bridge system include stiffening girders/trusses, the main suspension cables, and the anchorages for the cables at each end of the bridge.

Bearing is a component of a bridge which typically locates between bridge substructures and superstructures, playing an important role in the force transmission and in accommodating the deformation caused by temperature variation and the earthquake. A bridge bearing carries the loads or movement in both vertical and horizontal directions from the bridge superstructure and transfers those loads to the bridge piers and abutments. The loads can be live load and dead load in vertical directions, or wind load, earthquake load, etc., in horizontal directions. The longer the span of the cable supported structure, the more slenderness hence wind becomes a critical design factor. The wind action affects not only the bridge structure, but also the cables. These elements, under wind load alone, can cause severe damage to the structure if not designed properly. The high stress level in a small cross section having no bending rigidity makes the cable an extremely sensitive element to oscillation, So the Analysis and Design to be carried out properly in the STAADPRO software, check for the permissible deflection as per relevant IS codes.

Cable vibration is a common phenomenon in cables. To prevent the excessive vibration amplitudes from affecting the integrity of the structure, damping devices are being implemented.

The foundation design shall be suitable for the Seismic requirement of Rourkela as per latest IS code.

The design shall be consider the maximum wind speed of Rourkela as per IS 875.
As foundation may encounter the river water in rainy season, hence Grade of concrete to be used shall not be less than design Mix M30 and grade of reinforcement steel shall be Fe 500.

The Analysis, Design and Drawings for the Suspension bridge need to be approved by Indian Institute of Technology before submitting for the RSCL approval.

1.1.1.11. Decorative tower
Decorative tower of MS structure claded with GRC jali of minimum height 12m with cantilevered branches to be constructed. Design and Analysis shall be carried by the reputed software STAADPRO. Each element should be designed as per IS codes.

1.1.1.12. Gazebo
RCC gazebos to be constructed. All the load i.e. permanent (Dead load), Live load, seismic load & wind load to be considered. Design and Analysis shall be carried by the reputed software STAADPRO for the critical load combinations. Each element should be designed as per IS 456 and IS 13920 codes.
2 TECHNICAL SPECIFICATIONS FOR CONCRETE WORK

2.1 EARTHWORK

2.1.1 SCOPE OF WORK
The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, appliances and materials and in performing all operations in connection with earthworks of all underground supplies and services and for all structural units, stock piling, of specifications and applicable drawings, and subject to terms and conditions of the contract. The scope of this section of specifications is also covered with detailed specifications as laid down herein. Contractor has to provide the Topographical survey and the Geotechnical Investigation report After conducting all the soil test required as per the IS codes.

2.1.2 GENERAL

2.1.2.1 The Contractor shall acquaint himself with the nature of the ground, existing structures, foundations and subsoil which might be encountered during excavation of earthworks. The Employer does not guarantee or warrant in any way that the material to be found in the excavation will be similar in nature to that of any samples which may have been exhibited or indicated in the report, drawings or in any other contract documents or to material obtained from boring or trail holes. The contractor shall be deemed to have made local and independent inquiries and shall take the whole risk of the nature of the ground subsoil or material to be excavated or penetrated and the Contractor shall not be entitled to receive any extra or additional payment nor to be relieved from any of his obligations by reasons of the nature of such ground subsoil or material.

2.1.2.2 All excavations, cutting, and fills shall be constructed to the lines, levels and gradients specified with any necessary allowance for consolidation, settlement and drainage so that at the end of the period of maintenance the ground shall be at the required lines, levels and gradients.
During the course of the Contract and during the period of maintenance any damage or defects in cuttings and fills, structures and other works, caused by slips, falls or basins or any other ground movement due to the Contractor's negligence shall be made good by the Contractor at his own cost.

2.1.3 SITE PREPARATION

2.1.3.1 The Contractor shall construct and maintain accurate bench marks so that the lines and levels can be easily checked by the Project Engineer. The Contractor shall Construct and maintain such ditches, in addition to those shown on the plans, as will adequately drain areas under construction.

2.1.3.2 The Contractor shall perform a joint survey with the Project Engineer's representative of the area where earthwork is required, plot the ground levels on the drawings and obtain approval from him before starting the earthwork.

2.1.3.3 The Contractor shall Construct and maintain such ditches, in addition to those shown on the plans, as will adequately drain areas under construction.

2.1.3.4 The Contractor shall perform a joint survey with the Project Engineer's representative of the area where earthwork is required, plot the ground levels on the drawings and obtain approval from him before starting the earthwork.

2.1.4 EXCAVATIONS

2.1.4.1 Excavation shall include the removal of all material of every name and nature. Excavations shall be carried out in accordance with excavation plans and sections shown on the Drawings and as directed by the Project Engineer.

2.1.4.2 The major portion of excavations shall be carried out by mechanical excavators and excavated materials disposed off to stock on spoil as per drawings or as directed by the Project Engineer. The excavation which cannot be done by mechanical means including leveling, trimming and finishing to the required levels and dimensions shall be done manually. The material suitable for fill and back fill shall be stock piled within the free haulage limit of the 200m of the works.
2.1.4.3 The Contractor shall give reasonable notice that he intends to commence any excavation and he shall submit to the Project Engineer full details of his proposals. The Project Engineer may require modifications to be made if he considers the Contractor's proposals to be unsatisfactory and the Contractor shall give effect to such modifications but shall not be relieved of his responsibility with respect to such work.

2.1.4.4 For major excavations, the Contractor shall submit for the prior approval of the Project Engineer full details and drawings showing the proposed method of supporting and strutting etc. The design, provisions construction, maintenance, and removal of such works shall be the responsibility of the Contractor and all cost in these respects shall be included in the unit rates for the permanent work.

2.1.4.5 The Contractor's attention is drawn particularly to his obligations under the general conditions in respect of those works which are in close proximity to existing buildings.

2.1.4.6 The Contractor shall preserve the complete excavation from damage from slips and earth movements, ingress of water from any source whatsoever and deterioration by exposure to the sun and the effects of the weather.

2.1.4.7 All excavation of every description, in whatever material encountered shall be performed to the elevations and dimensions shown on the drawings in such a manner as to avoid interruption to work in other parts of the site. The Contractor shall be responsible for injury to the permanent works caused by excavation on other parts of the works.

2.1.4.8 Excavation shall extend to sufficient distance from walls and footing to allow for placing and removal of forms, installations of services and for inspection, except where the concrete for walls and footings is authorized to be deposited directly against excavated surfaces.

2.1.4.9 All excavations in foundations shall be taken to 150mm and shall be trimmed carefully to a smooth and level surface, immediately after trimming to the final elevation a layer of building concrete shall be placed to the thickness shown on the drawings. All excavations for foundations which have been trimmed and disturbed shall be compacted and covered by concrete by the end of the day. It is specifically brought to the notice of the Contractor that any excavation taken down to the trimmed elevation which is left overnight or for any length of time thereafter, uncovered by the blinding concrete, shall be required to be trimmed to such lower elevation as directed by the Project Engineer and any extra work or any consequent increase in the quantities caused thereby shall not be paid to the Contractor.
2.1.4.10 No excavation shall be refilled nor any permanent work commenced until the foundation has been inspected by the Project Engineer and his permission to proceed given. If excavation for sub-structures is carried below the required level, as shown in the drawings or as directed by the Project Engineer, the surplus depth shall be filled in with concrete of same grade as of blinding concrete at the sole cost of the Contractor.

2.1.4.11 All excavation shall be performed in the dry. The placing of blinding concrete, placing of reinforcement and casting of the permanent works in the excavation shall be carried out in the dry and the Contractor shall have sufficient equipment for this purpose. Adequate precautions shall be taken to prevent any corrosion due to undercutting from underneath the previously constructed adjoining foundations.

2.1.4.12 Existing utility lines to be retained, as well as utility lines constructed during excavation and backfilling, and if damaged, shall be required to be repaired by the Contractor at his expense. Any existing utility lines which are not known to the Contractor in sufficient time to avoid damage, if inadvertently damaged during excavation, shall be repaired by the Contractor and adjustment in payment will be made as approved by the Project Engineer. When utility lines which are to be removed, are encountered within the area of operations the Contractor shall notify the Project Engineer in ample time for necessary measures to be taken to prevent interruption of the service.

2.1.4.13 Excavated material suitable for use as filling material shall be stock piled within the free haulage limit 200m of works as directed by the Project Engineer. This stock piled material shall be transported back to places requiring fill or backfill. Surplus or material unsuitable for use as filling shall be disposed of by the Contractor at locations approved by the Project Engineer within specified free haulage limit.

2.1.4.14 The Contractor shall make independent enquiries and perform and make independent observations to ascertain the water table in the areas of excavations during the period when the construction works are in progress. The Contractor shall take whole risk of any nature for fluctuation of the water table from his own findings. The Employer is not bound in any way and shall not be responsible for any information given by him or any information, observations or values obtained from his reports, drawings and documents.

2.1.4.15 Excavation for Recharge pits, Recharge trenches shall be taken out to the levels and dimensions as the Project Engineer may direct.
2.1.4.16 Before starting the excavations, the Contractor shall ensure the correct alignment of the recharge trenches and location of recharge pits on the ground, the depth and width of excavation of the trench and pits, all in accordance with the drawings and instructions of the Project Engineer.

2.1.4.17 The Contractor at his cost shall provide to the satisfaction of the Project Engineer all timbering, approved supports and shores and bracings to the sides of the excavated trench and foundations in such a manner to secure the sides of the trench and excavations from falling or adverse movement. All responsibility connected with such shoring shall rest with the Contractor. Adequate clearance / working space on both sides of the structure/pipe line shall be provided for which no payment shall be made.

2.1.4.18 Without the written permission of the Project Engineer no more than 50.0m the trench shall be opened in advance of the completed pipe line. The bottom of all excavations shall be carefully leveled. Any pockets of soft or loose material in the bottom of the pits and trenches shall be removed and the cavities so formed filled with lean concrete at the Contractor's expense.

2.1.4.19 The Project Engineer may require the Contractor to excavate below the elevations shown on the drawings or he may order him to step above the elevations shown depending upon the suitable foundation material encountered.

2.1.4.20 If for any reasons, the levels grades or profiles of the excavations are changed adversely, the Contractor shall at his own cost be liable to bring the excavations to the required levels and profiles as shown on the drawings or as directed by the Project Engineer.

2.1.5 **EXCAVATION TOLERANCES**

Excavation shall be performed within the tolerances for excavation limits indicated on the drawings. Where no tolerance limits are indicated excavation shall be performed to tolerances established by the Project Engineer as accepted for the design and type of work involved.
2.2 **BACK FILLING**

2.2.1 After completion of foundation footing, foundation, walls, and other construction below the elevation of the final grades and prior to backfilling, forms shall be removed and the excavation shall be cleaned of trash and debris.

2.2.2 The backfilling shall include filling around the foundations, trenches.

2.2.3 Filling shall be approved selected material from excavation or other predominantly granular material and free from slurry, mud, organic or other unsuitable matter and capable for compaction by ordinary means.

2.2.4 The excavated material if found suitable shall be stock piled within the free haulage limit of the site of the works. This material shall be used for backfilling if approved by the project engineer and shall be transported by the contractor any where required for the purpose of backfilling work in this contract.

2.2.5 The contractor shall provide the approved quality fill and backfilling material as required to complete the fill/backfilling work.

2.2.6 Fill in around trenches and pits shall be carefully placed with fine material to cover the completely before the normal infilling is done.

2.2.7 Material for back filling shall be as approved by the project engineer and shall be placed in layers of 150 mm measured as compacted material and saturated with sufficient water and compacted to produce in-situ density not less than 95% of the maximum density at optimum moisture content as per relevant IS Codes.

2.2.8 All filled areas shall be left neat, smooth and well compacted with the top surface consisting of the normal site surface soil unless otherwise directed.

2.2.9 Depending on the depth of fill the project engineer may instruct increased thickness of successive layer to be placed.

2.2.10 Fill shall not be placed against foundation walls prior to approval by the project engineer. Fill shall be brought up evenly on each side of the walls as far as practicable. Heavy equipment for spreading and compacting the fill shall not be operated closer to the wall than a distance equal to the height of the fill above the top of footing.

2.2.11 Depending on the depth of fill the project engineer may instruct increased thickness of successive layer to be placed.
2.2.12 Fill shall not be placed against foundation walls prior to approval by the project engineer. Fill shall be brought up evenly on each side of the walls as far as practicable. Heavy equipment for spreading and compacting the fill shall not be operated closer to the wall than a distance equal to the height of the fill above the top of footing.

2.2.13 In case the contractor is instructed to arrange for the fill material the quality of the fill material will be subject to the approval of the project engineer. The project engineer shall require the contractor to carry out various tests of the fill material. All such tests shall be made at an approved laboratory at the cost of the contractor. Once a material from a specific source has been approved, the material for the same quality and from that source only shall be used. Any fill material from borrow pits which has not been approved or the quality of which differs from the approved material shall be rejected outright. The project engineer reserves the right to order removal of any such materials brought to the site of works at his discretion at contractor's expense. In order to ensure satisfactory compaction, it will be necessary to carry out, depending upon the type of material, particle size distribution tests, determination of organic content tests, maximum and minimum density tests and determination of optimum moisture content for the filling material.

2.2.14 The method of compaction, namely type of compactor, type of roller, weight of roller and number of passes proposed by the contractor for any particular fill material shall be subject to the approval of the project engineer after completion of satisfactory field tests, subsequent to the laboratory analyses, using the materials and equipment proposed to be used for the earth work in conditions similar to those likely to be encountered during construction.

The final selection of the soil moisture content, the thickness of layers, the type of compaction equipment and the number of passes shall be decided after these tests, which shall be conducted at contractor's expense.

2.2.15 Having established the method of compaction to be used, no departure from this approved method shall be permitted without the prior approval of the project engineer. Adequate control of the fill and compacting operations shall be ensured by in-situ density tests and in order to obtain significant results, not less than two measurements shall be carried out per one hundred square meters of area compacted. The frequency of tests shall be determined on site and may be varied at the discretion of the project engineer. Compaction shall not be less than 95% in-situ density with respect to the maximum density, at optimum moisture content.
2.2.16 The exact thickness of layers and the method of placing and compacting the fill shall be determined by the field tests, as stated above, but not withholding the results of these trails, fill shall not be placed in layers exceeding 200mm in thickness. In order to maintain control of the thickness of layers, timber profiles shall be used wherever feasible. The travelers of such profiles for each layer of fill shall be checked by the supervisory staff of the project engineer. The contractor shall provide adequate supply of water and sufficient capacity of mechanical water carriers to ensure uniform and uninterrupted operation of compaction. The project engineer may forbid the contractor to proceed with placing and/or compaction of fill and/or order removal and re-compaction of such fill when he finds that the contractor has insufficient or defective equipment or that the fill has been improperly laid and/or compacted.

2.2.17 If it is found necessary to alter the moisture content of the fill material in any way, then very strict control shall be exercised over the wetting and/or the drying process and frequent moisture content tests.

2.2.18 The fill material should be well graded non-cohesive and nearly silt-free (silt content between 5 to 10 percent) salt free and free of organic materials (less than 2%). It should also be free of stones larger than 100 mm. It should be of such nature and characteristics that it can be compacted to the specified densities in reasonable length of time. It shall be free of plastic clays, of all materials subject to decay, decomposition or dissolution and or cinder or other material which corrode piping and other metals.

2.2.19 TOLERANCES
The stabilization of compacted backfill/fill surfaces shall be smooth and even and shall not vary more than 100mm in 3 meters from true profile and shall not be more than 12.5mm from true elevation.

2.2.20 DISPOSAL OF SURPLUS MATERIAL

2.2.20.1 The rejected unsuitable material and surplus excavated material shall be disposed of within 200 m free haulage limit measured from boundary of the works to places or as directed by the Project Engineer.

2.2.20.2 The disposal of surplus excavated material shall include loading, unloading, transporting, stacking, spreading as directed by the Project Engineer.
2.3 **PLAIN AND REINFORCED CEMENT CONCRETE**

The work covered by this section of the Specifications consists of furnishing all plant, labor, equipment, appliances and materials, and in performing all operations in connection with the supply and installation of plain and reinforced concrete work, complete in strict accordance with this section of the Specifications and relevant documents, subject to the Conditions of the Contract.

2.3.1 **GENERAL**

2.3.1.1 Full co-operation shall be given to other trades to install embedded items and/or any associated services.

2.3.1.2 Embedded items shall have been inspected, and tests for concrete and other material or for mechanical operations shall have been completed and approved, before concrete is placed.

2.3.1.3 Formwork shop drawings shall be designed and prepared by the Contractor at his own cost. Approval of shop drawings as well as those of mock-ups/actual samples of finished concrete shall be obtained before Work is commenced.

2.3.1.4 Contractor shall prepare bar bending schedules, and get the same approved by the Project Engineer, prior to commencement of work.

2.3.2 **RELATED SPECIFICATIONS**

The codes and standards generally applicable to the work of this section are listed herein after.

- **IS 269**: Ordinary and low heat Portland Cement
- **IS 8041**: Rapid Hardening Portland Cement
- **IS 455**: Portland slag cement
- **IS 1489**: Portland Pozzolana Cement
- **IS 8112**: High Strength Ordinary Portland Cement
- **IS 383**: Coarse and fine aggregates from natural sources for concrete
- **IS 456**: Code of practice for plain and reinforced concrete
- **IS 516**: Method of sampling and analysis of concrete
- **IS 1199**: Method of sampling and analysis of concrete
- **IS 1139**: Hot rolled deformed bars
- **IS 23896**: Methods of testing of aggregates for concrete (Part I to III)
- **IS 2751**: Recommended Practice for welding for reinforcement bars
- **IS 9103**: Admixtures for concrete
2.3.3 MATERIALS

2.3.3.1 CEMENT

a. Port land pozzolana Cement or equal type of cement shall be used as per the site condition, but prior approval should be taken up by the contactor from the Engineer in charge. Only one brand of each type of cement shall be used for concrete in any individual member of the structure. Cement shall be used in the sequence of receipt of shipment, unless otherwise directed.
b. There shall be sufficient cement at site to ensure that each section of Work is completed without interruption.
c. Cement reclaimed from cleaning of bags or from leaky containers shall not be used.
d. Contractor shall provide and erect, at his own cost, in a suitable place, dry, well ventilated, and water proof shed of sufficient capacity to store the cement.
e. The cement shall be used as soon as possible after delivery, and cement which the Project Engineer considers has become stale or unsuitable through absorption of moisture from the atmosphere or otherwise shall be rejected and removed immediately from the site at Contractor’s expense.
f. The mixing together of different types of cement shall not be permitted.

2.3.3.2 AGGREGATES

a. The sources of supply of all fine and coarse aggregates shall be subject to the approval of Project Engineer.
b. All fine and coarse aggregates shall be clean and free from clay, loam, silt, and other deleterious matter. If required, Project Engineer reserves the right to have them washed by the Contractor at no additional expenses. Coarse and fine aggregates shall be delivered and stored separately at Site. Aggregates shall not be stored on muddy ground or where they are likely to become dirty or contaminated.
c. Fine aggregate shall be hard coarse sand, crushed stone or gravel screenings and shall conform to requirements of IS: 383 latest edition.
d. Coarse aggregate shall be gravel or broken stone or hard, durable material free from laminated structure and conforming to IS: 383 latest edition. The aggregates shall be graded as follows for use in mass concrete as in foundations:
Coarse aggregate for all cast-in-place concrete other than mass concrete as for foundations shall be graded with the following limits:

<table>
<thead>
<tr>
<th>TOTAL PASSING</th>
<th>PERCENT BY WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot; Sieve (25.00 mm)</td>
<td>100</td>
</tr>
<tr>
<td>3/4&quot; Sieve (19.00 mm)</td>
<td>90-100</td>
</tr>
<tr>
<td>3/8&quot; Sieve (9.50 mm)</td>
<td>20-55</td>
</tr>
<tr>
<td>No. 4 Sieve (4.75 mm)</td>
<td>0-10</td>
</tr>
</tbody>
</table>

2.3.3.3 Water:

Only clean potable water from the city supply, tube well installed at the Site or from other sources approved by Project Engineer shall be used. Contractor shall supply sufficient water for all purposes, including mixing the concrete, curing and cleaning plant and tools. Where doubts exist as to the suitability of the water, it shall be tested in accordance with IS: 3025. Where water can be shown to contain any sugar or an excess of acid, alkali or salt, Project Engineer may refuse to permit use. As a guide, the following concentrations represent the maximum permissible values:

a. To neutralize 200 ml sample it should not require more than 2 ml of 0.1 normal NaOH.

b. To neutralize 200 ml sample it should not require more than 10 ml of 0.1 normal HCL.

c. Percentage of solids should not exceed the following:

<table>
<thead>
<tr>
<th>PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic</td>
</tr>
<tr>
<td>Inorganic</td>
</tr>
<tr>
<td>Sulphates</td>
</tr>
<tr>
<td>Alkali Chlorides</td>
</tr>
</tbody>
</table>

In case of doubt, Project Engineer may require that concrete mixed with water proposed to be used should not have a compressive strength lower than 90 percent of the strength of concrete mixed with distilled water.
2.3.3.4 Reinforcement

a. Reinforcement for concrete shall conform to the respective IS or other standards as specified in the drawings and Contract Documents or as may be specified by Project Engineer.

b. Unless otherwise specified, all plain reinforcing bars shall comply with the requirements of IS: 432.

c. Unless otherwise specified, all deformed reinforcing bars shall comply with the requirements of IS: 1786 for deformed cold worked steel bars and shall have minimum characteristic stress of 500 N/sq mm.

d. Reinforcement shall be obtained only from manufacturers approved by Project Engineer. If and when required Contractor shall provide all necessary facilities to Project Engineer for the selection of test pieces and shall cause these to be prepared and submitted where directed for tests at Contractor's cost.

e. Reinforcement of all types is to be stored at Site in an approved manner so as to avoid damage.

f. Contractor shall report immediately on receipt of any consignment, having any deviation in the standard weights of the reinforcing bars.

g. CONCRETE MIX PROPORTIONS

2.3.4 GENERAL:

The proportions of ingredients shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement by the methods of placing and consolidation employed on the Work, but without permitting the materials to segregate or excessive free water to collect on the surface. Specific approval of the Project Engineer is required to waive limitations on mixture proportions.

The proportions of ingredients shall be selected to produce the proper placeability, durability, strength and other required properties.

2.3.5 STRENGTH

The Specified compressive strength of the concrete cube, shall be minimum 25 N/sq mm. Samples from fresh concrete shall be taken as per IS: 1199 and cubes shall be made, cured and tested at 28 days in accordance with IS: 516.

2.3.6 DURABILITY

Requirements of Clause 7 of IS: 456-1978 shall be followed.
2.3.7 **SLUMP**

Unless otherwise permitted or specified, the concrete shall be proportioned and produced to have a slump of 100 mm or less. A tolerance of up to 25 mm above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated.

2.3.8 **MAXIMUM SIZE OF COARSE AGGREGATE:**

The nominal maximum size of the aggregate shall be 20 mm for all portions of the structure except footings which may be 38 mm. These limitations may be waived if, in the judgement of the Project Engineer, workability and methods of consolidation are such that the concrete can be placed without honeycomb or voids.

2.3.9 **ADMIXTURES:**

If required or permitted, admixtures used shall be in accordance with the manufacturer's instructions except as otherwise specified herein.

2.3.10 **METHODS OF OBTAINING MIX DESIGN:**

For concrete of normal weight, mix proportions to provide the desired characteristics shall be developed using the methods/procedure covered by the Recommended Practice for Selecting Proportions for Normal Weight Concrete ACI-211.1-77/ IS:456-1978. Trial mixtures having proportions and consistencies suitable for the Work shall be made based on above codes, using at least three different water-cement ratios which will produce a range of strengths encompassing those required for the Work. Trial mixes shall be designed to produce the specified slump. The temperature of concrete used in trial batches shall be reported. For each water-cement ratio, compression test of cube shall be made, cured, and tested in accordance with IS:1199 and IS:516. From the results of these tests a curve shall be plotted showing the relationship between the water-cement ratio and compressive strength. From this curve, the water-cement ratio to be used in the concrete shall be selected to produce the required design strength. The cement content and mixture proportions to be used shall be such that this water-cement ratio is not exceeded when slump is the maximum permitted. Control in the field shall be based upon maintenance of proper cement content and slump.
2.4 **Ready mix concrete**

2.4.1 **GRADES AND STRENGTH REQUIREMENTS OF CONCRETE**

**General**

Ready mix Concrete shall consist of the material described under site batched concrete sections, using separate coarse and fine aggregate in an appropriate combination determined in the course of the mix design. The overall grading shall be such as to produce a concrete of the specified quality which will work readily in to position without segregation. The ready mix concrete shall conform to IS: 4926 and shall be delivered in agitating trucks.

**Slump**

The water shall be added to the cement and aggregate during mixing to produce concrete having a sufficient workability to enable it to be well consolidated, to be worked into the corners of the shuttering and around the reinforcement to give the specified surface finish, and to have the specified strength. Water cement ratio shall be maintained as per IS 456-1978 when a suitable amount of water has been determined, the resulting consistency shall be maintained throughout the corresponding parts of the work and tests shall be conducted to ensure the maintenance of this consistency. The max slump at the point of the discharge should not exceed 110mm max.

**Concrete Grades**

Grade of concrete used in the works shall be shown on the drawings or as directed by the Architect/Project Manager.

**TRANSPORTING CONCRETE**

Concrete shall be transported in agitating trucks without contamination, loss of ingredients or segregation. In no case shall a period of more than 4 hours have elapse between the wetting of mix and discharge of the concrete at site.
2.4.2 **CONCRETE PLACEMENT**

2.4.2.1 Concrete, when deposited, shall have a temperature of not less than 5°C (41°F) and not more than 32°C (90°F).

2.4.2.2 The concrete shall be placed in the positions and sequences indicated on the drawings, in this specification and/or as directed by the Architect/Project Manager.

2.4.2.3 Contractor shall give adequate notice to the Architect/Project Manager of his intention to concrete any section of the works.

2.4.2.4 Except where otherwise directed, concrete shall not be placed unless the representative of the Architect/Project Manager is present and has previously examined and approved the positioning, fixing and condition of the reinforcement or any other items to be embedded and the cleanliness, positioning and suitability of the concreting surface.

2.4.2.5 The concrete shall be deposited as nearly as possible in its final position. It shall be placed in such a manner as to avoid segregation of the concrete and displacement of the reinforcement, other embedded items, or formwork. It shall be brought up in horizontal layers not exceeding 450 mm in compacted thickness unless otherwise authorized or directed by Architect/Project Manager. Concrete shall not be placed simultaneously on each side of large horizontal specified or approved construction joints.

2.4.2.6 Shuttering for walls or thin sections of considerable height shall be provided with openings or other devices that will facilitate the cleaning of the accumulation of hardened concrete on the shuttering or on the metal reinforcement above the level of the concrete and the removal of concrete in the case of segregations.

2.4.3 **QUALITY CONTROL**

2.4.3.1 In order to ensure that the quality of materials and the mix proportions are suitable for the particular grade of concrete required are so maintained, sampling and testing shall be carried out regularly during the course of the works.

2.4.3.2 Workability testing shall be carried out in accordance with IS:456. The results shall lie within the range upon which the accepted mix design is based. Testing shall be carried out at such a frequency that the required workability is consistently achieved.
2.4.3.3 Samples of concrete shall be taken at random in accordance with IS: 516 at the time and place of deposition of the concrete at a frequency of sampling for each grade of concrete and from each concrete mixing plant at six cubes of 150 mm nominal size per 50 cubic meters of concrete placed in the works or twice per week.

2.4.3.4 Notwithstanding the foregoing, additional samples shall be taken by the contractor when directed by the Architect/Project Manager. The test cube procedure shall be in accordance with IS: 516 throughout.

2.4.3.5 Compliance with the specified characteristic strength shall be assumed if:
   a. Each of the six cubes in a group has a test strength not less than the characteristic strength or,
   b. Not more than one cube has test strength less than the specified characteristic strength but not less than 85% of the specified characteristic strength and the average strength of the group of four test results is not less than the specified characteristic strength plus the standard deviation of the group.

2.4.4 SEVEN DAY CUBE TESTS
Acceptance of concrete is based on the 28th day results. However, the contractor shall establish a relationship between 7 days and 28 days strengths by carrying out 7 days tests at the time of performing the laboratory testing and from subsequent quality control testing. This relationship shall be used in interpreting any further test results to predict the probable value of the corresponding 28 days cube strengths. The contractor shall without delay advise the Architect/Project Manager of any sample that appears likely to fail to meet the specification and the contractor shall take any necessary action to minimize the effect of such failure.

2.4.5 ACCEPTANCE CRITERIA
The general Acceptance Criteria of any and all of the concrete work shall be as per the relevant Clauses of IS. 456. If any of the works tests are not up to the standard, the Architect/Project Manager shall have the power to stop the work until the reason is investigated and steps taken to prevent further low results. The contractor shall not be entitled to any claims on account of such delays. Any concrete carried out from the batch that is afterwards found to be faulty, will be liable for rejection and if so directed, the contractor shall at his own expenses dismantle and replace the defective work and any work built thereon or shall take such other measures as may be deemed necessary by the Architect/Project Manager. At the discretion of the Architect/Project Manager, the contractor may be allowed to prove by means of a load test to be carried out at his own expense, that the concrete is capable of safely withstanding the loads as specified in the test.
2.4.6 QUALITY OF WATER

- Water used for both mixing and curing shall conform to IS: 456. Potable water is generally satisfactory. Water containing any excess of acid, alkali, sugar or salt shall not be used.
- The pH value of water shall not be less than 6.
- Seawater shall not be used for concrete mixing and curing.
- The proposed admixtures shall comply with requirements of specification part 11- Water sealing materials.

2.5 STEEL REINFORCEMENT

2.5.1 SCOPE OF WORK

The work to be done under this section consists of furnishing, cutting, fabricating, bending, placing and tying steel reinforcement in concrete structures or elsewhere as shown on the drawings or directed by the Project Engineer. The scope of this section of specifications as laid down herein.

MATERIAL AND SIZE OF BARS

Reinforcement for concrete shall conform to the respective Indian or other standards as specified in the drawings and in the contract documents or as may be specified by the Project Engineer. Unless otherwise specified, all plain mild steel reinforcing bars shall comply with the requirements of IS: 432 (Part- I). Unless otherwise specified, all deformed reinforcing bars shall comply with the reinforcements of IS: 1786 for deformed cold twisted steel bars and shall have a minimum characteristic strength of 500 N/sqmm.

Reinforcement shall be obtained only from manufacturers approved by the Consultant/Project Engineer. Each consignment of reinforcement steel shall be accompanied by a manufacturer's certificate or shall refer to a previous certificate, if the consignment is from the same batch, showing that the reinforcement steel complies with the following requirement.

If such certificate is not made available or if the Consultant / Project Engineer considers that the manufacturer's tests are inadequate, samples shall be taken for acceptance test from different consignments as the Project Engineer may direct and shall be tested at the Contractor's cost should the result of such that any sample does not meet with the specifications, the whole consignment shall be rejected and removed from the site at the Contractor's cost.
2.5.1.1 Reinforcement of all types is to be stored on site in approved manner so as to avoid damage.

2.5.1.2 Reinforcement shall be free from all loose or flaky rust and mill scale or coating, including ice, and other substance that would reduce or destroy the bond. Reduced section steel reinforcement shall not be used.

2.5.1.3 If such certificate is not made available or if the Consultant / Project Engineer considers that the manufacturer's tests are inadequate, samples shall be taken for acceptance test from different consignments as the Project Engineer may direct and shall be tested at the Contractor's cost should the result of such that any sample does not meet with the specifications, the whole consignment shall be rejected and removed from the site at the Contractor's cost.

2.5.1.4 If such certificate is not made available or if the Consultant / Project Engineer considers that the manufacturer's tests are inadequate, samples shall be taken for acceptance test from different consignments as the Project Engineer may direct and shall be tested at the Contractor's cost should the result of such that any sample does not meet with the specifications, the whole consignment shall be rejected and removed from the site at the Contractor's cost.

2.5.1.5 Reinforcement of all types is to be stored on site in approved manner so as to avoid damage.

2.5.1.6 Reinforcement shall be free from all loose or flaky rust and mill scale or coating, including ice, and other substance that would reduce or destroy the bond. Reduced section steel reinforcement shall not be used.

2.5.1.7 Steel wire mesh reinforcement shall conform to requirement of relevant Indian codes or those of ASTM: A 185-64 or BS. 4483, 1969: Standard Specifications for welded steel wire fabric for concrete reinforcement. It shall be used where shown on the drawings.

2.5.1.8 Applicable standards

Latest editions of Indian Standards.

DELIVERY & STORAGE

Delivery
Steel reinforcement bars shall be delivered in bundles firmly secured and tagged. Each bar or bundle of bars shall be identified by marks stamped on hot or cold or painted on or by any other means. The identifying marks shall contain the following information:

a. Name of the producer or his trade.
b. Standard to which the bars have been manufactured.
c. The clause, type and strength respectively.
d. The diameter.
e. The number of the test certificate (if available).

Storage
The method of storage shall be approved by the Project Engineer. Reinforcing bars shall be stored in racks or platforms above the surface of ground and shall be protected free from scaling, rusting, oiling, coatings, damage, contamination and structural defects prior to placement in works. Bars of different diameters and grades of steel reinforcement shall be kept separate.

2.5.1.9 BAR BENDING SCHEDULES
The Contractor shall prepare bar bending schedule of all the reinforcing steel bars and these bar bending schedules will be supplied to the Consultants/Project Engineer in duplicate on the basis of which the work shall be carried out. However, the Contractor shall be responsible to satisfy himself as to the correctness and accuracy of the bar bending schedule. Any discrepancy shall immediately be notified to the Consultant / Project Engineer before commencing work.

2.6 BRICK MASONRY

2.6.1 GENERAL
Brick Masonry shall consist of all work required in connection with constructing brick masonry at locations shown on drawings including, but not limited to, furnishing brick, port cement and sand for mortar and all other materials, and mixing, placing brick masonry as per bill of quantities.

2.6.2 MATERIALS
All portland cement for mortar shall be furnished by the Contractor and shall conform to the applicable requirements specified in the section "Plain and Reinforced Concrete". All sand for mortar shall be furnished by the Contractor and shall conform to the applicable requirements for sand specified in the section "Plain and Reinforced Concrete". All water used in the manufacture of bricks and in the preparation of mortar shall be free
from objectionable quantities of silt, organic matter, alkali, salts and other impurities, and will be tested and approved by the Project Engineer as per the guidelines of IS: 456.

2.6.3 MORTAR

a. MIX: Mortar for all brick masonry, except where otherwise directed by the Project Engineer, shall consist of one part cement to six parts of damp loose mortar sand by volume for brickwork 230mm and above. For brick piers, half brick walls, honeycombed brickwork and hollow (cavity) walls, the mortar mix shall consist of one part cement and four parts of sand. Quantity of water shall be just sufficient enough to produce proper consistency for the intended use. Where directed and approved by the Project Engineer, hydrated lime putty, shall be added to the mortar for increased workability. The putty shall, however, not exceed 25% by volume of the dry cement.

b. Methods and equipment used for mixing mortar be such as will accurately determine and control the amount of each separate ingredient entering into the mortar and shall be subject to the approval of the Project Engineer. Mortar shall be mixed only in sufficient quantities for immediate use and all mortar not used within 30 minutes after addition of the water to the mix shall be wasted. Re-tempering of mortar will not be allowed. The mixers shall be thoroughly cleaned and washed at the end of each day's work.

2.6.4 BRICK

a. All bricks shall be of first class quality made from good brick earth, free from saline deposits and shall be sand moulded. They shall be thoroughly burnt without being vitrified, shall be regular, uniform in shape and size with sharp and square edges parallel faces and of deep red or copper colour. First class bricks shall be homogeneous in texture and emit a clear ringing sound when struck, and shall be free from flaws, cracks, chips, stones and nodules of lime. First class brick in an oven dried condition shall not absorb more than 1/5 of its weight of water when immersed for one hour in water at 21 to 27 degrees centigrade and shall show no signs of efflorescence on subsequent drying. The average compressive strength of five representative first class bricks shall be 15N/mm. sq. and shall no result shall fall below 10 N/mm sq. The bricks in general shall conform to the requirements of IS: 1077.

b. All bricks shall be manufactured by the Trench Kiln method or other standard methods approved by the Project Engineer. The earth used in manufacturing bricks shall be carefully selected and shall be free from objectionable quantities of lime, gravel coarse sand, roots, or other organic matter salts shall not exceed 0.3% and calcium carbonate shall not exceed 2.0%.

c. The moulds used in the manufacture of bricks shall be thoroughly sanded before each use and shall be sufficiently larger than the size of the bricks being manufactured to
allow for shrinkage in drying and burning. The size ready for use shall be 9" by 4 3/8" by 2 3/4" (229X 112X 70mm) and shall weigh between 3.2 to 4.2 Kilograms. All bricks shall have a "Frog" 1/4" deep on one face.

2.6.4.1 PLACING
a. The methods and equipment used for transporting the bricks and mortar shall be such as will not damage the brick nor delay the use of mixed mortar. Brick shall not be placed during rains sufficiently heavy or prolonged to wash the mortar from the brick. Mortar which becomes diluted by rain shall be removed and replaced before continuing with the work. All bricks to be used in brick masonry shall be moistened with water for three to four hours before they are used. The chosen method of wetting shall ensure that all bricks are thoroughly and uniformly wetted. All bricks shall be free from water adhering to their surface when they are placed in the brick masonry.

b. Bricks shall be laid "Frog" upward with mortar joints and in English bond as directed by the Project Engineer. Both bed and vertical joints shall be 6mm in thickness completely filled with cement mortar as specified herein, and each brick shall be bedded by firmly tapping with the handle of the trowel. All horizontal joints shall be parallel and all vertical joints in alternate courses shall be directly over one another. Excess mortar at the outer edges shall be removed and joints drawn straight with the edge of a trowel and a straight edge. All anchors and similar work required to be embedded in the brick masonry shall be installed as the work progresses. At the completion of the work all holes or defective mortar joints shall be cut out and repointed.

c. The exterior faces of the walls shall be finished by striking the joints as the work proceeds. The joints shall be struck by raking the green mortar after the brick work has been laid and finishing the joint with a pointing tool. Horizontal joints shall be struck to form weathered joints and vertical joints shall be struck with a V notch. Care shall be taken that the striking tools do not develop a cutting edge as the object of striking the joint is to compress the mortar into the joints.

2.6.5 CURING AND REPAIR
a. All brick masonry shall be water cured and shall be kept wet for least seven days by an approved method which will keep all surfaces continuously wet. Water used for curing shall meet the requirements of these specifications for water used in the manufacture of bricks.

b. If, after the completion of any brick masonry work, the brick are not in alignment or level or does not conform to the lines and grades shown on the drawings, or shows a defective surface, it shall be removed and replaced by the Contractor at his expense unless the Project Engineer grants permission, in writing to patch or replace the defective area.
2.7 **FINISHING**

2.7.1 **GENERAL**

2.7.1.1 All plaster work shall be of the best workmanship and in strict accordance with the dimensions of the drawings. All plastering shall be finished to true levels including plumbs, without imperfections, and square with adjoining work. It shall form proper foundations for finishing materials such as paint etc. Masonry and concrete surface to which plaster is to be applied shall be clean, free from efflorescence, sufficiently rough and keyed to ensure proper bond.

2.7.1.2 All chasing, installation of conduits, boxes, etc. shall be completed before any plastering is commenced on a surface. Chasing or cutting of plaster will not be permitted. Broken corners shall be cut back less than 150 mm on both sides and patched with plaster of Paris as directed. All corners shall be rounded to a radius. Contractor shall get samples of each type of plaster work approved by the Architect/Project Manager.

2.7.1.3 All chasing, installation of conduits, boxes, etc. shall be completed before any plastering is commenced on a surface. Chasing or cutting of plaster will not be permitted. Broken corners shall be cut back less than 150 mm on both sides and patched with plaster of Paris as directed. All corners shall be rounded to a radius. Contractor shall get samples of each type of plaster work approved by the Architect/Project Manager.

2.7.1.4 The materials used for plastering shall be proportioned by volume by means of gauge boxes. Alternatively it may be required to proportion the materials by weight.

2.7.2 **PLASTER WORK**

2.7.2.1 The joints in the brick work, concrete blocks, shall be raked to a depth of 15 mm while the masonry is green. Concrete surfaces to receive plaster shall be suitably roughened. All walls shall be washed with water and kept damp for 10 hours before plastering.

2.7.2.2 The plaster unless specified otherwise shall be average of 12 mm thick on walls. The finished texture shall be as approved by the Architect/Project Manager. The mix for plaster unless otherwise specified, shall be one part cement and four parts sand, to walls and one part cement, 3 parts sand to ceiling.

2.7.2.3 The interior plaster shall be applied in one coat only. The surface shall be trowelled smooth to an approved surface. All plaster work shall be kept continuously wet for seven days.
2.7.2.4 The external plaster shall be of two coats on an overall thickness of minimum 20 mm. Preparations of walls to receive plaster work shall be the same as in internal plaster. Backing coat shall be 12 to 15 mm thick with cement mortar 1:5 and finishing coat shall be with cement mortar 1:3.

Backing coats shall be combed on wet surface to form keys for finishing coat. All external plaster shall be waterproofed with approved water proofing powder added to cement.

For sand faced cement plaster, the finishing coat shall be in cement mortar 1:3, sand used shall be of selected color, properly graded and washed so as to give a grained texture. Finishing plaster coat shall be 8 mm thick, uniformly applied and surface finished with special rubbing by sponge pads and other tools and recommended by the Architect/Project Manager.

4.0 TECHNICAL SPECIFICATIONS FOR STEEL WORK

4.1.0 FABRICATION OF STRUCTURAL STEEL

SCOPE OF WORK
This specification covers the general requirements for supply of all steel items where specified, fabrication, inspection, testing and delivery at site of all fabricated structural steel items. This specification also covers design of all connections and substituted members, preparation of all shop fabrication drawings, inspection of fabricated items. The scope of work also includes, but is not limited to proper stacking and storage of fabricated materials, transport from place of storage to place of erection, wherever required. All the works shall be carried as per approved QA procedures.

4.2.0 APPLICABLE CODES STANDARDS AND SPECIFICATIONS

The pertinent clauses of the following Indian Codes, Standards and Specification (latest editions including all applicable official amendments, reaffirmations and revisions) shall apply to the material and workmanship covered by this specification. In the event of the conflict of certain requirements between this specification and the codes referred herein, this specification shall govern.

It is not the intent to specify herein all the codes and standards required for the satisfactory completion of work. The list of codes and standards indicates certain primary codes and standards and not all the codes required for the work under the contract. It is understood that
all the pertinent codes and standards shall form the part of this specification whether explicitly indicated or not.

IS 800  General Construction in Steel –Code of Practice
IS 803  Code Of Practice For Design, Fabrication And Erection Of Vertical Mild Steel Cylindrical Welded Oil Storage Tanks.
IS 806  Code Of Practice For Use Of Steel Tubes In General Building Construction
IS 808  Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections
IS 813  Scheme of symbols for welding
IS 814  Covered Electrodes for Manual Metal Arc Welding of Carbon And Carbon Manganese Steel-Specification
IS 816  Code of Practice for use of Metal Arc Welding for General Construction in Mild Steel
IS 822  Code of Procedure for Inspection of Welds
IS 1024  Code of practice for use of welding in bridges and structures Subjected to dynamic loading
IS 1161  Steel Tubes for structural purposes-Specification
IS 1182  Recommended Practice for Radiographic examination of Fusion Welded Butt Joints in Steel Plates.
IS 1239  Steel Tubes, Tubular and Other Wrought Steel Fittings-
IS 1239  Mild steel tubes, tubular and other wrought steel fittings-Part
IS 1363  Hexagon Head Bolts, Screws and Nuts of Product Grade ‘C’
IS 1367  Technical Supply Conditions for Threaded Fasteners (All Parts)
IS 1395  Low and medium alloy steel covered electrodes for manual metal Arc welding
IS 1852  Rolling and Cutting Tolerances for Hot Rolled Steel Products(4th Rev)
IS 2062  Hot Rolled low, medium and High tensile structural steel
IS 2595  Code of Practice for Radiographic Testing
IS 3502  Steel Chequered Plates-Specification.
IS 3600:  Method of testing fusion welded joints and weld metal in steel (All parts)
IS 3658  Code of Practice for Liquid Penetrate Flaw Detection
IS 3757  Specification for High Strength Structural Bolts
IS 4000  Code of Practice High strength bolts in Steel Structures
IS 4260  Recommended practice for ultrasonic testing of butt welds in Ferritic steel.
IS 4353  Submerged arc welding of mild steel and low alloy steels – Recommendations
IS 5334  Magnetic Particle Flaw Detection of Welds-Code of Practice
IS 6639  Specification for Hexagon Bolts for Steel structures
IS 7215  Tolerances for Fabrication of Steel Structures.
IS 9595  Metal Arc Welding of Carbon and Carbon Manganese Steels- Recommendations
IS 12778 Hot rolled parallel flanged section for beams, columns
SP:6(1) Structural Steel Sections.
AWS D1.1 Structural Welding Code: Steel

REGULATORY REQUIREMENTS:

The work covered in this specification, shall comply with all relevant government and local laws, regulations and standards. For subjects not covered by regulations, codes, standards or specifications, the materials and construction shall be based on good engineering practice, subject to approval by OWNER.

4.3 STEEL MATERIALS

Steel materials shall comply with the specifications mentioned and/or as called for on the design drawings. All materials used shall be new, unused and free from defects.

4.5. STEEL SUPPLY – BY CONTRACTOR.

4.5.1 All steel and other material shall be procured and supplied by the CONTRACTOR, from the reputed manufacturers as mentioned in tender document. Steel proposed to be procured from other manufacturers shall have prior approval from the OWNER before placement of procurement order. However, OWNER reserves the right to accept or reject material from other manufacturers. Materials from re-rollers will not be accepted. Steel procured shall conform to the applicable codes & standards mentioned in clause 2.0.

4.5.2 CONTRACTOR shall use materials for fabrication as specified in the approved drawings. All materials supplied by the CONTRACTOR shall be in sound condition, of recent manufacture, free from defects such as mill scales, slag intrusions, laminations, pitting, flaky, rust etc. and be of full weight and thickness as specified.
4.5.3 CONTRACTOR shall furnish the mill / manufacturer’s test reports, along with the materials and satisfactorily demonstrates the specific grade and quality. Material test certificate shall be original.

4.5.4 All materials required for the work shall be correlated with manufactures test certificates. In the absence of test certificates, CONTRACTOR shall test materials through reputed laboratory approved by ENGINEER for establishing quality, at CONTRACTOR’s cost and as directed by the ENGINEER.

4.5.5 Material supplied against this Test Certificates (TC) should have identification stamped or stenciled on them. All such identification markings shall be authenticated by the inspection agency, which has inspected and approved the material.

4.5.6 The CONTRACTOR shall furnish to the ENGINEER duplicate copies of all purchase order copies covering the material ordered by him for the project under reference and also test reports.

4.5.7 The ENGINEER shall have the right to test random samples to prove authenticity of the test certificates produced by the CONTRACTOR at the CONTRACTOR’s cost. Any material found not meeting the required specification would be rejected.

4.5.8 Whenever the CONTRACTOR desires to substitute structural members / shapes, plates for the sizes shown on the drawings, for want of availability of requisite materials, such substitutions shall be made only after authorization in writing by the ENGINEER. ENGINEER may also direct that substitution be made, when he considers such substitution to be necessary.

4.7 CONTRACTOR’S DRAWINGS (FABRICATION DRAWINGS)

4.7.1 Fabrication drawings shall be prepared by the CONTRACTOR or through an agency approved by ENGINEER at his own cost based on the ENGINEER’s Design drawing “Released for Construction” and their subsequent revisions. All the drawings for the entire work shall be prepared in metric units. The drawings shall preferably be of one standard size and the details shown there in shall be clear and legible. Drawings shall be prepared in computer tools and the details shall be drawn to the minimum scale as specified under.

   a) Marking Plan : 1:75
   b) Joint Details : 1:5; 1:10; 1:15
   c) Elevations: 1:20

4.7.2 CONTRACTOR shall not commence detailing unless ENGINEER’s design drawings are officially released for preparation of shop drawings. The CONTRACTOR shall be responsible for the
correctness of all fabrication drawings. Fabrication drawings shall be revised by the CONTRACTOR to reflect all revisions in design drawings as and when such revisions are made by the ENGINEER.

4.7.3 Key plan prepared by the CONTRACTOR shall indicate the fabrication / erection marking of each members and a table showing the corresponding fabrication drawing number where these members are detailed. Also each drawing prepared by CONTRACTOR shall indicate corresponding ENGINEER's design drawing number with revisions.

4.7.4 Each member shall be detailed separately unless members are identical in all respects with no deviation whatsoever. Shop detail drawings shall show all shearing, punching, drilling, bevel cutting, bending, and all welding in complete detail. All connections and splices shall be designed and detailed by the CONTRACTOR and clearly shown on the drawings. Bill of material shall show number, size, length, weight and assembly work of each erection piece. Bill of material for each drawing shall include fasteners/bolts, nuts, washers and other accessories complete with specification, size, length, numbers, etc for each erection mark and proper identification for each joint. Bill of material shall be prepared erection mark wise, showing weight of each component part and total weight of each erection mark. All revisions after initial issue of a drawing shall be clearly indicated with issue number and date of revision.

4.7.5 Each drawing prepared by the CONTRACTOR shall clearly indicate Names of OWNER, ENGINEER, CONTRACTOR, Project Title, Title of drawing, Scale, Notes, Details of revisions carried out etc; All titles, noting, markings and writings on the drawing shall be in English and all dimensions shall be in metric units. Before the commencement of preparation of fabrication drawings, CONTRACTOR shall discuss with the ENGINEER any specific requirement to be followed for fabrication drawing preparation.

4.7.6 No detailed shop drawings will be accepted by the ENGINEER unless they are complete and checked and approved by CONTRACTOR's qualified Structural ENGINEER and accompanied by an erection plan showing the location of all pieces detailed.

4.7.7 CONTRACTOR should check for erection clearance and ensure that detailing of connections is carefully planned to obtain ease in erection of structures including field-welded connection and bolting. Field connections/splices may be welded or bolted type as specified in design drawings.

4.7.8 CONTRACTOR shall submit design calculations for each and every connection detail proposed by him and also for any substitution for members, desired by him and approved by the ENGINEER. Fabrication drawings not accompanied by calculation for connection details are liable for rejection.

4.7.9 Each lot of drawings sent by CONTRACTOR for approval shall contain a limited number of drawings and shall be in an order and manner which follows erection sequence or as required
by ENGINEER based on priorities allocated. ENGINEER will return one copy of CONTRACTOR's drawing marked with ENGINEER's approval/comments. CONTRACTOR shall furnish the ENGINEER the required number of prints of all approved drawings for field use and record purpose.

4.7.10 In addition to standard engineering practice in detailing the following special requirements shall be strictly followed while detailing.

a) All butt welds shall be full penetration butt weld.

b) In the case of main columns fabricated out of plates, the weld connecting flanges and web to the base plate shall be double vee butt welds.

c) At column bases, wing plates shall be connected to the column flanges by full strength single Vee butt weld.

d) In the case of column, the thickness of the continuous fillet weld between flanges and web shall be a minimum of ½ the web thickness, unless a thicker size weld is specified in the design Drawings.

e) Shop splice location for flanges and web of columns shall be staggered by at least 500 mm such that only one full strength butt weld exist in one horizontal plane. Full strength butt weld for flanges shall be of single vee type and full strength butt weld for web shall be of double vee type.

f) Where the thickness of plates changes, in the case of flange plates, outside surface shall be kept flush. The thicker plate shall be chamfered to slope of 1 horizontal to 5 vertical so that at the location of weld thickness of plate will be same on either side of weld. In the case of webs at the location where the plate thickness changes, the plates will be kept symmetrical to the vertical axis: the thicker plates shall be given a chamfer on both sides such that at the location of butt welds, thickness of plate on either side will be equal.

g) Similarly where the width of the flange plate changes, the wider plate shall be tapered with a slope 1 horizontal to 5 vertical.

h) Site splicing may be by welding or by means of high tensile bolts. In the case of welded connection, efficiency of field butt weld shall be considered as 50% and cover plate shall be designed for 50% of the tensile strength of the plates spliced.

i) In the case of framing beams, the weld between flange and web shall be calculated based on standard formula considering the shear force as the full shear capacity of the web. Continuous weld shall be provided keeping size of weld uniform for the full length of girder. However, in no case the size of weld shall be less than half the web thickness.

j) Weld between flanges and web both for column as well as beams, shall be made using automatic welding machines, with proper sequence of welds to avoid warping.

k) Connection of bracings/tie beams to column shall follow the details given in the design drawings. Where such details are not given, the connection shall be designed for 50% of the tensile strength of the member unless design drawings indicate a higher load in the member.
The maximum size of the weld shall be less than or equal to the thickness of the rolled section at the location of connection.
l) Weld between flanges and web both for column as well as beams, shall be made using automatic welding machines, with proper sequence of welds to avoid warping.
m) Thickness of gusset plates shall be at least equal to the thickness of member connected and shall have adequate cross section to transfer the force at the point. If the members are connected on either side of gusset, thickness of gusset shall be more than sum of thickness of fillet weld on either side of gusset.

4.7.11 ENGINEER may review / approve the fabrication drawing at his option some, all or none of the fabrication drawings. Wherever such review is carried out the same shall be restricted to the following.

a) Review/ approval of the size of members, dimensions and general arrangement but shall not constitute approval of the connections between members and other details.
b) Correctness of overall dimensions, centre to centre distance, elevations. Important / typical connection details (adequacy of number of bolts / weld length for few connections only will be checked), working points for bracing members and orientation and sizes / sections of members.
c) Sequence of erection in the light of project requirements.
d) Whether the fabrication drawings broadly conform to details shown on design drawings and comply with technical specifications, general notes, any specific notes made on design drawings and generally with the requirement of good engineering practice.

4.7.12 It shall be clearly noted by the CONTRACTOR that even where review is done by the ENGINEER, the following shall be the sole responsibility of the CONTRACTOR.

a) Provision for erection.
b) Marking of members.
c) Cutting Lengths of members
d) Matching of Joints and holes
e) Provision kept in the member for all other interconnected members
f) Bill of materials.
g) Gusset sizes.
h) Connections

4.7.13 Approval by ENGINEER of any of the fabrication drawings shall not relieve the CONTRACTOR from the responsibility for correctness of engineering, design of connections, workmanship, and fit of parts, details, material, errors or omissions of any and all work shown thereon. ENGINEER’s approval shall not invalidate any claim for damages of any kind for incorrectly detailed / fabricated steel, notwithstanding any approval of such drawings by ENGINEER.
4.7.14 On completion of fabrication and erection, the CONTRACTOR shall update his fabrication drawings, incorporating all site changes and substitutions and shall submit two (2) sets of hard copies of such "as built" drawings to OWNER for record purpose. The CONTRACTOR shall also furnish two sets of soft copies of all final approved Contractors’ drawings in the form of CDs.

4.7.15 Time consumed by the CONTRACTOR in securing approval of drawings should not be added to the time allowed for completion of contract. A period of two (2) weeks from the dates of receipt of drawings by the ENGINEER should be anticipated for this item of procedure in the schedule.

4.7.16 All these fabrication drawings submitted by the CONTRACTOR will remain the property of the OWNER. OWNER reserves the right to use them in any manner whatsoever.

4.8 FABRICATION

4.8.1 GENERAL

4.8.1.1 Fabrication shall not be started until CONTRACTOR has received copies of such drawings upon which ENGINEER has endorsed his approval. Any work done prior to approval of CONTRACTOR’s fabrication drawings will be at the CONTRACTOR’s risk. The CONTRACTOR shall make such changes in the design when so directed, which are considered necessary to make the structures conform to the provisions and intent of the specifications, without any additional cost to the OWNER.

4.8.1.2 All workmanship and finish shall be of the best quality and shall conform to good engineering practice and the best-approved method of fabrication. All materials shall be finished straight and shall be machined / ground smooth, true and square where so specified.

4.8.1.3 All holes and edges shall be free of burrs. Shearing and chipping shall be neatly and accurately done and all portions of work exposed to view shall be neatly finished. Standard fabrication clearances as detailed in the American Institute of Steel Construction Manual / BIS Codes shall generally be followed unless otherwise directed / approved.

4.8.1.4 Materials at the shop shall be kept clean and protected from weather. Cutting, punching, drilling, welding and fabrication tolerances shall be generally as per relevant Codes and Standards. In addition the CONTRACTOR shall strictly adhere to the following.

a) All care should be taken to avoid undue welding distortions.

b) Complete layout shall be prepared and got approved by the ENGINEER before actual fabrications are started. If needed mock-ups may also be prepared.

c) All fit ups shall be got approved from the ENGINEER.
4.8.2 CONNECTIONS

4.8.2.1 All shop connections shall be welded unless otherwise specified in ENGINEER’s design drawing. Field connections can be either welded or bolted and as shown in design drawings. Bolts used for erection shall conform to IS-6639 and as specified in the design drawings. Bolts used for permanent connections shall be high strength tensile bolts and shall conform to grade ‘C’ as per IS:1363 and property class 8.8 (minimum) as per IS:1367 or as indicated in design drawings.

4.8.2.2 All connections shall be designed for forces indicated on the design drawings or as specified elsewhere in the specification/standard drawing if not given in the design drawings. The CONTRACTOR shall be responsible for selection of standard connections from AISC Manual of Steel Construction or any other standards approved by ENGINEER.

4.8.2.3 All connections shall be designed and detailed as per guidelines given in IS800 code.

4.8.2.4 In case of bolted connections, taper washers or flat washers or spring washers shall be used with bolts as necessary. In case of high strength friction grip bolts, hardened washers are used under the nuts or the bolt heads whichever are turned to tighten the bolts. The length of the bolt shall be such that at least one thread of the bolt projects beyond the nut, except in case of high strength friction grip bolts where this projection shall be at least three times the pitch of the thread.

4.8.2.5 In all cases where bearing is critical, the unthreaded portion of bolt shall bear on the members assembled. A washer of adequate thickness may be provided to exclude the threads from the bearing thickness, if a longer grip bolt has to be used for this purpose.

4.8.2.6 Not more than one shop splice shall be provided to make up the full length of a member. Shop splices to make the full member lengths shall be of full penetration butt welded type and radio graphically tested.

4.8.2.7 Transportation or the CONTRACTOR’s erection methods may require additional splices not shown on the drawings. The CONTRACTOR shall be responsible for the design and detailing of such splices or joints, and shall submit these for the ENGINEER’s approval.

4.8.2.8 All bolts, nuts, screws, washers, electrodes, etc. shall be supplied / brought to site 10% in excess of the requirement in each category and size. Rates shall cover the cost of this extra quantity and no additional payment will be made for this extra quantity supplied.

4.8.2.9 All members likely to collect rain water shall have drain holes provided.
4.8.3 STRAIGHTENING

4.8.3.1 Rolled material, before being worked, shall be straightened, unless otherwise specified. If straightening or flattening is necessary, it shall be done by methods that will not injure the material. Long plates shall be straightened by passing through a mandrel or levelling rolls and structural shapes by the use of mechanical or hydraulic bar/section straightening machines. Heating or forging shall not be resorted to without the prior approval of the ENGINEER in writing. In case of site fabrication, CONTRACTOR shall obtain ENGINEER's approval in writing on the straightening method proposed to be adopted before commencing the work.

4.8.3.2 Checking of the straightness of the structural members like angles, channels, beams etc. shall be done by using the thread. For checking of the straightness of the column sections piano wire shall be used. The sections, which are twisted beyond repairs, shall not be used for fabrication. Heating or hammering shall not be permitted. After removal of bends structural members shall be submitted for inspection and approval of ENGINEER.

4.8.4 CUTTING

4.8.4.1 Cutting may be done by shearing, cropping, sawing or machine flame cutting. All re-entrant corners shall be shaped notch free to a radius of at least 12-mm. Sheared or cropped edges shall be dressed to a neat workmanlike finish and shall be free from distortion and burrs.

4.8.4.2 Hand flame cutting shall be undertaken, only if so permitted by the ENGINEER and shall only be carried out by an expert in such work. Hand flame cut edges shall be ground smooth and straight.

4.8.4.3 Edges of flange cover plates and plates used to form any sections shall be ground smooth.

4.8.5 PUNCHING AND DRILLING

4.8.5.1 Holes in secondary members such as Purlins, grits, lacing bars etc. may be punched full size through material not over 12 mm thick. Holes should be clean cut, without burr or ragged edges. Holes for all other connections shall be drilled accurately and the burrs removed effectively. Where several parts are to be connected to very close tolerances such parts shall be first assembled, tightly clamped together and drilled through.

4.8.5.2 Sub-punching may be permitted before assembly, provided the holes are punched 3 mm smaller in diameter than the required size and reamed after assembly to the full diameter. The thickness of material punched shall not in such cases exceed 16 mm.
4.8.5.3 When match drilling is carried out in one operation through two or more separate parts, these parts shall be separated after drilling and the burrs removed.

4.8.5.4 Holes for turned and fitted bolts shall be drilled to a slightly smaller diameter and reamed to a diameter equal to the nominal diameter of the shank or barrel subject to tolerance specified in IS: 919.

4.8.5.5 Where reamed members are taken apart for transporting or handling, the respective pieces reamed together shall be so marked that they may be reassembled in the same position in the final setting up. No interchange of reamed parts will be permitted. Poor matching, over drilling and ovality in holes shall be a cause for rejection. Burning holes with gas is strictly prohibited.

4.8.5.6 Holes may be required to be drilled by the CONTRACTOR at no extra cost at site for installing equipment or steel furnished by other agencies. The information for this will be supplied to the CONTRACTOR by the ENGINEER before or after erection of the steel. Holes should be by drilling or other machining process and not by gas cutting sets.

4.8.6 ROLLING AND FORMING

Plates, Channels, Rolled Steel joists etc., for circular bins, bunkers, hoppers, gantry girders, etc., shall be accurately laid off and rolled or formed to required profile/shape as called for on the drawings. Adjacent sections shall be match-marked to facilitate accurate assembly, welding and erection in the field.

4.8.7 GRINDING:

Column ends bearing on each other, resting on base plates, compression joints designed for bearing, base plates coming in contact with column end and cap plate shall be ground smooth to ensure 90% contact with local gap not exceeding 0.10 mm (filler gauge shall be used to check this gap). Bottom edge of knife edge support (bearing stiffener) for crane girder and top of cap plates where the knife edge supports rest shall also be accurately ground as adobe. All ground surfaces shall be protected from dirt and mechanical damages till the assembly is completed. However the underside of base plate bearing on grout need not be machined.

4.8.8 WELDING

4.8.8.1 Before the start of the work, welding procedure shall be submitted to ENGINEER for approval. Welding shall be entrusted to only qualified and experienced welders who shall be periodically tested and graded as per relevant standards.

4.8.8.2 Welding procedure specification (WPS) shall be established and Qualification of weld procedure (QWP) shall be done as per approved standards. Welders employed shall also be
qualified as per above standards prior to taking up fabrication. CONTRACTOR shall obtain approval from ENGINEER before the start of the work.

4.8.8.3 Following pre-qualified welding process shall be employed for fabrication, erection and repair and the same shall have the approval of ENGINEER before adopting the welding process on the job.

a) Submerged Arc Welding (SAW).
b) Shield Metal Arc Welding (SMAW).
c) Gas Metal Arc Welding (GMAW).
d) Gas Tungsten Arc Welding (GTAW)

4.8.8.4 All welds shall be free from defects like blowholes, lack of penetration, undercutting, cracks etc. All welds shall be cleaned of slag or flux and show sections, smoothness of weld metal, feathered edges without overlap and freedom from porosity.

4.8.8.5 50mm on either side of the surfaces on which weld metal is to be deposited shall be smooth, uniform, free from fins, tears, burrs, cracks and absolutely free from grease, paint, loose scale, moisture or any other substance which would adversely affect quality and strength of weld.

4.8.8.6 Machining, thermal cutting or grinding may be employed for joint preparation or removal of unacceptable work or metal. The weld edges shall be smooth & regular surface, free from cracks & notches. Flame cut material above 50mm thick shall be pre-heated as per relevant standards prior to flame cutting and shall be subjected to ENGINEER’s approval.

4.8.8.7 All weld fit-up shall comply with tolerances specified in the relevant standards. The parts to be joined by fillet welds shall be brought into close contact as practicable and within the tolerable limits as per relevant codes & standards. All tack welds shall be made using qualified procedure and qualified welders. Any preheat requirement specified in the welding procedure shall also apply to tack welds. All tack welds shall be examined visually for defects and if found defective, shall be removed and re-welded. Throat thickness, leg length and length of tack weld shall be as per IS: 9595.

4.8.8.9 Welding of temporary attachment/fixtures to retain fit up is permitted in case the parts have a nominal thickness of at least 10 mm. Temporary attachments are welded at the minimum distance of at least 50 mm from the weld seam. Welding of temporary attachments/fixtures into the joint slot is not allowed. All temporary fixtures shall be removed after welding, by grinding them to weaken the welded portion and hammering thereafter followed by grinding the portion of any weld remaining on the base metal. A dye check at the discretion of the quality surveyor shall be done to detect any crack/defect at the point of fixture temporary weld.
4.8.8.10 It is not allowed to turn over and carry over heavy assemblies in tacking condition in order to control the geometric dimensions to the requirements of the drawings. The work shall be positioned for flat welding wherever practicable and overhead weld shall be avoided as far as possible.

4.8.8.11 In the joints of the parts with dissimilar thickness smooth transition of one part to the other must be provided by way of the gradual decreasing of the thickness of the thicker part with the slope of the surface not exceeding 15 degree.

4.8.8.12 Welding shall not be done when the surface of the members are wet or exposed to rain or high wind velocities unless the welding operator and the work are properly protected.

4.8.8.13 In joints connected only by fillet welds, the minimum size of fillet weld to be used shall be as per IS 9595-1996.

4.8.8.14 Welds shall be defect free and surfaces shall be thoroughly cleaned to remove all visible weld defects and extra material.

4.8.8.15 For all built up sections such as Columns, Crane Girders etc welding between web and flange plates shall be carried out by SAW process. Especially for butt welds of Crane girders full penetration of weld between top of web plate and top flange shall be ensured. Welding shall be continuous and shall be on both sides of the connecting member. One side fillet weld is not acceptable.

4.8.8.16 In general all welding shall be performed as per the recommendation specified in IS: 9595-1996.

4.8.8.17 Pre-heating and Post weld Heat treatment shall be carried out as per the acceptable standards and procedure and shall have prior approval from the ENGINEER. The pre-heat and inter pass temperature shall be checked just prior to initiating the arc for each pass. The weld joint details and procedure for Pre-heating and Post heating shall be submitted by the CONTRACTOR for approval from ENGINEER.

4.8.9 WELDING CONSUMABLES.

4.8.9.1 Electrodes, filler wires and flux used for welding shall be from approved manufacturers/Suppliers. CONTRACTOR shall submit the list of Electrode manufacturers proposed to be procured to the ENGINEER for approval. The CONTRACTOR shall furnish certification that electrode or electrode flux combination will meet the requirements of classification. The classification and size of electrode, arc length, voltage & amperage shall be suited to type and thickness of material, type of groove, welding positions and other circumstances attending work.
4.8.9.2 Only low hydrogen electrodes shall be used for welding. All electrodes having low hydrogen covering shall conform to relevant acceptable standards. These electrodes shall be purchased in hermetically sealed containers or baked by the user as recommended by electrode manufacturer. Electrode flux coating shall be sound and unbroken. Broken or damaged coating shall cause the electrodes to be discarded. Before welding, the electrodes shall be dried in a holding oven at 1200°C at least for one (1) hour or as per manufacturer’s recommendations. Only limited quantity shall be issued to the welders. The electrodes shall be kept in “carry ovens” and shall not be exposed to the atmosphere.

4.8.9.3 Welding plants and accessories shall have capacity adequate for welding procedure laid down and shall satisfy appropriate standards and be of approved make and quality. CONTRACTOR shall furnish and obtain approval from ENGINEER the details of equipment he proposes to deploy for the works. All the electrical plant in connection with the welding operation shall be properly and adequately earthed and adequate means of measuring the current shall be provided. Proper safety rules shall be strictly followed.

4.9 TESTING, INSPECTION AND REPORTS

4.9.1 GENERAL.

4.9.1.1 On award of work, the CONTRACTOR shall submit to ENGINEER, his Field Quality Plan (FQP), outlining the types, details and extent of inspection he proposes to execute, covered in the rates quoted for various items of work.

4.9.1.2 CONTRACTOR shall give due notice to ENGINEER in advance of the materials or workmanship getting ready for inspection. All rejected material shall be promptly removed from the shop and replaced with new material for ENGINEER’s approval / inspection. The fact that certain material has been accepted at CONTRACTOR’s shop shall not invalidate final rejection at site by ENGINEER if it fails to conform to the requirements of these specifications, be in proper Condition.

4.9.1.3 No material shall be painted or dispatched to site without the inspection and approval by ENGINEER unless such inspection is waived in writing by the ENGINEER.

4.9.1.4 Shop inspection by ENGINEER or submission of test certificates and acceptance thereof by ENGINEER shall not relieve CONTRACTOR from the responsibility of furnishing material conforming to the requirements of these specifications, nor shall it invalidate any claim which the ENGINEER may make because of defective or unsatisfactory material or workmanship.

4.9.1.5 CONTRACTOR shall provide all the testing and inspection services and facilities for shop work except where otherwise specified. CONTRACTOR’s inspection work shall be under the control
of competent Chief Inspector whose primary responsibility is inspection (reporting to Management) and not to production department.

4.9.1.6 For fabrication work carried out in the field, the same standard of supervision and quality control shall be maintained as in shop fabricated work. The inspection and testing shall be conducted in a manner satisfactory to ENGINEER. The inspection and testing on structural steel members shall be as set forth below:

4.9.2 MATERIAL TESTING.

4.9.2.1 All materials conforming to a particular Indian or any other standard as called for shall be tested as required by such standard. Proof in the form of certified test reports or mill certificates indicating that the required tests have been carried out as per specification at the source is acceptable.

4.9.2.2 If mill test reports are not available for any steel materials, the same shall be got tested by CONTRACTOR to ENGINEER’s satisfaction to demonstrate conformity with the relevant specification at his own cost.

4.9.2.3 Raw material with cracks, seams, laps, lamination and heavy pitting are not acceptable. Ultrasonic testing of plates above 50 mm thick shall be carried out for the soundness of material.

4.9.2.4 Engineer has option to specify additional inspection or testing as he deems necessary and the additional cost of such testing shall be borne by the CONTRACTOR.

4.9.2.5 The CONTRACTOR shall maintain records of all inspection and tests, which shall be made freely available to the ENGINEER and shall be submitted to the ENGINEER on completion of each stage of work.

4.9.3 TESTS ON WELDS

4.9.3.1 All welds shall be tested for flaws by any of the methods described under. The choice of the method adopted shall be determined by the OWNER. Following methods are generally recommended for the quality control of welded joints:

4.9.3.2 Magnetic Particle Test(MPT): All fillet welds in general structural steel work shall have their final passes fully tested by MPT. However, for fillet welds of size 10mm and above and/or critical areas, the root and final passes shall be tested using MPT. The ENGINEER shall however decide the requirements of this additional testing. For Complete penetration butt welds, the root and final passes shall be tested using MPT. All MPT shall be as per relevant acceptable standards. Defects if found, shall be repaired and retested. MPT shall be carried out using alternating current only. Direct current may be used with the permission of the ENGINEER. The
cost of demagnetizing after testing is deemed to be included in the quoted rates of the CONTRACTOR.

4.9.3.3 Dye Penetrant Test (DPT): MPT may be substituted by Dye Penetrant Inspection where the former is not feasible due to configuration. The testing should be in accordance with relevant acceptable standards.

4.9.3.4 Radio-graphic Inspection (RT): All completed full penetration butt welds to a length of about 10% shall be radio-graphed as per ENGINEER’s directive in accordance with the relevant acceptable standards. In case of crane girders 100 percent of the splicing shall be inspected by RT. In the case of hoppers of coal bunkers at least 10% of the circumferential as well as seam welds shall be inspected by RT.

4.9.3.5 Ultrasonic Testing (UT): Wherever built up sections for crane runway girders are fabricated, the T-joints of the sections shall be subjected to ultrasonic testing. 100 percent length of the seam as well as circumferential welds of hoppers of coal bunkers shall be inspected by UT.

4.9.3.6 Acceptance Standard: The acceptable standards for various weld tests shall be as per ASME Sec VIII- Div I or relevant acceptable standards.

4.9.4 INSPECTION OF WELDS.

4.9.4.1 Welding shall be carried out as per approved WPS and QWS by qualified welders.

4.9.4.2 All welds shall be inspected for flaws by any of the methods described, the choice of the method adopted shall be determined by the ENGINEER.

4.9.4.3 The correction of defective welds shall be carried out as directed by the ENGINEER without damaging the parent metal. When a crack in the weld is removed, magnetic particle inspection or any other equally positive means as prescribed by the ENGINEER shall be used to ensure that the whole of the crack and material up to 25 mm beyond each end of the crack has been removed. Cost of all such tests and operations incidental to correction shall be to the CONTRACTOR’s account.

4.9.4.4 CONTRACTOR shall perform the following minimum tests on welds if not covered in any clause mentioned, with no cost implication to the OWNER. CONTRACTOR’s quoted rate is deemed to have included the cost of such tests.

<table>
<thead>
<tr>
<th>SL NO</th>
<th>Location &amp; Type of weld</th>
<th>Type of Test</th>
<th>Extent of test</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All fillet welds in general other than those covered under</td>
<td>DPT</td>
<td>1% of fillet weld with minimum of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the Sl no 2,3,5,7 &amp; 8</td>
<td>one test on each member / joint</td>
<td></td>
<td></td>
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<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Fillet welds for plate thickness greater than 25 mm and fillet size more than 10 mm</td>
<td>MPT / DPT 10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Flame cut edges of plates more than 38 mm for fillet weld.</td>
<td>MPT / DPT 100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Flame cut edges of plates greater than 25 mm for butt welds.</td>
<td>MPT / DPT 100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Fillet welds between tension flanges and webs</td>
<td>MPT / DPT 100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Full penetration butt welds</td>
<td>DPT 100 % DPT shall be carried out after back gouging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Fillet Weld greater than 12 mm on flame cut edges of low alloy steel</td>
<td>MPT 100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Fillet Welds for built up girders, columns and other heavy structures for penetration.</td>
<td>Mac ro etch test One (1) test Per structure for penetration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Butt welds of thickness greater than 25 mm and less than 32 mm</td>
<td>MPT / DPT 100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Butt welds of thickness greater than 32 mm</td>
<td>RT 100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Butt welds of rolled sections having depth greater than 600 mm</td>
<td>RT 100%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.9.4.5 In addition to the minimum tests to be conducted by the CONTRACTOR, ENGINEER reserves his right to direct the CONTRACTOR to conduct additional tests. The extent, type and location of test shall be decided by the ENGINEER. These additional tests shall be conducted by the CONTRACTOR or through an approved agency in presence of the ENGINEER. If the test fails, the cost of that test shall not be payable to the CONTRACTOR. The tests which when successful will be paid for at the rates specified in the schedule.
4.9.4.6 WELD DEFECTS AND ACCEPTABLE CRITERIA

<table>
<thead>
<tr>
<th>Type of defect</th>
<th>Acceptance Criteria</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cracks</td>
<td>Not acceptable</td>
<td></td>
</tr>
<tr>
<td>Incomplete or lack of</td>
<td>Not acceptable</td>
<td></td>
</tr>
<tr>
<td>Fusion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mis-alignment of butt</td>
<td>0.25 x T (maximum</td>
<td>T: Thickness of thinner plate</td>
</tr>
<tr>
<td>welds</td>
<td>of 3 mm)</td>
<td></td>
</tr>
<tr>
<td>Reinforcement</td>
<td>Max reinforcement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>of 2 mm for t &lt; 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>mm for t &gt; 10 mm &lt; 15 mm.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 mm for 15 mm and greater</td>
<td></td>
</tr>
<tr>
<td>Undercut</td>
<td>0.25 mm deep max</td>
<td></td>
</tr>
<tr>
<td>Sharp edges</td>
<td>Min radius of 2 mm</td>
<td></td>
</tr>
</tbody>
</table>

4.9.4.7 WELD REPAIRS

Whenever weld repair is required, CONTRACTOR shall give prior intimation to the ENGINEER and obtain permission before the repair is taken up. When a defect is detected in a weld, it shall be removed by cutting / grinding and smooth blending of the area with parent metal without sharp edges, corners. If welding is required, the same shall be done using the qualified procedure / welder and stage inspection as per the original weld. Correction of defect in the same portion of the weld shall not be allowed more than two (2) times. Portion of the welding seams, which have been subjected to repair, must be indicated in the weld inspection reports.

4.10.0 INSPECTION AND TESTS ON STRUCTURAL STEEL FABRICATED MEMBERS

Inspection and tests on Structural Steel Fabricated Members shall be as set forth below:

4.10.1 All the fabricated parts of Structural Steel members shall be inspected at all stages of fabrication and assembly to verify that dimensions, tolerances, alignment and surface finish are in accordance with the requirements shown on the approved CONTRACTOR's shop drawings and/or ENGINEER's drawings.

4.10.2 Fit ups shall be examined by the quality surveyor as per the approved QA plan prior to welding the joint. All welds shall be inspected for flaws by the method described under the Clause 7.4 (Inspection Of welds).

4.10.3 The dimensions of the fit ups shall be maintained as specified in the fabrication drawings.

4.10.4 Dimensions of all the assemblies and sub-assemblies shall be as per fabrication drawings within the tolerances specified in IS 7215.
4.10.5 TOLERANCES

The dimensional and weight tolerance for rolled shapes shall be in accordance with IS:1852 for indigenous steel and equivalent applicable codes for imported steel. The tolerances for fabrication of structural steel shall be as per IS:7215.

4.11 TEST FAILURE

4.11.1 In the event of any failure of welding, structural steel members to meet inspection or test requirements, the CONTRACTOR shall notify the ENGINEER or his authorised representative. A design concession request has to be made and got approved from the ENGINEER or his representative before repair is undertaken. The quality control procedures to be followed to ensure satisfactory repair shall be subject to approval by ENGINEER.

4.11.2 CONTRACTOR shall maintain records of all inspection and testing which shall be made available to the ENGINEER or his authorised representative, for three years from the date of completion of the contract.

4.11.3 The ENGINEER has the right to specify additional testing as he deems necessary, and the additional cost of such testing shall be borne by the OWNER only in case of successful testing.

4.12 SHOP MATCHING

For structures like bunkers, tanks, etc. shop assembly is essential. For other steel work, such as columns along with the tie beams/bracings may have to be shop assembled to ensure satisfactory fabrication, obtaining of adequate bearing areas etc. if so desired by the ENGINEER. All these shop assemblies shall be carried out by CONTRACTOR at no extra cost to the OWNER.

4.13 DRILLING HOLES FOR OTHER WORKS

As a part of this Contract, holes in members required for installing equipment or steel furnished by other manufacturers or other CONTRACTORs shall be drilled by the CONTRACTOR at no extra cost to the OWNER. The information for such extra holes will be supplied by the ENGINEER.

4.14 MARKING OF MEMBERS

4.14.1 After checking and inspection, all members shall be marked for identification during erection. This mark shall correspond to distinguishing marks on approved erection drawings and shall be legibly painted and stamped on it. The erection mark shall be stamped with a metal dye with figures at least 20 mm high and to such optimum depth as to be clearly visible.

4.14.2 All erection marks shall be on the outer surface of all sections and near one end, but clear of bolt holes. The marking shall be so stamped that they are easily discernible when sorting out
members. The stamped marking shall be encircled boldly by a distinguishable paint to facilitate easy location.

4.14.3 Erection marks on like pieces shall be in identical locations. Members having lengths of 7.0 m or more shall have the erection mark at both ends.

4.15.0 ERRORS

Any error in shop fabrication which prevents proper assembling and fitting up of parts in the field by moderate use of drift pins or moderate amount of reaming will be classified by the ENGINEER as defective workmanship. In case ENGINEER rejects such material or defective workmanship, the same shall be replaced by the materials and workmanship conforming to the ENGINEER’s requirements by CONTRACTOR free of cost at site.

4.16.0 QUALITY SURVEILLANCE

4.16.1 GENERAL.

4.16.1.1 The ENGINEER shall subject all works and materials covered by this specification to Inspection.

4.16.1.2 The CONTRACTOR shall provide free access in his shop during working hours for the inspection staff, designated by the Engineer, at all phases of the work and assist them where necessary in conducting the inspection. The CONTRACTOR shall expeditiously furnish all gauges, instruments and other necessary measuring equipment required for inspection of the work in the shop. The shop inspection by the inspector is intended to ensure that the material and workmanship are in accordance with this specification, but it will not relieve the CONTRACTOR of any of his responsibilities for the product. The inspector’s inspection will include, but not be limited to, the following:

4.16.2 MATERIAL

The inspector will ascertain that only materials conforming to the requirements of this specification are used.

4.16.3 DIMENSION AND TOLERANCES

The ENGINEER will ensure and check that the structural members conform to the dimensions and tolerances as set out on the drawings and as required by the specification.

4.16.4 WELDING PROCEDURE
The ENGINEER will witness the welding and testing of any procedure qualification tests that are required by this specification. The ENGINEER will also check that welding procedure (including the electrode, flux, current, arc voltage, speed of travel) used are in accordance with the approved welding procedures.

4.16.5 WELDING EQUIPMENT

The ENGINEER will check the welding equipment to be used for the work to ensure that it is in such condition as to enable qualified welders to follow the procedures.

4.16.6 WELDER AND WELDING OPERATOR QUALIFICATIONS

4.16.6.1 The ENGINEER will permit welding to be performed only by welders and welding operators who are qualified by tests in accordance with relevant standards

4.16.6.2 When the quality of a welder or welding operators’ work, appears to be below the requirements, the ENGINEER may require testing of his qualifications by necessary tests.

4.16.7 WELDS

4.16.7.1 The ENGINEER will ascertain that the sizes, length and the location of all welds conform to the requirements of this specification and the approved fabrication drawings. Temporary welds used for the works shall be removed and ground flush with the original surface.

4.16.7.2 The ENGINEER will identify with a distinguishing mark of all parts of the joints that he has inspected and accepted.

4.16.7.3 The CONTRACTOR shall comply with all the demands of the ENGINEER to correct improper workmanship and to remove and replace, or correct as instructed, all welds found defective or deficient.

4.16.7.4 In the event of faulty welding or its removal for rewelding results in damage to the base metal in the judgment of the Engineer, or its retention is not in accordance with the intent of the plans and specification, the CONTRACTOR shall remove and replace the damaged materials at his own cost.

5.0 ERECTION OF STRUCTURAL STEEL

5.1 SCOPE
This specification covers the general requirements for erection of structural steel. In addition to provision of erection and transport equipment, the scope of work includes supply of tools and tackles, consumables, materials, labor and supervision and shall cover the following:

5.1.1 Storing and staking of all fabricated structural components/units/assemblies at site storage yards till the time of erection.
5.1.2 Transportation of structures from storage yard to site of erection, including multiple handling, if required.
5.1.3 All minor rectifications/ modifications such as:-
   i. Removal of bends, kinks, twists etc for parts damaged during transportation and handling
   ii. Reaming of holes which do not fit properly or which are damaged, for use of next higher size bolt.
   iii. Plug-welding and re-drilling of holes which do not register and which cannot be reamed for use of next higher size bolt.
   iv. Drilling of holes which are either not drilled at all or are drilled in incorrect position during fabrication.
5.1.4 Fabrication of minor missing items as directed by the OWNER.
5.1.5 Verification of the position of embedded anchor bolts and inserts w.r.t lines and levels, installed by others based on Geodetic Scheme /Bench Mark/Reference co-ordinates to be furnished by OWNER.
5.1.6 Verification of actual dimensions of structures (erected by others) which would have bearing on the cutting lengths, end connections etc of those members which are to be erected under this scope of work.
5.1.7 Assembly at site of steel structural components wherever required, including temporary supports and staging

5.1.8 Making arrangements for providing all facilities for
   i. Conducting Ultrasonic Testing (UT) by reputed testing laboratories approved by OWNER.
   ii. Making available test films / graphs, with reports / interpretation.
5.1.9 Rectifying at site damaged portions of shop primer by cleaning and application touch-up paint.
5.1.10 Erection of structures including making connections by bolts/ High strength Friction Grip bolts / welding as per drawing.
5.1.11 Alignment of all structures true to line, plumb and dimensions within specified limits of tolerance.
5.1.12 Application at site after erection, required number of coats of primer and finishing paint as per specification.
5.1.13 Rectification of structures as per preliminary acceptance report and Final acceptance report.
5.1.14 All necessary items of work required for satisfactory completion of job on schedule.

5.2 APPLICABLE CODES STANDARDS & SPECIFICATIONS

The pertinent clauses of the following Indian Codes, Standards and Specification (latest editions including all applicable official amendments, reaffirmations and revisions) shall apply to the material and workmanship covered by this specification. In the event of the conflict of certain requirements between this specification and the codes referred herein, this specification shall govern. It is not the intent to specify herein all the codes and standards required for the satisfactory completion of work. The list of codes and standards indicates certain primary codes & standards and not all the codes required for the work under the contract. It is understood that all the pertinent codes and standards shall form the part of this specification whether explicitly indicated or not.

Reference codes and standards:

IS 800 General Constructions in Steel – Code of Practice.
IS 806 Code of Practice for Use of Steel Tubes In General Building Construction.
IS 822 Code of Procedure for Inspection of Welds.
IS:1363 Hexagonal Head Bolts, screw nad nut of Product grade C IS:1367
Technical Supply Conditions for threaded fastener (all parts)
IS 4000 Code of Practice High strength bolts in Steel Structures.
IS 7205 Safety code for erection of structural steel
IS 7969 Safety code for handling and storage of building Materials
IS:9595 Metal Arc Welding of Carbon and Carbon manganese steel.
IS 12843 Tolerances for erection of steel structures.
SP:6(1) Structural Steel Sections.
AWS D1.1 Structural Welding Code: Steel

5.3 REGULATORY REQUIREMENTS

The work covered in this specification, shall comply with all relevant government and local laws, regulations and standards. For subjects not covered by regulations, codes, standards or specifications, the materials and construction shall be based on good engineering practice, subject to approval by OWNER.
5.4 ERECTION SCHEME

5.4.1 CONTRACTOR after the award of work shall submit a detailed erection scheme covering the period of completion of all the works covered under the specification for ENGINEER’s approval. The erection scheme shall include but not limited to the following.

i. Methods proposed to be employed for transporting his equipments, tools, tackles, gas cylinders, electrodes and all that is necessary to site.

ii. Type, capacity and quantity of equipment that the CONTRACTOR proposes to bring to site for unloading, transporting within the site, and handling, assembling, hoisting and erecting of the structural steel components for all these operations.

iii. Strength and trade wise composition of the work force and supervisory personnel that will be deployed by the CONTRACTOR for the various operations.

iv. Any special specific scheme being adopted for erection of special / complicated structural elements such as heavy roof trusses etc.

5.4.2 A brief write-up covering the above activities shall be submitted along with the bid document by the Bidder during submission of his bid.

5.4.3 ENGINEER reserves the right to direct the CONTRACTOR either at the start or during the contract period, to mobilize additional resources in terms of labour, material, equipment, tools and plant etc at no cost to the OWNER if in his opinion that the resources employed by the CONTRACTOR does not meet the schedule of completion.

5.5 ERECTION PROGRAMME

5.5.1 Within two (2) weeks of acceptance of bid the CONTRACTOR shall submit a detailed erection programme with dates and estimated completion time for various parts of the work for ENGINEER’S approval. This programme shall broadly comprise the following:

i. Layout plan identifying the areas proposed for unloading, main storage, Subsidiary storage and assembly

ii. Transportation of fabricated material between the storage and work areas.

iii. Layout to indicate the points at which proposed erection begins, direction in which it is proposed to progress, the deployment of equipment, access route for cranes to reach work areas, etc.

iv. The locations and extent of site offices and stores, labor quarters if any. v. Layout of electrical cables and water pipes from the tap-off points.

vi. Details of the method of handling, transport, hoisting and erection including false work/staging, temporary bracing, guying, etc. along with complete details of the quantity and capacity of the various items of erection equipment that will be used.
vii. Site organization chart showing the number of supervisory personnel, and the number and composition of the various gangs.

viii. Safety measures to be adopted at site of erection and organization chart showing safety personnel.

5.5.2 Any modifications to the erection programme directed by ENGINEER for the reasons of inadequacy of

i. The quantity and/or capacity of the erection equipment.

ii. Erection personnel and supervisors, temporary bracing, guying etc.,

iii. Safety of the erection methods, or stability of the erected portions of structures, or unsuitability of the erection sequence due to interference with the work of other agencies.

iv. Any other unforeseen events which may delay the schedule.

v. Safety measures proposed.

Shall be incorporated by CONTRACTOR and the work shall be carried out in accordance with the revised programme. Approval by ENGINEER shall not relieve the CONTRACTOR from the responsibility for the safe, sound, accurate and timely erection of structural steel work as required by ENGINEER/OWNER. CONTRACTOR shall also make no extra claims for bringing additional equipment to site for erection, if so directed by ENGINEER.

CONTRACTOR shall be deemed to have visualized all erection problems while bidding for the work and no additional compensation shall be claimed on this account.

5.6 SITE OPERATIONS

5.6.1 CONTRACTOR shall employ an experienced and qualified graduate Engineer who shall be in full time charge of the job and responsible for all site activities.

5.6.2 CONTRACTOR shall complete all preliminary works at site well before the arrival of structural steel, such as establishment of a well equipped and adequately staffed site office, stores, unloading gantry, unloading and preassembly yard, labour quarters if any, electrical and water connections, electrical winches, derricks, cranes, compressors, all tools and tackles, rivet guns, welding sets, torque wrenches, spud wrenches, staging, etc. as well as experienced erection and supervisory personnel as part of this contract and any other work that may be necessary so as to start erection immediately after the arrival of the first batch of steel at site.

5.6.3 CONTRACTOR shall furnish at his own expense, the necessary non inflammable staging and hoisting materials or equipment required for the erection work and shall remove and take them away after completion of the job.

CONTRACTOR shall also provide necessary passageways, fences, safety belts, helmets, lights and other fittings to the satisfaction of OWNER / ENGINEER and to meet the rules of local authorities and for protection to his men and materials. A licensed electrician shall be kept on the
job for the entire duration of the work to maintain CONTRACTOR’s electrical equipment and connections.

5.6.4 CONTRACTOR shall protect all existing plant, structures, piping, conduits, equipment and facilities against damage during erection. Any damage caused by CONTRACTOR shall be rectified entirely at CONTRACTOR’s cost, to the satisfaction of OWNER / ENGINEER. If work has to be carried out adjacent to existing switch yards or electrical installations which are live, CONTRACTOR must ensure suitable safety precautions in consultation with ENGINEER.

5.6.5 If a portion of the work of the project area cannot be made available to CONTRACTOR for his activities due to operations being carried out by other agencies, he shall suitably modify his sequence of operations so as to continue work without interruption. CONTRACTOR shall work in coordination with other agencies working on the project site and plan his work suitably so as not to hinder the progress of construction at site.

5.6.6 The Suitability and capacity of all plant and equipment used for erection shall be to the satisfaction of the OWNER/ENGINEER.

5.7 ACCEPTANCE, HANDLING AND STORAGE

5.7.1 The fabricated material received at erection site shall be verified with respect of marking on the key plan / marking plan or shipping list.

5.7.2 Any material found damaged or defective shall be stacked separately and the damaged or defective material shall be painted in distinct color for identification and the same shall be brought to the notice of ENGINEER.

5.7.3 No dragging of steel shall be permitted. All fabricated items shall be stored 300mm above ground on suitable packing to avoid damage. It shall be stored in the order required for erection, with erection marks visible. All storage areas shall be prepared and maintained by CONTRACTOR. Steel shall not be stored in the vicinity of areas where excavation or grading will be done and, if so stored temporarily, this shall be removed by CONTRACTOR well before such excavation and/or grading commences to a safe distance to avoid burial under debris.

5.7.4 Scratched or abraded steel shall be given a coat of primer in accordance with TCE specification M4-405-04 (painting of structural steel) after unloading and handling prior to erection. All milled and machined surfaces shall be properly protected from rust/corrosion by suitable coating and also from getting damaged.

5.8 ANCHOR BOLTS, EMBEDDED PARTS AND FOUNDATIONS
5.8.1 CONTRACTOR shall carefully check the location, level and layout of anchor bolts embedded in foundations constructed by others, to ensure that the structures can be properly erected as shown on the drawings. Any discrepancy in the anchor bolts/foundation shall be reported to ENGINEER.

5.8.2 CONTRACTOR shall carefully check the actual dimensions of structures and also the location, level and sizes of embedded parts a) in the RC beam/column and/ or b) cleats / plates provided in steel beam /column constructed by others to receive structures covered under this scope of work. CONTRACTOR shall take note of discrepancies if any, shall be reported to ENGINEER and fabricate the structures covered under this contract suitably before the commencement of erection.

5.8.3 Levelling of column bases to the required elevation may be done either by providing shims or three nuts on the upper threaded portion of the anchor bolt. All shim stock required for keeping the specified thickness of grout and in connection with erection of structures on foundations, crane brackets or at any other locations shall be of good M.S. plates and shall be supplied by CONTRACTOR at his cost.

5.8.4 A certain amount of chipping/cleaning of foundations and preparing the area is considered normal and shall be carried out by CONTRACTOR at no extra cost.

5.8.5 Where beams bear in pockets or on walls, bearing plates shall be set and levelled as part of the work. All grouting under column base plates or beam bearing plates will be carried out by CONTRACTOR, unless the grouting is specifically excluded from the CONTRACTOR’s scope.

5.9 ASSEMBLY AND CONNECTIONS

5.9.1 Field connections may be effected either by bolting, welding or by use of high strength friction grip bolts as shown in the design and erection drawings.

5.9.2 All bolts, nuts, washers, rivets, electrodes required for field connections shall be supplied by CONTRACTOR free of cost. The materials shall have prior approval from the OWNER/ENGINEER and necessary test certificates shall be furnished to ENGINEER’s approval. Materials shall be procured from the reputed manufacturers with prior approval from OWNER/ENGINEER.

5.9.3 All assembling shall be carried out on a level platform.

5.9.4 Drifts shall be used only for drawing the work to proper position and must not be used to such an extent as to damage the holes. Size of drifts larger than the nominal diameter of hole shall not be used. Any damaged holes or burrs must be rectified to the satisfaction of ENGINEER.
5.9.5 Corrections of minor misfits and reasonable amount of reaming shall be considered as a part of erection. Any error in the shop, which prevents proper fit on a moderate amount of reaming and slight chipping or cutting, shall be immediately reported to ENGINEER.

5.10 ERECTION

5.10.1 Erection work shall be taken up after receipt of clearance from the ENGINEER.

5.10.2 All structural steel shall be erected as per approved Design / fabrication drawings.

5.10.3 For safety requirements during erection, provisions of IS: 7205, IS:7969, IS800 and other relevant codes shall be strictly followed.

5.10.4 Erection shall be carried out with the help of maximum mechanization possible.

5.10.5 Prior to commencement of erection, all the erection equipment, tools, tackles, ropes etc shall be tested for their load carrying capacity. Such tests may be repeated at intermediate stages also if considered necessary. Frequent visual inspection shall be done of all vulnerable areas and components to detect damages or distress in the erection equipments, if any.

5.10.6 Temporary bracing, whenever required, shall be provided to sustain forces due to erection loads and equipment etc. Erected parts of the structure shall remain stable during all stages of erection when subjected to action of wind, dead weight and erection forces etc. Such bracings shall be left in place as long as may be required for safety and stability. Specified sequence of erection of vertical and horizontal structural members shall be followed.

5.10.7 Erected members shall be held securely in place by bolts to take care of dead load, wind / seismic load and erection load.

5.10.8 All structural members shall be erected with erection marks in the same relative position as shown in the appropriate erection and shop drawings.

5.10.9 All connections shall achieve free expansion and contraction of structures wherever provided.

5.10.10 No final bolting or welding of joints shall be done until the structure has been properly aligned and approved by ENGINEER.

5.10.11 For positioning beams, columns and other steel members, the use of steel sledges is not permitted.

5.10.12 Instrumental checking of correctness of initial setting out of structures and adjustment of alignment shall be carried out in sequence and at different stages as required using precision survey instruments. The final levelling and alignment shall be carried out immediately after completion of each section of a building.
5.10.13 The CONTRACTOR shall design, manufacture, erect and provide false work, staging temporary support etc.. Required for safe and accurate erection of structural steelwork and fully responsible for the adequacy of the same.

5.10.14 The CONTRACTOR shall also provide facilities such as adequate temporary access ladders, gangways, tools & tackles, instruments etc. to OWNER for his inspection at any stage during erection.

5.10.15 Proper size steel cable slings, etc., shall be used for hoisting. Guys shall not be anchored to existing structures, foundations, etc. unless so permitted by ENGINEER in writing. Care shall be taken to see that ropes in use are always in good condition.

5.10.16 Steel columns in the basement, if any, are to be lowered and erected carefully with the help of a crane and/or derrick without damaging the basement walls steel or floor.

5.10.17 Structural steel frames shall be erected plumb and true. Frames shall be lifted at such points that they are not liable to buckle and deform. Trusses shall be lifted only at node points. Trusses which are very slender in the lateral direction shall be provided with temporary lateral supports till the horizontal bracings are erected. All steel columns and beams shall be checked for plumb and level individually before and after connections are made.

5.10.18 Chequered plates shall be fixed to supporting members by welding or by countersunk bolts as shown/specify in relevant drawings and/or as directed by ENGINEER. The edges shall be made smooth and no burrs or jagged ends shall be left. While splicing, care should be taken so that there is continuity in pattern between the two portions. Care should also be taken to avoid distortion of the plate while welding. The erection of chequered plates shall include:

a. Welding of stiffening angles/vertical stiffening ribs as per drawings
b. Cutting to size and making holes to required shape wherever necessary to allow service lines such as piping, cables etc to pass through
c. Splicing as shown in relevant drawings
d. Smoothening of edges
e. Fixing of chequered plates by welding and/or countersunk bolts
f. Providing lifting hooks for ease of lifting.

10.19 Cutting, heating or enlarging holes may be carried out only with prior written approval from the ENGINEER.

5.11 FIELD CONNECTIONS:

5.11.1 Assembly by Permanent Bolts:
5.11.1.1 The number of washers on permanent bolts shall not be more than two (2) and not less than one (1) for the nuts and one (1) for the bolt head.

5.11.1.2 Only wooden rams or mallet shall be used in forcing members into position in order to protect the metal from injury or shock.

5.11.1.3 Where bolting is specified on the drawing, the bolts shall be tightened to the maximum limit. The threaded portion of each bolt shall project through the nut by at least one thread. Tapered washers shall be provided for all heads and nuts to achieve uniform bearing on sloping surface.

5.11.1.4 To prevent loosening of nuts, spring washers or lock-nuts shall be provided as specified in the design / shop drawings.

5.11.1.5 All machine fitted bolts shall be perfectly tight and the ends shall be checked to prevent nuts from becoming loose. No unfilled holes shall be left in any part of the structure.

5.11.2 ASSEMBLY BY WELDING:

5.11.2.1 All field assembly by welding shall be executed in accordance with the requirements for shop fabrication. Where the steel has been delivered painted, the paint shall be removed before field welding for a distance of at least 50 mm on either side of the joints to be welded.

5.11.2.2 All other requirements of welding and its acceptance standards shall be in accordance with clauses specified in TCE.M4-405-01 (Supply and Fabrication of structural steel).

5.11.3 Assembly by High Strength Friction Grip Bolts (HSFG Bolts)

5.11.3.1 Assembly of structures with HSFG bolts shall conform to IS:4000

5.11.3.2 The mating surface shall be prepared in accordance with the requirements of design in order to achieve required properties to develop adequate friction between the surfaces.

5.11.3.3 The mating surfaces shall be absolutely free from grease. Lubricant, dust, rust etc and shall be thoroughly cleaned before assembly.

5.11.3.4 The nuts shall be tightened up to the specific torque with the help of torque wrench or by half-turn method with the help of pneumatic wrench lever.

5.11.3.5 The direction of tightening of the nuts shall be from the middle towards the periphery of assembly.

5.11.3.6 After desired tightening the bolt heads, nuts and edges of the mating surfaces shall be sealed with a coat of paint to obviate entry of moisture.

5.12 INSPECTION

ENGINEER/OWNER or their authorised representatives shall have free access to all parts of the job during erection and all erection shall be subjected to their approval. In case of faulty erection,
all dismantling and re-erection required will be at CONTRACTOR's cost. No paint shall be applied to rivet heads or field welds or bolts until these have been approved by ENGINEER.

5.14. PAINTING

5.14.1 After steel has been erected, all bare and abraded spots, field welds, bolt heads and nuts shall be spot painted. Before paint is applied, the surface shall be dry and free from dust, dirt, scale and grease.

5.16 CLEAN UP OF WORK SITE

During erection, the CONTRACTOR shall without any additional payment, at all times keep the working and storage areas used by him, free from accumulation of waste materials or rubbish. Before completion of erection, he shall remove or dispose of in a satisfactory manner all temporary structures, waste and debris and leave the premises in a condition satisfactory to OWNER/ENGINEER.

6.0 PAINTING OF STRUCTURAL STEEL

6.1. SCOPE

6.1.1. This specification covers the general requirements for shop and field painting for Structural Steel works using hot /cold rolled steel sections joined by using bolting and/or welding.

6.1.2. Briefly the scope of works covered under this specification are; i. Supply of all primers, paints and all other materials required for painting other than Owner's supply.

ii. Furnishing of all labor, materials, tools & equipment and the performance of all operations and incidentals necessary for surface preparation, painting, handling, storing, transporting, scaffolding etc.

iii. Testing of paints as per the relevant codes in the Standard Laboratory identified by the Owner and furnishing of required test certificates for Owner’s approval.

iv. Repair work of damaged / pre-erection / fabrication shop primer and weld joints at field.

v. Inspection of painting system after its application to conform to the specification requirement.

vi. Any other requirement as required for satisfactory completion of specified work.

1.3. Reference shall be made to Data Sheet-A for Paint system and Data Sheet-B for the structures covered in the scope of works.

6.2. EXCLUSIONS

This specification excludes paintings of the following structures /equipment.
Mechanical & electrical equipment and parts.

i. Buried & Overhead piping works

ii. Storage tanks

iii. Insulated parts

iv. Any other items of work specifically excluded in the scope of works.

6.3. APPLICABLE CODES, STANDARDS

The pertinent clauses of the following Indian / International Codes, Standards And Specification (latest editions including all applicable official amendments, Reaffirmations and revisions) shall apply to the material and workmanship covered by this specification. In the event of the conflict of certain requirements between this specification and the codes referred herein, this specification shall govern.

It is not the intent to specify herein all the codes and standards required for the satisfactory completion of work. The list of codes and standards indicates certain primary codes & standards and not all the codes required for the work under the contract. It is understood that all the pertinent codes and standards shall form the part of this specification whether explicitly indicated or not.

6.3.1. Indian Standard Codes

1. IS:5 Colours for ready mixed paints and Enamels
2. IS:101 Methods of sampling and test for paints, varnishes and related products (all parts & all sections).
3. IS:104 Ready mixed paint, brushing, zinc chrome, priming
4. IS:158 Ready Mixed paint, Brushing, Bituminous, Black, Lead free, Acid, Alkali and heat resisting.
5. IS:1303 Glossary of Terms relating to paints
7. IS:2932 Enamel, synthetic, exterior:(a) undercoating (b) finishing- Specification
8. IS: 9954 Pictorial Surface Preparation Standards for Painting of Steel Surfaces.

3.2. International Standard Codes

i. SSPC Society for Protective Coatings (USA) Volt I & II
ii. NACE National Association of Corrosion Engineers, USA(NACE)
iii. ISO 8501 Preparation of Steel Substrates before application of Paints and related products. Visual assessment of Surface cleanliness.(Part 1&2)

iv. ISO 8502 Preparation of Steel Substrates before application of Paints and related products-Tests for assessment of Surface cleanliness. (Part 1-4)

v. ISO 8503 Preparation of Steel Substrates before application of Paints and related products-Surface roughness Characteristics of blast-cleaned steel substrates. Part 1 & 2

6.4. HEALTH, SAFETY AND REGULATORY REQUIREMENTS

6.4.1. The work covered in this specification, shall comply with all relevant government and local laws, regulations and standards. For subjects not covered by regulations, codes, standards or specifications, the materials and construction shall be based on good engineering practice, subject to approval by Owner.

6.4.2. CONTRACTOR shall ensure that all health and safety regulations are observed for the erection of scaffolding and use of the selected paint material.

6.4.3. All necessary precautions shall be taken to ensure the safety of personal and property. Extreme caution shall be used when working with oil or oil-based paints, cleaning fluids etc., especially in close proximity to oxygen piping or oxygen equipment. Heavy concentrations of volatile or toxic fumes must be avoided and in confined areas, blowers or exhaust fans shall be used.

6.4.4. Rags and other waste material soiled with paints, thinners or solvents shall be kept in tightly closed metal containers while on the jobsite and not in use. Legal disposal of waste materials outside plant site premises is Contractor’s responsibility.

6.4.5. Lead being hazards material it is recommended to use lead free paint as per requirement of clause 3.6 of IS158.

6.5. SURFACE PREPARATION OF STEEL

One or more of the following methods of surface preparation shall be followed, depending on condition of steel surface and as specified in the data data sheet. ENGINEER reserve the right to instruct the type of surface preparation depending upon the condition of material. Recommended methods of surface preparation of steel briefly are as under.

a) Solvent Cleaning.

b) Manual or hand tool cleaning.

c) Mechanical or power tool cleaning.

d) Abrasive Blast cleaning.
It is necessary that the CONTRACTOR shall have to resort to any one or combination of the above method of surface preparation to achieve the required acceptable standard. Hence the rate quoted shall take into account for such preparation.

6.5.1. SOLVENT CLEANING

All contaminants like oil, grease removal shall be carried out either by special solvents or by degreasing agents. Application and cleaning of solvents shall be as per manufacturer’s instructions and shall be in accordance with SSPCSP1.

6.5.2. MANUAL OR HAND TOOL CLEANING

This method of cleaning shall be used to remove all loose mill scale, loose rust, loose paint and other loose detrimental foreign matter by use of nonpowered hand tools. The minimum acceptable standards in case of manual or hand tool cleaning shall be in accordance with ISO 8501- St2 / SSPC-SP2.

6.5.3. MECHANICAL OR POWER TOOL CLEANING

This method of cleaning shall be used to remove all mill scale, rust, paint and other detrimental foreign matter by use of power assisted hand tools. The minimum acceptable standards in case of power tool cleaning shall be in accordance with ISO 8501- St3 / SSPC-SP3.

6.5.4. ABRASIVE BLAST CLEANING (SHOT BLASTING / GRIT BLASTING)

6.5.4.1. Shot / Grit blasting shall be resorted to only after removal of grease, oil and other contaminants as per SP-1. Special care shall be taken on weld areas to remove flux and spatter. Precautions shall be taken when grit or shot blasting of light gauge steel surfaces, to ensure that buckling does not occur due to continuous impingement of grit or steel shots under high velocity. Surface anchor profiles shall be measured by Testex tape – press-o-film and the

Finished surfaces shall conform to the requirements of ISO 8501- Sa 2½ / SSPC-SP10.

6.5.4.2. Blast cleaning shall not be performed where dust can contaminate surfaces undergoing such cleaning or during humid weather conditions having humidity exceeding 85%.

6.5.5. TESTS ON SURFACE PREPARATIONS

The following inspection and tests shall be performed on the steel surfaces subjected to surface preparation. Test / inspection reports shall be submitted to ENGINEER for his approval and acceptance.

i. Visual examination of surface preparation with comparators.

ii. Profile check of the prepared surface with suitable “profilometer “eg.TESTEX method.
6.6. PAINT MATERIAL

6.6.1. PROCUREMENT

All types of paints required for the work shall be as per the requirement of relevant IS codes and procured from the reputed manufacturers. List of some of the manufacturers are as under. However contractor shall obtain the detailed list of approved paint manufacturers from the ENGINEER before initiating the procurement action.

i. Asian Paints (I) Ltd.
ii. Berger Paints Ltd.
iii. Cipy Polyurethane Pvt Ltd

6.6.2. STORAGE

The Paint material shall be stored strictly in accordance with the instructions of the paint manufacturer. In general painting materials should be stored in dry, cool, well ventilated and frost free area.

6.6.3. PACKING

All paints delivered to the fabrication shop / site shall be in original sealed container, as packed by the manufacturer. Paint containers shall clearly mark with paint manufacturer’s name, batch number, date of manufacture, shelf life and a clear indication of the type and colour of the product.

6.6.4. MIXING

Paint shall be thoroughly mixed prior to application. Mixing shall be done in a well-ventilated, clean and dust-free area. Paint shall be mixed by rotating power mixers or rolling rigs, until a uniform consistency is achieved. Multiple pack paint materials shall be mixed in accordance with and under the conditions as specified by the paint manufacturer. Pot life as specified by the paint manufacturer shall be strictly followed.

6.6.5. THINNER AND SOLVENTS

Only additives, thinners, solvent etc as recommended by the paint manufacturer shall be used. A possible extension of the “pot life” by addition of thinners is prohibited.

6.6.6. TESTS ON PAINT

In order to ensure that the supplied paint meets the stipulations, samples of paint shall be tested in laboratories to establish quality of paint with respect to

i. Viscosity.
ii. Adhesion/ bond of paint in steel surfaces.
iii. Adhesion / simulated salt spray test.
iv. Chemical analysis (percentage of solids by weight)
v. Normal wear resistance as encountered during handling & erection
vi. Resistance against exposure to acid fumes etc.

Alternatively manufacturer’s test certificates shall be furnished by the Painting CONTRACTOR in respect of above tests for ENGINEER’s approval and acceptance. ENGINEER reserves the right to test the paint material either before the commencement of work or during the progress of work if in his opinion the paints supplied are of inferior quality and does not meet the codal Requirements.

6.6.7. PAINT SAMPLE

Before buying the paint in bulk, it is recommended to obtain sample of paint and establish “Control Area of Painting”. On control area surface preparation, painting shall be carried out in the presence of Engineer and the Manufacturer of paint.

6.6.8. FINISHING PAINT

Color /Shade of the finishing paint shall be as per the choice of the Owner and Contractor shall obtain prior approval before procurement action is initiated.

6.7. PAINT APPLICATION

Painting shall be carried out by any one or the combination of the following method of application to suit the site condition and the type of paint being used. Manufacturer’s recommended method of application shall be strictly followed.

i. Brush Application.

ii. Roller Application.

iii. Spray Application.

6.7.1. BRUSH APPLICATION

Brush application of paint shall be in accordance with the following.

i. Brushes shall be of a style and quality that will enable proper application of paint

ii. Round, Oval or Wide flat brushes shall be used depending upon the surface irregularity, rough or pitted steel, large flat painting areas etc

iii. There shall be a minimum of brush marks left in the applied paint.

iv. Surfaces not accessible to brushes shall be painted by spray.

7.2. ROLLER APPLICATION

Suitable rollers of different nap length to suit varying surface roughness shall be used. Rollers are not generally recommended for application of primers. Roller application shall only be used if the first or priming coat of paint has been applied by brush or other means. Manufacturer’s recommendation shall be strictly followed for roller applied paints.
6.7.3. SPRAY APPLICATION

6.7.3.1. Airless or pneumatic spray application shall be in accordance with the following

i. Airless spray application shall be as per steel structure paint Manual Vol 1 & Vol 2 SSPC, USA.

ii. Spraying shall be carried out keeping the spray gun at the minimum suitable distance from the work piece and consistently at 90° to the surface being painted.

iii. Correct spray tips, air pressures etc as recommended by the equipment supplier shall be adopted.

6.7.3.2. Air spray application shall be in accordance with the following:

i. The equipment used shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied, and shall be equipped with suitable pressure regulators and gauges.

ii. Appropriate pressure and nozzles shall be those recommended by the manufacturer of the equipment for the material being sprayed. The equipment shall be kept in satisfactory condition to permit proper paint application.

iii. Correct combination of air volume, air pressure and fluid flow to give good atomization shall be ensured to get a defect free painted surface.

iv. Traps or separators shall be provided to remove oil and condensed water from the air. These traps or separators must be of adequate size and must be drained periodically during operations. The air from the spray gun impinging against the surface shall show no condensed water or oil.

v. Ingredients shall be kept properly mixed in the spray pots or containers during application by continuous mechanical agitation.

vi. Spray equipment shall be kept sufficiently clean so that dirt, dried paint and other foreign materials are not deposited in the paint film. Any solvents left in the equipment shall be completely removed before applying paint to the surface being painted.

6.7.3.3. Selection of type of spray application shall depend upon the type of paint coating being used. At all time paint manufacturer’s recommendation shall be strictly followed.

6.8. COATING PROCEDURE

6.8.1. COMPATIBILITY

General Compatibility between primer, intermediate and top coats, as applicable for individual painting system shall be established through the paint manufacturer supplying the paints. Primer and finishing paint for the entire project shall preferably be procured from the same manufacturer. Mixing of material from different manufacturers is strictly prohibited.
6.8.2. Surface shall not be coated in rain, wind, when steel surface temperature is less than 50 °C, or when the relative humidity is greater than 85%.

6.8.3. Applied paint system shall be allowed to cure at ambient and surface temperatures between 10 °C and 60 °C with relative humidity below 85%. All paint shall be air curing.

6.8.4. A suitable test area (approx 0.5 m²) shall be painted with agreed paint system. The test area shall be fully coated with all coats of the agreed coating system using the tools and equipment to be used for the actual coating work. The painted test area shall be maintained for the duration of the project. Painting on test piece shall be carried out such that all the coats shall be made visible for reference at all time.

6.8.5. Structural steel shall be preferably prime coated at shop and subsequent finish coats shall be carried out at site after the alignment and erection is complete. Portions of structural steel members to be embedded into the concrete shall not be painted.

6.8.6. Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly.

6.8.7. Surfaces inaccessible after erection, including top surfaces of floor beams supporting grating / chequered plate /RC Slabs shall receive one additional coat of finish paint over and above the number of coats specified prior to erection.

6.8.8. Each coat of paint material shall be applied as continuous film uniform thickness free of pores. Any spot or areas missed in application shall be recoated and permitted to dry before the next coat is applied. Applied paint should have the desired wet film thickness.

6.8.9. Each coat shall be in proper state of cure or dryness before the application of succeeding coat. Material shall be considered dry for recoating when an additional coat can be applied without development of any detrimental film irregularities, such as lifting or loss of adhesion of the under coat. Manufacturer’s instruction shall be strictly followed for intercoat intervals.

6.8.10. No paint shall be force dried under conditions which will cause checking, wrinkling, blistering formation of pores or detrimentally affect the condition of the paint.

6.8.11. No drier shall be added to paint on the job unless specifically called for in the manufacturer’s specification for the paint.

6.8.12. Paint shall be protected from rain, condensation, contamination, snow and freezing until dried to the fullest extent practicable.

6.8.13. Blast cleaned surface shall be coated with one coat of primer before surface degradation occurs but in no case later than 3hrs. Irrespective of the method of surface preparation, the first coat of primer shall be applied not later than 2-3 hours after preparation and on dry surface.
6.8.14. When the successive coat of the same colour is specified, alternate coat shall be tinted as far as practicable; sufficient to produce enough contrast to indicate complete coverage of the surface. The tinting material shall be compatible with the material and not detrimental to its service life.

6.8.15. All field welded areas on shop painted item shall be mechanically cleaned (including the weld area proper, adjacent areas contaminated by weld spatter or fumes and areas where existing primer, intermediate / finishing paint is burnt). Subsequently, new primer and finishing coats of paint shall be applied as per painting specification.

6.8.16. Care shall be taken to protect adjacent equipment, piping, structures etc., from spillage and spatter during field painting by use of adequate temporary covers. If surfaces are accidentally spattered or sprayed, the paint shall be immediately and thoroughly removed. For cleaning of spillages an inert absorbent material shall be used.

6.8.17. All structures shall receive appropriate number of primer, intermediate and finishing coats in order to achieve overall DFT as per the drawings / specifications/ data sheets.

6.9. PAINTING SYSTEM

6.10. REPAIR OF COATED SURFACE

6.10.1. Wherever shop primer painting is scratched, abraded or damaged, the surfaces shall be thoroughly cleaned using emery paper and power driven wire brush wherever warranted, and touched up with corresponding primer. Touching up paint shall be matched and blended to eliminate conspicuous marks.

6.10.2. If more than 30% area of the painted surface of an item requires repair, the entire surface shall be repainted. In such an event no extra payment will be permitted.

6.11. TEST ON PAINTING SYSTEM

Following inspection and tests shall be performed during and after the application of paint system.

i. Wet film thickness (WFT) spot checks shall be carried out during the course of painting operation to ensure that film thickness is being maintained.
ii. Dry film thickness (DFT) check of intermediate and final coating layers in accordance with the specification and /or paint manufacturer’s recommendation.
iii. Quality of adhesion between the coating system and the steel substrate and of the adhesion between the coatings layers shall not be less than those specified in the Codes / Standards.
iv. Porosity Check: Holiday detection test shall be carried out and all indications shall be repaired as per approved repair procedures.
6.12. FINAL INSPECTION

6.12.1. As part of the Quality Assurance, a final inspection in the presence of the representatives of OWNER and CONTRACTOR shall be conducted prior to the final acceptance of the paintwork.
Part of this final inspection checks shall be

i. Visual check of the appearance

ii. Checks on DFT’s of the total applied coating system

iii. Shade verification


v. Scratch Test

vi. Adhesion test.

6.12.2. As part of acceptance procedure, a report shall be prepared that shall include:

i. General:
   - Names of the Painting Contractor and the responsible personal
   - Scope of work
   - Dates when the work was carried out.
   - Copy of the work and quality plan
   - Deviations from this Specification and/or the quality plan.

ii. Inspection equipment
   - Type and calibration of instruments used.

iii. Surface Preparation
   - Condition of surface before preparation
   - Checks on the requirements as specified for cleaned surface.

iv. Coating application
   - Information on coating systems being applied (i.e. product names, DFT’s)
   - Checks on requirements as specified for coating application
   - Check on dry film thicknesses of the total coating system applied

v. Conditions
   - Checks on humidity, dew point and substrate temperature.

vi. Inspection reports
   - Copy of the inspection reports of the Contractor
   - Inspection from an independent third party

6.13. DOCUMENTATION

Contractor shall keep records and furnish the following documents to the Owner

i. A written quality plan with procedure for qualification trials and for the actual work.
ii. Daily progress report with details of weather conditions, particular of applications, number of coats and type of material applied, anomalies, progress of work versus program.

iii. Results of measurement of temperatures, relative humidity, surface profile, film thickness, holiday detection, adhesion tests with signature of appropriate authority.

iv. Particulars of surface preparation and paint application during trials and during the work.

v. Details of non-compliance, rejects and repairs.

vi. Type of testing equipments and calibration.

vii. Code and batch numbers of paint materials used including shelf life.

viii. Visual examination of surface preparation compared with the standards.

ix. Profile check of the prepared surface with suitable “profilometer.

x. Dry film thickness check of intermediate and final coating layers, in accordance with the specification and/or paint manufacturer’s recommendation.

xi. Checks/ tests carried out as per clauses above.

6.14. GUARANTEE

6.14.1. The paint system shall provide sufficient protection of the underlying steel surface against the attack of the environment, other than mechanical damage, chemical spillage as result of operational activities or other unusual occurrences from the outside caused by others.

6.14.2. The CONTRACTOR is fully responsible for the quality of the work and for all related QA/QC activities as indicated in the specification.

6.14.3. The CONTRACTOR shall guarantee quality of their coating works for the period specified in Data Sheet-B and for the coating condition as specified below.

6.14.3.1. The guarantee period starts from the date of acceptance of CONTRACTOR’s paint work.

6.14.3.2. Initial acceptance of any new coating work by OWNER will not release the CONTRACTOR of his obligation under this section until final inspection has been carried out and acceptance of the completed work has been agreed in writing.

6.14.3.3. These guarantee clauses regarding coating specifications are prevailing and supersede the warrantee requirements in General Conditions of Contract.
<table>
<thead>
<tr>
<th>Paint System</th>
<th>Surface Preparation</th>
<th>Primer Coat (µm)</th>
<th>Intermediate Coat (µm)</th>
<th>Top Coat (µm)</th>
<th>Dif (µm)</th>
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<td>1x75=75</td>
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TECHNICAL SPECIFICATION OF ELECTRICAL WORKS
1.0 **SCOPE OF WORK**

1.1 The scope of work covers the design, detailed engineering, preparation of construction drawing, manufacture, acceptance testing at manufacturer’s works or at any accredited agency, supply, packing, forwarding and delivery from manufacturer’s works/ place of storage to erection site including transit insurance, unloading, storage at site, moving from place of storage to place of installation, assembly, cleaning/ lubricating, touch up painting, erection, testing, commissioning, performance demonstration & O&M for 5 years and handing over of the following systems/ equipment on Design and Build basis of the Identified Project area.

The scope of work broadly includes;

1.1.1 Power Supply Arrangement to various elements of riverfront development such as Adventure Park, Outdoor Parking Areas, Bio Toilets and others.

1.1.2 Sub-metering with tariff meter (as per the latest guidelines and specification of the WESCO / OERC) to the leased-out areas such as Kiosks, Commercial shops, Boating Facilities, Adventure Park & Food Kiosks.

1.1.3 Illumination of Landscape area

1.1.4 Illumination of Outdoor Parking Areas & Streets

1.1.5 Illumination of Miscellaneous Area Lighting

1.1.6 Illumination of Proposed Pathways/ Walkways.

1.1.7 Illumination of Garden area and Trees.

1.1.8 Flood Lighting at Ghat Areas and Steps.

1.1.9 Illumination of Indoor area like toilet blocks, office, Electrical/ Technical rooms, ticket & information counter and Outdoor area like Parking, Entry-Exit Points and Roads.

1.1.10 Standby Diesel Generator Set for the entire area pocket wise.

1.1.11 Distribution Transformer Panel, LT Panel, Common Area Outdoor Panel, Outdoor Lighting Feeder Pillar, High mast Lighting DB, Commercial Area DB, Indoor DB and Junction Box for power supply distribution.

1.1.12 Point Wiring for indoor lighting points like toilet blocks, office, ticket & information counter, electrical / technical rooms, etc.

1.1.13 LV Power and Control Cabling System.

1.1.14 Civil works including Foundation for the LT Panels, lighting poles, luminaires, high mast etc.

1.1.15 Earthing System.

1.1.16 Construction Power supply arrangement.

1.1.17 Liaison with Govt. Authorities.

1.2 CONTRACTOR shall ensure that design of equipments shall be as per specification requirements.

1.3 CONTRACTOR shall submit Quality Assurance Plan within 15 days after finalization of order. The QAP shall be discussed between RSCL and the CONTRACTOR before the QAP is finalized.

1.4 The CONTRACTOR shall carry out detailed engineering including schematic lighting solution...
Electrical Works

and prepare construction purpose drawings to make its own estimate of ratings & quantities in accordance with the design criteria provided in the technical specification and data sheets, for entire system including illumination system, electrical equipment, cabling system, earthing, and civil works required for completion of works.

1.5 The above drawings with plans, elevations, sections or any details (as required) shall be submitted to RSCL or its representative for approval.

1.6 3D rendered views of the proposed illumination plans shall be provided for approval for the entire project before supply and execution of the same.

1.7 Light fixtures selected by the CONTRACTOR shall be submitted to RSCL for approval.

1.8 The CONTRACTOR shall submit detailed electrical load calculation, sizing calculation of electrical equipments and explanation on how the fixtures identified are energy efficient before supply and execution of work.

1.9 CONTRACTOR shall take due care of the site Seismic conditions while designing all equipments/ components used in lighting and electrical systems covered in this specification. CONTRACTOR shall furnish list of design parameters considered in design to fulfill the above requirement.

1.10 Design and detailed engineering of the materials procured by CONTRACTOR is included in scope. CONTRACTOR shall submit each document/ calculations of system which is included in scope to RSCL or its representative for final review/ approval. All design documents/ calculations prepared by CONTRACTOR shall be duly signed by CONTRACTOR and stamped. Documents submitted without fulfillment of this requirement will not be considered as a submission and will be rejected.

1.11 Design documents/ calculations prepared by Sub-CONTRACTOR shall be approved by CONTRACTOR and stamped copy of approval along with no-deviation sheet from Sub-CONTRACTOR shall be submitted by the CONTRACTOR to RSCL or its representative for final review/ approval. Documents submitted without fulfillment of this requirement will not be considered as a submission and will be rejected.

1.12 Expert or manufacturer supervision for Sub-CONTRACTOR supplied material shall be provided by BIDDER and included in offer.

1.13 CONTRACTOR shall be solely responsible for any shortages or damages in transit for his supply scope, handling and/ or in storage of any materials and erection of the equipment, supply of erection tools at site. CONTRACTOR shall ensure that it will not affect any activity or project schedule. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc. shall be to the account of the CONTRACTOR.

1.14 Obtaining approval including load sanction/ load release from WESCO shall be in the scope of CONTRACTOR. All the statutory fees for the above approvals shall be borne by RSCL. Such payments shall be reimbursed to the CONTRACTOR upon submission of stamped receipts to the RSCL. The approvals will include consent for commencement of work and obtaining permission to charge/commission.

1.15 All the cost towards liaison with statutory Bodies for seeking all necessary statutory approvals and other activities involving Govt. Agencies viz., drawing approval, testing and commissioning etc, shall be borne by the CONTRACTOR.

1.16 The CONTRACTOR shall also liaison with Govt. Bodies if required like WESCO, PWD, CEIG, RMC etc. for obtaining required permission to work.

1.17 CONTRACTOR’s scope shall also include all civil works and structural works required for
installation of all electrical equipment/ systems such as equipment foundations, Pole foundations and all excavation and backfilling works including those for lighting, earthing, cabling systems etc.

1.18 BIDDER should visit site and get ascertained regarding the complete scope of work before submission of Bid.

1.19 This specification is the minimum requirement and should be read in conjunction with relevant latest specifications, requirements, rules and regulations of the Local Authority. Any additional requirements as per Local Authority or latest Standards shall be considered by BIDDER

1.20 All SAFETY considerations in design and manufacturing for safe operation & maintenance and safe practices during installation at site shall be in the scope of the CONTRACTOR. Cost towards accomplishing the same shall be included in the BID price and no extra claim shall be entertained later.

1.21 Equipments furnished/ supplied under this scope of works shall be complete in every respect with all mountings, fittings, fixtures, and standard accessories normally provided with such equipment and / or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specification. Materials and component not specifically stated in the specification but which are necessary for commissioning and satisfactory operation shall be deemed to be included in the scope of specification and shall be supplied without any extra cost. All similar standard components/ parts of similar standard equipment provided shall be inter-changeable with one another.

1.22 The CONTRACTOR shall be responsible for the selection and design of appropriate equipment to provide the best co-ordinated performance of the entire system. The design of various components, sub-assemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.

1.23 The material supplied by the CONTRACTOR shall be subject to approval of the designated Authorities of RSCL. Samples of the Supply material under the scope of works shall be inspected by RSCL or their representatives either at site or at Manufacturer’s works and approve them for supply and execution. Notwithstanding any approval/ instruction given otherwise, if the RSCL, during random check up, finds any non conformance with the quality of material supplied by the CONTRACTOR with respect to the technical specifications, RSCL shall have the Authority to reject the entire lot/ batch of that particular material and ask to replace without any cost and time impact to RSCL.

1.24 During the construction at site, it shall be the CONTRACTOR’s responsibility to take care of the safety and security of its person and material at site. The CONTRACTOR shall be self reliant with all the requirements including tools and tackles for digging, filling, erecting, lifting, etc. and consumables required for construction like electricity and water at his own cost.

1.25 The CONTRACTOR shall carryout the installations in a safe and responsible manner without any inconvenience or danger to public. The CONTRACTOR shall take care not to damage any public/ private property by mistake or by intention during the course of work with its actions and shall be well insured to compensate the owner in case any such incidence happens.

1.26 CONTRACTOR shall plan and carry out all supply, installation, testing and commissioning of the entire electrical system conforming to the approved drawing, technical specification and good engineering practices.

1.27 Even if all components of a system included in this specification are not explicitly identified and/
or listed herein, these shall be supplied under this contract to ensure completeness of the system and facilitate proper operation and easy maintenance. Any and all other works not indicated above but necessary/required to complete the job in all aspects, are included in the CONTRACTOR’s scope.

1.28 RSCL reserves the right to issue addendum to the technical specification to indicate modification/changes in the requirements, if so required at a later date.

2.0 DESIGN CONCEPT

2.1 The design concept of lighting system as a whole is based on providing visually and aesthetically improved illumination; providing safe, reliable & stable power and efficient performance of electrical system.

2.2 The design standard described herein is in accordance with latest BIS standards and National Lighting Code 2010.

2.3 The design standards described herein are generally in compliance with the Central Electricity Authority Regulations 2010, latest Indian Standards, State Electricity board standards and code of practices already established in the country.

2.4 The design ambient temperature for all electrical equipment shall be 45°C.

3.0 POWER DISTRIBUTION ARRANGEMENT

3.1 As indicated above the architectural section the riverfront is divided into 5 pockets.

3.2 Thus, the power for the River front development is to be supplied at 11kV from the nearest source. Since there is an existing feeder running along the river front the supply for the development is to be tapped from this existing transmission line.

3.3 Presently 11kV Raw Water Feeder of the 33/11kV Panposh Substation is proposed to be tapped for the power supply.

3.4 Considering various zones of riverfront & the increase in the load in future, the requirement for transformers and 100% emergency backup by Diesel Generator should be calculated.

3.5 A dedicated two pole structure with GOD, Lightning arrester, Dropout fuses and Distribution Transformer along with tariff meter is to be installed for HT supply requirements by WESCO as per the WESCO specifications and directions.

3.6 Tariff metering is to be provided as per the latest guidelines and specification of the WESCO.

3.7 All power supply arrangement including installation of two pole structure with transformer up to tariff meter is considered in the Project Scope.

3.8 One Distribution Transformer Panel is to be provided at each supply point. The panel shall have two (2) MCCB at Incomers and MCB’s at outgoings for further distribution of the load.

3.9 The feeder pillars are to be provided for power distribution over the landscape area and other area. The zone of the feeder pillar should be limited to outgoing circuit of length not more than 300 meters on either side.

3.10 Diesel Generator set should be considered provide 100% load back up for all proposed loads.

3.11 The Distribution Transformer Panel shall be provided with two 4P MCCB’s with Auto change over switch. The auto changeover switch shall control the incoming supply in such a way that in one time only one incomer supply shall feed the bus. The Distribution Transformer panel shall have
incoming from transformer as well as the DG.

3.12 The power for PHED requirement shall be feed from PHED LT Panel having 4P MCB incomer and outgoings as per requirement of plumbing.

3.13 Outdoor Lighting Feeder Pillars shall cater to the landscape lighting, toilets, water ATMs with 4P MCB incoming and DP MCB outgoings. These panels shall be provisioned with 24-hour Astronomical timer.

3.14 The commercial areas shall be fed from Commercial LT panels with 4P MCB incoming and 4P MCB outgoing. The power from these commercial panels shall supply to LT meters and 4P MCB in a GI enclosure.

3.15 Cabling system shall comprise of 1.1 kV grade, XLPE/ PVC insulated, multi-stranded Al/ Cu, GI round wire/ flat strip armoured power cable. All the Cables shall be laid in DWC HDPE pipe (As per IS 16205) and buried underground at minimum depth of 750mm.

3.16 Separate and individual power cable of 1.1 kV grade, XLPE/ PVC insulated, multi-stranded Al/ Cu, GI round wire/ flat strip armoured is to be provided for illumination of Pathway lighting and landscape lighting. The size of the cable provided shall not be less than 4 Sq mm. Al.

3.17 Internal point wiring is to be done as per Odisha PWD building norms.

3.18 The size of the cable provided shall not be less than 2.5 Sq mm, Cu for small lights like down lighters, step lights, bulk heads etc.

3.19 Three-way Junction boxes of IP67 has been considered for the distribution of the power to the load points. Separate junction boxes to be provided for supplying load to Garden area lighting, tree lighting, uplighters, wall lighting.

3.20 Based on the load distribution over the Landscape area, adequate numbers of Outdoor Feeder Pillars are to be provisioned for further distribution of the power. The Local Distribution Board supply power to the various elements of Landscape and other areas as required.

4.0 DESIGN CRITERIA

4.1 ILLUMINATION SYSTEM

4.1.1 Latest version of related IS Standards and National Lighting Code 2010 (NLC) shall be referred for designing Illumination for different areas.

4.1.2 Lighting design shall be performed using DiaLux Software version 4.12 or its latest version.

4.1.3 The illumination shall be designed creatively for enhancement and improvement of the look and feel of the various elements of the project area aesthetically and visually. This criteria for such illumination cannot be defined in terms of standard values or factors as specified in the standards for all elements however certain elements like pathway / walkway, Riverfront area etc shall be
designed as per required standards as specified.

4.1.4 While designing the lighting system major principles of designs to be followed are as follows

(a) Lighting Lux Level.
(b) Luminance Distribution.
(c) Direction of Incidence of Light and Shadow effect.
(d) Free Public movement.
(e) Hazard free space for Visitors and Pedestrians.
(f) Daytime Appearance of the Installation - It is very important to ensure that the luminaire positions determined for night time lighting are aesthetically appropriate and do not spoil the view of the site during the day.
(g) Glare - It is necessary to eliminate direct and/or reflected glare which could disturb visitors and pedestrians.
(h) Accessibility for Maintenance - For periodical maintenance, lamp replacement, cleaning of luminaires and readjustment of disturbed luminaires should be as easy as possible. Care shall be taken during the designing stage to make the installation accessible and ensure easy handling of luminaires.
(i) No Light Pollution including the Night sky.

4.1.5 Lighting Design

(a) Following factors shall be considered while arriving at the utilization factor to determine the number of fixtures for each area.

(i) Maintenance Factor

a. Indoor Area Lighting with LED Luminaire: 0.8
b. Outdoor Area Lighting with LED Luminaire: 0.8

(ii) Uniformity factor shall be considered as per National Lighting code 2010.

(iii) The illumination levels given in below table shall be considered for the illumination of the respective area.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Area</th>
<th>Illumination Level (Lux) - Average values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>General Garden Area</td>
<td>4-10 Lux</td>
</tr>
<tr>
<td>2</td>
<td>Path Way/ Walk Way/ Cycle Track/ Ramp</td>
<td>15 Lux</td>
</tr>
<tr>
<td>3</td>
<td>Parking</td>
<td>50 Lux</td>
</tr>
<tr>
<td>4</td>
<td>Internal Roads/ Entry-Exit points</td>
<td>15 Lux</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Area</td>
<td>Illumination Level (Lux) - Average values</td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Restaurant / Kiosk plaza</td>
<td>250 Lux</td>
</tr>
<tr>
<td>6</td>
<td>Toilet Block/ Public Toilet</td>
<td>100 Lux</td>
</tr>
<tr>
<td>7</td>
<td>Admin Office/ Ticket &amp; Information Counter</td>
<td>200 Lux</td>
</tr>
<tr>
<td>8</td>
<td>Ghat Area</td>
<td>30 Lux</td>
</tr>
<tr>
<td>9</td>
<td>Adventure Park</td>
<td>20 Lux</td>
</tr>
</tbody>
</table>

(b) The proposed lighting fixtures for the riverfront development is as indicated in the table below:

<table>
<thead>
<tr>
<th>Sr No.</th>
<th>Type of fixture</th>
<th>Typical Fixture</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LED Bollard</td>
<td></td>
<td>Landscape area as per Lighting plan</td>
</tr>
<tr>
<td></td>
<td>Philips Make BCP400 LED09 D CW PSU GR S1 220-240V 7043 having 1 x 17Watt IP 65 die casting housing LED Bollard with polycarbonate diffuser. The luminaire should be minimum 500 lumens output and the color temperature of this fixture should be 6500K (natural white) or equivalent.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>LED Up-Lighter</td>
<td></td>
<td>Tree and Artistic Wall Up lighting of Riverfront Area</td>
</tr>
<tr>
<td></td>
<td>35W/30W IP65 Aluminium die-cast with color powder coating housing with optical lens. The luminaire should be min 4144 lumen output and color temperature should be 4000k. Make Ligman cat no-MIC3 MI-50383 / MIC3 MI-50384RGBW or equivalent.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sr No.</td>
<td>Type of fixture</td>
<td>Typical Fixture</td>
<td>Place</td>
</tr>
<tr>
<td>--------</td>
<td>----------------</td>
<td>----------------</td>
<td>-------</td>
</tr>
</tbody>
</table>
| 3      | LED Post Top Fixture  
Bajaj Make Post of Lamp 45 W LED  
BGCP 45W LED WW LED post top with decorative circular design compliant to dark sky norms with polycarbonate opal diffuser and IP 65 protection. The luminaire should be min 4800 lumen output and color temperature should be 4000k (Warm Light) or equivalent | ![LED Post Top Fixture](image1.png) | Walkways & Pathways for Riverfront Area |
| 4      | Flood Light  
100W IP66 with heat sink design integrated in high pressure die cast aluminium housing. Make-Bajaj cat no-BJFL 100W LED I or equivalent. | ![Flood Light](image2.png) | For High Mast Lighting in Ghat Areas |
| 5      | LED Strip (Wall Washer)  
LED strip wall washer 15W/mtr IP65 with driver and external power supply  
Bajaj cat no 75W PROFESSIONAL LED STRIP IP65 WH or equivalent | ![LED Strip](image3.png) | For landscaped step lighting |
| 6      | Bulkhead  
10W IP66 Surface mounted fixture. The luminaire should be min 600 lumen output and color temperature should be 6500k. Make Philips: WT202W LED6S NW PSU S2 PC or equivalent. | ![Bulkhead](image4.png) | At Ramp and Stair Areas |
<table>
<thead>
<tr>
<th>Sr No.</th>
<th>Type of fixture</th>
<th>Typical Fixture</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Pendant Light-1x24W LED Pendant Light including the luminaries and pendant. Make Philips part no-410581166 or equivalent.</td>
<td>![Image]</td>
<td>For Gazebos, Pergolas</td>
</tr>
<tr>
<td>8</td>
<td>Philips make WT201C LED 40S L 120, IP65 luminaire Indoor luminaire, 20-40 W, 6500K, Polycarbonate Housing</td>
<td>![Image]</td>
<td>For Indoor Area, Public Toilets etc.</td>
</tr>
<tr>
<td>9</td>
<td>12 W LED Bulbs</td>
<td>![Image]</td>
<td>Kiosks, Food Courts</td>
</tr>
<tr>
<td>10</td>
<td>LED Strip Light -IP65 LED Strip Lights: 14.4 W/m with LED 1200lm 120° Beam 4200K.5m of length per piece. With LED Strip power supply IP67 100W. Make - Disano Fosnova make Strip - LED - IP65 or equivalent</td>
<td>![Image]</td>
<td>For Landscaped Step lighting</td>
</tr>
</tbody>
</table>

Note: Pictures are indicative and taken from internet / vendor catalogues.

4.1.6 Selection Of Luminaries-
(a) Selection of the luminaries for Landscape and Riverfront lighting shall be done on the basis of specifications provided in Datasheet.
(b) CONTRACTOR shall submit the detail lighting plan in consultation with landscape architect and take prior approval from RSCL or its representative after award of contract.
(c) CONTRACTOR shall provide better options for lighting concept and LED luminaries with
optimized cost.

4.2 **CABLE SIZING**

4.2.1 The CONTRACTOR shall ensure that cable and wires associated with the power distribution and control systems, point wiring and all other installations throughout the Works are adequately rated for their use. Following main aspects shall also be considered while deciding the final size of the cables.

a) Supply voltage and frequency.
b) All cables shall be selected to carry the corresponding full load current under site conditions.
c) Route length and disposition of cables.
d) Maximum allowable temperature rise under normal full load condition based on the material of cable insulation (XLPE/ PVC).
e) For Cables emerging from LTDB, fault clearing time shall be considered as 0.5 second.
f) For Cables emerging from MCCB / MCB outgoing, fault clearing time shall be considered as 0.01 second.
g) CONTRACTOR shall note that, the above fault clearing times are minimum to be considered & fault clearing time shall be according to Power system.
h) Appropriate de-rating factors as per cable manufacturer’s catalogue and enlisted below shall be considered for sizing the cable:

- Ambient Air Temperature (minimum 45°C).
- Ambient ground temperature (minimum 40°C to be considered)
- Laid in Air / ducts/ directly in ground etc.
- Depth of cable burial (minimum 750 mm for LT)
- Thermal Resistivity of Soil (minimum 150°C Cm/ W to be considered)
- No. of cables in a group-touching each other or separated by a distance
- Any other de-ration factors as applicable & as per Manufacturer’s catalog.

i) The number of light fixture controlled by a single feeder pillar outgoing circuit shall be limited based on the voltage drop at the farthest light fixture. The cumulative voltage drop at that point shall not exceed by 5%.

j) Cables up to & including 4.0 sq.mm shall be Cu multi-stranded conductor with galvanized steel round wire armoured & balance cables shall be Al multi-stranded conductor with galvanized steel round wire/ flat strip armoured.
k) Control cables shall be Cu multi-stranded conductor with galvanized steel round wire/ flat strip armoured. For multi core cables above 7 cores, minimum two spare cores shall be considered.

4.3 PANEL SIZING

4.3.1 Rating shall be suitable for carrying full load current of the equipments.

4.3.2 It shall be suitable for short circuit rating for 1sec duration.

4.3.3 The bus-bars shall be sized considering the following criteria:

I. Sleeves made of insulating material on all bus bars.

II. Design ambient temperature 45 Deg C.


IV. Bus bars being inside the panel; De-ration for enclosure and ventilation.

V. Bus bar suitability for carrying rated current continuously.

VI. Configuration of bus bars and Proximity effect.

VII. The main bus shall be designed based on the load rating as well as the actual fault level for specified duration at the location of the Panel/ board with 10% tolerance.

VIII. Earth bus of the panel shall be sized suitable for the above fault level for the same duration.

4.4 DG SIZING

i. The capacity of the DG shall be based on the total simultaneous maximum demand of the loads. All the loads which shall be considered for DG sizing with diversity and load factors.

ii. After consideration of 10% contingency over the above maximum demand (MD), sizing of the selected DG shall be such that the maximum loading of the DG shall not exceed 80% at 0.8 PF.

4.5 FAULT LEVEL CALCULATIONS

Fault level at the secondary of the transformer and at 415V LT panels shall be calculated based on the transformer rating and impedances of transformer and connecting cables.

4.6 EARTHING SYSTEM

4.6.1 The safety earthing shall be on the basis of following codes and standards

- IS 3043 -2018; Code of practice for Safety Earthing.
- CEA guidelines - 2010

4.6.2 The fault levels considered shall be as follows:

<table>
<thead>
<tr>
<th>System</th>
<th>Fault level in kA</th>
</tr>
</thead>
</table>

### Electrical Works

#### 4.6.3

Following factors shall be considered for sizing the earthing conductor:

- **Design Ambient Temperature**: 45°C
- **Allowable temperature rise of steel welded joints**: 500°C
- **Fault Clearing Time**: 1 Sec
- **Overall earthing resistance**: ≤ 1 Ohms

#### 4.7 CIVIL DESIGN

4.7.1 All the Civil foundation design shall be suitable for the Seismic requirement of Rourkela as per latest IS as the city of Rourkela falls in the Seismic Zone-II.

4.7.2 The design shall be considering the maximum wind speed as per IS 875-1987(Reaffirmed 1997).

4.7.3 Proposed flood light pole foundation shall be designed according to condition of soil at riverside as it has very poor soil bearing capacity.

4.7.4 As foundation may encounter the river water in rainy season, hence Grade of concrete to be used shall not be less than design Mix M30 and grade of reinforcement steel shall be Fe 500.

4.7.5 80mm (ID) DWC HDPE Pipe of appropriate length shall be embedded to draw the cable from the power cable.

4.7.6 Minimum requirement for Civil Foundations for Lighting poles up to a height of 12.5 m are as follows:

- (a) Depth of the foundation should be 2000 mm minimum.
- (b) Plan dimensions of footing should be 2500mm x 2500mm having depth D=600 mm Minimum.
- (c) Four anchor bolts shall be of M24 and 750 mm total length is required.
- (d) Grade of concrete to be used shall be M30 and grade of reinforcement steel shall be Fe500.
- (e) Concrete pedestal Size - 500 mm x 500 mm

4.7.7 Minimum requirement for Civil Foundations for the Lighting Pole of height 6 m are as follows:

- (a) Depth of the foundation considered is 1200 mm minimum.
- (b) Plan dimensions of footing considered is 900mm x 900mm having depth D=200 mm Minimum.
(c) Steel in foundation base in both directions considered is T 10 @ 150 mm c/c.

(d) Size of base plate considered is 250 mm X 250 mm having thickness 12 mm.

(e) Four anchor bolts of 16mm dia and 700 mm total length.

(f) Grade of concrete to be used considered is M20 (1:1.5:3) and grade of reinforcement steel considered is Fe 500 or Fe415.

(g) 40mm DWC HDPE Pipe of 1m length shall be embedded to draw the cable.

(h) This foundation design of pole will be applicable for all types of soils i.e. soft soil, medium soil and hard soil.

(i) 40mm DWC HDPE Pipe of 1m length shall be embedded to draw the cable from the power cable.

5.0 TECHNICAL SPECIFICATION

5.1 LIGHTING LUMINARIES

5.1.1 Applicable Standard

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Brief Title</th>
<th>IS/IEC Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Testing procedure of photometric testing for LED luminaires</td>
<td>LM 79</td>
</tr>
<tr>
<td>2.</td>
<td>Testing procedure on the lifespan of LEDs</td>
<td>LM 80</td>
</tr>
<tr>
<td>6.</td>
<td>Limits of Harmonic Current Emissions</td>
<td>IS 14700-3-2-2008</td>
</tr>
<tr>
<td>7.</td>
<td>DC or AC supplied electronic control gear for LED modules performance requirements</td>
<td>IEC 62384-2006</td>
</tr>
<tr>
<td>8.</td>
<td>Lamp control gear: particular requirements for DC or AC supplied electronic control gear for LED modules</td>
<td>IEC 61347-2-13-2014</td>
</tr>
<tr>
<td>10.</td>
<td>Electro Magnetic compatibility (EMC)- Limits for Harmonic current emission— (equipment input current ≤ 16 A per phase)</td>
<td>IEC 61000-3-2-2018</td>
</tr>
<tr>
<td>11.</td>
<td>EMC Immunity requirement</td>
<td>IEC 61547-2009</td>
</tr>
</tbody>
</table>
5.1.2 Environmental Conditions
The average atmospheric condition during the year is mentioned below. The equipment shall be designed to work in such environmental conditions:

(a) Maximum ambient air temperature: 45° C
(b) Minimum ambient air temperature: 5° C
(c) Max. Relative humidity: 90%
(d) Atmosphere: Dusty and Humid

The equipment shall be suitable to sustain and work in the humid and dusty atmosphere of Rourkela.

5.1.3 Luminary/Fixture Description
(a) All Luminaires shall be UL/CE/BIS certified, robust & sturdy, manufactured out of Quality raw material/ inputs with proper Quality checks at each step designated to last long in the kind of application they are selected to work.
(b) All selected Luminaires shall be minimum IP65 protected except indoor luminaires and certified for IK 07.
(c) All RGB luminaires shall be manufactured from well binned LEDs to provide and maintain same Colour consistency over long duration of operations.
(d) The Luminaires shall offer Flicker free output for long duration.
(e) All Luminaires shall be Suitable to operate at auto-switching input voltage for 100 – 240
VAC, 50 Hz power supply with the tolerances as mentioned in the data sheet.

(f) The luminaire light output (lumen) shall be constant and shall be able to withstand allowable supply source voltage variations/ fluctuations, spikes.

(g) The entire fixture shall consume rated wattage as per data sheet maximum at full output.

(h) The LED luminaries shall be single, self-contained device with integral electronic control gear, without requiring on-site assembly for installation.

(i) Fixture shall have lens options.

(j) All the Luminaire shall be complete with necessary accessories & mounting arrangements.

(k) The Luminaries shall have housing as mentioned in datasheet.

(l) The LED system should be digitally driven using noise-shaping pulse width modulation (PWM) techniques and use integral and differential nonlinear control.

(m) LED fixture shall merge line voltage with control data and deliver them to the fixture over a single standard cable from the power and data interface to ensure minimum cabling work to aesthetic and safety purpose.

(n) A microprocessor-controlled SSL driver shall be provided that efficiently and accurately will condition and manage power output to LED systems directly from line voltage.

(o) The Luminaries Housing shall be suitable for termination of 4C X 2.5 sqmm copper conductor PVC insulated flexible Cable with Double Compression Cable Glands

(p) All the connecting wires inside the Luminaire shall be low smoke halogen free, fire retardant cable.

(q) Luminaires should conform to the IS standards for Safety & Performance and test certificates as per IS 16107-2012 should be provided by the manufacturer. In case of luminaires are imported, the CONTRACTOR shall conform to test parameters as per equivalent standards.

(r) The electrical component of the LED and LED driver must be suitably enclosed in sealed unit to function in environment conditions mentioned earlier.

(s) Design of the thermal management shall be done in such a way that it shall not affect the properties of the diffuser.

(t) All LED fixtures shall undergo a minimum 24-hour burn-in test during manufacturing.

(u) The LED fixture shall be operated at constant and carefully regulated current levels. LEDs shall not be designed to be driven beyond their specified nominal voltage and current.

(v) High-power LED fixtures shall be thermally protected using metal core board, gap pad,
and/or internal monitoring firmware thermal management techniques.

(w) LED fixture housing shall be designed to transfer heat from the LED board to the outside environment.

(x) The equipment should be compliant to IEC 60598-1, IEC 62031 and IEC/ PAS 62612 depending on the type of luminary.

(y) All the material used in the luminaries shall not contain any toxic material and fire retardant confirming to relevant standards.

(z) The control gear shall comply to the provisions of IEC 61347-2-13-2014, IEC 62031-2018 and IEC 62384-2006 as appropriate.

(aa) LED luminaries, should conform to the various National / International standards for safety & performance. Manufacturer should provide test reports as per LM 79 & LM80. The test report from NABL accredited laboratory shall be submitted along with the technical proposal/ Bid for LED as well as Luminaires.

(bb) Outdoor LED fixtures shall meet lumen maintenance standards as per LM-80, pass water ingress testing, and pass general endurance testing.

(cc) All hardwired connections to LED fixture shall be reverse-polarity protected and shall provide high-voltage protection in the event that connections are reversed or shorted during installation.

(dd) In Rourkela the switching surges are expected in the power supply system. Appropriate surge protection shall be provided by the CONTRACTOR for all the Luminaires offered by it. Such protections can either be provided centrally at the Feeder Pillar or at each individual luminaire level or a combination of both, as may be decided by the CONTRACTOR. No claim for failure of Luminaires, on account of voltage surges other than Lightning surges, will be considered.

(ee) The Luminaires shall be suitable for operation within the input supply voltage range specified. The driver of the light should be able to sense and cut-off power to the light in case of phase-to-phase/ 440 V fault. No claim in this regard shall be considered.

(ff) The lighting fixtures offered shall comply with the data sheet.

(gg) The luminaire shall have a warranty period of 5 years.

(hh) The CONTRACTOR shall develop and submit as built drawings of entire electrical system and operational manuals for all the fixtures installed to RSCL or its representative after the completion of work.

(ii) All Luminaries under CONTRACTOR’s supply scope shall be guaranteed against quality (including any component failure and deterioration/appearance of corrosion symptoms. This shall also cover any fading (reduction)/ deterioration of reflector coating). In such case the defective luminaire shall be replaced without any cost. In case identical defects are observed on more than 5% of particular type of luminaire (installed quantity), then the complete lot of supplied/ installed luminaires of similar type shall be replaced free of
Offer shall include comprehensive technical details of the luminaires being offered. The details must be sufficient to take in to consideration maximizing of energy efficiency and minimizing overall power consumption.

5.2

TECHNICAL SPECIFICATIONS OF LIGHT POLE

5.2.1 The Product should be designed for the specific climatic and environmental conditions of the region to ensure full durability and safety throughout its designed life.

5.2.2 Poles shall be designed to withstand the maximum wind speed as per IS 875-1987(Reaffirmed1997). The top loading i.e. area and the weight of fixtures are to be considered to calculate maximum deflection of the pole and the same shall meet the requirement of BS EN 40-3-3:2013.

5.2.3 The pole shaft shall have octagonal cross section and shall be continuously tapered with single longitudinal welding. There shall not be any circumferential welding of the pole shaft. The welding of the pole shaft shall be done by Submerged Welding process.

5.2.4 All octagonal pole shafts shall be provided with the rigid flange plate of suitable thickness with provision for fixing minimum 4 foundation bolts of size not less than M24. The base plate shall be fillet welded to the pole shaft at two locations i.e. from inside and outside.

5.2.5 All poles shall be decorative type.

5.2.6 The materials of the pole as follows:

- a. Pole - Conforming to grade S355J0,
- b. Base Plate: - Fe 410 Conforming to IS 226-1975(Reaffirmed1983)/ IS 2062-2011,
- c. Foundation Bolts: - 6.8 Gr. as per IS 1367-2002,
- d. Ring Type Bracket
- e. Pole Sections: - The Octagonal Poles shall be in single piece with single longitudinal welding joint,

5.2.7 The pole manufacturing & galvanizing unit shall be ISO 9001: 2000 & ISO 14001 certified to ensure consistent quality & environmental protection.

5.2.8 The poles shall have integrated Junction box with openable door of adequate size at the elevation of 750 mm from the base plate. The door shall be hinged type with mechanical interlock, dust proof, weather proof and vandal resistant and shall ensure safety of inside connections and
components. The door shall be flush with the exterior surface and shall have suitable locking arrangement. The pole shall be adequately strengthened at the location of the door to compensate for the loss in section.

5.2.9 The door of the Junction Box shall permit clear access to the components inside viz., termination strips, connectors, MCBs, cables etc. There shall also be suitable arrangement for the purpose of earthing.

5.2.10 For street Light poles four way connectors shall be provided along with Slide lock suitable for connecting 1.1 kV grade, minimum 4 core X10 sqmm AL cable. It shall also inhouse DP MCB’s of suitable size, 2.5 sqmm connectors for looping with 2.5 Sqmm Copper wires for connecting to the luminaries through 1.1 kV grade, 3 core X 2.5 mm² PVC insulated copper conductor flexible un-armoured Cable from the terminal block to the fixture within the pole. All the cables laid through the pipe shall be without any joint. The final sizes of cable shall be selected based on the voltage drop limitation.

5.2.11 Two nos. Earth Buss shall be provided at the bottom of the pole (diagonally opposite) suitable for connecting 25X6 mm GI/ CU earth strip or 8 SWG wire for earthing of the poles. Similar Earth Buss suitable for connecting 4 sqmm copper wire shall be provided on the control plate inside the Junction Box for earthing of the electrical components.

5.2.12 Two nos. 40mm DWC HDPE pipe sleeves of suitable length shall be provided through the foundation upto the Junction Box for entry of power cable.

5.2.13 Earthing of 5 set of pole shall be carried out with one dedicated earth electrode. The earth electrode shall be GI pipe electrode as recommended in the latest version of IS 3043-2018. The earth electrode shall be connected with GI strips to the two distinct earth bosses on the pole. Poles of each set shall be inter connected with minimum 8 SWG GI wire.

5.2.14 Aesthetic appearance - All the grooves and carvings of the pole unit shall be free from any kind of distortion for a pleasing aesthetic appearance.

5.2.15 The Poles shall be bolted on a pre-cast foundation with a set of foundation bolts of size not less than M24 for greater rigidity.

5.2.16 All the material/equipment/accessories shall be supplied with manufacturer's test certificates.

5.2.17 BIDDER shall submit the Proposed Product Catalogue, Detail Data sheet, spare parts list and drawing of Pole & accessories along with the BID for each product quoted.

5.2.18 BIDDER shall arrange for all the tools and equipment's.

5.2.19 Concrete foundations shall be provided for all the light poles as per design criteria mentioned for Civil work above.

5.3 TECHNICAL SPECIFICATIONS OF DISTRIBUTION BOARDS

5.3.1 Applicable Standards:
The design, manufacture and performance of equipment shall conform to the latest standards
specified below,

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Brief Title</th>
<th>IS/IEC Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Metal Enclosed Switchgear</td>
<td>IS 3427-1997 (Reaffirmed2002)</td>
</tr>
<tr>
<td>4.</td>
<td>Control Switches &amp; Push button</td>
<td>IS 6857-1972</td>
</tr>
<tr>
<td>7.</td>
<td>Indicating instruments</td>
<td>IS 1248-2003</td>
</tr>
</tbody>
</table>

5.3.2 LT Distribution Board shall be Outdoor type, Steel Support/foundation mounting, Weatherproof, double door, single front, compartmentalized enclosure with locking facilities.

5.3.3 Feeder Pillars (FP) and LDB shall be Outdoor type, Steel Support/foundation mounting, Weatherproof, double door, single front, compartmentalized enclosure with locking facilities.

5.3.4 Feeder Pillars (FP) and LDB shall be made of Galvanised sheet steel enclosure. All the feeder pillars shall be Outdoor type with permanent rain canopy and shall be dust, damp and vermin proof. All feeder pillars shall conform impact resistance of IK7 and above and shall be minimum IP55.

5.3.5 Feeder Pillars (FP) and LDB shall be provided with compartmentalized enclosure. One separate compartment shall be for Incomer, incoming cable and Busbar. One separate compartment for outgoing MCB’s. One separate compartment for outgoing terminals and cables.

5.3.6 Feeder Pillars (FP) and LDB shall be of sheet steel enclosed and shall be fully dust and vermin proof, with canopy. The sheet steel used shall be cold rolled and min 2 mm thick. The gland plate shall be min 2mm thick.

5.3.7 The fabricated enclosure shall not have any welds or bolt heads apparent from outside. All fabrication work like cutting, drilling, punching, shearing & welding etc. related to the enclosure shall be complete before proceeding to 7 tank process. The fabricated body shall be thoroughly cleaned and treated by chemical agents as required to produce a smooth surface free of scales, grease and rust.

5.3.8 The LT Distribution Board shall consist of Incoming Four Pole (FP) MCCB with Thermal magnetic OL, SC and EF release, phase indicating lamps. Metering shall be done as per WESCO specification. However, the Outgoing shall have at least 7 numbers FP MCB.

5.3.9 The LT Distribution Board shall have cable entry at the bottom suitable for terminating double
compression glands for minimum 1 Run of 3.5 C X 95 sq.mm Aluminium conductor, XLPE insulated armoured cable at the incoming terminal and minimum 5 Runs of 4 core 25 sq.mm. Aluminium conductor, XLPE insulated armoured cable at the outgoing terminal.

5.3.10 The feeder pillar shall consist of Incoming of 2 nos Four Pole (FP) MCB, phase indicating lamps and the Outgoing shall have at least 6 nos FP MCBs. It shall have cable entry at the bottom suitable for terminating double compression glands for minimum 2 Runs of 4 core 25 sq.mm. Aluminium conductor, XLPE insulated armoured cable and minimum 5 Runs of 4 core 4 sq.mm. Aluminium conductor, XLPE insulated armoured cable at the outgoing terminal.

5.3.11 The LDB shall consist of Incoming of 1 no 4P RCBO, phase indicating lamps and the Outgoing shall have at least 6 nos 4P MCBs. It shall have cable entry at the bottom suitable for terminating double compression glands for minimum 1 Runs of 4 C X 4 sq.mm Aluminium conductor, XLPE insulated armoured cable at the incoming terminal and minimum 5 Runs of 4 core 4 sq.mm. Aluminium conductor, XLPE insulated armoured cable at the outgoing terminal.

5.3.12 There shall be balance distribution of load among the all LTDB, feeder pillars and LDBs. Load on each circuit shall be equally distributed.

5.3.13 All MCCB/MCBs/ RCBOs/RCCBs shall be comply with the relevant IS and IEC standards. It shall be current limiting type and shall provide a cut off in, < 10 ms for prospective currents during faults. It shall be provided with fixed thermal overload, short circuit and earth fault release as appropriate. The breaking capacity of the MCB shall be 10KA for 1 sec.

5.3.14 Both the doors shall have panel type lock with keys in duplicate as per the requirements of the RSCL.

5.3.15 All the LTDB and feeder pillars provided for landscape area shall be of uniform height and shall be mounted with the bottom of the panel at minimum 500mm above the Finished Ground or Floor level as the case may be supported with metal structure and foundations.

5.3.16 Feeder Pillars and LDBs provided for Riverfront area shall be mounted at sufficient height (not less than 1 m or above the flood level) near pedestal area or alternately can be mounted in elevated garden area so that river water cannot enter it during rainy/flood season The panel shall be within operable height i.e. less than 1800m.

5.3.17 A danger notice board written in English, Hindi and Assamese shall be made of 2mm thick GI plate and shall be provided on the front door of the feeder pillar.

5.3.18 The power and control components are as listed below;

(i) Copper bus bar with SMC support insulators shall be provided for power distribution within the feeder pillar. The size of phase and neutral shall be equal.

(ii) All connecting power & control wiring shall be carried out with stranded copper conductor PVC insulted wires. Minimum size of control wiring shall be 1.5 sq. mm and power wiring shall be 4 sq. mm.

(iii) An Aluminium / GI Earth bus shall be run at the bottom of the Feeder Pillar which shall be connected to the earth leads at the two extreme ends for connecting the GI earthing strip from the electrode.

5.3.19 DWC HDPE pipe of suitable size (minimum 40 mm) for conveniently accommodating the above incoming and outgoing cables shall be laid upto the feeder pillar for carrying the buried cables upto the feeder pillar for termination. The GI strip for earthing shall be laid with proper dressing.
5.3.20 The LTDBs and feeder pillar shall be mounted on prefabricated Galvanised Steel Support structure duly fastened with a concrete foundation with M20 concrete suitable to sustain the local geological conditions, seismic conditions and max wind speed requirements.

5.3.21 Painting:
(a) All sheet steel work shall be paint through 7 tank electrostatic powder coating process in accordance with the required procedure and with the applicable standards. The DB enclosures shall be powder coated with shade as per RAL-7032.
(b) The final finished thickness of paint film on sheet steel enclosure shall not be less than 80 microns. Finished painted appearance of equipment shall present an aesthetically pleasing appearance, free from dents and uneven surfaces.

5.3.22 Earthing
(a) Al/ GI earth bus bars of adequate size shall be provided for the entire length of the panel. The framework of the enclosure shall be connected to this earth bus. Provisions shall be made for connection form this earth bus to the main earthing bus bar coming from the earth pit on both sides of the DBs.
(b) The earth continuity conductor of each incoming and outgoing feeder shall be connected to this earth bus bar. The armour of cables shall be properly connected with earthing clamp and the clamp shall be ultimately bonded with the earth bus bar.

5.3.23 Cable Entry:
(a) The DBs shall have provisions of cable entry from bottom. The removable cable gland plate shall be provided to make entry dust and vermin proof.
(b) The DBs shall have provisions for fixing the multi-core cable glands.
(c) The cable glands support plates shall be 3 mm thick.
(d) Cable entries to the DBs shall be from the bottom unless otherwise specified. Cable gland shall be double compression screwed type and made of brass.

5.3.24 Molded Case Circuit Breakers (MCCB)
(a) The MCCBs shall conform to IEC 60947 & the latest applicable standards.
(b) All MCCBs shall be of fixed type unless otherwise specified in the specifications elsewhere.
(c) MCCBs shall be of four pole with neutral construction arranged for simultaneous four/three-pole manual closing and opening and for automatic instantaneous tripping on short circuit.
(d) The ON, OFF and TRIP positions of the MCCB shall be clearly indicated by using LED indications.
(e) MCCBs shall be with ICS = ICU = 100%
(f) MCCB shall be capable of withstanding the thermal stresses caused by overloads and the mechanical stresses caused by the peak short circuit current of value associated with the switch gear rating.

(g) All the MCCBs shall be of current limiting type and shall provide a cut off in 4-8 milliseconds for prospective currents during faults.

(h) All the MCCBs shall be provided with rotary operating handle with door interlock.

(i) MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit ratings.

(j) All MCCBs shall be provided with additional 2 NO + 2 NC contacts, exclusively for Purchaser’s use.

5.3.25 Power & Control Wiring Connections:

(a) Terminals for both incoming and outgoing cable connections shall be suitable for 1.1kV grade Al/ Cu conductor XLPE armoured cable and shall be suitable for connections of solder less sockets for the cable size.

(b) Both control and power terminals shall be properly shrouded. Power terminals shall be of stud type.

(c) 20 % spare terminals shall be provided on each terminal block. Sufficient terminals shall be provided on each terminal block so that not more than one outgoing wire is connected to per terminal.

(d) Suitable barriers of enclosures shall preferably separate terminals strips for power and control from each other.

(e) Wiring inside the modules for power, control, protection and instruments etc shall be done with use of 1.1 kV grade, multi stranded Cu, PVC FRLS wiring.

(f) Wires for connection to the door shall be flexible. All conductors shall be crimped with solder less sockets at the ends before connections are made to the terminals.

(g) Particular care shall be taken to ensure that the layout of wirings is neat and orderly. Identification ferrules shall be filled to all the wirings terminations for ease of identification and to facilitate checking and testing.

(h) Washers shall be used for all Copper and Aluminum connections.

(i) Final wiring diagram of power and control circuit with ferrule nos shall be submitted along with the DBs as one of the documents against the contract.

5.3.26 Terminals:

(a) The outgoing terminals and neutral shall be brought to a cable alley suitably located and accessible from the panel front.
(b) The current transformer for instruments metering shall be mounted on the disconnecting type terminal blocks. No direct connection of incoming or outgoing cables to internal components of the distribution board is permitted; only one conductor may be connected in one terminal.

5.3.27 Current Transformers:

(a) Current transformers shall be of cast resin type. Insulation Class shall be Class ‘E’ or better.

(b) Unless otherwise specified, the minimum performance requirement of current transformers is as follows:

I. Measuring CTs - Burden as per requirement with 20% buffer, accuracy class 1.0.

II. Current transformer (CT) shall have polarity markings indelibly marked on each transformer and at the lead terminations at the associated terminal block

III. CT shall be able to withstand the thermal and mechanical stresses resulting from the maximum short circuit current

IV. Test links shall be provided in both secondary leads of the CTs to easily carry out current and phase angle measurement tests.

V. Identification labels giving type, ratio, output and serial numbers shall be provided.

5.3.28 Indicating Lamps shall be, Clustered LED type and of low watt consumption.

5.3.29 Junction Box

(a) 3 way junction boxes with terminals shall be provided for branching and terminating lighting cables when required for Landscape area lighting.

(b) The junction boxes shall be dust and vermin proof and shall be made up of Thermoplastic with removable cover plate, two earthing terminals each with nut, bolt and washer. Boxes shall be additionally weather proof. The Junction Box shall have ingress protection of IP67.

(c) The boxes shall have provision for wall, column, pole or structure mounting or buried underground and shall be provided with cable/conduit entry knock outs, terminal blocks, as required.

(d) The terminal blocks, with specified number of terminals, shall be mounted securely on brackets welded to the back sheet of the box. The terminals shall be 1100 V, grade, one piece construction complete with terminals, insulation barriers, galvanised nuts, bolts and washers and provided with identification strips of PVC. The terminals shall be made of Copper alloy and shall be of box clamp type.

5.4 CABLING SYSTEM

5.4.1 All the LV Power cables shall be 1100V grade, multi-stranded, Al / Copper conductor, XLPE insulated, extruded inner & outer PVC sheath compound type ST2 and galvanised steel strip.
5.4.2 All cables shall conform to IS 7098 – Part I-1988 (Reaffirmed 2003) and all armouring shall confirm to latest version of IS: 3975-1999.

5.4.3 For all LT power and control cables, double compression glands with aluminium lugs for Aluminium cables and tinned Copper lugs for Copper cables shall be used in indoor and outdoor application.

5.4.4 The termination shall be inclusive of miscellaneous items such as clamps, cleats, cable tags, cable markers etc.

5.4.5 In general cable installation works shall be carried out in accordance with IS 1255 – 1983 (Reaffirmed 1996).

5.4.6 For Underground cables, all cables shall be laid in HDPE and DWC pipes laid by excavation. The top of the pipe shall be atleast 1000mm below the finished ground level. There should not be any joints between two lighting fixtures.

5.4.7 Separate cables shall be provided for Pathway lighting, tree lighting and area lighting. The cables shall be laid in HDPE pipe of size not less than 40 mm by excavation 750mm below finished ground level.

5.4.8 The Cables for Pathway/ Walkway lighting shall be laid in the Conduit.

5.4.9 LTDB incoming cables shall be provided in Double walled corrugated pipes (DWC) of size not less than 110 mm by excavation 750mm below finished ground level.

5.4.10 Cables within the Landscape area shall be laid buried in DWC pipe not less than 40mm dia. The cables shall be looped between the fixtures with the help of Junction box.

5.4.11 Cable Glands
(a) Double compression type cable glands with rubber hoods shall be used for the termination of all the power and control cables. Cable glands shall be brass casting, machine finished and Nickel-plated to avoid corrosion and oxidation. Rubber components used in cable gland shall be of neoprene.

(b) For single core cables, gland shall be with brass ring.

(c) Cable glands shall be with metric threads.

(d) Cable glands shall be conical (& not flange type).

(e) All glands shall be provided with rubber hoots.

5.4.12 Cable Lugs
(a) Cable lugs shall be of tinned Copper, solder less crimping type for Cu cables & Al lugs for the Al cables.

(b) The current rating of the lugs shall be same as that of the respective cable conductors.

(c) Ring type cable terminations shall be used.

(d) Insulated lugs are not acceptable for any cable terminations.
(e) Bi-metal strip/ Bi-metallic lug shall be used whenever two different metals are to be connected together.

(f) Fork terminals shall be used for luminaries& decorative switch/ socket. Pin terminals may be acceptable during execution only in case other terminals/ lugs cannot be accommodated.

(g) Reducer / wire pin terminals shall be avoided for MCB terminations. MCB terminations shall be with ‘long palm terminals.

(h) All terminations in Feeder Pillars / enclosure for earthing & neutral busbars / terminals shall be with ring type terminals.

(i) All earthing terminations shall be with ring type lugs only.

(j) All control & interlock cable terminations shall be with ring type lugs.

(k) Anticorrosion/ anti-oxidation compounds shall be used for crimping lugs. This shall especially be ensured for Al cable terminations & any bimetallic terminations (Cu cable termination using tinned Copper lugs).

5.4.13 If termination is done with crimping tool employing crimping die then forming dies shall be used to make the sector shaped conductor into a round conductor before crimping the lugs on the conductor. The lug must not be crimped directly on the sector conductor. Before crimping the lug, the conductor shall be thoroughly cleaned and special jelly applied over it to prevent further oxidation.

5.4.14 Point Wiring

(a) Point wiring work shall include the, PVC conduit, joints, connectors, conduit accessories, FRLS PVC insulated stranded copper conductor wires and earthing wires, pull boxes, ceiling rose, clamps, cleats, hardware, accessories, anchor fasteners, modular switch boards with cover plates, switches, sockets, box, blank plates, receptacles and all other necessary accessories as per specifications etc.

(b) Wiring shall be done in wire colour codes. Colour code of wire for Phases, Neutral and Earth shall be separate. The necessary connector if found required for looping of wires from one switchboard to another switchboard shall be included in the scope.

(c) Lighting fixtures and toilet exhaust fans shall be grouped on the single circuit wherever required. However, separate circuits shall be used for receptacles wiring.

(d) Wires of the different phases shall not be laid in the same conduit.

(e) Switchboard shall be recessed mounted.

(f) The switch boxes, receptacle boxes etc. shall be made up of 16 SWG sheet steel.

(g) The wire and cable indicated below for distribution of the power are the minimum requirement. The CONTRACTOR shall arrive at the actual size based of the design criteria
mentioned above.

(h) Point wiring in the Shops, Electrical room, Admin office, Ticket & information centre and Public Toilet block shall be done as per the following points,

(i) Point Wiring for the luminaries from the DB to the switchboard and from the switchboard to the luminaries shall be done with 750V grade min 2.5 Sq.mm (2Nos.-Ph.+N) & 1.5 Sq.mm (for earthing of socket) PVC insulated, multistrand Cu conductor flexible wires running through 25mm inner dia.1.6mm thick, black stove enamelled painted PVC conduit running concealed/exposed in false ceiling and concealed on brick wall

(ii) Point Wiring for the 6A Raw power socket from the DB shall be done with 750V grade 2.5 Sq.mm (2Nos.-Ph.+N) & 1.5 Sq.mm (for earthing of luminaire) FRLS PVC insulated, multistrand Cu conductor flexible wires running through 25mm inner dia.1.6mm thick black stove enamelled painted PVC conduit running concealed/exposed in false ceiling and concealed on brick wall.

5.5 DG SET

5.5.1 The scope of works include supply, installation, testing and commissioning of DG-Set with weather proof acoustic enclosure, AMF panel for providing stand-by source of power supply.

5.5.2 The DG Set shall be complete with Diesel engine coupled with Alternator, DG Controller panel mounted on common base frame with anti vibration pads, etc.

   a) The Diesel engine shall be complete with Lube oil system, HSD day tanks, Radiator cooling system, Electrical starting system along with control panel suitable for Automatic Mains Failure (AMF), Air intake and Exhaust system, Fuel oil system, engine mounted accessories, day tank, nameplate and piping and associated instrumentation etc.

   b) The Alternator shall be complete with excitation system, Automatic Voltage Regulator (AVR) and Governing system.

   c) Common base frame for Engine and Alternator coupled together complete with DG controller, interconnecting piping, anti vibration pads etc.

5.5.3 The diesel engine shall be suitable for High Speed Diesel (HSD) firing.

5.5.4 The acoustic enclosure shall be compatible to restrict noise level below 75 dB at distance of 1 m. Contractor to provide extra cover if required for acoustic enclosure.

5.5.5 The complete DG set with common base frame shall be provided with adequate number of anti vibration pads for mounting on a foundation block.

5.5.6 DG set shall be capable of black start and shall be designed without any limitations on the number and frequency of starts.

5.5.7 The DG sets shall be capable of automatic starting in advent of main electric supply failure. Additional provision for manual starting shall be provided.

5.5.8 The DG Set should be designed to eliminate harmful vibration stress during normal operation, acceleration & deceleration.

5.5.9 The complete DG Set should be mounted on a rigidly fabricated steel base and longitudinal beams shall be rigidly deployed with cross braces to avoid buckling during transportation,
installation & operation.

5.5.10 The DG Set moving parts should withstand 15% of the rated synchronous speed. However the Generator, exciter & fly wheel should be designed to withstand over speed of 25% without damage.

5.5.11 Casting & Forging shall confirm to the respective material specifications as per standard and details of the same should be submitted with the ENGINEER/PURCHASER for verification and record.

5.5.12 The parts subjected to friction & large variation in temperature should be designed to support/permit expansion and contraction without resulting in leakage & damage.

5.5.13 Fuel Oil Lines(part of DG Set) should be designed to locate as far as possible away from the engine exhaust lines so that the damage to the neighboring part or equipment is prevented in the event of pipe break or leakage.

5.5.14 All the piping used for DG Set Construction should be hydro-tested at 1.5 times of the rated pressure for a minimum of two hours and report for the same should be submitted with PURCHASER. All terminal connections and joints shall be of welded type. Flanged, screwed connections and joints should be avoided.

5.5.15 HP rating, Fuel Consumption guarantee should be as per standard.

5.5.16 CONTRACTOR shall have rigid inspection procedure laid down to ensure quality of workmanship, material specifications, painting quality, drawings, mechanical and electrical accuracy of components in his works.

5.5.17 The Direction of Rotation of the Machine should be marked properly in visible/strategic locations.

5.5.18 Starting of the DG set shall be with Electric starting system and same shall be complete, but not limited to the following:
   a) Starter motor.
   b) Maintenance free batteries, with capacity suitable for minimum six (6) starts.
   c) Engine driven Battery charger.

5.5.19 Diesel engine

5.5.20 Diesel Engine shall be of proven design, direct injection; radiator cooled conforming to ISO 3046 / BS 5514 and complete with following system:
   a) Lube Oil System with initial fill of lube oil.
   b) Engine cooling system with Radiator and engine driven fan.
   c) Electric starting system with starter, maintenance free batteries and AC mains charger.
   d) Air intake and Exhaust system
   e) Fuel Oil system with day tank.

5.5.21 AIR INTAKE SYSTEM

The Air Intake System shall be complete, but not limited to the following:
   a) Engine mounted Air intake filter and silencer.
   b) All necessary piping including, specialties like bends, flanges, expansion joints, etc.; and supports.
5.5.22 **LUBE OIL SYSTEM**

It shall be complete in all respects but not limited to the following:

- a) Engine Mounted Lube Oil Sump.
- b) Engine operated lube oil pump.
- c) Plate/Shell and tube type water cooled lube oil cooler.
- d) Full flow paper cartridge type oil filters.
- e) All necessary piping, valves, specialities, instrumentation and supports.
- f) First fill of lube oil and all other lubricants, greases and consumables.
- g) Pressure switches shall be provided to give alarm if pressure falls below a set value and subsequently TRIP the unit when the minimum safe pressure limit is reached. Level Indicator/Dip stick shall be provided for level measurement.

5.5.23 **ENGINE COOLING SYSTEM**

Radiator cooled engine shall be provided. For Radiator cooled engine, the engine cooling system shall complete, but not limited to the following:

- a) Radiator with engine driven fan
- b) All necessary piping, valves, specialities, instrumentation and supports

5.5.24 **FUEL OIL SYSTEM**

Day tank with fittings and instruments as mentioned in Data sheet A shall be provided for each DG set.

5.5.25 The day tank, as minimum, shall have following accessories:

- a) Inlet connection with filter and flange
- b) Inlet connection for return from fuel pump
- c) Outlet connection with valve
- d) drain connection with valve
- e) overflow connection with flange
- f) Vent connection
- g) Manhole/Handhole for cleaning
- h) Level gauge with isolation valves
- i) Two (2) numbers level switches with two independent switch contacts each, for ‘High’ and ‘Low’ oil Level.

5.5.26 **Fuel system**

Fuel (Diesel) system to the engine shall be supplied from a fuel tank. The supplier should provide a fuel tank of adequate capacity, including 10% reserve capacity to be installed in a weather proof enclosure. The supplier should provide mechanical fuel level indicator with ‘Low’ and ‘High’ markings. Also fuel level indication should be provided in the AMF panel with alarm for Fuel level ‘low’. The fuel tank shall be free standing, floor mounting type with mounting brackets, fuel inlet and outlet, air vent, drain plug, opening with cover for direct filling from the top of the tank.
5.5.27 Engine starting system

Starting of the diesel engine shall be of electric starting. The electric starting system should have starter motor, Lead acid starter Batteries, battery charger and necessary instrument and accessories to indicate the condition of the batteries.

5.5.28 Batteries

The batteries shall be sized taking in to account the starting load requirement of the DG set. Lead acid batteries, of suitable capacity to start the engine by 24V DC electrical starting Motor without struggling, and with suitable capacity of battery cable. The batteries must be capable to try 3 unsuccessful starts continuously. The batteries have to be placed on a suitable well painted steel stand.

5.5.29 Air intake system:

Air intake system should have requisite air filters and complete interconnecting piping, supports etc.

5.5.30 EXHAUST PIPING AND STACK

5.5.31 Each DG set shall be provided with heavy-duty residential type silencer. Exhaust stack, if specified in data sheet A, shall be self supported and designed as per IS 6533-1989 (Reaffirmed 2010).

5.5.32 The exhaust of each DG Set shall be led through separate exhaust air ducting. The ducting shall comprise of necessary fittings, expansion joints, Residential type silencer, Rain Hoods etc. This ducting shall be routed out of the acoustic enclosure & structurally supported. Vertical run of exhaust ducting shall be as per the statutory requirements of central and local pollution control board. The structural support could be common for more than one vertical run of exhaust of DG sets. The exhaust ducting and supporting structure shall be supplied and installed by the CONTRACTOR complete with all supports, hangers, hardware, expansion joints and insulation with cladding. Bending radius of pipes/ducts should be more than three times of the NB of chosen pipe.

Engine governing system: The engine governing system shall be of class ‘A’ hydraulic governor. An over speed trip mechanism shall be provided to automatically shut off the fuel supply in case of set speed reading above 110% of rated speed.

5.5.33 The Alternator

The Alternator shall be screen protected, drip proof, separately excited system (with PMG) of brush less, continuously rated to give an output at 0.8 pf at 415V, 50Hz, 1500rpm,3 phase, 4wire. The alternator should be provided with automatic voltage regulator with voltage regulation of ± 0.5% (MX321) and is designed, tested for confirming to IS 4772-1983 (Reaffirmed 2001) or IEC 34-2016.

The insulating material of the alternator shall be non-hygroscopic and fully tropicalised. The Alternator shall be suitable for operation with its neutral solidly grounded. The neutral shall be formed at the terminal box.

Alternator windings shall be of Class H insulation with Class F temperature rise and tropicalised. The alternator shall have pre-packed grease lubricated ball or roller bearings and provided with facilities for re-greasing whilst in service.
The alternator shall be capable of maintaining a short circuit current of three times full load current for a period of 10 seconds. The alternator shall be fitted with an anti-condensation heater. No individual harmonic shall exceed 1% and the total harmonic shall not exceed 3%. The alternator, its neutral and control panel shall be earthed as per relevant standards. The alternator rotor assembly shall comprise exciter rotor, full wave silicon bridge rectifier surge protection device and salient pole rotating field system. The rotor shall be fitted with interconnected pole face damping windings. Voltage regulation shall be maintained to within ±2.5% for a power factor of 0.8 to unity, including hot to cold variations. The steady state frequency droop between no load and full load shall not exceed 5%. Transient voltage deviation following a step load of 60% of rated at a power factor of between 0.4 and zero shall not exceed 15% with a voltage recovery time to 97% rated voltage not exceeding 0.5 second. The set shall be capable of continuous operation with a phase current imbalance of 33% of rated current whilst maintaining the output voltage within ±5% of rated.

5.5.34 Mounting

Design, fabricate suitable base frame, which is a welded construction using channel iron etc. to mount D-G set. The whole set and base frame should be mounted on 12 Nos. (min) of heavy duty type Anti vibration mounts of DUNLOP’ (b – SERIES) or its equivalent make.

5.5.35 AMF control panel

The automatic mains failure (AMF) panel should be made out of well painted 16SWG sheet steel enclosure with necessary components like MCCB for local isolation, control relays, timers, busbars, protective relays, metering, battery charger, indication, annunciation system etc should be provided.

The panel shall be inbuilt in the DG acoustic enclosure, mounted on the surface such that it can be operated and monitored from outside/ without entering the enclosure.

The AMF should be operating in Test/ manual / auto mode and 3 attempt starting facility with necessary control relays.

5.5.36 Earthing

The Generator Neutral should be earthed with 2Nos. of Copper plate electrode and GI pipe electrode for Body earthing as per IS 3043-2018.

5.5.37 Tests

Supplier shall perform all standard tests (Shop tests) on Engine and alternator and the test reports pertaining to the engine and alternator should be submitted.

5.5.38 Acoustic and Weather proof Enclosure

Acoustic enclosure for DG set along with DG controller. The DG set with the acoustic enclosure shall be type tested and certified from approved testing agencies.

The acoustic enclosure or acoustic treatment of enclosure shall be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on the higher side.

The DG set shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB (A) as per applicable CPCB norm requirements.
5.5.39 STATUTORY APPROVALS
The CONTRACTOR shall obtain approval from the Statutory Bodies listed herein. All the input data, documents and drawings etc. required for obtaining approvals from the Statutory Bodies shall be prepared and submitted by the CONTRACTOR:

a) Electrical Inspector  
b) Local Electric Supply Company  
c) Local Pollution Control Authority  
d) Airport authority (if required)

5.5.40 TRAINING OF PURCHASER's PERSONNEL

a) The CONTRACTOR shall undertake to train two Supervisors selected and sent by PURCHASER. These Supervisors shall be given special training in shop laboratory and drawing office of the CONTRACTOR where the equipment will be designed, manufactured and in any other plant where similar capacity and type of system designed, manufactured and supplied by CONTRACTOR are under installation, testing, operation and maintenance to enable the Supervisors to get completely conversant with the system / equipment supplied under this contract.

b) The period of training shall be minimum one (1) week per engineer.

c) The CONTRACTOR’s supervisory personnel at site shall continuously and intensively instruct and train adequate number of PURCHASER's operating and maintenance personnel at site during commissioning of the plant to enable them to take over the proper operation and maintenance of the plant after commissioning.

5.5.41 PAINTING
All the exposed, un-insulated surfaces shall be painted as per following:

a) Paint shall be 2 coats of primer followed by 2 coats of epoxy paint. Paint thickness shall be minimum 120 micron DFT.

b) The grade of paint shall be chosen such that it will withstand the maximum temperatures to which the components painted will be subjected to.

c) Any intermediate cleaning required between successive coats of paint shall also be carried out as per the manufacturer’s standard.

d) All the machined surfaces should be protected against rust and corrosion by applying Rust Inhibitor before assembling. All the casted items should be sand blasted, degreased and thoroughly cleaned before painting.

5.5.42 GUARANTEES AND PERFORMANCE REQUIREMENTS

A) GENERAL
The DG Set shall perform satisfactorily to meet the guarantee requirements specified to the entire satisfaction of the PURCHASER / ENGINEER.

B) DESIGN LIFE
a) Design Life of rotating equipment (like Engine, alternators etc) and static equipment (Acoustic Enclosure, HSD storage tank) shall be minimum fifteen (15) years and twenty
(20) years respectively.

b) The bidder shall furnish schedule of routine maintenance, periodic maintenance and major overhaul of the equipment.

c) The Bidder shall guarantee availability of spares for the equipment offered in his bid for the entire design life.

d) The bidder to furnish address and contact details of nearest service centre and indicate the period taken by the service Engineer to attend the service call.

5.5.43 SYSTEM PERFORMANCE GUARANTEE

The CONTRACTOR shall guarantee that upon completion of work, all installed systems there of shall be in full accordance with the requirements of the contract and shall be perfect as to materials and workmanship and shall remain so for a minimum period of namely twenty four (24) months or 5000 running hrs from the date of successful commissioning and performance testing of the plant whichever is earlier.

CONTRACTOR shall submit charts / performance curves for selected equipment with the operating points duly marked on them. If during the shop test it is found that the equipment does not meet specification, any modification/ replacements of any part or equipment as a whole are required, the same shall be done by the CONTRACTOR at no extra cost to the PURCHASER. For any failures during performance warranty period, the parts shall be supplied at supplier cost including fright, tax and servicing/repair (including labour).

5.5.44 SPECIFICATION OF HIGH SPEED DIESEL (HSD)

The specification of fuel for performance guarantees shall be as follows:

(a) Type of fuel oil HSD
(b) Specification and grade IS: 1460-2005
(c) Kinematic Viscosity @ 40 deg. cSt. 2.0 - 4.5
(d) Density, @ 25°C, Kg/ m³ 827
(e) Flash point, minimum 35°C
(f) Pour point (Winter/ Summer) 3°C / 15°C
(g) Ash content, % by weight Max. 0.01
(h) Water content, % by volume Max. 0.05

5.5.45 QUALITY ASSURANCE/QUALITY CONTROL PROGRAMME

a) Only critical inspection stages have been indicated in the enclosed “Minimum Inspection Requirements” documents. This is however, not intended to form a comprehensive programme as it is the CONTRACTOR’s responsibility to draw up and implement such programme duly approved by the PURCHASER. The detailed Quality Plans for manufacturing and field activities should be drawn up by the BIDDERS, separately in the
format attached and shall be submitted to PURCHASER at the time of submitting his offer.

b) All the sub-CONTRACTORs proposed by the CONTRACTOR for procurement of major bought out item including castings, forgings, semi-finished and finished components/equipment shall be subject to PURCHASER's review/clearance for systems and packages.

c) A consolidated list of all major equipment including bought outs like pumps, valves, fans etc. shall be submitted by the CONTRACTOR along with the offer for PURCHASER's review/comments.

d) The PURCHASER reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the CONTRACTOR's or their SUB-CONTRACTOR's quality management and control activities. The CONTRACTOR shall provide all necessary assistance to enable the PURCHASER to carry out such audit & surveillance.

e) The CONTRACTOR shall undertake an inspection and testing programme during manufacture in his works and that of his sub-contractor to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identification and acceptability of all materials, parts and equipment. He shall carry out all tests/inspections required to establish that the items/equipment conform to requirements of contract specification and the relevant codes/standards specified therein, in addition to carrying out tests as per the approved Quality Plan.

f) CONTRACTOR shall use calibrated instruments for testing, with traceability to NATIONAL /INTERNATIONAL levels. If not the PURCHASER/CONSULTANT will not witness the tests till the same is organised.

g) Only latest edition of the codes/standards and specifications shall be used for materials and testing. The latest edition is reckoned with the date of contract awarded.

h) Copies of all the test certificates/calibration reports/internal inspection reports shall be furnished by the CONTRACTOR during the relevant inspection stages to the PURCHASER/CONSULTANT.

i) The BIDDER shall furnish his fully documented, operational manual on the quality assurance programme (QAP) indicating the following minimum details:

1. Organization chart for the following quality inspection activities:
   i) Purchasing of raw materials and bought out items
   ii) Engineering and design
   iii) Manufacturing

2. Applicable quality standards and procedures for material, design and manufacture including non-destructive testing.

3. QAP for design engineering and documentation control system

4. The inspection and tests programme indicating details of inspections/tests to be carried out during various manufacturing stages indicating acceptance norms, extent of inspection by the CONTRACTOR as given in the enclosed format. PURCHASER will review and approve the
programme indicating his ‘HOLD’ points. These stages will be witnessed by the PURCHASER's ENGINEER/AUTHORISED REPRESENTATIVE.

5. Procurement of control system for equipment or services purchased outside including approval of sub-suppliers/sub-contractors and surveillance on sub-suppliers/sub-contractors.

6. Material control to ensure that only the approved materials are used in the manufacture.

7. Details of final stages of inspection and tests at shops.

8. Corrective actions on items or systems containing significant conditions adverse to quality.

9. Control and inspection of material handling, storage, packing and shipping.

10. Quality records/test certificates/calibration reports of testing & measuring instruments with traceability to National Standards, to provide objective evidence that all quality assurance requirements have been met.

11. Quality assurance based on feedback received from the previous operating installations.

5.6  EARTHING SYSTEM

5.6.1 Applicable Standard:

The general design shall be on the basis of following codes and standards (their latest amendments) in line with design criteria & specification requirements.

(a) IS 3043-2018 –Code of practice for Safety Earthing

(b) Central Electricity Authority (CEA) Regulations – 2010

(c) National Building Code 2016

The maximum values of earth fault current for the design of the earthing system shall be calculated as per the design criteria.

5.6.2 The design basis for designing earthing conductor is indicated under design criteria for electrical system.

5.6.3 GI Pipe electrodes shall be provided for all the equipment and system earthing.

5.6.4 For DG, Two pipe earth pits shall be provided for the body earthing and two copper plate earth pits shall be provided for the neutral earthing.

5.6.5 The earth plate shall be buried in specifically prepared earth pit 3 mtr. below ground with alternate layers of charcoal and salt, 40 NB GI pipe with funnel with a wire mesh for watering and bricks masonry block CI Cover complete as per IS 3043-2018 with necessary length of double Copper earth flat bolted with lug to the plate complete connected to the transformer neutral with end socket as per direction and duly tested by earth tester conforming to IS as per drawing and
specifications complete with 600 x 600 x 3.15 mm Copper earth plate or as specified by CEIG.

5.6.6 Earth electrodes shall be of heavy duty galvanized mild steel pipe of not be less than 40 mm NB or as specified by CEIG. The earth electrode shall be complete with alternate layers of charcoal/ coke, salt and Black cotton soil; GI pipe with meshed funnel for watering; brick masonry block and CI Cover, with necessary test link conforming to IS 3043-2018 or as specified by CEIG.

5.6.7 The minimum spacing between two adjacent earthing pits shall not be less than 2000mm and shall be kept 1500 mm away from footings of the structure.

5.6.8 Earthing chamber shall be of RCC/ brick chamber of 600 mm x 600 mm, with hinged cast Iron chequered cover plates. The covers shall have holes for handling. Earthing pits (chambers) shall be painted Green and the earth-pit number shall be marked on it.

5.6.9 Two separate earth pit shall be provided to outdoor feeder pillars with earth flat. Size of the flat shall be determined with respect to fault level.

5.6.10 GI Pipe electrodes shall be provided 1 No. for every consecutive 5 light poles and stone column lights as per IS 3043 - 2018 or better. Electrode shall be connected to the equipments by two runs of GI strip laid in HDPE/ DWC pipes. Size of the flat shall be determined with respect to fault level. Minimum 8 SWG wire looping shall be done for the group of 5 light poles/stone column lights.

5.6.11 Minimum 8 SWG GI wire shall be carried along with the cable in the HDPE pipe laid for distributing power to the landscape area.

5.6.12 Wherever earthing conductor passes through HDPE pipe, sleeves shall be provided. Both ends of the sleeve shall be sealed to prevent the passage of water through the sleeves.

6.0 MAKE LIST

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Description</th>
<th>Approved Make</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GI Octagonal Lighting Pole</td>
<td>Bajaj/ Philips/ Valmont/ Neozone</td>
</tr>
<tr>
<td>2</td>
<td>LED Chip</td>
<td>Cree, Osram, Nichia, Philips Lumileds</td>
</tr>
<tr>
<td>3</td>
<td>Lighting Fixtures</td>
<td>Philips/ Ligman/ Wipro/ Bajaj/ Havells/Lighting Technology</td>
</tr>
<tr>
<td>4</td>
<td>Cable</td>
<td>UNIVERSAL /RPG/ CCI /KEI/ POLY CAB</td>
</tr>
<tr>
<td>5</td>
<td>DG</td>
<td>Cummins, Kirloskar Oil Engines, Caterpillar, Mitsubishi</td>
</tr>
<tr>
<td>6</td>
<td>Gland/Lugs</td>
<td>As per OPWD Approved list or Dowells, Commet, Connectwell or Equivalent</td>
</tr>
<tr>
<td>7</td>
<td>Earthing Material</td>
<td>As per OPWD Approved list</td>
</tr>
<tr>
<td>8</td>
<td>MCCB , MCB, RCCB, RCBO and other Switchgears</td>
<td>Schneider, Siemens, ABB, L&amp;T, MDS, Hager, Havells, C&amp;S or Equivalent</td>
</tr>
<tr>
<td>9</td>
<td>Time Switch</td>
<td>L&amp;T GIC, Siemens, Schneider, Legrand, Hager, ABB, Havells, C&amp;S or Equivalent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>10</td>
<td>Energy meter, MFM</td>
<td>L&amp;T (Quasar) or Equivalent</td>
</tr>
<tr>
<td>11</td>
<td>Contactor and other switchgears</td>
<td>L&amp;T, Siemens, Schneider, ABB,</td>
</tr>
<tr>
<td>11</td>
<td>HDPE/ DWC Pipe</td>
<td>Rex, Gemini, Duraline, Alcorr or Equivalent</td>
</tr>
<tr>
<td>12</td>
<td>Junction Box</td>
<td>Hensel or Equivalent</td>
</tr>
<tr>
<td>13</td>
<td>LT Panels</td>
<td>As per OPWD Approved list</td>
</tr>
</tbody>
</table>

Note:-

(i) RSCL shall decide the above makes of the materials. The CONTRACTOR has to comply with the approved makes given in the tender document.

(ii) The CONTRACTOR shall offer the equipment of makes mentioned above. Other makes are subjected to Client approval before procurement.

(iii) Samples from all the approved makes shall be offered for selection.

7.0 LIST OF DRAWING AND DOCUMENTS

7.1 Following list of the documents and drawings shall be submitted to RSCL or its representative with Bid documents

(a) SLD of Power distribution
(b) Lighting Design & Calculations for each Area (Dialux IES Files shall be provided along with PDF)
(c) Pictorial formations / digital renders themes/ Views from all angles and close ups using 3D software.
(d) Illumination Concept for each element
(e) 3D Rendered view of identified fixtures from all sides.
(f) Bill of quantity of identified fixtures.
(g) UL/CE/BIS certification of selected luminaries.
(h) Test report of luminaries as per LM79 & L80.
(i) NABL accredited test report of luminaries.

7.2 Following list of the documents and drawings shall be submitted to RSCL or its representative
after award of contract,

7.3 **Calculations**

(a) Electrical Load List and demand Calculations
(b) Earthing Calculations for Electrical System
(c) Cable schedule with Sizing Calculations
(d) Lighting Calculations for each Area (Dialux IES Files shall be provided along with PDF)

7.4 **DG**

(a) DG sizing Calculations
(b) General Arrangement and Sectional Drawing of the DG Set with Acoustic Enclosure, Fuel tank and Foundation
(c) Data sheets of Engine, Alternator, Battery, AVR, AMF panel
(d) General Arrangement of Foundation
(e) Civil Construction drawing of Foundation
(f) Earthing Layout
(g) Engine Drawings and Test Certificates
(h) Alternator Drawings and Test Certificates
(i) AMF Panel
   (i) GA Drawing
   (ii) Power and control Wiring Diagram
   (iii) Type test certificate for IP protection
(j) Bill of Quantities along with Make and Model of each item.
(k) Type test certificates of DG set including Heat Run test and IP protection with Acoustic enclosure.

7.5 **For Light fixtures and luminaries**

(a) Illumination Concept for each element
(b) Lighting Calculations for each Area - Dialux /AGI calculations, visualizations and glare control lumen maintenance. (Software Files shall be provided along with PDF)
(c) Type of Fittings, Soft Copy of Catalogues, Data Sheet, Polar Diagrams, Cone Diagrams, IES Files of the luminaries should be submitted
(d) Pictorial formations / digital renders themes/ Views from all angles and close ups using 3D
software.

(e) Lighting layout of area as per application.
(f) Rendered view of identified fixtures.
(g) Bill of Quantities.
(h) UL/CE/BIS certification of selected luminaries.
(i) Test report of luminaries as per LM79 & L80.
(j) NABL accredited test report of luminaries.

7.6 **For Electrical equipments**

(a) Single Line Diagram for Power Distribution
(b) Equipment Sizing calculations.
(c) Cable layout, Earthing layout.
(d) Bill of Quantities

7.7 **LTDB/ Outdoor Feeder Pillar/ LDB**

(i) GA Drawing
(ii) Type test Certificate for Short Circuit withstand capacity
(iii) Type test certificate for IP protection
(iv) Door open view of Distribution boards
(v) Data sheet of major Equipments
(vi) Wiring Diagram
(vii) Bill of Quantities
(viii) Makes Of Components offered
(ix) Foundation drawings and supporting arrangement drawing

7.8 **Octagonal Poles**

(i) GA Drawing
(ii) Type test Certificates
(iii) Foundation drawings

7.9 **Construction Drawings of the following**

(a) Cable schedule
(b) Circuit distribution scheme
(c) Cable routing drawing
(d) Equipment Layout
(e) Power Distribution Scheme
(f) Switch Board Schedule
(g) Point Wiring Drawing for Lighting and power
8.0 **DATA SHEET**

a) **For Indoor Luminaries**-

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Requirements / Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>LED Luminaries complete with all accessories for recess / surface / pendant mounting</td>
</tr>
<tr>
<td>Rated Voltage</td>
<td>240V</td>
</tr>
<tr>
<td>Operating Voltage Range</td>
<td>220-240 volt AC.</td>
</tr>
<tr>
<td>Frequency</td>
<td>50±3 Hz</td>
</tr>
<tr>
<td>Driver Type</td>
<td>Constant Current based Electronic Driver</td>
</tr>
<tr>
<td>Housing Material</td>
<td>Metallic CRCA Powder Coated Body/Extruded aluminum frame</td>
</tr>
<tr>
<td>Mounting</td>
<td>Recess/Surface Mounted</td>
</tr>
<tr>
<td>Optics</td>
<td>Symmetric</td>
</tr>
<tr>
<td>System Power Efficiency</td>
<td>≥ 85%</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-20 Deg C to + 50 Deg C</td>
</tr>
<tr>
<td>Operating Humidity</td>
<td>10% to 90% RH</td>
</tr>
<tr>
<td>System efficacy</td>
<td>≥100 Lm/Watt; (≥65 Lm/Watt)</td>
</tr>
<tr>
<td>LED chip Efficacy</td>
<td>LM80 report, to be submitted.</td>
</tr>
<tr>
<td>LED Drive Current</td>
<td>&gt;350 – &lt;750 mA</td>
</tr>
<tr>
<td>Leakage Current</td>
<td>As per IEC 60598</td>
</tr>
<tr>
<td>LED Wattage</td>
<td>1-3 W</td>
</tr>
<tr>
<td>Power Factor</td>
<td>≥0.90</td>
</tr>
<tr>
<td>Colour Rendering Index</td>
<td>≥70</td>
</tr>
<tr>
<td>Rated Minimum LED Life</td>
<td>50,000 Burning Hours</td>
</tr>
<tr>
<td>Driver Life</td>
<td>&gt;50000 Burning Hours</td>
</tr>
<tr>
<td>Parameters</td>
<td>Requirements/Values</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Maximum temperature rise for the Driver</td>
<td>≤ 30 Deg C from ambient</td>
</tr>
<tr>
<td>Heat Sink Temperature</td>
<td>≤ 15 Deg C from ambient</td>
</tr>
<tr>
<td>Total Harmonics Distortion (THD)</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>IP Protection</td>
<td>IP 20</td>
</tr>
<tr>
<td>IK protection for Optic Cover</td>
<td>&gt;IK05</td>
</tr>
<tr>
<td>Minimum Surge Protection</td>
<td>&gt;3kV</td>
</tr>
<tr>
<td>Protection Required in Driver Module</td>
<td></td>
</tr>
<tr>
<td>Short Circuit</td>
<td>Yes; Constant current limit mode.</td>
</tr>
<tr>
<td>Over Voltage</td>
<td>Yes;</td>
</tr>
<tr>
<td>Over Temperature</td>
<td>Yes; Auto Shut Off.</td>
</tr>
<tr>
<td>Under Voltage</td>
<td>Yes;</td>
</tr>
<tr>
<td>String Open Protection</td>
<td>Yes;</td>
</tr>
</tbody>
</table>

**For Road Light Luminaries-**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Requirements/Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>LED Luminaries complete with all accessories including driver, internal wiring with FRLS wires, etc., for Road Lighting, Parking Lighting, Entry-Exit Lighting, etc.</td>
</tr>
<tr>
<td>Rated Voltage</td>
<td>240V</td>
</tr>
<tr>
<td>Operating Voltage Range</td>
<td>220-240 volt AC. But luminaries shall be tested for 100V to 300 V AC</td>
</tr>
<tr>
<td>Frequency</td>
<td>50 Hz +/- 3%</td>
</tr>
<tr>
<td>Power Factor</td>
<td>&gt; 0.95</td>
</tr>
<tr>
<td>LED wattage</td>
<td>1-3 Watt</td>
</tr>
<tr>
<td>LED chip Efficacy</td>
<td>&gt;135 Lm/Watt system lumen output at 25 degree C, supported by LM80 report, to be submitted.</td>
</tr>
<tr>
<td>Parameter</td>
<td>Specification</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>LED Drive current</td>
<td>&gt;=350 mA&lt;750 mA</td>
</tr>
<tr>
<td>LED Beam Angle</td>
<td>CONTRACTOR to decide</td>
</tr>
<tr>
<td>Colour Temperature</td>
<td>≥5500K.</td>
</tr>
<tr>
<td>Rated Minimum LED Life (L70)</td>
<td>50000 Burning Hours (With only 30% Lumen Degradation or 70% Lumen maintenance)</td>
</tr>
<tr>
<td>System efficacy</td>
<td>≥ 100 Lm/Watt</td>
</tr>
<tr>
<td>Total Lumen Output</td>
<td>CONTRACTOR to offer</td>
</tr>
<tr>
<td>Colour Rendering Index of Luminaires</td>
<td>&gt;70</td>
</tr>
<tr>
<td>System Power Efficiency</td>
<td>≥ 90%</td>
</tr>
<tr>
<td>Driver Type</td>
<td>Constant Current based Electronic Driver</td>
</tr>
<tr>
<td>Driver Efficiency</td>
<td>&gt; 90%</td>
</tr>
<tr>
<td>Driver Life</td>
<td>&gt;50000 hrs.</td>
</tr>
<tr>
<td>Maximum temperature rise for Driver</td>
<td>&lt;30 Deg C at 45 Deg C ambient</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-20 Deg C to + 50 Deg C</td>
</tr>
<tr>
<td>Luminaries body temperature after 12 hours of continuous operation</td>
<td>≤ 30 Deg C from 45 Deg C ambient</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>&lt; 85 Deg C - self certified by Manufacturer</td>
</tr>
<tr>
<td>Heat Sink Temperature</td>
<td>≤ 15 Deg C from ambient</td>
</tr>
<tr>
<td>Solder point temperature</td>
<td>&lt; 70 Deg C</td>
</tr>
<tr>
<td>Operating Humidity</td>
<td>10% to 95% RH</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>Control Gear</td>
<td>Prewired with low smoke halogen free, fire retardant e beam cable up to terminal block. Fuse protection shall be provided inside.</td>
</tr>
<tr>
<td>Operating Hours</td>
<td>Dusk to Dawn (max 12 Hrs.)</td>
</tr>
<tr>
<td>Total Harmonics Distortion (THD)</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>Construction</td>
<td>High power SMD and LED must be mounted on Copper MCPCB for high thermal conductivity and fastest heat transfer from the LED junction</td>
</tr>
<tr>
<td>IP Protection</td>
<td>IP66 or more; no water stagnation anywhere</td>
</tr>
<tr>
<td>Luminary Housing</td>
<td>Pressure Die Cast Aluminum (grade 5000 or similar) housing with corrosion resistant polyester powder coating &amp; safety as per IEC 60598-2014,Amd 2017 / IS 10322-1982 (Reaffirmed 2005). Mounting bracket with aiming &amp; locking facilities. Large surface area with fins to dissipate the heat to ambient air</td>
</tr>
<tr>
<td>Heat Sink</td>
<td>Well-designed thermal management system with defined heat sink - Aluminium extrusion</td>
</tr>
<tr>
<td>Clip / Fastners</td>
<td>Corrosion free/ Stainless steel.</td>
</tr>
<tr>
<td>Wire</td>
<td>The connecting wires used inside the luminaries, shall be Low Smoke Halogen Free, fire retardant e-beam cable and fuse protection shall be provided in input side.</td>
</tr>
<tr>
<td>Materials</td>
<td>Halogen free and fire retardant confirming to UL94.</td>
</tr>
<tr>
<td>Optics</td>
<td>Secondary lens array should be provided for optimized roadway photometric distribution. Lens material should be optical high grade PMMA with more than 90% light transmittance.</td>
</tr>
<tr>
<td>IK protection for Optic Cover</td>
<td>&gt;IK07</td>
</tr>
</tbody>
</table>
### c) For Flood Lights:

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>LED Luminaries complete with all accessories for Ghat area Lighting</td>
</tr>
<tr>
<td><strong>Make of LED</strong></td>
<td>Cree/Nichia/Osram/Lumileds</td>
</tr>
<tr>
<td><strong>Body of fittings</strong></td>
<td>Die Cast Aluminium</td>
</tr>
<tr>
<td><strong>Wattage</strong></td>
<td>Not less than 100 W</td>
</tr>
<tr>
<td><strong>System efficacy (lm/w)</strong></td>
<td>Minimum 110lm/watt</td>
</tr>
<tr>
<td><strong>Luminaries capable for color changing</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>CCT</strong></td>
<td>6000 K</td>
</tr>
<tr>
<td><strong>Operating voltage</strong></td>
<td>100-270 VAC</td>
</tr>
<tr>
<td><strong>Lifetime</strong></td>
<td>50000 Hours @L70 25 Degree C</td>
</tr>
<tr>
<td><strong>Operating Temperature</strong></td>
<td>0 to +45 degree Centigrade</td>
</tr>
<tr>
<td><strong>Ingress Protection</strong></td>
<td>IP66</td>
</tr>
<tr>
<td><strong>Mandatory test reports</strong></td>
<td>LM-79,LM80</td>
</tr>
<tr>
<td><strong>Luminaire connectors</strong></td>
<td>Weather proof IP rated connectors</td>
</tr>
<tr>
<td><strong>Lens type</strong></td>
<td>Tampered Glass</td>
</tr>
<tr>
<td><strong>Surge Protection</strong></td>
<td>Minimum 5kV internal and 10kV external</td>
</tr>
</tbody>
</table>
d) For Walkway and Pathway Luminaries -

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>LED Luminaries complete with all accessories for Pathway and Walkway Lighting</td>
</tr>
<tr>
<td>CCT</td>
<td>Minimum 3000K</td>
</tr>
<tr>
<td>Ingress Protection</td>
<td>IP65</td>
</tr>
<tr>
<td>Impact protection</td>
<td>IK07</td>
</tr>
<tr>
<td>Mounting</td>
<td>Pole top entry suitable for Luminaire mounting</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>220-240V AC</td>
</tr>
<tr>
<td>Wattage</td>
<td>Not less than 40 W</td>
</tr>
<tr>
<td>Lumen O/P</td>
<td>85 lm/watt</td>
</tr>
<tr>
<td>CRI (typical)</td>
<td>70 (nominal)</td>
</tr>
<tr>
<td>Power factor</td>
<td>&gt;0.9</td>
</tr>
<tr>
<td>Operating Voltage Range</td>
<td>140 V — 270 V at 50Hz (+/- 5%)</td>
</tr>
<tr>
<td>Working temperature</td>
<td>0 to +45 degree Centigrade</td>
</tr>
<tr>
<td>Housing Material</td>
<td>Die-Cast aluminium housing</td>
</tr>
<tr>
<td>Diffuser Material</td>
<td>Polycarbonate</td>
</tr>
<tr>
<td>Lifetime</td>
<td>50000 hrs @ L70 50 Degree C</td>
</tr>
<tr>
<td>Surge Protection</td>
<td>Minimum 5kV</td>
</tr>
<tr>
<td>Mandatory Certification</td>
<td>Luminaire should be UL/cUL/FCC/Class A/CE/PSE/BIS certified.</td>
</tr>
<tr>
<td>Mandatory test reports</td>
<td>LM-79,LM80</td>
</tr>
</tbody>
</table>
e) **For Tree Lighting Luminaries**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>LED Luminaries complete with all accessories for Tree Lighting</td>
</tr>
<tr>
<td>Make of LED</td>
<td>Cree/Nichia/Osram/Lumileds</td>
</tr>
<tr>
<td>Body of fittings</td>
<td>Die Cast Aluminium</td>
</tr>
<tr>
<td>System Wattage at maximum output, steady state</td>
<td>Monochromatic - Not less than 35 W and RGB - Not less than 30 W</td>
</tr>
<tr>
<td>Beam Angle</td>
<td>As per design criteria and site requirement</td>
</tr>
<tr>
<td>Lumens Output</td>
<td>Minimum 4000 Lumens for monochromatic and 1400 Lumens for colour changing</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>100-270 V AC</td>
</tr>
<tr>
<td>Lumen maintenance L70 B10 at 25degree</td>
<td>50000 Hours @L70 50 Degree C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>0 to + 45 Deg Centigrade</td>
</tr>
<tr>
<td>Ingress Protection</td>
<td>IP66</td>
</tr>
<tr>
<td>Mandatory Certification</td>
<td>Luminaire should be UL/cUL/FCC/Class A/CE/PSE/BIS certified.</td>
</tr>
<tr>
<td>Mandatory test reports</td>
<td>LM-79,LM80</td>
</tr>
<tr>
<td>Housing Material</td>
<td>Die Cast aluminium</td>
</tr>
<tr>
<td>Luminaire connectors</td>
<td>Weather proof IP rated connectors</td>
</tr>
<tr>
<td>Surge Protection</td>
<td>Minimum 5kV</td>
</tr>
<tr>
<td>Lens type</td>
<td>Tampered Glass</td>
</tr>
</tbody>
</table>
f) **Bollard Lighting:-**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>LED Luminaries complete with all accessories for Pathway and Walkway Lighting</td>
</tr>
<tr>
<td>CCT</td>
<td>Minimum 6500K</td>
</tr>
<tr>
<td>Ingress Protection</td>
<td>IP65</td>
</tr>
<tr>
<td>Impact protection</td>
<td>IK07</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>220-240V AC</td>
</tr>
<tr>
<td>Wattage</td>
<td>Not less than 17 W</td>
</tr>
<tr>
<td>Lumen O/P</td>
<td>900 lm/watt</td>
</tr>
<tr>
<td>Power factor</td>
<td>&gt;0.9</td>
</tr>
<tr>
<td>Operating Voltage Range</td>
<td>140 V — 270 V at 50Hz (+/- 5%)</td>
</tr>
<tr>
<td>Working temperature</td>
<td>0 to +45 degree Centigrade</td>
</tr>
<tr>
<td>Housing Material</td>
<td>Die-Cast aluminium housing</td>
</tr>
<tr>
<td>Lifetime</td>
<td>50000 hrs @ L70 50 Degree C</td>
</tr>
<tr>
<td>Mandatory Certification</td>
<td>Luminaire should be UL/cUL/FCC/Class A/CE/PSE/BIS certified.</td>
</tr>
<tr>
<td>Mandatory test reports</td>
<td>LM-79,LM80</td>
</tr>
</tbody>
</table>
9.0 PRE COMMISSIONING TESTS ON ELECTRICAL SYSTEM EQUIPMENT TO BE CARRIED OUT AFTER INSTALLATION:

10.1 PRE-COMMISSION TESTS: Pre-commissioning tests in the specification requirements for various equipments but not limited to following shall be carried out by CONTRACTOR in presence of Purchaser/ Purchaser’s representative. Commissioning shall be carried out only after obtaining satisfactory results, acceptable to Purchaser/ Purchaser’s representative.

10.2 LT Distribution Boards:
   (a) IR Values of power & control circuits.
   (b) Interlocks circuits
   (c) Indication / Panel space heater circuit

10.3 DG:
   (d) Testing the set in Auto / Manual / Test modes.

10.4 Testing for all Interlocks

10.5 Full load test on the set for Eight hours

10.6 Power and Control Cables:
   (a) IR Values

10.7 Lighting System:
   (a) Visual inspection for operating problems
   (b) System activation -burning in the lamps for 100 Hrs
   (c) Measuring light level & reflectance.

10.8 Earthing System:
   (a) Earthing resistance of each electrode.
   (b) Overall earthing resistance of the system for a group which is interconnected.
WATER SUPPLY, LANDSCAPE IRRIGATION AND SEWERAGE
1.1.1 PLUMBING, WATER SUPPLY & SEWERAGE

1.1.1. Scope

This section covers design and execution of water supply works for all utility buildings, landscaping irrigation, sanitary installations, etc. The brief items of works included are;

- Sinking and development of bore well including installation of pumps along with electrical, piping works.
- Laying of pipe network including installation of sprinkler system
- Installation/construction of water storage tanks both underground and over head
- Pumping works
- Installation of water ATM at all pockets
- Installation of Bio toilets.
- Soak Pit for discharging effluent of Bio digestor including all connection and piping works
- Storm Water Drainage

The contractor shall provide all design calculations for pumping works, pipe network and irrigation system and get it approved from RSCL.

1.1.2. Population and demand calculation

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Pocket-1</th>
<th>Pocket-2</th>
<th>Pocket-3</th>
<th>Pocket-4 &amp; 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent Population</td>
<td>10</td>
<td>4</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Commercial Population</td>
<td>20</td>
<td>35</td>
<td>35</td>
<td>25</td>
</tr>
<tr>
<td>Floating Population</td>
<td>500</td>
<td>400</td>
<td>400</td>
<td>1200</td>
</tr>
<tr>
<td>Landscape area*</td>
<td>5300</td>
<td>10000</td>
<td>11000</td>
<td>8477</td>
</tr>
<tr>
<td>Domestic Demand (ltr)</td>
<td>10725</td>
<td>8926</td>
<td>8926</td>
<td>21780</td>
</tr>
<tr>
<td>Irrigation demand (ltr)</td>
<td>29150</td>
<td>55000</td>
<td>60500</td>
<td>46623</td>
</tr>
</tbody>
</table>

Note: landscape area given is tentative. Actual landscape area to be considered by contractor based on landscape drawing.
1.1.3. Source

Although PHED supply will be available, tube well to be considered as PHED supply is meant for domestic use only. Requirement of tube well shall have to be calculated for entire water requirement for safer side.

1.1.4. Concept

Water from PHED supply and tube well will first stored in under ground tank located at each pocket. For domestic purpose, water from under ground tank will be supplied to over head tank proposed at each toilet block. From over head tank water will be supplied under gravity for domestic uses.

For landscape irrigation water will be supplied by direct pumping from the under ground tank. For this purpose separate pump for domestic supply and landscape irrigation to be provided.

1.1.5. Description of The Works

- Service connection from PHED supply line
- Drilling and development of 200mm dia deep tube wells including installation of submersible pumps of required head and discharge and all required mechanical & electrical works. The number of tube well shall be so decided that the entire water demand is met with. However minimum 4 numbers to be provided.
- Design and construction of RCC underground water tank for each pocket as per specified size.
- Provide and installation Polythene/PVC over head tanks.
- Electronic sensor based water level indicator will be considered in the design for water tanks to monitor the water level in the tanks.
- Design, installation of pumps and construction of pumping station including all electrical, mechanical works, automatic pump controller for pumping water from underground tank to overhead tank and for irrigation system.
- Laying of pipe line network including required valves, fittings, water meters at inlet and outlet of tanks. The network shall be provided with required number of valves, water meters, taps and other accessories as directed by employer.
- Installation of sprinkler irrigations system for landscape area and drip irrigation system for shrubs and plants
- Complete internal plumbing and sanitary installation for dual water supply including provisioning of twin overhead storage tank for potable and recycle water supply.
- Installation of water ATMs – 4 nos
- Installation of bio toilets at each toilet complex including construction of soak pit.
- Construction of inspection chamber and waste pipe line from toilets and connection to bio digestors thereafter effluent discharge facility from bio digestor to soak pits.

1.1.6. **List of Indian Standard**

All services being planned generally in conformity with the requirement/recommendation contained in the following Indian standards (BIS)

a) National Building Code - 2016
b) SP: 35: Hand Book on Water Supply & Drainage
c) UPC – Uniform Plumbing Code
d) CPHEEO – Manual on Water Supply and Treatment
e) CPHEEO – Manual on Sewer and Sewage Treatment
f) IS 1172: 1993 – Code of basic requirements for water supply, drainage and sanitation.

1.1.7. **Internal Soil and Wastewater Drainage System**

Soil and waste water drainage system from the building is designed as dual stack system (soil and waste stack separately). The vent pipe is designed for soil vertical stack only. Vent vertical stack is connected to soil line at each floor to protect water seal of European water closet against siphoning. Each shaft will have independent soil and waste vertical stack.

The waste generated from the pantry, utility, etc., shall be collected through a separate vertical pipe waste stack. The waste stack shall be extended minimum 750mm above the terrace parapet level as a waste vent through the roof. Sewage from the water closets and urinals shall be connected through a soil stack. The soil stack shall be extended minimum 1200mm above the terrace parapet level as a soil vent and fitted with vent cowl.

The minimum outside diameter of the 110 mm for vertical soil and 82 mm for waste stack will be designed. Diameter will vary as per the design flow and load. The soil stack shall be directly connected to the inspection chamber. The waste stack shall be connected to the inspection chamber through a gully trap. The gully trap shall have deep water seal, which will prevent foul gases and the entry of cockroaches into the toilet area. The spacing of the inspection chambers shall be kept to a maximum of 15 - 18mtrs.
The sewerage network comprises series of inspection chambers/manholes with varying invert level with interconnecting pipes. The minimum diameter of the external sewer network will be 200mm and the maximum diameter will vary as per the design flow. The drop manholes shall be constructed at places where the depth of drop exceeds 600mm from building sewer to the main sewer. It is ensured that the flow from building a sewer to the main sewer shall be smooth and free from noise.

Internal soil and waste pipes for toilet blocks will be designed within the sunken portion. Floor cleanout will be provided as per design for ease of maintenance. Toilet sunk of 250 to 350 mm is considered to fulfil minimum slope requirement of soil and wastewater drainage piping in sunken portion. Deep seal P traps shall be provided for Floor drains and Urinal traps. All fixtures and appliances shall be fully trapped to prevent backflow of foul gases and odour into the toilets.

Sewers are designed to carry wastewater along with the suspended solids in such a manner that deposition and odour nuisance is kept to a minimum. Sewers are also designed for self-cleansing velocities. The pipe design at the change in the direction of flow shall be designed in such a way that the hydraulic jump phenomenon will not occur.

1.1.8. Design Criteria

**DESIGN CRITERIA FOR SPRINKLER IRRIGATION**

- Type- Fixed Solid Set
- Design Pressure – 24m to 35m
- Sprinkler spacing – Half of waited diameter
- Supply hours- Four to six hours

**Under ground water tank**

The storage capacity of underground tank shall be enough for satisfying the irrigation requirement as well as domestic requirement, however the minimum capacity shall not be taken less than 70% of the daily requirement. Water from the tank shall be supplied to over head tank for domestic purpose and landscape irrigation purpose. Necessary appurtenances such as inlet, outlet, overflow, vent pipes etc shall be provided.

Based on minimum requirement, tank capacity are provided below:

<table>
<thead>
<tr>
<th>Pocket</th>
<th>Under Ground Tank (ltr)</th>
<th>Over head Tank (Ltr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pocket-1</td>
<td>9000</td>
<td>3500</td>
</tr>
<tr>
<td>Pocket-2</td>
<td>16500</td>
<td>3000</td>
</tr>
</tbody>
</table>
Pumps

The pumps shall be horizontal submersible pumps with 100% standby. The pumping shall be considered for 4-6 hrs working per day. Power supply arrangement shall be made for the pump house. Automation shall be provided for operation of pumps.

Approximate requirement of pumps are provided below for reference purpose only. Contractor shall have to provide actual capacities based on design calculations.

<table>
<thead>
<tr>
<th>Pocket</th>
<th>Tube well pump</th>
<th>Domestic water pump</th>
<th>Landscape irrigation pump</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pocket-1</td>
<td>5 HP</td>
<td>0.75 Hp</td>
<td>5 HP</td>
</tr>
<tr>
<td>Pocket-2</td>
<td>5 HP</td>
<td>0.75 Hp</td>
<td>7.5 HP</td>
</tr>
<tr>
<td>Pocket-3</td>
<td>5 HP</td>
<td>0.75 Hp</td>
<td>7.5 HP</td>
</tr>
<tr>
<td>Pocket-4&amp;5</td>
<td>5 HP</td>
<td>1.5 HP</td>
<td>5 HP</td>
</tr>
</tbody>
</table>

Pipe Material

- Plumbing – uPVC
- Pumping lines - GI
- Landscaping irrigation – uPVC/ MDPE

Class of pipe shall be commensurate to the maximum pressure in the system.

The Pipe line should be designed in conformity with CPHEEO Manual and relevant IS codes

Tube Well

Scope under this works include broadly as follows:
- Hydrogeological investigation
- Drilling of bore well. The size and depth of bore well be shall be so decided that, the safe yield of all bore wells shall meet the demand of non-domestic demand.
- Yield test, draw dawn test
- Construction of pump house at each bore well
- Installation of submersible pumps of required capacity and head to discharge water from bore wells to different points.
- All Electrical works
- Designing and laying of rising main from bore wells to different units.
The above works are for reference purpose, the contractor shall have to execute all the works as required by employer to complete the work in all respect.

**Design specifications**

- **Type of drilling method** – As per nature of formation below the ground the best suitable drilling methods are either Direct or Reverse rotary method, with drilling diameter of minimum 20”/18”.
- **As per expected presence of good quality of groundwater** the casing assembly of PVC casings pipe (Schedule-80) (8” Diameter) plain & strainer pipes may be lowered in the tubewell.
- **The annular space between wall of the bore & casing assembly, should be filled by well sorted “Pea Gravel”**.
- **The development of tubewell to be recommended first by high capacity air compressor** (Min. 300 cfm / 150 psi as per IS - 2800 part II) followed by an over pumping unit.
- **Additional gravel should be filled, after completion of development.**
- **The tubewell shall be sealed at top, by Cement sealing, preferably upto 1 m depth, to prevent percolation of surface run-off in the tubewell.**
- **The litho-logs obtained from the tubewell to be collected & preserved at every 3 m interval for further study & record.**
- **The submersible pump set related to expected discharge, water level, drawdown & total head, to be recommended for installation in the tubewell.**
- **The tubewell should be plugged at bottom by “bail plug” & at top by “well cap”**.
- **The pump set should be of approved make, confirming to IS specifications, suitable for 415 volts, 3 phase, 50 cycles AC supply, having delivery outlet, suitable for connecting 100 mm outer diameter GI pipe.**
- **The pump set shall be lowered by 100 mm outer diameter, threaded GI pipes, which shall be connected by sockets. Flat MS flanges may be applied at joints for additional support.**
- **A steel rope may also be used for connection of pump, along with GI pipes, for additional support.**

**Storage Tanks**

- **Common underground Tank** – Should be adequate for meeting the demand of domestic demand and irrigation demand considering the pumping hours, however shall not be less than 70% of daily water requirement of respective pockets.
- **Material of construction - RCC**
- **Individual Overhead Tank- 30% of storage of domestic water requirement.**
- **Material of construction – PVC tank. Required staging to with MS structure of minimum 4m height to be constructed for placing of over head storage tank.**

**Soil, Waste & Vent pipe system**

a) **Soil and waste water drainage system from the building is designed as dual stack system (soil and waste stack separately).**

b) **The vent pipe is designed for soil vertical stack only. All vertical pipes will be terminated as vent pipe at terrace level. The waste stack shall be extended minimum 850mm above the**
terrace level as a waste vent through the roof. The soil stack shall be extended minimum 1200mm above the terrace level as a soil vent and fitted with vent cowl.

c) The size of vertical stacks will be not less than 110 mm dia for soil stack, 110 mm diameter for the waste stack, and 75 mm dia for vent stack.

d) uPVC type B (SWR) pipes and fittings with rubber ring joints is being proposed for soil, waste, vent disposal for all floors.

e) All ground floor toilets/waste appliances shall be connected to the Manholes directly. Gully traps have been proposed for waste connections.

f) All toilets are proposed to be sunken by 450mm and internal Soil & Waste pipes area designed to run in the sunken area.

**Pipework**

a) All stacks shall be installed in shafts on the external face of the buildings or in internal shafts within the building as per the architectural planning of the toilet.

b) It is proposed to provide suitable access to pipe shafts from within the toilets or from outside for maintenance as per the architectural plans and feasibility.

c) The provision includes providing clean-out doors and plugs for maintenance where necessary and required.

d) Deep seal P traps shall be provided for floor drains and urinal traps. All fixtures and appliances shall be fully trapped to prevent backflow of foul gases and odour into the toilets.

e) Self-cleansing velocity is determined by considering the particle size and specific weight of suspended solids in sewers. The velocity of 0.75 m/ sec to 1.2 m/ sec at design peak flow is considered.

f) To avoid erosion caused by excessive velocity and presence of sand and gritty materials in the sewer. The system is designed in such a way that velocity in sewer shall not exceed 2.4 m/sec.

**Bio Digestor**

Capacity of biodigestors are provided below:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Capacity of Bio digester tank (Cum)</th>
<th>No of Tanks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pocket-1</td>
<td>5</td>
<td>1 no- 5 cum</td>
</tr>
<tr>
<td>Pocket 2</td>
<td>5</td>
<td>1 no- 5 cum</td>
</tr>
<tr>
<td>Pocket 3</td>
<td>5</td>
<td>1 no- 5 cum</td>
</tr>
<tr>
<td>Pocket-5</td>
<td>12</td>
<td>2 no- 6 cum</td>
</tr>
</tbody>
</table>
1.1.9. Storm Water Drainage

SCOPE OF WORK:
Proper storm water drainage facility to be provided in the site. The drains shall be RCC box drain. The top cover will be perforated RCC slab.
Scope includes
- Survey, rain fall analysis
- Design and execution of internal drainage

DRAINAGE
The contractor on board shall design the drainage network considering the National Building code and 2 years return IDF curve with following design criteria:

- **Computation of Design Flow**: Rational formula \( Q_p = CIA/360 \) shall be used
- **Return Period**: 2 years for internal drainage
- **Time of Concentration**: The empirical formula, (Kirpich) shall be used
- **Co-efficient of Runoff**: CPHEEO / as per the Surface drainage design Manual, US department of Transportation)
- **Method of Computing Flow**: Manning’s formula
- **Co-efficient of Roughness**: as per Relevant IS / International standards
- **Other Design Parameters**

The design parameters for the drainage system shall be followed as per the following table.

**Table: Design Parameters**

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Design Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>System</td>
<td>Gravity system</td>
</tr>
<tr>
<td>2</td>
<td>Minimum and maximum velocity</td>
<td>As per CPHEEO manual</td>
</tr>
<tr>
<td>3</td>
<td>Time of Concentration</td>
<td>As per CPHEEO manual</td>
</tr>
<tr>
<td>4</td>
<td>Coefficient of Run off</td>
<td>As per CPHEEO manual</td>
</tr>
<tr>
<td>5</td>
<td>Manning’s ’n’ value</td>
<td>As per CPHEEO manual</td>
</tr>
<tr>
<td>6</td>
<td>Minimum Free Board</td>
<td><strong>Drain Width (m)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt; 0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.3 to 0.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.9 to 1.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;1.5</td>
</tr>
</tbody>
</table>
1.1.10. Commissioning of the System

On completion of the Trial Run, commissioning of the System shall be done by the Contractor. The total time allotted for commissioning of the full system is 30 days. The commissioning of the system shall be considered as fully achieved after the entire system has run continuously for a period of 7 days without any breakdown to the satisfaction of Engineer. If continuous run is not achieved fully to the satisfaction of Engineer, the Contractor has to do the needful to achieve the same at his cost.

All the Costs including the cost of staff, water, electricity, chemicals, other consumables that are required for Operation & Maintenance of System during Commissioning period shall be borne by Contractor. It is the obligation of contractor to dispose off the water from the pipe line, if required as per the direction of employer to the nearest water body/drain in an environmentally friendly manner without affecting the project area.

1.1.11. Storm Water Drainage

SCOPE OF WORK:
Proper storm water drainage facility to be provided in the site. The drains shall be RCC box drain. The top cover will be perforated RCC slab.

Scope includes
- Survey, rain fall analysis
- Design and execution of internal drainage

DRAINAGE
The contractor on board shall design the drainage network considering the National Building code and 2 years return IDF curve with following design criteria:

- **Computation of Design Flow**: Rational formula \( Q_p = CIA/360 \) shall be used
- **Return Period**: 2 years for internal drainage
- **Time of Concentration**: The empirical formula, (Kirpich) shall be used
- **Co-efficient of Runoff**: CPHEEO / as per the Surface drainage design Manual, US department of Transportation
- **Method of Computing Flow**: Manning’s formula
- **Co-efficient of Roughness**: as per Relevant IS / International standards
- **Other Design Parameters**
  - The design parameters for the drainage system shall be followed as per the following table.

   **Table: Design Parameters**
<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Design Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>System</td>
<td>Gravity system</td>
</tr>
<tr>
<td>2</td>
<td>Minimum and maximum velocity</td>
<td>As per CPHEEO manual</td>
</tr>
<tr>
<td>3</td>
<td>Time of Concentration</td>
<td>As per CPHEEO manual</td>
</tr>
<tr>
<td>4</td>
<td>Coefficient of Run off</td>
<td>As per CPHEEO manual</td>
</tr>
<tr>
<td>5</td>
<td>Manning’s ‘n’ value</td>
<td>As per CPHEEO manual</td>
</tr>
<tr>
<td>6</td>
<td>Minimum Free Board</td>
<td>Drain Width (m)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt; 0.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.3 to 0.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.9 to 1.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;1.5</td>
</tr>
</tbody>
</table>

1.1.12. **Documents to be submitted by Contractor**

Contractor shall submit following documents/drawings for approval from employer before execution of work.

- Topographical survey and drawing
- Geotechnical Investigation report suggesting location and number of tube wells
- Landscape irrigation design calculations
- Pump capacity calculations
- Drainage calculation
- Drawings:
  - Landscape irrigation layout drawing
  - Under ground tank drawing
  - General Arrangement drawing from Tube well to under ground drawing and under ground tank to over head tank
  - Drainage layout drawing
  - Typical cross section of drain
  - Any other drawings as required for construction as per direction of engineer
TECHNICAL SPECIFICATION

The works shall be performed conforming to the Indian Standard codes, specifications as per P.W.D, PHED, OERC, NBC, etc as applicable. Wherever such specifications are not available, CPWD specifications, relevant references, manuals etc. shall be followed as directed by Employer.
TECHNICAL SPECIFICATIONS FOR WATER SUPPLY, SANITARY & DRAINAGE WORKS

1 **SCOPE**

Following are the scope:

- Sinking and development of bore well
- Yield test
- Installation of all pumping, electrical and piping works
- Laying of pipe line works for different utilities
- Laying of irrigation network along with sprinkler system
- Installation of underground /overhead water tanks
- Installation of water transfer/booster pumps as required

1. This specification covers the general requirements of providing and laying water mains and water supply piping, providing and fixing sanitary fixtures and piping and providing and laying drainage lines.

2. For specifications, mode of measurements and scope of work covered under the respective items for the work included under this contract, following documents shall be referred to in the order of precedence as given below:

   a) Description of the items and notes if any given in the Schedule of Quantities.
   b) Scope of work
   c) Drawings
   d) Specifications.
   e) Additional / Special Conditions of Contract.
   f) General Conditions of Contract.
   g) Applicable Codes and Standards as specified herein with amendments/ revisions issued till date.

   In the event of any discrepancy among the documents referred above, the document in the higher order of precedence shall prevail.

3. In the event of any element of the specification not being available in any of the documents mentioned above, the instructions of the Engineer-in-Charge in writing shall be followed by the Contractor.

4. The Work shall be carried out in accordance with the drawings and designs as would be issued to the Contractor by the Engineer-in-Charge duly signed and stamped by him. The Contractor shall not take cognizance of any drawings, designs, specifications, etc. not bearing Engineer-in-Charge's signature and stamp. Similarly, the Contractor shall not take cognizance of instructions given by any other Authority except the instructions given by the Engineer-in-Charge in writing.

5. The Work shall be executed and measured as per approved drawings and schedules.

6. The Contractor shall acquaint himself fully with the partial provisions for supports that may be available in the structure and utilize them to the extent possible. In any case, the Contractor shall provide all the supports regardless of provisions that have been already
made. Nothing extra shall be payable for situations where bed plates (for supports) are not available or are not useful

7. The Contractor shall incorporate seismic considerations of anchoring and isolation in the design of the systems as called for the different equipment.

8. Shop coats of paint that may be damaged during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas, then coated with paint to match the finish over the adjoining shop painted surface.

9. In addition to the sectional testing carried out during the construction, the Contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakage and shall replace all defective materials in the system. Any consequential damage is done, on account of Contractors carelessness, open or burst pipes or failure of fittings, during testing and commissioning to the building, furniture and fixtures shall be made good by the Contractor

2.0 GENERAL PROVISION

2.1 Scaffolding

2.1.1 Only steel tube scaffolding of approved design shall be used for all works. The scaffold structure shall comply with the requirements of IS: 4014 and IS : 3696. An independent tied scaffold (double scaffold), which has two lines of standards, shall be provided with the inner line kept at least one board clear of the finished face with extended transoms, or hop up baskets to carry an inside board. Diagonal braces shall not prevent the material being moved along the scaffold run. The scaffolding shall be suitably packed at the ends to prevent damage to the finished work.

2.2 Protection

2.2.1 Protection against damage: Care shall be taken to avoid damage from any cause at all stages. Packing pieces used for protection shall not disfigure or otherwise permanently mark the Works.

2.2.2 Surface protection shall be afforded by careful handling and the avoidance of the use of hooks, crowbars, or other implements that are likely to damage the works.

2.2.3 During installation of piping, the open end of pipe shall be protected with temporary cover to prevent dust or other materials entering in it.

2.2.4 Protection during construction: Decorative surfaces shall be carefully protected during construction by a temporary cover.

2.2.5 Protection of finished work: At all stages of the Contract it is essential that all works are properly protected.

2.2.6 Suitable packing shall be used to ensure that scaffolding does not damage erected stone, marble, granite or other finished works.

2.2.7 Any disfigurement, discoloration or imperfection whatsoever due to any reason shall not be accepted and the Contractor shall either remedy the
same or redo the work at no extra cost. The decision of the Engineer-in-Charge, as to whether any work either in whole or in part is acceptable or not shall be final and binding on the Contractor.

2.3 Guarantee

The Contractor shall guarantee and undertake to maintain and rectify the various components of the Plumbing work installed by him for successful performance for a period as indicated in the Datasheet-A. The Contractor shall indemnify the Engineer-in-Charge for a similar period against any damage to property and injury to persons on account of any defective work or maintenance carried out by the Contractor. The format and text of the Guarantee and the Indemnity Bond shall be given by the Engineer-in-Charge.

3.0 APPLICABLE CODES, STANDARDS, AND PUBLICATIONS

All equipment, supply, erection, testing, and commissioning shall comply with the requirements of Indian Standards and code of practices given below as amended till date. All equipment and material being supplied by the contractor shall meet the requirements of IS, and other Codes/Publications as given below.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP:6(1)</td>
<td>Structural steel sections</td>
</tr>
<tr>
<td>IS:325</td>
<td>Three phase induction motors</td>
</tr>
<tr>
<td>IS:554</td>
<td>Dimensions for pipe threads where pressure-tight joints are required on the threads</td>
</tr>
<tr>
<td>IS:694</td>
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4.0 QUALITY ASSURANCE AND QUALITY CONTROL

1. The Work shall conform to high standards of design and workmanship, shall be structurally sound and aesthetically pleasing. Quality standards prescribed shall form the backbone for the quality assurance and quality control system.

2. At the site level, the Contractor shall arrange the materials, their stacking/storage in an appropriate manner to ensure the quality. Contractor shall provide equipment and manpower to test continuously the quality of materials, assemblies etc. as directed by the Engineer-in-Charge. The test shall be conducted continuously and the result of tests
maintained. In addition, the Contractor shall keep appropriate tools and equipment for checking alignments, levels, slopes and evenness of surface.

3. The Engineer-in-Charge shall be free to carry out tests as may be considered necessary by him at his sole discretion, from time to time, in addition to those specified in this document. The Contractor shall provide the samples and labour for collecting the samples. Nothing extra shall be payable to the Contractor for samples or for the collection of the samples.

4. The test shall be conducted at the site laboratory that may be established by Engineer-in-Charge or at any other Standard Laboratory selected by Engineer-in-Charge.

5. The Contractor shall transport the samples to the laboratory for which nothing extra shall be payable. In the event of Contractor failing to arrange transportation of the samples in proper time Engineer-in-Charge shall have them transported and recover two times the actual cost of the Contractor’s bills.

6. Testing charges shall be borne by the Contractor.

7. Testing may be witnessed by the Contractor or his authorized representative. Whether witnessed by the Contractor or not, the test results shall be binding on the Contractor.

5 SOIL, WASTE, VENT AND RAINWATER PIPES

5.1 SCOPE OF WORK

Soil, waste, vent, and rainwater disposal scope shall include Supply, Installation, testing, commissioning and successful handing over to the client as per the drawings, specifications, and schedule of quantities.

All soil, waste and storm water disposal for the portion above ground level to the public sewers shall be by gravity, whereas from the basements it shall be by pumping. Without restricting to the generality of the foregoing, the soil, waste, vent and rainwater pipes system shall inter-alia include the following:

a) Vertical and horizontal soil, waste, vent and rainwater pipes and fittings, joints, supports, paints, and connections to fixtures.

b) The connection of all pipes to sewer lines as shown in the drawings at ground level.

c) Floor and urinal traps, clean out plugs, inlet fittings, and rainwater (roof) outlets.

d) Testing of all pipes and fittings in the workshop.

e) Testing, commissioning and handing over of all pipes lines after installation.

5.2 GENERAL REQUIREMENTS

5.2.1 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.
5.2.2 Pipes shall be fixed in a manner so as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

5.2.3 Pipes shall be securely fixed to walls, and ceilings with suitable clamps at intervals specified. Only approved type of anchor fasteners shall be used for fixing pipes on RCC ceilings and RCC/masonry walls.

5.2.4 Access doors for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance.

5.2.5 Long bends shall be used on all main pipelines as far as possible. Use of elbows shall be restricted for short connections.

5.2.6 Wherever piping is going across the separation/expansion joints of buildings, the piping shall be provided with flexible connectors on both sides of such joints or on the single side depending on whether any wall is to be crossed or not.

5.3 WASTE PIPE FROM APPLIANCES

5.3.1 Waste pipe from appliances e.g. washbasins, baths, sinks, and urinals etc. shall be of UPVC confirming IS 4985 as given in the Schedule of Quantities.

5.3.2 The internal diameter sizes of outlet branch waste pipes for different fittings shall be as follows:

<table>
<thead>
<tr>
<th>Fitting</th>
<th>Diameter</th>
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</thead>
<tbody>
<tr>
<td>Wash basin</td>
<td>32 dia</td>
</tr>
<tr>
<td>Urinals</td>
<td>50 dia</td>
</tr>
<tr>
<td>Sink</td>
<td>50 dia</td>
</tr>
<tr>
<td>Nahani Trap</td>
<td>75 diameter, 50 mm seal</td>
</tr>
<tr>
<td>Multi Floor Trap</td>
<td>75 or 100 dia. as required, with 50 mm or 75 mm seal / bolted aluminium grating in 25×25 MS angle</td>
</tr>
<tr>
<td>P Trap</td>
<td>75 mm water seal as required with bolted aluminum grating in 25×25 MS angle</td>
</tr>
</tbody>
</table>

5.3.3 All pipes shall be fixed in gradient towards the outfalls of drains. Pipes inside a toilet room shall be in chase unless otherwise shown on drawings. Where required pipes may be run at ceiling level in suitable gradient and supported on structural clamps as directed by the Engineer-in-Charge. Spacing for the clamps shall be 3000mm for vertical runs and 2400mm for horizontal runs.
5.3.4 Pipes shall be UPVC tubes conforming to IS: 4985 and quality certificates shall be furnished. Pipes shall be provided with all required fittings conforming to IS: 4985 e.g. tees couplings, bends, elbows, unions, reducers, nipples, plugs etc. All UPVC waste pipes shall be terminated at the point of connection with the appliance with an outlet of suitable diameter. Pipes shall be painted as specified in tender.

5.3.5 The pipes shall be of class III, 6 Kg/cm². The pipes shall conform to IS 4985 - 2000. Fittings shall be of injection moulded PVC conforming to IS 7834 (Part1) - 1975.

5.3.6 Pipe sleeves and inserts, etc. through RCC wall of buildings either external or internal or for water tanks shall be of PVC provided with water bar flanged.

5.3.7 W.C. pan connectors shall suit the requirements as per drawing, with 40 dia. vent horn for connection to the anti-siphonage pipe. Pan connector shall be of C.I. or lead.

5.3.8 Connection to the sewer or stormwater collection sumps to be perfectly watertight and as specified in the drawing.

5.3.9 Rainwater flashing shall be of 150 × 100 or 230 × 150 fitted on to the bell mouth of rainwater pipes inlet and then covered with cast iron grating and extension piece.

5.3.10 All rainwater pipes and fittings shall be soil type variety conforming to I.S. 1729 - 1964 or equivalent. This shall apply to pipe outside buildings within the building or in separate shafts.

5.3.11 Bathroom C.P. grating shall be having bolted down design out of heavy cast brass with chromium plating of the best-approved standards.

5.3.12 Cast iron grating shall be flat with a perfect edge and of the best quality procurable of the specified width and thickness and in the available length.

5.4 PIPE LAYING AND FIXING

The pipe laying and jointing shall be done in accordance with IS 7634 (Part 3) – 1975. Pipes shall be cut to size and chamfered well. Burr’s if any shall be removed. Pipes and fittings shall be joined using solvent cement or rubber ring joints. The pipes and fittings shall be jointed accurately without any stress to achieve leak proof joints.

5.5 TESTING

The method which is commonly in use is filling the pipe with water, taking care to evacuate any entrapped air and slowly raising the system to the test pressure at 3Kg/cm². The pressure testing may be followed as follows. The field test pressure to be imposed should be not less than the greatest of the following:

- One and half times of maximum sustained operating pressure.
- One and half times the maximum pipeline static pressure.

- Sum of the maximum sustained operating pressure and the maximum surge pressure.

- Sum of the maximum pipeline static pressure and the maximum surge pressure, subject to a maximum equal to the works test pressure for any pipe fittings incorporated.

- The field test pressure should wherever possible be not less than 2/3rd working pressure and should be applied and maintained for at least four hours. If the visual inspection satisfies that there is no leakage the test can be passed.

- A test register shall be maintained and all entries signed and dated by Contractor and Engineer-in-Charge. A Performa of the proposed test register shall be submitted to the Engineer-in-Charge for approval.

- All pipes in wall chase or meant to be encased or buried shall be hydro tested before the chase is plastered or the pipe encased or buried.

5.6 CUTING AND MAKING GOOD HOLES / CHASES

Pipes shall be fixed and tested as the building work proceeds. Contractor shall provide all necessary holes, cut outs and chases in structural members as the building work proceeds. Wherever holes are cut or left originally, they shall be made good with cement concrete 1:1:2 (1 cement: 1 coarse sand :2 stone aggregate 20mm nominal size) or cement mortar 1:2 (1 cement :2 coarse sand) as directed by the Engineer-in-Charge and the surface restored as in original condition to the entire satisfaction of the Engineer-in-Charge at no extra cost.

5.7 DRAINAGE ACCESSORIES

a) Floor Trap / Urinal Trap Grating

Floor/ urinal traps grating shall be of stainless steel square / round of size 125 x 125 mm square/round as approved by client & shown in the drawing. Floor trap assembly shall be provided with round stainless steel strainer basket as a cockroach trap. Entire assembly shall be complete with ring, frame, outer cup, inner cup, grating, screws etc. of an approved make.

b) Floor Cleanout

Floor cleanout cover shall be of stainless steel square / round of size 125 x 125 mm square/round as approved by client & shown in the drawing. Floor cleanout assembly shall be complete with ring, outer frame, cover, screws etc. of an approved make.

c) Ceiling Cleanout

Ceiling cleanout cover shall be in nickel bronze / PVC plug type / GI flanged type of round shape matching pipe size as approved by client & shown in the drawing. Ceiling cleanout assembly shall be threaded with key hole for opening / flanged type suitable for pipe. Threaded cover shall be used up to 100 mm size & above shall be GI flanged type with GI
nails & bolts. PVC cover shall be used for PVC drainage piping only, whereas nickel bronze & GI flanged type cover shall be used for HDPE / CI / CI LA pipe work.

d) Cockroach Traps

Floor/ urinal traps shall sealed cover provided with 100-150mm square or round stainless steel cockroach trap assembly complete with ring, outer cup, inner cup, jali etc. of an approved make.

e) Wire Balloons / Grating For Rain Water Pipes

The wire balloons and the domical gratings shall conform to IS: 1729. The wire balloons shall be of galvanised steel. The CI domical gratings for the roof outlet shall be minimum 13mm thick.

Leaf and Gravel grates along with a perforated ring shall be made out of M.S. flat/bars of a design and dimension as shown in the drawing or as directed by the Engineer-in-Charge. These shall be painted with epoxy paint with a DFT of 200 microns.

Wire balloons/gratings for rainwater pipes shall be measured by numbers for different sizes. Leaf and gravel grates along with the perforated ring shall be measured in kgs.

5.8 RAINWATER PIPES

All rainwater pipes shall be of UPVC as shown in drawing & specified in specification. UPVC piping shall conform to IS: 13592 g or as specified in the schedule of quantities.

5.9 RAIN WATER OUTLET

a) Rain water out shall be preferably scupper type drain with cast iron body & cast aluminium grating with stainless steel screws. Suitable adopter / connector shall be used to match the pipe. Wherever shafts are not available near rain water outlet, dome type rain water outlet shall be installed.

b) Rain water outlet shall be tested for water leaking, prior to waterproofing treatment. Extreme care shall be taken, while sealing gap between rain water outlet & wall / slab.

5.10 CLAMPS

Wherever MS/GI clamps are required to be anchored directly to brick walls, concrete slabs, beams or columns, nothing extra shall be payable for clamping arrangement, RCC block and making good with cement concrete 1:2:4 mix (1 cement:2 coarse sand: 4 stone aggregate 20mm nominal size) as directed by the Engineer-in-Charge.

5.11 ANGELS / CHANNELS

Slotted angles/ channels shall be measured per linear metre of finished length and shall include support bolts and nuts, length embedded in the cement concrete blocks of 1:2:4 (1cement: 2 coarse sand: 4 stone aggregate 20mm nominal size) formed in the masonry walls; nothing extra shall be paid for the cement concrete block and making good the masonry wall, anchor fasteners etc. complete.
5.12 **INSTALLATION OF SOIL, WASTE & VENT PIPES**

All Horizontal pipes running below the slab and along the ceiling shall be fixed on structural adjustable clamps, sturdy hangers of the design as called for in the drawings. The pipes shall be laid in uniform slope and proper levels. All vertical pipes shall be truly vertical fixed by means of stout clamps in two sections, bolted together, built into the walls, wedged and neatly jointed. The branch pipes shall be connected to the stack at the same angle as that of fittings. All connections between soil, waste and ventilating pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts. Where the horizontal run off the pipe is long or where the pipes cross over building expansion joints etc. suitable allowance shall be provided for any movements in the pipes by means of expansion joint etc. such that any such movement does not damage the installation in any way.

Before joining, the interior of the socket and exterior of the spigots shall be thoroughly cleaned and dried. The spigot end shall be inserted into the socket right up to the back of the socket and carefully centered by two or three laps of threaded spun yarn, twisted into ropes of uniform thickness, well caulked into the back of the socket. No piece of yarn shall be shorter than the circumference of the pipe. The jointed pipe line shall be at required levels and alignment. The reminder of the socket is left for the lead caulking. Where the gasket has been tightly held, a jointing ring shall be placed round the barrel against the face of the socket. Molten Lead shall be poured to the remainder of the socket.

The joint shall not be covered till the pipeline has been tested under pressure. Rest of pipeline shall be covered so as to prevent the expansion and contraction due to variation in temperature.

**Rainwater Pipes**

All open terraces shall be drained by rainwater down takes.

Rainwater down takes are separate and independent of the soil and waste system and will discharge to rainwater harvesting tank and excess rainwater will be diverted to the external stormwater drain.

6 **WATER SUPPLY SYSTEM**

6.1 **SCOPE OF WORK**

The scope shall include supply, installation, testing, commissioning and satisfactory handing over of the complete water supply system to client as per drawings, specifications and schedule of quantities. The water supply system shall inter-alia include the following:

a) Distribution system from main supply or overhead tank to all fixtures and appliances for cold water.

b) Pipe protection and painting.

c) Control valves, masonry chambers and other appurtenances.
d) Connections to all plumbing fixtures, tanks, appliances and municipal mains

c) Inserts, nozzles for R.C.C. tanks

The term water supply is used as indicative of all water supply work required and necessary for the building including such external work as may be necessary to make the system functional.

The scope of this section comprises the supply, installation, testing and commissioning of piping network for water supply for internal & external services as follows:

a. Tapping from available main source /Tanker water supply/

b. Domestic water supply.

c. Flushing water supply

The contractor shall make all necessary application and arrangements for his work to be inspected by the Local Authorities.

The contractor shall be solely responsible for obtaining the Authorities approval of his works prior to the handing over of the complete water supply / distribution installation to the owner.

6.2 GENERAL REQUIREMENTS

6.2.1 If necessary and if approved by the Engineer-in-Charge, where unavoidable, bends may be formed by means of a hydraulic pipe bending machine for pipes up to 20mm dia. No bending shall be done for pipes of 25mm diameter and above. After bending zinc rich paint shall be applied wherever the zinc coating is damaged.

6.2.2 Valves and other appurtenances shall be so located as to provide easy accessibility for operations, maintenance and repairs. Valves shall be located at a height not exceeding 1.6m above their operating floor/platform level. Where such a provision is not possible and the valve is to be frequently operated a MS chain shall be provided for its operation.

6.3 CPVC PIPE

Supplying, Installing, Testing and Commissioning of exposed and concealed Cold & Hot water Chlorinated Polyvinyl Chloride (CPVC) pipework. Pipes shall confirm as per ASTM D 2846, SDR 11 up to 50 mm diameter and ASTM F441, Schedule 40 pipe for above 50 mm diameter. Fittings shall be as per ASTM F438, Schedule 40 for pipe up to 50 mm diameter and ASTM F439, Schedule 40 for pipe above 50 mm diameter. The fittings and specials such as tees, elbows, couplers, bends, enlargers, flanges, unions connectors, adapters etc. with CPVC brass threaded combination/ transition specials such as male adapters, brass threaded female adapters, brass FPT Tee, Brass FPT elbow, etc. where connection with metal is to be made including necessary drilling holes, chasing walls and making the same good in cement mortar 1:1, restore the same to original condition neatly as directed by the Engineer. Joints to be made
with CPVC solvent cement shall be as per ASTM F493. Manufacturer's recommendation shall be followed for installation of pipe & jointing of CPVC pipework

6.4 **uPVC PIPE**

Supplying, Installing, Testing and Commissioning of exposed and concealed Cold & Hot water unplasticized Polyvinyl Chloride (uPVC) pipework. Pipes shall confirm as per ASTM D 1785 schedule 80/40 or IS 4985 depending on the pressure requirement in the system.

6.5 **GI PIPES, FITTINGS AND VALVES**

6.5.1 All pipes inside the buildings and where specified, outside the building shall be M.S. galvanized steel tubes conforming to IS: 1239 of Class specified. When Class is not specified they shall be Heavy Class. All embedded / concealed pipes shall be of heavy duty.

6.5.2 Fittings shall be of malleable cast iron galvanized, of approved make. Each fitting shall have manufacturer's trade mark stamped on it. Fittings for GI pipes shall include couplings, bends, tees, reducers, nipples, unions, bushes etc. Fittings etc. shall conform to IS: 1879.

6.5.3 Pipes and fittings shall be jointed with screwed joints using Teflon tape suitable for water pipes. Care shall be taken to remove burr from the end of the pipe after cutting by a round file. All pipes shall be fixed in accordance with layout and alignment shown on the drawings. Care shall be taken to avoid air pockets. Necessary vents and drains shall be provided at all high and low points respectively. GI pipes inside toilets shall be fixed in wall chases well above the floor. No pipes shall be run inside a sunken floor as far as possible. Pipes may be run under the ceiling or floors and other areas as shown on drawings. All pipe joints after testing of the line shall be seal welded and the weld plus the adjoining portion shall be given two coats of zinc rich primer.

6.5.4 **Bib cocks and stop cocks**

All bib cocks and stop cocks shall be of C.P. brass conforming to IS: 781 of tested quality and approved make and design, of diameter as specified in schedule of quantities.

6.5.5 **Clamps**

GI pipes in shafts and other locations shall be supported by GI clamps of design approved by the Engineer-in-Charge. Pipes in wall chases shall be anchored by iron hooks. Pipes at ceiling level shall be supported on structural clamps fabricated from MS structures as described tender. Pipes in shafts shall be supported on slotted angles/ channels as specified/ as directed.

6.5.6 **Unions**
Contractor shall provide adequate number of unions on all pipes to enable easy dismantling later when required. Unions shall be provided near each gunmetal valve, stop cock or check valve and on straight runs as necessary at appropriate locations as required for easy dismantling and/ or as directed by the Engineer-in-Charge.

6.5.7 Flanges

Flanged connections shall be provided on pipes as required for maintenance/ ease in dismantling or where shown on the drawings, all equipment connections as necessary and required or as directed by the Engineer-in-Charge. Connections shall be made by the correct number and size of the GI nuts/ bolts as per relevant IS Standards and made with 3mm thick insertion rubber washer/gasket. Where hot water or steam connections are made insertion gasket shall be of suitable high temperature grade and quality approved by the Engineer-in-Charge. Bolt hole dia for flanges shall conform to match the specification for CI sluice valve as per IS: 780. Gaskets shall conform to IS: 11149.

6.5.8 Trenches

All GI/PVC/HDPE pipes running below ground shall have minimum cover of 600mm.

6.5.9 Excavation to be taken to proper depth

Excavation shall be done in all conditions of soil and to such a depth that the sewers / or other pipes shall rest as described in the several clauses relating thereto and so that the invert may be at the levels given on the section. Should the contractor excavate the trench to a greater depth than is required the extra depth shall have to be filled up with concrete at the contractor’s own cost to the requirements and satisfaction of the client / consultants.

6.5.10 Back filling (IS: 12288 – 19S87)

After the sewer or other piping work has been laid and proved to be water-tight, the trench or other excavation shall be refilled. Utmost care shall be taken in doing this so that no damage is caused to the sewer and other permanent works.

6.5.11 Painting

a) All pipes above ground shall be painted with one coat of red lead and two coats of synthetic enamel paint of approved shade and quality to give an even shade, or as specified by the Engineer-in-Charge.

b) Hot water pipes in the chase:

All hot water pipes fixed in wall chase shall be properly insulated by elastomeric tape as per manufacturer’s recommendation.

6.5.12 Pipe protection

Where specified, pipes below the floor or below ground shall be protected against corrosion by the application of two or more coats of solvent-based rubberized asphaltic primer to give a uniform coat covered with ‘Pipe coat Hiper’, a puncture resistant non
woven polyester mat. The application of pipe coat primer and "Hiper" membrane shall be as specified by the manufacturer.

6.6 VALVES & FITTINGS

6.6.1 Sluice Valves

Sluice valve shall conform to IS 14846-2000 relevant internationally recognized standards.

They shall be of non-rising spindle type. The valve shall be furnished with a bushing arrangement for replacement of packing without leakage. They shall also have renewable channel and shoe linings. The gap between the shoe and channel shall be limited to 1.5 mm.

The gate face rings shall be securely pegged over the full circumference.

Valve of 450mm and above shall be provided with thrust bearing arrangement for ease of operation.

Valve of diameter 400 mm and above shall be provided with enclosed gear arrangement for ease of operation. The operation gear of all valves shall be such that they can be opened and closed by one man against an unbalanced head 15% in excess of the maximum specified rating. Valve and any gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 400N.

All valves, spindles and hand wheels shall be positioned to give good access for operational personnel.

All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.

Specification for Sluice Valve

Standard: IS - 14846:2000

Ends: Flanged and drilled as per IS-1538

Material of Construction

(A) Body: Grey CI, IS-210, FG 260

(B) Bonnet: Grey CI, IS-210, FG 260

(C) Non rising Stem: High tensile brass, IS 320 / 6912, Gr.HTB-2 / FHTB-2

or Stainless Steel, IS 6603, Gr.12Cr1304Cr 18Ni10 04Cr17Ni.12 MO2

(D) Wedge: Grey CI, IS 210, FG 260

(E) Stem Nut: Leaded tin Bronze, IS: 318,Gr.LTB-2

(F) Body seat ring, wedge face :: Leaded tin Bronze,

   IS: 318,Gr.LTB-2 ring & bushes.

(G) Gland packing: Jute & Hemp, IS: 5414

(H) Hand Wheel: Grey CI, IS-210, Gr. FG-260
(I) Nuts: Carbon steel, IS–1363(Part-3),Class 4.0

(J) Bolts:: Carbon steel ,IS-1363 (Part-3),Class 4.6

(K) Bonnet Gasket: Rubber, IS-638, Type -B

Hydro test Pressure as per IS-14846:2000

<table>
<thead>
<tr>
<th>Rating</th>
<th>Test for</th>
<th>Test Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>PN 1.0</td>
<td>Body</td>
<td>15 kg / cm² (1.5 MPa)</td>
</tr>
<tr>
<td></td>
<td>Seat</td>
<td>10 kg / cm² (1.0 MPa)</td>
</tr>
<tr>
<td>PN 1.6</td>
<td>Body</td>
<td>24 kg / cm² (2.4 MPa)</td>
</tr>
<tr>
<td></td>
<td>Seat</td>
<td>16 kg / cm² (1.6 MPa)</td>
</tr>
</tbody>
</table>

6.6.2 Butterfly Valves

Resilient seated butterfly valve shall be as per IS 13095-1991/ BS 5155. Valve shall be suitable for mounting in any position.

The valve seat shall be of integrally cast or replaceable design. When the valve is fully closed, the seal shall seat firmly so as to prevent leakage. The seat surfaces shall be machined smooth to provide a long life for the seal.

All fasteners shall be set flush so as to offer the least resistance possible to the flow through the valve.

Valve shall be suitable for throttling purpose.

All valve, spindles and hand wheels shall be positioned to give good access for operational personnel.

Valve of diameter 450 mm and above shall be provided with enclosed gear arrangement for ease of operation. The operation gear shall be such that they can be opened and closed by one man against an unbalanced head 15% in excess of the maximum specified rating. Valve and any gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 400 N.

All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.

Specification & M.O.C. of Butterfly valve :

General
a Type Both end flanged hand wheel / Gear operated
b Rating of valves PN 1.6
c Manu. Standard IS-13095:1991 / BS 5155
d Sizes and quantity As per Price schedule

Material of construction
6.6.3 Non-Return Valve

The valve shall be suitable for mounting on a horizontal pipeline and flow direction shall be clearly embossed on the valve body.

Valves shall possess high speed closing characteristics and be designed for minimum slam condition when closing.

Dual plate check valves shall conform to API 594 and API 598. They shall have metal to metal sealing. The spring action shall optimize the equal closing rates of each plate especially when the friction coefficients are uneven due to one plate resting upon one another. The plates shall not drag on the seat while opening. The plates shall not vibrate under full or partial flow condition.

In case of the nozzle check valve, the disc shall be correctly positioned at all times to achieve fully non-slam closure. The spring shall be fully shielded from the flow stream by the central flow diffuser.

Tilting disc non-return valve shall incorporate a double offset shaft with a variable angle tilt disc configuration. Sealing shall be metal to metal. The disc shall be stable and shall not vibrate under full or partial load conditions.

Valve of diameter greater than 450 mm shall be provided, in addition to others, feet and jacking screws. Hinge pins / shaft shall preferably be square in section to ensure positive location of flaps and provide for secure fixing.

Specification for Reflux Valve (Non Return Valve)

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ends</td>
<td>Flanged flat face and drilled in accordance IS.</td>
</tr>
<tr>
<td>Type</td>
<td>Swing type</td>
</tr>
</tbody>
</table>

Materials of Construction for Reflux Valve (Non Return Valve)

| (A) Body, cover, door, bearing holder | Grey CI, IS-210, FG 260 |
| (B) Hinge pin, door pin & door       | S.S., IS-6603, 12Cr12 |
| Suspension pin                       |                           |
| (C) Body seat rings                  | Leaded Tin Bronze, IS-318, Gr.LTB-2 |
| (D) Door face ring                   | Leaded Tin Bronze, IS-318, Gr.LTB-2 |
## Scope of Work & Technical Specifications

### (E) Bearing bushes/ Bearing block
Leaded Tin Bronze, IS-318, Gr.LTB-2

### (F) Plugs for hinge pin / Air release
Leaded Tin Bronze, IS-318, Gr.LTB-2

#### Plug

### (G) Nuts
Carbon steel, IS-1363(Part-3),Class4.0 (H)

### Bolts
Carbon steel, IS-1363(Part-3),Class 4.6

### (I) Gasket
Rubber, IS : 638, Type –B

**Hydro test Pressure as per IS-5312(Part – I):2000**

<table>
<thead>
<tr>
<th>Rating</th>
<th>Test for</th>
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</tr>
<tr>
<td></td>
<td>Seat</td>
<td>16 kg / cm² (1.6 MPa)</td>
</tr>
</tbody>
</table>

### Materials of Construction for DPCV

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Component</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>Body Cast Iron</td>
<td>IS 210 Gr. FG 260</td>
</tr>
<tr>
<td>(b)</td>
<td>Disc</td>
<td>Aluminum Bronze</td>
</tr>
<tr>
<td>(c)</td>
<td>Stop &amp; hinge pin</td>
<td>SS AISI-410</td>
</tr>
<tr>
<td>(d)</td>
<td>Seat ring ( Disc)</td>
<td>EPDM Rubber</td>
</tr>
<tr>
<td>(e)</td>
<td>Bearings (Body&amp; Plate lug)</td>
<td>PTFE</td>
</tr>
<tr>
<td>(f)</td>
<td>Body Seat</td>
<td>SS AISI-410</td>
</tr>
<tr>
<td>(g)</td>
<td>Spring</td>
<td>Spring steel</td>
</tr>
</tbody>
</table>

### 6.6.4 Forged Brass Ball Valve

(a) Valves of size 50 mm Dia. and below shall be full bore quarter turn lever operated female threaded forged brass hard chrome plated ball valves conforming to IS: 554. Valve shall have PTFE body seat rings and gland packing, forged brass ball, stem and bonnet, carbon steel nut washer and lever and finished in chrome. Valves shall have the minimum working pressure of 16 bars. Valves shall be tested at manufacturer's works and the same stamped on it.

### 6.6.5 Air Release Valve (AV)

Tamper Proof Air Valves shall be cast iron body, cover and cowl. Temper Proof Air valve working temperature shall be upto 50° C.

**Hydraulic Test Pressure shall be as mentioned below.**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Rating</th>
<th>PN 1.0</th>
<th>PN 1.6</th>
<th>Duration</th>
</tr>
</thead>
</table>

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Water Supply  Page 34
Technical Particulars of Temper Proof Air Valve

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description</th>
<th>Particulars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design and Manufacturing Code</td>
<td>AWWA C512</td>
</tr>
<tr>
<td>2</td>
<td>Size (\text{Qty})/Pressure Rating (PN)</td>
<td>As per Price Bid</td>
</tr>
<tr>
<td>3</td>
<td>Ends</td>
<td>Flanged</td>
</tr>
<tr>
<td>4</td>
<td>Type</td>
<td>Temper Proof</td>
</tr>
</tbody>
</table>

**MATERIAL OF CONSTRUCTION (M.O.C)**

1. **Body** | Cast Iron  
2. **Float** | Stainless Steel  
3. **Cover** | Cast Iron  
4. **Seat** | Nitrile Rubber  
5. **Nozzle** | Bronze  
6. **Bolts and Nuts** | Carbon Steel  
7. **Gasket** | EPDM  

### 6.6.6 Ball float valve

Ball valves with Heavy duty float to be fixed in storage tanks as shown in the drawing and shall consist of cast brass lever arm having copper balls (26 SWG) screwed to the arm integrally. The copper ball shall have bronze welded seams. The closing/opening mechanism incorporating the piston and cylinder shall be non-corrosive metal and include washers. The size and construction of ball valves and float shall be suitable for desired working pressure operating the supply system.
6.6.7 TESTING

(a) All pipes, fittings, and valves shall be tested in accordance with IS: 2065 except as may be modified hereunder. All pipes, fittings, and valves, after fixing at the site, shall be tested to a hydrostatic pressure of 10 kg/cm² or 1.5 times the shut-off head of the pump whichever is greater.

(b) The test pressure shall be maintained for a period of at least thirty minutes without any drop in pressure.

(c) A test register shall be maintained and all entries shall be signed and dated by Contractor(s) and the Engineer.

(d) After commissioning of the Water Supply System, the Contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently and effectively. Valves which do not operate efficiently and effectively shall be replaced by new ones at no extra cost and the same shall be tested as above.

(e) All pipes in wall chase or meant to be encased or buried shall be hydro tested before the chase is plastered or the pipe encased or buried.

6.7 PRESSURE REDUCING VALVE SET

Each pressure reducing valve set shall be complete with pressure reducing or pressure regulating valve, isolating valves, pressure gauges on inlet and outlet, pressure relief valve on outlet and filter on the inlet.

Each pressure reducing valve shall contain loading neoprene diaphragm and a full floating, self-aligning, ignition resistant seat and shall be of the single stage, pressure reduction type with provision for manually adjusting the delivery pressure. The valve shall fail safe to the low pressure.

Valves shall be capable of operating at the maintaining automatically the respective delivery pressure and flow rates as indicated and shall not be liable to creep. Valves shall also be capable of maintaining the pre-set downstream pressure under static condition.

The filter on each inlet to a pressure reducing valve shall be of a replaceable porous sintered metal type.

(a) Pressure reducing valves are used to lower pipeline pressure to a predetermined set point. Pressure reducing valves protect installations against excessive pressure from the supply.

(b) Pressure reducing valves automatically controls downstream pressure, from no flow to full open flow, without regard to changes in inlet pressure. Outlet pressure control is smooth and precise since the friction and hysteresis of the valve and pilot are negligible.
(c) Because the valve will not chatter or slam under low flow conditions, it is not necessary to parallel pressure reducing valves with a second smaller size control valve to obtain accurate pressure control at low flow rates. In any size, pressure reducing valves will control pressure right down to shut off.

(d) Spring loaded pressure reducing valves operate by means of a force equalizing system. The force of a diaphragm operates against the force of an adjustment spring. If the outlet pressure and therefore diaphragm force fall because water is drawn, the then greater force of the spring causes the valve to open. The outlet pressure then increases until the forces between the diaphragm and the spring are equal again. The inlet pressure has no influence in either opening or closing of the valve. Because of this, inlet pressure fluctuation does not influence the outlet pressure, thus providing inlet pressure balancing.

6.8 PRESSURE RELIEF VALVES

Each pressure relief valve shall be of the fully enclosed type and fitted with hand easing gear.

Each pressure relief valve in a pressure reducing station shall have a flow capacity equal to that of the pressure reducing valve. PRV shall be of Brass.

Pressure relief valves in locations other than reducing stations shall have flow capacities equal to that of the associated equipment.

6.9 LEVEL CONTROLLED SOLENOID VALVES

A solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through a solenoid: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports.

Level sensor based solenoid valve will be installed at terrace level for automatic operation of the water transfer pump set.

6.10 UNDERGROUND / OVERHEAD STORAGE TANKS

6.10.1 Storage tanks for water supply shall be in RCC.

6.10.2 Each tank shall be provided with lockable type manhole cover fabricated from MS sheet or standard cast iron tank covers. Manhole covers shall be of an appropriate size as directed by the Engineer-in-Charge.

6.10.3 Each storage tank shall be provided with high and low-level annunciation by means of magnetic level switches.

6.10.4 One solid state electronic annunciation panel fully wired with a visual display and audible alarm unit shall be provided to indicate the following:

- High and low-level alarms for each water storage tank.
On/ off status of all Pump sets namely domestic

6.10.5 All the necessary arrangements for fixing the panel shall be provided by the Contractor.

6.10.6 All the cabling from the respective level switches to the Annunciation Panel, MCC Switchgear to Annunciation Panel, including power supply from MCC shall be provided by the Contractor.

6.10.7 The number of outgoing terminals shall be equal to the number of incoming terminals from field/ MCC with 20% margin, so that necessary interconnection to BMS could be done at a later date.

6.11 TESTING

6.11.1 All pipes, fittings and valves shall be tested in accordance with IS: 2065 except as may be modified herein under. All pipes, fittings and valves, after fixing at site, shall be tested to a hydrostatic pressure of 10 kg/cm² or 1.5 times the shut off head of the pump whichever is greater.

6.11.2 The test pressure shall be maintained for a period of at least thirty minutes without any drop in pressure.

6.11.3 A test register shall be maintained and all entries shall be signed and dated by Contractor(s) and the Engineer-in-Charge.

6.11.4 After commissioning of the water supply system, the Contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently and effectively. Valves which do not operate efficiently and effectively shall be replaced by new ones at no extra cost and the same shall be tested as above.

6.11.5 All pipes in wall chase or meant to be encased or buried shall be hydro tested before the chase is plastered or the pipe encased or buried.

6.12 INSULATION

6.12.1 All open hot water flow and return pipes shall be insulated with preformed fibrous pipe sections conforming to IS: 9842.

6.12.2 Insulation to pipes shall be with pre-moulded pipe sections, the thickness for sections shall be:

a) Pipe 50mm diameter and below - 25mm thick
b) Pipe 65mm diameter and above - 40mm thick

6.12.3 Application:

a) All surfaces shall be thoroughly cleaned with a wire brush.

b) One layer of approved primer shall be applied and pre-moulded pipe insulation sections shall be fixed.
c) One layer of aluminum foil of thickness 0.711mm (20 SWG), shall be applied as a finish layer.

6.12.4 Insulation for hot water pipes in the chase:

All hot water pipes in chase shall be insulated with 3 mm elastomeric tape as per manufacturer’s recommendations.

6.13 CONNECTION TO RCC WATER TANKS (PUDDLE FLANGE)

The contractor shall provide all inlets, outlets, washouts, vents, ballcocks, overflows control valves and all such other piping connections including a level indicator to water storage tanks as called for. All pipes crossing through RCC work shall have puddle flanges fabricated from GI pipes of required size and length and welded to 6/8 mm thick MS plate. All puddle flanges must be fixed in true alignment and level to ensure further connection in proper order.

Full way gate valves of an approved make shall be provided as near the tank as practicable on every outlet pipe from the storage tank except the overflow pipe. Overflow and vent pipes shall terminate with mosquito proof grating with the bronze screen on vent.

The overflow pipe shall be so placed to allow the discharge of water is readily seen. The overflow pipe shall be of a size as indicated. A stop valve shall also be provided in the inlet water connection to the tank. The outlet pipes shall be fixed approximately 75mm above the bottom of the tank towards which the floor of the tank is sloping to enable the tank to be emptied for cleaning.

The floor and the walls of the tank shall be tiled with glazed tiles up to the overflow level. Alternatively, food grade epoxy to be applied.

6.14 LEVEL SENSORS

Level sensor shall consist of the control unit, preamplifier and one full insulated probe-mounted vertically or two-part insulated probe mounted from tanks side wall adjustable switching system for pump control application, the same to be housed in stove enamel painted cast aluminium weatherproof suitable for black panel/wall mounting etc.,

The enclosure of probes shall be manufactured with the SS316 material. The least count of the central unit with amplifier should be +/- 0.10mm for response value of 30 seconds.

6.15 LEVEL INDICATORS

A level control system with electronic level probes is mounted on the face of the reservoir. The top two level sensors provide the ON-OFF signal for the treated water transfer pumps. A third level sensor enunciates a low-level alarm condition to the paging system and a fourth sensor enunciates an alarm to the paging system and stops the domestic water pumps from operating.

6.16 INSULATION

The insulation for hot water pipes shall be done as specified in Bill of Quantities and accordingly following guidelines shall be followed:
6.17 **PAINTING / PIPE PROTECTION / INSULATION**

Unless otherwise specified painting/ pipe protection/ insulation for pipes shall be measured and paid for separately. These shall be measured per linear meter along the center line of the pipe, over the finished surface and shall include all valves and fittings for which no deduction shall be made.

6.18 **AIR RELEASE VALVES**

Air release valve shall be installed as per specifications provided in BOQ.

Table Commonly Adopted Size of Air Valves

<table>
<thead>
<tr>
<th>Size of Main mm</th>
<th>Type of Valve</th>
<th>Size of Air Valve mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>Single air valve</td>
<td>20</td>
</tr>
<tr>
<td>100</td>
<td>Double air valve</td>
<td>40</td>
</tr>
<tr>
<td>125-200</td>
<td>Double air valve</td>
<td>50</td>
</tr>
<tr>
<td>250-350</td>
<td>Double air valve</td>
<td>80</td>
</tr>
<tr>
<td>400-500</td>
<td>Double air valve</td>
<td>100</td>
</tr>
<tr>
<td>600-900</td>
<td>Double air valve</td>
<td>150</td>
</tr>
<tr>
<td>1000-1200</td>
<td>Double air valve</td>
<td>200</td>
</tr>
</tbody>
</table>

a) Air release valves shall be single acting type air valves with cast iron body and bronze/gunmetal internal parts and plastic float.

b) Each air release valve shall be provided with a cast iron isolating sluice valve specification given above

6.19 **BIO DIGESTOR**

**Technical Specification For Bio Digester**:-

1. Material: FRV
2. Bio-Digester Wall Thickness: 4-5-6mm
3. Color of panel : As approved by RSCL.
4. Inoculums Culture - 30%:70%
5. DRDO approved

6.20 **WATER VENDING MACCHINE**

Scope:
Providing and fixing water vending machine of 100 LPH capacity along with water chiller and storage tank.

Features
- Complete SS cabinet, food great 304
- Compact modal inbuilt advance technology RO+UV+Mirnal system with chilling & normal water dispensing facility
- Multi coin & Card operating machine
- Multi dispensing facility 300ml, 500ml, 1Ltr, 2Ltr, 5Ltr, 10Ltr, 20Ltr.
- Inbuilt GSM technology monitoring all Sales & Service

Technical Specification

<table>
<thead>
<tr>
<th>100 LPH Water Vending Machine</th>
<th>Technical Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>RO Capacity</td>
<td>100 Liter per hour</td>
</tr>
<tr>
<td>Water Chiller</td>
<td>100 Liter</td>
</tr>
<tr>
<td>Storage Tank</td>
<td>100 Liter</td>
</tr>
<tr>
<td>Water Capacity/Day</td>
<td>1200 Liter per day</td>
</tr>
<tr>
<td>Total Power</td>
<td>1.5 KW</td>
</tr>
<tr>
<td>MOC</td>
<td>Stainless Steel</td>
</tr>
<tr>
<td>Coin Operated</td>
<td>1,2,5,10</td>
</tr>
<tr>
<td>Smart Card Operated</td>
<td>1-20 liter water at a time by Smart Card</td>
</tr>
<tr>
<td>Software</td>
<td>Inbuilt GSM Remote Sales Monitoring</td>
</tr>
<tr>
<td>Dispensing</td>
<td>300 ml, 500 ml, 1 ltr, 2 ltr, 5 ltr to 20 ltr</td>
</tr>
<tr>
<td>Dimension (H<em>W</em>D)</td>
<td>6.5<em>3</em>3</td>
</tr>
<tr>
<td>Weight</td>
<td>150 kg</td>
</tr>
<tr>
<td>Warranty</td>
<td>1 year</td>
</tr>
</tbody>
</table>

INPUT REQUIREMENTS :
- Input Voltage 12V - 13.5V @ 200mA.
- Multicoin Validator.
- Flow sensors 2 No’s.

OUTPUT REQUIREMENTS :
- Solenoid Valves 12V DC - 2 No’s. (Each 12V / 3Amps)
- 1.3.2 Pump -12V DC. (12V / 10A)
- 1.3.3 Battery Charging - 13.8V / 1A

MULTICOIN VALIDATOR :
It shall allow to programming 6 types of coins.
- One Rupee coins small & big coin.
- Two Rupee coin only big coin.
- Five Rupee small old & new coin.
- Ten Rupee coin new only.
WATER VENDING TAP’S: Minimum 2 tap’s, as per user convenient, from any Tap, Water can be drawn by pressing its switch.

WATER VENDING VOLUME CALIBRATION: It shall allow to increase and decrease the flow sensor pulse to calibrate and fix the defined water volumes as required.

TECHNICAL SPECIFICATION FOR IRRIGATION WORKS

SCOPE OF WORK

The scope of work under this shall include, but not limited to,

a) Supply, installation and commissioning of the pressurized irrigation system

b) Supply, installation and commissioning of all items included in the scope of works as described below (but not limited to):

i) Disc Filter
ii) All pump, piping, valves and associated fittings
iii) Sprinklers/Drippers/laterals
iv) Irrigation control system
v) All wiring and associated fittings.

c) Execution of Civil, Mechanical, Electrical, Instrumentation and Piping work as specified including Engineering, Supply, Fabrication, Erection, Installation and Commissioning of Landscape Irrigation system.

d) Regardless of the items, quantities or description contained in the drawings, or specification, it is the contractor’s responsibility to ensure the proper functioning of Irrigation system.

e) The detailed Irrigation drawings and documents shall be prepared covering all the items

f) Training about automated items to the ASCL Operation and Maintenance staff for period of one month.

g) Operation and Maintenance of Irrigation system till the issue of Completion Certificate.

DESIGN INTENT

a) The design intent of this irrigation system is to supply sufficient irrigation water to the landscape area.
b) Landscape areas will be watered using automated drip and sprinkler irrigation systems and in some place with hose pipe from Quick coupling valves, where it is not feasible to installed irrigation systems.

Deliverables

Hard and Soft copies of the following deliverables shall be submitted
a) O & M manuals  
b) As Built drawings (3 sets of Hard copies + one set of soft copy)  
c) Catalogues for Spare parts  
d) Test certificate of major equipment.  
e) Warranty certificate of all major items.  
f) Weekly progress reports during Construction stage.

1  PUMP

A. SUBMERSIBLE VERTICAL PUMPS

PUMP

- The pump shall conform to IS 8034: 2000 amended up to date.
- The pump shall be submersible bore well type directly coupled to submersible electric motor with built in anti-thrust bearing. The pump set shall be complete with suction strainer, anti-thrust streamlined non return valve and submersible type copper conductor cable of suitable size.
- Inlet passage of the suction casing shall be designed reduce entry losses and strainer shall be provided in suction casing to restrain large solids entering the pump. For submersible type cables, clamping arrangement and cable guard shall be provided on pump casing.
- Each metallic impeller shall be dynamically balanced to Grade G 6.3 of IS 11723.
- The pump characteristic shall be non overloading type to ensure trouble free operation in the entire operating range.

ELECTRIC MOTOR

a) The submersible motor shall conform to IS 9283. The electric motor shall be three phase squirrel cage, water filled submersible type.

b) The motor shall be suitable for operation on 415V (3 phase), 50 Hz electric supply with required RPM capable of delivering the rated output with
   i) The terminal voltage differing from its rated value by not more than +6% and -15%
   ii) The frequency differing from its rated value by not more than 3%
   iii) Any combination of b) and ii).

c) Motor shall be capable of running continuously at a B. H. P. (brake horse power) not less than 10% in excess of that absorbed by pump set under any operating conditions.

d) Starting current for the motor shall be limited to 6 times the full load current.

e) Motor shall have minimum starting torque of 140% FLT and maximum starting torque 200% FLT. It shall have 100% FLT during running condition.

f) Contractor shall submit the motor details including manufacturer’s guarantee for efficiency and P.F. at full load, no load, 3/4 load, 1/2 load.

MATERIAL OF CONSTRUCTION

The material of construction shall be suitable for application and site conditions. The material of construction shall be as follows:

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Component</th>
<th>Material of Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Pump bowl</td>
<td>High graded CI</td>
</tr>
<tr>
<td>2.</td>
<td>Impeller</td>
<td>Bronze Gr LTB2 / 20% Glass filled Noryl</td>
</tr>
<tr>
<td>3.</td>
<td>Diffuser</td>
<td>20% Glass filled Noryl</td>
</tr>
<tr>
<td>Sr.</td>
<td>Component</td>
<td>Material of Construction</td>
</tr>
<tr>
<td>-----</td>
<td>------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>4</td>
<td>Stage casing</td>
<td>High graded CI</td>
</tr>
<tr>
<td>5</td>
<td>Motor casing</td>
<td>SS 304</td>
</tr>
<tr>
<td>6</td>
<td>Pump shaft</td>
<td>SS 410</td>
</tr>
<tr>
<td>7</td>
<td>Motor shaft</td>
<td>SS 410</td>
</tr>
<tr>
<td>8</td>
<td>Bearing bush</td>
<td>Bronze IS 318 Gr LTB 2,3,4,5</td>
</tr>
<tr>
<td>9</td>
<td>Base</td>
<td>Cast iron / Brass</td>
</tr>
<tr>
<td>10</td>
<td>Fasteners</td>
<td>SS 304</td>
</tr>
<tr>
<td></td>
<td>Strainers</td>
<td>SS 304</td>
</tr>
</tbody>
</table>

**TESTING**

Each pump-motor set shall be factory tested at manufacturer’s works as per I.S. 8034 to determine following characteristics covering the full operating range.
- Head- Discharge curve
- Efficiency curve
- Dynamic balancing of rotor, impeller

**CERTIFICATES**

Contractor shall furnish:
- Performance characteristic curves.
- Catalogue of pump set and details of pump and its motor.
- Manufacturing test certificate, Guarantee card and list of parts for the pump sets.
- Operation and maintenance manuals for the pump set.
- Drawings showing cross sections of pumps, mounting arrangements, list of materials and necessary curves along with their offer.

In the event of any pump failing to meet the specified requirement of pump set it shall be modified and retested until the requirements are fulfilled. The inspections and testing of the pump set are at contractors cost.

**B. SUBMERSIBLE OPEN WELL PUMPS**

**DESIGN REQUIREMENTS:**

Pump shall be submersible open well monobloc type.

The pump shall be capable of delivering the required flow rate for both continuous and intermittent operations, at the specified operating conditions. The pump shall be designed to have minimum maintenance and easy accessibility to all components.

Flow rate versus head curve shall have stable and continuously rising characteristics towards the shut-off with the highest at shut off. In case of unstable (dropping) characteristics the duty point shall be well away from the unstable region. Besides the actual flow rate versus head curve, curves for minimum and maximum impeller diameters shall also be shown.

Pumps of a particular category shall be identical and shall be suitable for single as well as parallel operation with equal load division at any point in between the maximum and minimum system resistance. Components of identical pumps shall be inter-changeable.

Pumps shall run smooth without undue noise and vibration. Noise level produced individually or collectively shall not exceed 85 dB (A) measured at a distance of 1.0 metres.
from the source in any direction. The overall vibration level shall be as per zones A and B of ISO 10816-1.

The power rating of the pump driver shall be the larger of the following considering the frequency variation:

The maximum power required from zero discharge to run-out discharge at site climatic condition.
110% of the power required at any operating point in between the maximum and minimum system resistance curves for any combinations of pumping.
115% of the power required at the design point.

The critical speed of the pump shall be not less than 130% of the normal operating speed of the pump.

The pump set shall be capable of withstanding the accidental rotation in reverse direction. The direction of rotation shall be clockwise viewed from the drive end.

CONSTRUCTION FEATURES
Pump casing shall be of robust construction. The pump suction casing between the pump and motor shall be guarded by a perforated strainer to prevent the entry of any suspended materials in the water.

Closed Impeller shall be equipped with seal rings on their hubs.

The impeller shall be statically and dynamically balanced. Pump bearings shall be water lubricated and protected against ingress of sand and other suspended particles.

In case of open impeller, the pump shall be designed to take care of the additional thrust produced.

Double Mechanical seals shall be provided to protect the motor from ingress of water along the shaft. The preliminary and secondary seals shall be oil-lubricated with tungsten carbide or silicon-carbide faces and they should be equipped with an electrical monitoring system for seal failure detection.

Motor shall be directly coupled to the pump shaft and shall be a hollow shaft motor with thrust bearings capable of taking thrust load developed by the pump and the dead weight of the shaft and impeller.

In addition to accessories which will listed by vendor in data sheet, any other accessories required for safe and efficient operation of pump shall be provided.

INDUCTION MOTOR FOR SUBMERSIBLE PUMPS
The submersible motor shall confirm to IS: 9283:2013

PERFORMANCE AND CHARACTERISTICS
Motors shall be capable of giving rated output without reduction in the expected life span when operated continuously under varying voltage and frequency supply conditions.
Motor shall be of oil-filled or oil-lubricated or water-filled type. Pressure equalising diaphragm and sand guards with seals shall be provided to prevent the outside water and sand entering the motor.

The starting current of motor shall not exceed 200% of rated full load current for star/delta starting and 600% of rated full load current for DOL starting, under any circumstances.

Motors shall be suitable for full voltage direct-on-line starting or star-delta starting.

Motors shall be capable of starting and accelerating the load with the applicable method of starting, without exceeding acceptable winding temperatures, when the supply voltage is in the range 85% of the rated motor voltage to maximum permissible voltage.

The locked rotor current of the motor shall not exceed 600% of full load current (subject to tolerance as per the applicable standard).

Motors shall be designed to withstand 120% of rated speed for two minutes without any mechanical damage, in either direction of rotation.

The motor vibrations shall be within the limits specified in applicable standard unless otherwise specified for the driven equipment.

Except as mentioned herein, the guaranteed performances of the motor shall be met with tolerances specified in applicable standard (IS: 9283:2013).

The stator winding shall be made from high conductivity annealed copper conductor; PVC insulated winding wires conforming to IS 8783 for wet type motors. The stator winding shall be of high conductivity annealed copper enamelled insulated wires confirming to IS 4800 for dry type motors.

2 SUBMERSIBLE CABLE
The cable shall be PVC insulated and PVC sheathed, flexible, 3 core flat type. The size of the conductor shall be adequate for continuous use under water service. The submersible cable shall conform to IS 9283. The cable gland shall be properly sealed to prevent entry of pumped liquid into the motor. Suitable cable guards and supporting clamps for cable shall be provided.

The cable shall be terminated above ground level in a local terminal box with facility for terminating cable. The local terminal box with outlets for incoming and outgoing cables shall be in pump vendor’s scope.

The size of the conductor and length of cable should be suitably selected so that the voltage drop at motor terminals does not exceed 3 percent of the rated voltage.

3 EARTHING
Earthing of the motor shall be done in accordance with the relevant provisions of IS: 3043:1987. For fixed installation, earthing connection may be made to discharge pipe clamp.

4 INSULATION
Any joints in the motor insulation such as at coil connections or between slot and end winding sections shall have strength equivalent to that of the slot sections of the coil. The insulation shall be given tropical and fungicidal treatment for successful operation of the motor in hot, humid and tropical climate. The tropical sing treatment shall be as per the applicable standard.

5 TEMPERATURE RISE

The temperature-rise test of the motor shall be taken with the motor coupled to the suitable pump to give the full load output of the motor. When the various temperatures are stabilized, the set is stopped and the temperature-rise of the stator winding by the resistance method shall not exceed 35°C at rated voltage and 45°C at 85% of the rated voltage. During the test, the temperature of the cooling water may not exceed 45°C. As the cable resistance will also be substantial, it is necessary that while calculating the temperature rise by resistance method, due care is taken to account for the correct hot and cold resistance of windings.

6 CONSTRUCTION FEATURES OF MOTOR

The motor shall be suitable for continuous use in fully or partially submerged condition. A built-in cooling system if required shall be provided to allow the motor to operate continuously at its rated output regardless of whether the electric motor is submerged or not by providing either external or internal cooling arrangement.

7 TESTS AND INSPECTION

Hydro-test pressure on casing shall be 1.5 times maximum discharge head or twice differential head whichever is higher. Maximum discharge head is defined as the sum of the shut-off head and maximum suction head. Unless otherwise stated, the hydrostatic tests on the casing shall be conducted for a minimum duration of 30 minutes.

The pumps shall be tested in accordance with HIS, ISO 9906 and IS 5120, at rated speed at manufacturer’s works to measure capacity, total head, efficiency and power. The negative tolerance on efficiency shall be limited to 2.5% and not 5% as indicated in IS 5120. These tests shall form the basis for acceptance of pumps except for vibration and noise. The pumps shall be tested over the range covering from shut-off head to the maximum flow. The duration of the test shall be minimum one (1) hour. Minimum five (5) readings approximately equidistant shall be taken for plotting the performance curves.

After installation, the pumps shall be subjected to testing at site also. If the site performance is found not to meet the requirements regarding vibration and noise as specified. The equipment shall be rectified or replaced by the vendor, at no extra cost to the purchaser.

8 PERFORMANCE GUARANTEE

Performance parameters to be guaranteed by the vendor. Pump or any portion thereof is liable for rejection, if it fails to give any of the guaranteed performance parameters.

9 PENALTY:

If guaranteed efficiencies are not achieved during the test, client shall have the right to reject the pump or right to accept the equipment with lower efficiencies & shall have right to charge penalty for that.

10 DRAWINGS
The following drawings shall be submitted by the BIDDER along with their proposal.

1. Preliminary outline dimensional drawing showing details of pump set, installation details, civil foundation, clearances, minimum submergence, etc.

2. Performance curves for capacity vs total head, efficiency, and input to motor. The capacity range shall be zero flow to run out flow.

3. Typical cross sectional drawing showing constructional details.

11 MATERIALS OF CONSTRUCTION

Unless otherwise specified in Data Sheet, the Material of Construction for the pumps shall be as follows:

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Component</th>
<th>Material of construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Casing</td>
<td>Cast Iron IS:210 Gr. FG 220</td>
</tr>
<tr>
<td>2.</td>
<td>Impeller</td>
<td>SS ASTM A351 CF8M</td>
</tr>
<tr>
<td>3.</td>
<td>Shaft</td>
<td>SS ASTM A276 TYPE 410</td>
</tr>
<tr>
<td>4.</td>
<td>Shaft sleeve</td>
<td>Bronze</td>
</tr>
<tr>
<td>5.</td>
<td>Motor body</td>
<td>Cast Iron</td>
</tr>
<tr>
<td>6.</td>
<td>Sealing</td>
<td>Mechanical seal</td>
</tr>
</tbody>
</table>

PVC PIPES AND FITTINGS

A. Pipes

The pipes shall be round and shall be supplied in straight lengths with socketed ends. The internal and external surfaces of pipes shall be smooth, clean, and free from grooving & other defects. The ends shall be cleanly cut and square with the axis of the pipe. The pipes shall be designed by external diameter and shall conform to IS: 4985. The pipes shall be of Class-III; 6 kg/cm² pressure rating.

B. Fittings

Fittings shall be injection Moulded and shall be 10 kg/cm² pressure rating and conform to Indian Standard.

PIPE WORK

1. The acceptable class of pipes shall be is 4985:2000 PVC pipe
2. The laying, jointing, thrust blocking and testing shall be performed to the pipe as per manufacturer’s recommendations. If there be any conflict with this specification; the contractors will notify the employer’s representative for resolving it at site.

3. Mainline - Pipes will be solvent weld jointed supplied in standard 6 meter lengths. All fittings will be solvent weld jointed as per manufacturer or as per Indian standard.

4. Sub-mains and laterals
   a. Pipe will be solvent weld jointed supplied in standard 6 meter lengths.
   b. PVC fittings upstream of the sub-main/isolation valve will be at pressure rating 50% greater than the pipe rating.
   c. Pipe ends should be cut square and shaving removed
   d. All joints will be primed and left to cure for one hour undisturbed

5. Laying of pipe work.
   a. Pipes will be laid in the routes and sizes as indicated on the drawings. In the case where multiple pipes or electrical conduits are laid in the same trench, they must be located side by side, not crossing each other or stacked one upon the other. Minimum 50 mm gap shall be maintained between two pipelines, when two or more pipelines laid in the same trench.
   b. All pipe laying and jointing will be performed in situ in the trench on the prepared bedding; not assembled above ground and placed in the trench at a later stage.
   c. At the end of each day’s work, all open ends of pipework and conduit will be plugged and staked to prevent entry of vermin, dirt, water or moisture and movement of the pipe.
   d. Where pipe is required to pass over or under drainage pipe, the Contractor is to ensure a minimum clearance of 50 mm between the irrigation pipe and the drainage pipe.

6. Crossings
   a. Electrical Cables
      A separate PVC electrical conduit will be installed for the high voltage cables. The high voltage cables must not share a conduit with low voltage cables
   b. Low voltage cables
      This conduit must be separated by minimum 300 mm from the high voltage conduit (if any).
   c. Conduit
      The size of the conduit will allow easy pulling of cables. So the minimum size of conduit used will be 25 mm. If the number of cables increased to 7 then go for 40 mm conduit. If the conduit is exposed to sunlight in any place, it will be UV resistant.

Road crossing
   a. Pressure pipe
      Where the pipe work goes under a road, the contractor will install:
      i) U-PVC pipe sleeve of sufficient diameter to allow easy installation of the PVC pipe.
      ii) GI pipe of equivalent internal diameter to the PVC pipe.
   b. Depth
      The minimum depth of the sleeve and conduits will be 600 mm measured to the top of the sleeve.
   c. Ends of sleeve and conduits
      These will be clearly marked above ground for ease of future location.

Pathways & internal maintenance road crossings
a. Pressure pipe
   Where the pipe work goes under pathways, the contractor will install uPVC pipe sleeve of
   sufficient diameter to allow easy installation of the PVC pipe.

b. Depth
   The top the pipe and conduits will be a minimum 450 mm below the base of the pathways.

7. Trench Work
   a. Mixing of soil layers
      When the depth of the trench extends through different soil structures (e.g., sand
capping, topsoil, clay, and native earth), the contractor will:
      i) Remove each layer and place it separately on the surfaces.
      ii) Refill the trench to restore the original layers of soil.
      iii) Mixing of the different soil layers is not limited.

b. Mainline excavation
   i) Trenching for mainlines will be performed by hand digging only
   ii) The depth of trench for mainline shall be minimum 600 mm from the finish ground level.
   iii) The material removed whilst digging will be placed no closer than 300 mm to the top
edge of the completed trench and there will be a minimum of loose soil left in the bottom
of the trench prior to pipe laying.

c. Sub-main/Lateral line excavation
   i) Trenching for lateral lines will be performed by hand digging or by backhoe with a
maximum bucket width of 300 mm, to minimize disturbance to the surrounding area.
   ii) The depth of trench for sub mainline shall be minimum 450 mm from the finish ground
level.
   iii) These trenches will be straight with the bed level and graded.

d. Back Filling
   i) Where trench work encounters unsuitable bedding material such as hard clay, rock,
shale, loose stones, excessive tree roots, etc. a 100 mm bed of sand or loam will be placed
below pipe in the trench prior to pipe laying.
   ii) This policy will apply to back filling of all trenches, where the pipe will be covered with
100 mm of sand or loam to prevent similar debris coming in contact with the pipe or control
cables. Under no circumstances will construction debris of any kind be included in any
back fill material.
   iii) Allowances should be made for back filling during the heat of the day to minimize the
effects of thermal expansion and contraction on pipe already laid.
   iv) Trenches will be back filled on the same day as they are excavated. i.e. trenches will
not be excavated until required. This is to prevent flooding of trenches and floatation of
pipes.

e. Compaction
   i) Compaction should take place only after suitable bedding and back filling has been
completed to the satisfaction of the Employer’s Representative.
   ii) Compaction can be achieved by either:
      - plate compaction in layers not exceeding 300 mm
      - wheel rolling with a suitable vehicle after 450 mm of cover is provided
   iii) Regardless of which method is used, it will remain the Contractor’s responsibility to
ensure reinstatement of trench subsidence during both the contract and the defects liability
period.

f. Fixing & Staking
The Fixing & staking of the mainline, valve and controller will be done by the contractor subject to approval by the Employer’s Representative. The contractor will supply the stakes as follows:
a. Each will be 1 m long.
b. The top of the stake will be flanged to make it highly visible from a distance of 200 m to prevent damage from machinery.
Different colour flags if required will be used for
- Quick Coupling valves
- Mainline
- Controller

8. **Thrust Blocks**
Mainline concrete thrust blocks will be placed on all fittings that are subject to unbalanced thrust forces created by pressure and fluid movement. That is, at all mainline bends, tees, reductions, expansion, caps, isolation valves etc. Excavation of the thrust bearing surfaces will be at right angles to the line of thrust and located in either solid, undisturbed soil or soil which has been compacted specifically for that purpose. In case of bigger pipes (80 mm dia and above), thrust blocks of cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate of 20 mm nominal size) shall be constructed on all bends. The thrust blocks must have cured for 24 hours before pressure testing.

**FILTER**
The filters to be used on this system shall be to suit the nominated total flow rate. The filter is to have a maximum 1 mtr pressure loss across it. The Contractor is to provide full details and operating characteristics of the filter he intends to use on this system including pressure loss and backwash water requirements for approval by the Employer’s Representative. Filter element shall be with mesh of 100 micro size and economical element with high filtration efficiency. Maximum operating pressure 10 kg/sq.cm.

**AIR VALVES**
Air Valves will be double acting air/vacuum release valves. These valves will be isolated from the mainline by gate valve. Air valves will be installed so that they are a minimum 100 mm and a maximum 200 mm below grade.

**QUICK COUPLING VALVES (QCV)**
These will be 20mm (3/4") quick coupling valves. Each QCV will be securely attached to a solid stake to prevent rotation. 20 mm (3/4") plastic coupler keys and swivel hose elbows will also be provided by the contractor to enable use of the QCV’s. The QCV shall have a thermoplastic locking cover. The cover shall be able to opened with suitable locking key. The valve body construction shall be one/ two piece type. The valve body & coupler key shall be made from cast red brass. The seat disc plunger shall be spring loaded to maintain the valve in closed position at zero inlet pressure. The QCV shall be able withstand 10 bar pressure.

**ISOLATION VALVES**
Isolation Valves:
a. Mainline isolation points will be achieved by installing PVC ball valves at designated locations. These valves will be housed in valve boxes.
b. The valve handle will be located within 150 mm from the top of the valve box for ease of operation.
VALVE BOXES

Valve Boxes

All valve boxes will be with a green colour lid or an approved equivalent, fitted with bolted down lids. All valve pits will be constructed of bricks. There will be no contact between the pipe and the valve box or valve pit. Solenoid valves, isolating valves, flush valves and quick couplers shall be installed in an access box of sufficient size to permit ready removal of the valve inner assemblies without removing the box from the ground. Valve numbers and station numbers must be clearly marked inside and outside to the box with a permanent paint or by using plastic tags. Valve boxes and covers shall be green in colour. Valve box covers shall locking type, secured with a 3/8-inch stainless steel bolt, washer and nut. The valve box & cover shall be able to sustain a load up to 650 kg. All gravel used in valve boxes shall be washed crushed gravel of approximately ¾ inch size. No pea gravel shall be used.

SWING JOINT

All swing joint (articulated) risers are to be swing joint risers or an approved equivalent with O ring sealing for the threaded joints. The length of all swing joint risers will be 300 mm or as per site requirement.

SPRINKLERS

The sprinkler will be gear driven /spray type as per requirement.

a) All gear driven drivers will be bottom/side connected to the lateral pipe work via swing joint or pipe with necessary fittings.
b) Each sprinkler will be initially installed as per lawn or shrub height at the site with the top parallel to the grade but 75 mm to 100 mm above.
c) Each sprinkler will be enveloped in a compacted sand bed and sand surround to enable easier resetting of the sprinkler height. The sand surround will be 100 mm diameter. The sand will be compacted to prevent subsidence.

POP-UP SPRINKLER

a) The sprinkler shall be of the gear-driven rotary type or rotary spray type, capable of covering 5 to 12 m spacing range 2 to 3.5 m kg/cm². The sprinkler shall include a set of five (5) interchangeable nozzles.
b) The sprinkler shall be available in an adjustable part-circle configuration. The adjustable part-circle unit shall be minutely adjustable from 0° to 360° or 70° to 360°. The adjustable unit shall be adjustable in all phases of installation, i.e., before installation, after installation (static), and after installation while in operation. The pop-up versions of the sprinkler shall have a ratcheting riser assembly for final arc orientation.
c) The sprinkler shall have a 102 mm, 152 mm, or 305 mm pop-up stroke. The pop-up sprinkler shall be available with a drain check valve to prevent low head drainage, and be capable of checking up to 7 feet of elevation change. If the elevation exceeds 2.1 m, use check valve.
d) The sprinkler shall have an exposed surface diameter after installation of 30 mm. The sprinkler shall have a 12.5 mm or 20 mm inlet. The sprinkler shall be serviceable after installation by unscrewing the body cap, removing the riser assembly, and extracting the inlet filter screen.
e) The body and riser of the sprinkler shall be constructed of noncorrosive, heavy-duty A.B.S. plastic. The sprinkler shall carry a minimum of two-year warranty.
f) All sprinklers shall be covered by pipe sleeve of suitable size to protect it from lawn mower.

POP-UP SPRAYS AND ROTOR CONNECTION

a) The flexible connection between the irrigation sprays/rotors and the sub-main shall be via. Swing joint of U.V. stabilized, class 5, LDPE (Low Density Polyethylene pipe) pipe, manufactured to BS 1972/67 - 3287. All Swing joints shall have size, class, manufacturers name and standard printed on it.
b) Service saddle of class 5 or Compression fittings shall be used for pipe connection to the sprays/rotor. The fittings shall have the body, locking ring, thrust collar and internal barb manufactured from master batch U.V. stabilized polyethylene. The locking ring shall be manufactured from acetylic resin and the rubber seal material. The fitting shall have a pressure rating of 10 bar and shall secure the pipe with an external locking ring plus an internal push fit barbed adapter.

PRESSURE COMPENSATING Dripper LINE (IN-LINE)

The drip line shall be brown in colour. The dripper line shall have pressure compensating emitters welded to the inside surface at selected intervals. The pressure compensating dripper shall consist of “dual regulation” utilizing both turbulent flow labyrinth and EPDM diaphragm. The dripper shall be continuously self-cleaning and should have an inlet filter capable of being cleaned by flushing the line. Pressure compensation shall be between 0.5 kg/cm² to 4 kg/cm². The coefficient of manufacturing variability must be less than 0.04 as determined by the vendor. The dripper line must be warranted against solar damage for 10 years. The dripper line shall be able to be installed with the dripper in any orientation. Temperatures to 60°C shall not affect dripper flow rate. The dripper shall have a large “water path” outlet that acts as a mechanical barrier to root intrusion. The drip line shall be of 16mm diameter and dripper flow rates of 3.5 lph. Pressure compensating dripper line spacing shall be 300 or 450 mm depending on the planting pattern.

VALVES

All valves (ball, gate, globe, check, safety) shall be of gun metal or PVC as suitable for the particular service. All valves shall be of the particular duty and design. Valves shall either be of screwed type or flanged type, with suitable flanges and noncorrosive bolts and gaskets. Tail pieces shall be supplied along with valves. Gate, globe and check valves shall conform to Indian Standard IS: 776 and non-return valves and swing check type reflux to IS: 5312. Sluice valves, where specified shall be flanged sluice valves of cast iron body. The spindle, valve seat and wedge nuts shall be gunmetal. They shall generally have non rising spindle and shall be of the particular duty and design. The valves shall be supplied with suitable flanges, non-corrosive bolts and asbestos fiber gaskets. Sluice valves shall conform to Indian standard IS: 780 and IS: 2906. Ball valves shall be of openable type. It shall have a pressure rating of minimum 10 Kg/Cm².

a. Electric Control Solenoid Valve

The valve body and bonnet shall be constructed of heavy duty glass reinforced nylon body and internal parts shall be stainless steel diaphragm shall be nylon reinforced nitrile rubber. Solenoid coil shall be encapsulated in moulded epoxy. Normally closed diaphragm
type, slow opening and closing. Should be rated 24V-50Hz -2 watts. Maximum pressure rating shall be not less than 15 kg/sq.cm. BSP inlet/outlet, solenoid plunger shall incorporate self-flushing type stainless or internal filter. Provision for manual open/close and flow control stem with cross handle for regulating the flow. All valves shall be provided between 0.5 – 7 kg/sq.cm (within an accuracy of ±0.35) kg/cm² regardless of upstream pressure. The pressure regulator shall be with a calibrated dial for dry setting of the outlet pressure.

The valve shall be capable for pressure regulating electrical and manual mode operation using external and internal bleeds. The valve shall be inline or angle configuration as per the requirements. The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation. Only Moulded uPVC/Brass fittings shall be used with solenoid valve assemblies.

b. Pressure Reducing Valve

Each pressure reducing valve set shall be complete with pressure reducing or pressure regulating valve, isolating valves, pressure gauges on inlet and outlet, pressure relief valve on outlet and filter on inlet. Each pressure reducing valve shall contain loading neoprene diaphragm and a full floating, self-aligning, ignition resistant seat and shall be of the single stage, pressure reduction type with provision for manually adjusting the delivery pressure. The valve shall fail safe to the low pressure. Valves shall be capable of operating and maintaining automatically the respective delivery pressure and flow rates and shall not be liable to creep. Valves shall also be capable of maintaining the pre-set downstream pressure under static condition. The filter on each inlet to a pressure reducing valve shall be of replaceable porous sintered metal type.

GARDEN HOSE

The garden hose shall be superior quality flexible PVC hose with polyester yarn reinforcement which shall give the extra strength & resistance in twisting and stretching. The pipe shall have high gloss finish and good visibility. It shall have good cold and warm resistance. The burst pressure shall be 35 bars. The hose shall be supplied with the hose reel.

PIPE SLEEVES

Pipe sleeves, next larger diameter than pipes shall be provided wherever pipes pass through walls & slabs and annular space filled with fiberglass & finished with retainer rings. All pipes shall be accurately cut to the required sizes in accordance with relevant BIS codes and burrs removed before laying. Open ends of the pipe shall be closed as the pipe is installed to avoid entrance of foreign matter.

POINT OF CONNECTION

Tapping point will be provided at the site by project team and should be utilized for section wise irrigation system installation as shown in the layout. Only one point of connections (POC) would be made using Clamp saddles so as to minimize excavation at various places in view of depth of existing Mainline (0.6 Meters). Submain line of 63, 50 or 40mm would start from POC after valve installation. Irrigation programs of all valves should be coordinated with flow and pressure availability.

IRRIGATION CONTROL SYSTEM
The system will be controlled by the outdoor type single stations battery operated Irrigation Controller. The controller will be installed inside the valve box. All necessary fittings like battery, cables & connectors should be installed as per standard & as per instruction of owner requirements.

i) All electrical connections will be performed by licensed electrical personnel.

ii) All cabling be in accordance with the relevant statutory authority requirements.

a. Low Voltage (solenoid) control cables
   The cables running from irrigation controller sectional valve will comply with the following:
   - They will be PVC sheathed.
   - There will be a spare active cable run along the length of each common cable.
   - A 1m loop of cable will be left at each solenoid to facilitate future valve maintenance.
   - Cables joint will only be accepted at each solenoid valve.
   - The only acceptable method of joining cables will using connectors used in Landscape Irrigation work.

b. Installation of Cables
   - All cables will be tested for continuity before installation with a mega-ohm.
   - This test will repeated after the cables have been installed in the ground but before back filling.
   - The cables must not be connected to any other electrical equipment while they are being tested.
   - All tests will be carried out by the contractor and approved by the Employer’s Representative.

**TESTING PROCEDURES**

a. Adjustment of the system:
   The contractor will adjust the various components of the irrigation system to ensure the overall operation of the system is efficient.

b. Static pressure test
   A static test of two hours at 1.5 times the working pressure of the mainline (but no higher than the pressure rating of the pipe) will be performed if required at the completion of the tapping band installation stage of each section of the mainline.
   During the period of the static test, the pressure will not drop by more than 0.25 kg/sq.cm
   All isolation valves and thrust blocks must be in place and cured for the mandatory period of time. Air valves, quick coupling and lateral valve assemblies must be completed and the lines thoroughly flushed and primed prior for testing. There will be no permissible leaks at any point in the system. All tests will be carried out by the contractor and approved by the Owner’s Representative.

**COMMISSIONING**

The commissioning of irrigation controller system will be carried out by the manufacturer’s representative in conjunction with and approved by the Owner’s Representative.
The commissioning will include, at the time of hand over, a demonstration of all sections and individual elements pertaining to the operation of the irrigation system.

**HAND OVER**
Before hand over, the Contractor shall ensure the following; In addition to the static pressure test or commissioning, the completed system must be operated without fault for at least one week prior to hand over. Should any major leaks occur during this period, the static pressure test procedure will be repeated once the problem has been rectified. If the system is repaired, then it must operate for at least one week without fault prior to hand over being accepted. In lieu of an official hand over, any works properly tested, commissioned (if applicable) and used by the Owner for at least one week without fault will be deemed as handed over.

QUALITY

All the equipment’s, to be supplied under this contract, has to be as per the list of Approved Makes or the experienced manufacturer. The equipment of only those manufacturers, who have sufficient proven experience of manufacturing the respective equipment of similar capacity, shall be considered.
The respective equipment should have been manufactured, supplied on at least 5 installations, commissioned successfully and should be running satisfactorily since at least last 5 years continuously.

WARRANTY

Comply with the requirements of each type of Equipment and specification mentioned elsewhere in this document. Warrant all components to be free of defects in materials or workmanship for 12 months from date of satisfactory completion of performance test.

Individual warranties by component manufacturer in lieu of single source responsibility by the main Equipment manufacturer shall not be acceptable. Items which fail during the warranty period, excluding expendable items, shall be replaced without cost to the Owner / Employer. Provide manufacturer's guarantee and warranty certificates prior to equipment start-up.

DATA SHEETS

SUBMERSIBLE PUMPSET

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Particulars</th>
<th>Unit</th>
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<td>Efficiency at duty point</td>
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### Scope of Work & Technical Specifications

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### GATE VALVES

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### NON RETURN VALVES

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<td>'O' ring</td>
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### BALL VALVES

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<tr>
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<td>Type</td>
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<td>2</td>
<td>Material of Construction</td>
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</table>
### Scope of Work & Technical Specifications

| 2.1 | Body & body connector | - |
| 2.2 | Ball | - |
| 2.3 | Seat | - |
| 2.4 | Stem | - |
| 2.5 | Body Seal | - |
| 2.6 | Stem seal | - |

#### Design parameters

| 3.1 | Size | mm |
| 3.2 | Rating | Kg/cm² |

#### Testing

| 4.1 | Shell | Kg/cm² |
| 4.2 | Seat | Kg/cm² |

### QUICK COUPLER VALVE

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<td>3.</td>
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<td>4.</td>
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<td>5.</td>
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### Scope of Work & Technical Specifications

#### Water Supply

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<td>5.</td>
<td>Colour of the Pipe</td>
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<td>6.</td>
<td>Burst Pressure</td>
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#### GARDEN HOSE

#### VALVE BOX

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<td>3.</td>
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### PREFERRED VENDOR LIST

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<tr>
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<tr>
<td>2.</td>
<td>PVC pipes &amp; fittings</td>
<td>Jain / Finolex / Supreme</td>
</tr>
<tr>
<td>3.</td>
<td>Gate valves</td>
<td>Leader / Zoloto / Kirloskar Brothers Ltd</td>
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<td>4.</td>
<td>Gunmetal Valves (Sluice &amp; Check)</td>
<td>Zoloto / Sant / Leader</td>
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<tr>
<td>5.</td>
<td>Solenoid valve</td>
<td>Rainbird / Toro / Hunter</td>
</tr>
<tr>
<td>6.</td>
<td>Ball valves</td>
<td>Chemtech Industrial valves P. Ltd / G M Engineers / Hawa Engineers Ltd</td>
</tr>
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<td>7.</td>
<td>QCV, Key, Swivel elbow</td>
<td>Jain / Rainbird / Harit</td>
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<td>8.</td>
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<td>Rainbird / Toro / Hunter</td>
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### Scope of Work & Technical Specifications

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<th></th>
</tr>
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<td>9.</td>
<td>Drip line &amp; Drippers</td>
<td>Rainbird / Hunter</td>
</tr>
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<td>10.</td>
<td>Irrigation controller</td>
<td>Rainbird / Toro</td>
</tr>
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<td>11.</td>
<td>Garden Hose Pipes</td>
<td>Rainbird / Jain Irrigation / B.S.Hydro-pneumatic</td>
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<tr>
<td>12.</td>
<td>Valve/Surface Box</td>
<td>Rainbird / Jain Irrigation / Hunter</td>
</tr>
<tr>
<td>13.</td>
<td>Cables</td>
<td>Finolex / Polycab</td>
</tr>
</tbody>
</table>

### Technical Specifications for Storm Water Drainage

The following codes and standards unless specified herein shall be referred to, or equivalent to the approval of Engineer.

**RELEVANT IS CODES**

<table>
<thead>
<tr>
<th>IS 783</th>
<th>Code of practice for laying of concrete pipes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS 3764</td>
<td>Excavation work-code of safety.</td>
</tr>
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<td>IS 2720</td>
<td>Methods of test for soils</td>
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<tr>
<td>(Part 1)</td>
<td>Part 1 Preparation of dry soil samples for various tests.</td>
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<td>Part 34 Determination of density of soil in place by rubber balloon method.</td>
</tr>
<tr>
<td>Document Reference</td>
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<td>(Part 38)</td>
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<tr>
<td>IS 12592</td>
<td>Precast concrete manhole cover and frame-specification : 2002</td>
</tr>
<tr>
<td>IS 8112</td>
<td>43 grade ordinary Portland cement-specification : 1989</td>
</tr>
<tr>
<td>IS 5961</td>
<td>Specifications for cast iron grating for drainage purposes : (Reaffirmed 2003)</td>
</tr>
<tr>
<td>IS 1786</td>
<td>Specification for high strength deformed steel bars and wires for concrete reinforcement: 1985 (Reaffirmed 1990)</td>
</tr>
<tr>
<td>IRC SP-50-1999</td>
<td>CPHEEO Manual for Sewerage and Drainage -2014-MoUD, GoI</td>
</tr>
<tr>
<td>IRC SP-42-1994</td>
<td>Guidelines on Urban Drainage</td>
</tr>
<tr>
<td>IS 12592: 2002</td>
<td>Precast Concrete Manhole Cover and Frame- Specification</td>
</tr>
<tr>
<td>IRC SP-42-1994</td>
<td>Guidelines on Road Drainage</td>
</tr>
<tr>
<td>SP 7 (Part-9 Section-1) 1983</td>
<td>National Building Code of India</td>
</tr>
<tr>
<td>SP 35:1987</td>
<td>Hand book on water supply &amp; drainage</td>
</tr>
<tr>
<td>IS 1172 :1993</td>
<td>Code of Basic requirements for water supply, drainage and Sanitation</td>
</tr>
<tr>
<td>I.S. 3370 part I to IV</td>
<td>Code of practice for concrete structure for the storage of liquids</td>
</tr>
<tr>
<td>IS 1893-2002 part I to V</td>
<td>Criteria for earthquake —resistant design of structures</td>
</tr>
<tr>
<td>IS 1992-1969 / IS 6403-1971</td>
<td>Code for exploration to find the safe bearing capacity</td>
</tr>
<tr>
<td>IS 875 part I to III,1987</td>
<td>Code of practice for design loads for building and structures</td>
</tr>
<tr>
<td>IS 7357</td>
<td>Code of practice for structural design of tanks</td>
</tr>
<tr>
<td>IS 1786-1985</td>
<td>High strength deformed steel bars and wires for concrete reinforcement</td>
</tr>
</tbody>
</table>
Scope of Work & Technical Specifications

- **Channel Shapes**: Rectangular box type drains.
- **Material**: RCC
- **Minimum and Maximum Velocities**
  - Minimum velocity: 0.75 m/s (IRC SP 50)
  - Maximum velocity: 3.0 m/s (CPHEEO manual) -for concrete drains
- **Minimum free board**:
- **As per clause 4.9.3 of IRC -SP 50(b)**,
- **Road gully chambers**
  - Spacing at every 10m interval.
  - As per the typical road section requirements for various ROW roads
  - These chambers are of 50x45x60cm made of brick masonry with 500x450mm CI horizontal grating as per relevant IS standards.
- **Manhole and manhole covers**
  - Precast concrete manhole covers with frame at every 50m interval.
  - 20mm square bar foot rest shall be provided at every 0.5m interval (staggered) till the bed of the drain as per the relevant IS standards
- **Plot connections**
  Minimum of two storm water drainage connections connecting to main road drains are to be provided from every individual plots to prevent the frequent cutting of service road. RCC pipes with chambers are suggested for plot connections

**PARTICULAR SPECIFICATION**

**RCC STORM WATER DRAINS**
The drains to collect storm water network shall be made of reinforced cement concrete with concrete cover slabs on the top. For the material specifications pertaining to reinforced cement concrete, previous sections shall be referred to. All storm water drains shall be constructed with proper excavation, construction of RCC drains t true lines and levels as per the relevant drawings etc as per the direction of Engineer in Charge.

- **Road Gully Chamber with Horizontal Grating**:
The chamber shall be of brick masonry of specified class and shall have a C.I. grating with frame fixed in 15 cm thick cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) at the top and as per the drawing and directions of Engineer In charge. The size of the chamber shall be taken as the clear internal dimensions of the C.I. frame. The chamber shall have a connection pipe from the road gully chamber to the drain and shall be of 150mm NP-4 class RCC pipe material confirming to IS-458. The chamber shall be built at the location finalised by the Engineer-in-Charge. Generally the spacing of the chambers is at every 10m interval depending upon the grading of the road channel and the area of the drainage. Horizontal Gully Grating shall be of cast Iron grating and frames conforming to IS: 5961. The gully grating cover shall be hinged to the frame to facilitate its opening for cleaning and repairs. The weight of grating shall be minimum 75 Kg.

- **Brick Work**
The brick work for the chamber shall be with class 75 bricks in cement mortar 1:4 (1 cement: 4coarse sand). The external joints of the brick masonry shall be finished smooth, and the joints of the pipes with the masonry shall be made perfectly leak proof. The walls shall be built of one brick thickness.

- **Plaster and Pointing**
The walls of the chambers shall be plastered inside with 12 mm thick cement plaster 1:3 (1 cement: 3 coarse sand) finished smooth. Where the saturated soil is met with, the external surface of the walls shall be plastered with 12 mm thick cement plaster 1:3 (1 cement: 3 coarse sand) finished smooth up to 30 cm above the highest sub-soil water level with the approval of the Engineer-in-Charge. The plaster shall further be water proofed with addition of approved water proofing compound in a quantity as per manufacturer’s specifications and as per the directions of engineer in charge. For earth work excavation, bed concrete brick work, plaster and pointing, R.C.C. work and refilling of earth, relevant specifications provided earlier shall be followed. The earth work excavation shall be true to dimensions and levels shown on the plans or as directed by the Engineer-in-Charge.

- **Weep holes**
  Weep holes, 50 to 75 mm square shall be provided at 2 m vertically and horizontally unless otherwise specified in the entire length of storm water drain. The lowest weep hole shall be at about 30 cm above the ground level. All weep holes shall be surrounded by loose stones and shall have sufficient fall to drain out the water quickly. These weep holes shall be of RCC pipe / PVC pipe material as approved by the engineer in charge.

- **Pre-Cast Concrete Manhole Covers & Frames:**
  Pre-cast reinforced cement concrete manhole covers intended for use in Storm water generally conform to IS 12592 and shall be installed (at regular intervals / at every 50m c/c) at the locations shown in the drawings or as per the directions of the Engineer In Charge. For details specifications provided in the earlier sections shall be referred to. CI footsteps as per the specifications provided earlier shall also be embedded in the RCC drains at the manhole entry points for maintenance of the storm water drainage system.
1.0 INFORMATION & COMMUNICATION TECHNOLOGY (ICT) COMPONENTS

Scope of Works

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bullet Camera - 2MP Outdoor</td>
<td>20 Nos</td>
</tr>
<tr>
<td>'128 Channel NVR (with 60 TB Storage 30 Days)</td>
<td>1 no</td>
</tr>
<tr>
<td>'Client Workstation</td>
<td>1 no</td>
</tr>
<tr>
<td>Automatic Ticket Dispenser</td>
<td>2 nos</td>
</tr>
</tbody>
</table>

CLOSED-CIRCUIT TELEVISION (CCTV) CAMERA

Closed-circuit television (CCTV) Camera, also known as video surveillance, is the use of video cameras to transmit a signal to a specific place, on a limited set of monitors. It differs from broadcast television in that the signal is not openly transmitted, though it may employ point to point (P2P), point to multipoint (P2MP), or mesh wired or wireless links.

1.1.1 Indicative Solutions Architecture - CCTV

An indicative solution architecture proposed for the installation of CCTV Surveillance System at entire Brahmani Riverfront Development area and further monitoring at ICCC at Rourkela One - Building to enhance monitoring and management of security incidents in the building area is presented in the figure below:

![Figure 1: Reference - CCTV Solutions Architecture](image-url)
As highlighted in the figure above the network comprises of network of CCTV cameras, which are connected to Network Video Recorder (NVR)/Storage servers which stores and converts the video input as per the output requirement. The converted video feed is relayed to the monitoring station at campus, which is monitored by operators. On the event of detection of an incidence or possible cause of event, an alert is generated. Based upon the nature of alert the operator informs the concerned department for their timely response and resolve of the incident.

1.1.2 Major Components Details

1.1.3 Weather Proof Housing

The Housing shall be weather proof to IP 66. It shall have demister, sun shield internal and external fan for cooling. The minimum internal dimensions of the housing shall be 400 x 110 x 95mm and shall be capable of housing the camera and zoom lens.

Housings suitable for Indoor applications shall also be provided by the bidder.

The camera enclosure shall feature a removable / sliding / hinged type cover to allow easy access to the camera, lens and the camera mounting platform. The camera mounting platform shall be constructed from rigid non-conducting material. It shall be removable and shall allow for adjustment of height. Glands shall be provided for easy installation of the power and video cables. An optically clear and distortion free viewing window shall be provided. The housing shall be suitable for obstruction free viewing. The enclosure shall have a powder coated or epoxy finish. The design and colour shall be aesthetically suitable for the location in which it is used. Mounting brackets to suit the location of installation shall be supplied and these shall be designed to conceal the cables of the camera. For outdoor cameras, the enclosure shall be provided with a sun shroud, thermostatically controlled heater and blower. The protection class of these enclosures shall be IP 65 or better.

1.1.4 Power Supply for External (Outdoor) Camera

Power supply unit shall be well filtered, regulated, have constant voltage under load and shall have the following additional features:

- Output: 24V dc OR 12 V dc.
- Input: 230 V, 50 Hz, nominal.
- Power consumption: as required.
- Replaceable fuse: as required.
- Rectifier: silicon full wave bridge.
- Filter, choke and dual condensers.
• Hook-up (+) (-) terminals strip with terminal screws.
• Line cord: 2 m (6ft.), 3 (three) conductor with strain relief.

1.1.5 Accessories
The Housing should be made of extruded Aluminium and should be weather proof. The minimum internal dimensions of the housing should be capable of housing the camera and the Verifocal lens.
• The camera housing should be: Compatible to camera
• Suitable for the make and model no of cameras offered and as specified by the manufacturer
• Should be compact and indoor / outdoor type as required.
• Suitable for operation in upright and inverted position’
• Should be weather proof in case of outdoor mounting.
• Should be Vandal proof

1.1.6 Camera Mount
• The camera mount should be of the same make as that of camera and suitable for the model number offered as specified by the manufacturer.
• It shall be compact and indoor / outdoor type as required.
• It shall be support the weight of camera. Camera accessories such as housing pan & tilt head in any vertical or horizontal position.
• It shall be weatherproof in case of outdoor mounting.

1.1.7 Speed Dome Controller/PTZ Controller
• Speed Dome Controller should have variable speed joystick, LCD for programming and it should be able to control the Encoders as well as speed dome for PAN / TILT / Zoom functions.

1.1.8 Video Wall Rack
The video wall mountings should be of powder coated MS frames/supports and should be strong enough to take care weight of all Monitors. It should be suitably fabricated in such a way that only screens of monitors should be visible outside. Power supply wiring with suitable capacity sockets /earthing should be neatly installed on the rack. Video wall
computers should also be enclosed in the rack. The supporting frames of monitors should not sag due to its weight.

### 1.1.9 Cables

<table>
<thead>
<tr>
<th>Connectivity</th>
<th>Cable Type</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camera to L2 Switch</td>
<td>UTP CAT 6</td>
<td>RJ45</td>
</tr>
<tr>
<td>L2 Switch to L3 Switch in control room</td>
<td>Single Mode Fibre</td>
<td>SC / OFC,</td>
</tr>
<tr>
<td>L3 Switch to Video Wall/Switches</td>
<td>UTP CAT 6</td>
<td>RJ45</td>
</tr>
<tr>
<td>From L3 switches to NVR/NAS Box</td>
<td>UTP CAT 6</td>
<td>RJ45</td>
</tr>
</tbody>
</table>

### 1.1.10 Installation of UTP cable

- Cables should be dressed and terminated in accordance with the manufacturer's recommendations and/or best industry practices.
- Pair untwist at the termination should not exceed one-half an inch.
- Bend radius of the cable in the termination area should not be less than 4 times the outside diameter of the cable.
- The cable jacket should be maintained as close as possible to the termination point.
- Cables should be neatly bundled and dressed to their respective panels or blocks. Each panel or block should be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- The distance between UTP data cable and any power cable should be more than 4 inches.
- Each cable should be clearly labelled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labelled within the bundle, where the label is obscured from view should not be acceptable.
- Cables should be installed in continuous lengths from origin to destination (no splices).
- Horizontal distribution cables should be bundled into groups of not greater than 40 cables. Cable bundle quantities in excess of 40 cables may cause deformation of the bottom cables within the bundle.
• Cables should not be attached to ceiling grid or lighting support wires.
• Any cable damaged or exceeding recommended installation parameters during installation should be replaced by the contractor prior to final acceptance at no cost.
• A self-adhesive label or PVC marker ferules should identify the Cables. A cable label should be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate. Similar label or marker ferrules should also be placed on a section of the cable near to the patch panel termination.
• Pulling tension on 4-pair UTP cables should not exceed 25-pounds for a single cable or cable bundle. The pathway should be adequately sized so as not to exceed the 80% cross-section fill of cables. The pathway should be securely installed in the facility.
• Care should be taken when pulling cables into trucking to avoid damage due to snagging. Trucking partitions should be used to separate the data cables from power, and bridges should be used where data cables have to cross the mains.

1.1.11 Instruction of OFC cable
• Proper cable preparation is essential for splicing and installation. The following points outline some special precautions which are specific to fibre optic cable installation and therefore need to be noted.
• Fibre Stress: The fibres in the cable should not be subject to any undue stress. This means that if the cable is to be pulled into a long duet route then the specialized equipment and procedures should be used. As well, if the cable runs vertically for a significant length (more than 10m) then loop should be provided every 10m.
• Bend Radius: The cable manufacturer’s minimum bend radius should be observed. i.e. there should be no bends tighter than specified either during installation or once cable has been seen fixed.
• Cable Ties: If cable ties are used, then it is very important that they are not over tightened, thereby causing localized bending and fibre stress.
• Spare Cable: At least 5m of cable should be left at each end to allow testing, positioning of enclosures, spare fibre for repairs etc. Where appropriate, spare loop of cable should be included along the cable run to assist repair in case of accidental damage.
• Labeling: All cables and cable end should be labeled clearly.
• Cable End Protection: Where cable ends are to be left exposed then they should be sealed with heat shrink caps to prevent ingress of dirt or moisture.
• Earthing: In many circumstances completely non-metallic fibre optic cables can be used to eliminate all earthing problems. If metallic elements are present then they should be earthed in accordance with the installation.
1.1.12 Light guide Interconnect Unit (LIU)

It should be installed for terminating the OFC cables. It shall provide minimum bending radius and the splice trays shall function as a splice cover for pigtail splicing. It shall be of complete Aluminium fully powder coated. Cable glands shall be provided for secure anchoring the incoming cables. Rubber grommets shall be provided at the cable entry point for tight sealing. The splice tray shall also be of Aluminium powder coated with splice holder. Cable spools shall of flame retardant.

1.1.13 OFC Connectors

It shall be single mode SC type with push-pull mechanism. Fully compliance with latest industry standards. It shall be possible for selection of wide range of ferrule hole diameter selection.

1.1.14 OFC Adapters

It shall be suitable for single mode SC type fibre cable connectors. Fully compliance with latest industry standards. It shall be with snap / latch mechanism.

1.1.15 OFC Patch Cords

It shall be suitable for single mode SC type fibre cable connectors with plastic moulded plug type connectors. Standard 2.5 mm ceramic ferrules shall be used. It shall be compact and easy to connect.

1.1.16 Power Wiring System

Rigid PVC (heavy duty) Conduit Wiring System as per IS: 9537.

1.1.17 Conduits

- All rigid conduit pipes shall be of PVC and be ISI marked. The wall thickness shall be not less than 1.6 mm for conduit upto 32 mm dia and less than 2 mm for conduits above 32 mm dia.

- The maximum number of PVC insulated sables conforming o ISI: 694-1990 that can be drawn in one conduit as per standard norms. Conduit sizes shall be selected accordingly in each room.
• No conduit less than 20 mm in diameter shall be used.

• Flexible conduits will only be permitted for interconnections between switchgear, DB’s and conduit terminations in wall.

• All flexible conduits used in the system should be Halogen free, flame retardant and self-extinguishing polyamide conduits.

1.1.18 Conduits Accessories

• The conduit wiring system shall be complete in all respects, including their accessories.

• All conduit accessories shall be of solvent cement plastering type and under no circumstances pin grip type of clamp grip type accessories shall be used.

• Bends, couplers, etc. shall be solid type in recessed type of works and may be solid or inspection type as required.

• Saddles for surface conduit work on wall shall not be less than 0.55 mm (24 gauge) for conduit up to 25 mm dia. and not less than 0.9 mm (20 gauge) for larger diameter.

• The minimum width and the thickness of clips used for fixing conduit to steel joints, and clamps shall be per standard norms.

1.1.19 Outlets

• The switch box or regulator box shall be made of metal on all sides, except on the front (In case of cast boxes). The wall thickness shall be at least 2 mm and in case of welded mild steel sheet boxes, the wall thickness shall not less than 1.2 mm (18 gauge) for boxes up to a size of 20 cm x 30 cm, and above this size 1.6 mm (16 gauge) thick MS boxes shall be used. He metallic boxes shall be duly painted with anticorrosive paint before erection.

• An earth terminal with stud and 2 metal washers shall be provided in each MS box for termination of protective conductors and for connection to socket outlet/metallic body of fan regular etc.

• Clear depth of the box shall not be less than 60 mm, and this shall be increased suitably to accommodate mounting of fan regulators in flush pattern.
• The fan regulators can also be mounted on the switch box covers, if so stipulated in the tender specifications, or if so directed by the Engineer-in-charge.

• Except where otherwise stated, 3 mm thick phenolic laminated sheets as per clause shall be fixed on the front with brass or cadmium plated iron screws as approved by the Engineer-in-charge.

1.1.20 Wires

Wires shall comply the following features:

• PVC insulated with a rating of 105 deg. C bright annealed electrolyte grade (99.9% pure) copper standard conductors multi drawn simultaneously (Unilay, twisted conductors) for uniformity of resistance, dimension and flexibility.

Color coded as below:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase – R</td>
<td>Red</td>
</tr>
<tr>
<td>Phase – Y</td>
<td>Yellow</td>
</tr>
<tr>
<td>Phase – B</td>
<td>Blue</td>
</tr>
<tr>
<td>Neutral</td>
<td>Black</td>
</tr>
<tr>
<td>Earth</td>
<td>Green</td>
</tr>
</tbody>
</table>

1.1.21 Installation

• The conduit work of each circuit or section shall be completed before the cables are drawn in.

• Conduit pipes shall be joined by means of couplers and accessories only.

• Cut ends of conduit pipes shall have no sharp edges, nor any burrs left to avoid damage to the insulation of conductors while pulling through such pipes.
1.1.22 Bends in conduit

- All necessary bends in the system, including diversion, shall be done either by neatly bending the pipes without cracking with a bending radius of not less than 7.5 cm, or alternatively by inserting suitable solid or inspection type normal bends, elbows or similar fittings, or by fixing cast iron inspection boxes, whichever is most suitable.

- No length of conduit shall have more than four bends from outlet to outlet.

- Additional requirements for recessed conduit work.

1.1.23 Marking

- The chase in the wall shall be neatly made, and of ample dimensions to permit the conduit to be fixed in the manner desired.

- In the case of buildings under construction, the conduit shall be buried in the wall before plastering, and shall be finished neatly after erection of conduit.

- In case of exposed brick/rubble masonry work, special care shall be taken to fix the conduit and accessories in position along with the building work.

1.1.24 Fixing conduits in chase

- The conduit pipe shall be fixed by means of staples hooks or by means of saddles, not more than 60 cm part, or any other approved means of fixing.

- All joints of conduits pipes shall be treated with some approved preservative compound to secure protection.

1.1.25 Fixing conduits in RCC work

- The conduit pipe shall be laid in position and fixed to the steel reinforcement bard by steel binding wires before the concreting is done. The conduit pipes shall be fixed firmly to he steel reinforcement bars to avoid their dislocation during pouring of cement concrete and subsequent tamping of the same.

- Fixing of standard bends or elbow shall be avoided as far as practicable, and all curves shall be maintained by bending the conduit pipe itself with a long radius which will permit easy drawing in of conductors.
• Location of inspection / junction boxes in RCC work should be identified by suitable means to avoid unnecessary chipping of the RCC slab subsequently to locate these boxes.

1.1.26 Fixing inspection boxes

• Suitable inspection boxes of the minimum requirement shall be provided to permit inspection, and to facilitate replacement of wires, if necessary.

• These shall be mounted flush with the wall or ceiling concrete. Minimum 65 mm depth junction boxes shall be used in roof slabs and the depth of the boxes in other places shall be as per IS:2667 – 1977.

1.1.27 Fixing switch boxes and accessories

• Switch boxes shall be mounted flush with the wall. All outlets such as switches socket outlets, etc. shall be flush mounting type, unless otherwise specified in the Additional Specifications.

1.1.28 Bunching of cables

• Cables shall always be bunched so that the outgoing and return cables are drawn into the same conduit.

• In case of three phase loads, separate conduits shall be run for each phase from the distribution boards to the load points, or outlets as the case may be.

1.1.29 Specifications of CCTV Cameras & Accessories

1.1.29.1 IP Dome Camera

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</thead>
<tbody>
<tr>
<td>Image Sensor</td>
</tr>
<tr>
<td>Resolution range</td>
</tr>
</tbody>
</table>
## Indoor HD Dome Camera - Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame rate</td>
<td>30 fps at full resolution (16:9) or better</td>
</tr>
<tr>
<td>Compression</td>
<td>H.265/H.264 or superior, MJPEG</td>
</tr>
<tr>
<td>WDR Measured according to IEC 62676 Part 5</td>
<td>80 db or better</td>
</tr>
<tr>
<td>Video Streaming</td>
<td>Quad streaming Stream, fully configurable</td>
</tr>
<tr>
<td>Alarm Input and Output</td>
<td>01 I/p, 01 relay O/P</td>
</tr>
<tr>
<td>Network Port</td>
<td>RJ45 10/100 Base T</td>
</tr>
<tr>
<td>Protocol</td>
<td>TCP, HTTP, HTTPS, SMTP, SNMP, SNTP, RTP, RTSP, SSL, 802.1x, QoS, DNS, ICMP, UPNP, DDNS, IP v4 &amp; v6 Remote Administration: Remote configuration and status using web based tool</td>
</tr>
<tr>
<td>Lens</td>
<td>3 to 9 mm</td>
</tr>
<tr>
<td>Focus</td>
<td>Auto focus and zoom</td>
</tr>
<tr>
<td>Illumination / Sensitivity at F1.3, 30IRE</td>
<td>0.3 lux lux; Mono: 0.03 lux IR Distance, 30 meters or better</td>
</tr>
<tr>
<td>Audio</td>
<td>Built-in Microphone</td>
</tr>
<tr>
<td>Operating Temperature:</td>
<td>-20° - 50° C</td>
</tr>
<tr>
<td>Video Analysis(edge based)</td>
<td>Object in field, Line crossing , Enter / leave field, Loitering, Follow route, Idle / removed object, Counting, Occupancy, Crowd density estimation, Condition change, Similarity search - licenses for all these analytics to be considered with camera.</td>
</tr>
</tbody>
</table>
### Indoor HD Dome Camera - Specifications

<table>
<thead>
<tr>
<th>Electronic Shutter Speed (AES)</th>
<th>1/30 s to 1/10000 s</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLC</td>
<td>Required</td>
</tr>
<tr>
<td>Security</td>
<td>Network authentication with EAP/TLS, Embedded Login Firewall, on-board Trusted Platform Module (TPM) and Public Key Infrastructure (PKI) support.</td>
</tr>
<tr>
<td>Other features</td>
<td>ONVIF : Profile S Compliant Signal to Noise Ratio: ≥55db</td>
</tr>
<tr>
<td>Local Memory</td>
<td>Minimum 256 GB with class6 or higher from day one (during downtime of the connectivity to server, captured data should be stored locally and the same should automatically upload into the storage after restoring of connectivity)</td>
</tr>
<tr>
<td>Certification</td>
<td>CE, FCC, UL, EN</td>
</tr>
</tbody>
</table>

### 1.1.29.2 IP Bullet Camera

### HD Bullet Camera - Specifications

<table>
<thead>
<tr>
<th>Image Sensor</th>
<th>1/3&quot; Progressive Scan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution range</td>
<td>(3000 - 3900) x (1700- 2200) complied with SMPTE 274M-2008</td>
</tr>
<tr>
<td>Frame rate</td>
<td>30 fps at full resolution (16:9 ) or better</td>
</tr>
<tr>
<td>Compression</td>
<td>H.265/H.264 or superior, MJPEG</td>
</tr>
<tr>
<td>WDR Measured according to IEC 62676 Part 5</td>
<td>90 db or better</td>
</tr>
<tr>
<td>Video Streaming</td>
<td>Quad streaming Stream, fully configurable</td>
</tr>
</tbody>
</table>
## HD Bullet Camera - Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alarm Input and Output</strong></td>
<td>01 I/p, 01 relay O/P</td>
</tr>
<tr>
<td><strong>Network Port</strong></td>
<td>RJ45 10/100 Base T</td>
</tr>
<tr>
<td><strong>Protocol</strong></td>
<td>TCP, HTTP, HTTPS, SMTP, SNMP, SNTP, RTP, RTSP, SSL, 802.1x, QoS, DNS, ICMP, UPNP, DDNS, IP v4 &amp; v6 Remote Administration: Remote configuration and status using web based tool</td>
</tr>
<tr>
<td><strong>Lens</strong></td>
<td>3 to 12 mm</td>
</tr>
<tr>
<td><strong>Focus</strong></td>
<td>Auto focus and zoom</td>
</tr>
<tr>
<td><strong>Illumination / Sensitivity at F1.3, 30IRE</strong></td>
<td>0.3 lux lux; Mono: 0.03 lux  IR Distance, 50 mtrs or better with IR from camera OEM only</td>
</tr>
<tr>
<td><strong>Audio Compression</strong></td>
<td>Two way Audio : Required Input / Output : 1in and 1out</td>
</tr>
<tr>
<td><strong>Protection and housing</strong></td>
<td>IP66 and IK10 Rated camera enclosure from camera OEM</td>
</tr>
<tr>
<td><strong>Operating Temperature:</strong></td>
<td>-20° - 50° C</td>
</tr>
<tr>
<td><strong>Video Analysis(edge based)</strong></td>
<td>Object in field, Line crossing , Enter / leave field, Loitering, Follow route, Idle / removed object, Counting, Occupancy, Crowd density estimation, Condition change, Similarity search - licenses for all these analytics to be considered with camera.</td>
</tr>
</tbody>
</table>
### HD Bullet Camera - Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic Shutter Speed (AES)</td>
<td>1/30 s to 1/15000 s</td>
</tr>
<tr>
<td>BLC</td>
<td>Required</td>
</tr>
<tr>
<td>Defog</td>
<td>Required</td>
</tr>
<tr>
<td>Security</td>
<td>Network authentication with EAP/TLS, Embedded Login Firewall, on-board Trusted Platform Module (TPM) and Public Key, Infrastructure (PKI) support.</td>
</tr>
<tr>
<td>Other features</td>
<td>ONVIF: Profile S Compliant Signal to Noise Ratio: ≥55db</td>
</tr>
<tr>
<td>Local Memory</td>
<td>Minimum 512 GB with class6 (during downtime of the connectivity to server, captured data should be stored locally and the same should automatically upload into the storage after restoring of connectivity)</td>
</tr>
<tr>
<td>Certification</td>
<td>CE, FCC, UL, EN</td>
</tr>
</tbody>
</table>

1.1.29.3 IP PTZ Camera

### IP PTZ Camera Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image Sensor</td>
<td>1/3” Progressive Scan CMOS or better</td>
</tr>
<tr>
<td>Resolution</td>
<td>1920x1080, complied with SMPTE 274M-2008</td>
</tr>
<tr>
<td>Frame rate</td>
<td>60 fps at all resolutions</td>
</tr>
<tr>
<td>Compression</td>
<td>H.265/H.264 or superior, MJPEG</td>
</tr>
<tr>
<td>WDR Measured according to IEC 62676 Part 5</td>
<td>90 db or better</td>
</tr>
<tr>
<td><strong>IP PTZ Camera Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td><strong>Video Streaming</strong></td>
<td>Quad streaming Stream, fully configurable</td>
</tr>
<tr>
<td><strong>Alarm Input and Output</strong></td>
<td>01 I/p, 01 relay O/P</td>
</tr>
<tr>
<td><strong>Network Port</strong></td>
<td>RJ45 10/100 Base T</td>
</tr>
<tr>
<td><strong>Protocol</strong></td>
<td>TCP, HTTP, HTTPS, SMTP, SNMP, SNTP, RTP, RTSP, SSL, 802.1x, QoS, DNS, ICMP, UPNP, DDNS, IP v4 &amp; v6</td>
</tr>
<tr>
<td><strong>Lens</strong></td>
<td>(4.3-4.5) mm - (129-135) mm (F1.6 - F4.4) for 30x Optical zoom, Digital zoom of 16x</td>
</tr>
<tr>
<td><strong>Focus</strong></td>
<td>Automatic with manual override</td>
</tr>
<tr>
<td><strong>Illumination / Sensitivity at F1.6, 30 IRE</strong></td>
<td>Colour: 0.05 lux Mono: 0.01 lux. IR Distance: 170 Mtrs or better (Internal / External with 360 degrees coverage) IR from Camera OEM only</td>
</tr>
<tr>
<td><strong>Audio Compression</strong></td>
<td>Two way Audio : Required Input / Output : 1in and 1out</td>
</tr>
<tr>
<td><strong>Preposition Accuracy</strong></td>
<td>± 0.1°</td>
</tr>
<tr>
<td><strong>Protection:</strong></td>
<td>IP66 enclosure</td>
</tr>
<tr>
<td><strong>Operating Temperature:</strong></td>
<td>-20° to 60°</td>
</tr>
<tr>
<td><strong>Video Analysis (edge based)</strong></td>
<td>Object in field, Line crossing, Enter / leave field, Loitering, Follow route, Idle / removed object, Counting, Occupancy, Crowd density estimation, Condition change, Similarity search - licenses for all these analytics to be considered with camera.</td>
</tr>
<tr>
<td><strong>Electronic Shutter Speed (AES)</strong></td>
<td>1/30 s to 1/15000 s</td>
</tr>
</tbody>
</table>
### IP PTZ Camera Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLC</td>
<td>Required</td>
</tr>
<tr>
<td>Defog</td>
<td>Required</td>
</tr>
<tr>
<td>PAN and Tilt Speed</td>
<td>Pan: 0.1°/s - 240°/s; Tilt: 0.1°/s - 120°/s</td>
</tr>
<tr>
<td>Security</td>
<td>Network authentication with EAP/TLS, Embedded Login Firewall, on-board Trusted Platform Module (TPM) and Public Key, Infrastructure (PKI) support.</td>
</tr>
<tr>
<td>PAN &amp; Tilt Angle</td>
<td>PAN:360°; Tilt:0°-90°</td>
</tr>
<tr>
<td>Other features</td>
<td>ONVIF : Profile S Compliant Signal to Noise Ratio: ≥55db, Privacy mask supported at least 24 and 256 presets</td>
</tr>
<tr>
<td>Local Memory</td>
<td>Minimum 512 GB with class6 (during downtime of the connectivity to server, captured data should be stored locally and the same should automatically upload into the storage after restoring of connectivity)</td>
</tr>
<tr>
<td>Certification</td>
<td>CE, FCC, UL, EN</td>
</tr>
</tbody>
</table>

### 1.1.29.4 Network Video Storage (NVR)

<table>
<thead>
<tr>
<th>Features</th>
<th>Minimum Configuration Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>32 IP channels with 320 Mbps incoming bandwidth</td>
</tr>
<tr>
<td>Hard Drive Type</td>
<td>SATA</td>
</tr>
<tr>
<td>Type</td>
<td>Storage Server</td>
</tr>
<tr>
<td>Features</td>
<td>12 MP IP Camera Support for View and Playback</td>
</tr>
<tr>
<td></td>
<td>Real Time Live Display for 16 Channels at 1080P or 4 Channels at 4K</td>
</tr>
<tr>
<td></td>
<td>Extended Rack-Mount Unit with Advanced Connections</td>
</tr>
<tr>
<td>Features</td>
<td>Minimum Configuration Requirements</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Separate Internet and IP Camera Networks</td>
<td></td>
</tr>
<tr>
<td>Latest Video Compression Technology</td>
<td></td>
</tr>
<tr>
<td>Camera Support</td>
<td></td>
</tr>
<tr>
<td>Simultaneous Record and View</td>
<td></td>
</tr>
<tr>
<td>POE+ Switch</td>
<td></td>
</tr>
<tr>
<td>Simple Operation</td>
<td></td>
</tr>
<tr>
<td>DDNS</td>
<td></td>
</tr>
<tr>
<td>Local Control</td>
<td></td>
</tr>
<tr>
<td>Video Inputs, Audio Inputs/Output and Alarm Inputs/Outputs are Located on the Rear Panel</td>
<td></td>
</tr>
<tr>
<td>Use the PC Software or Built-In Web Application Via a Network for Live Vi, Playback and Configuration</td>
<td></td>
</tr>
<tr>
<td>Smartphone App</td>
<td></td>
</tr>
<tr>
<td>The Driver Can Control Pan/Tilt/Zoom (PTZ) Equipment Using Commands Sent Via IP Connection</td>
<td></td>
</tr>
<tr>
<td>Raid Software</td>
<td></td>
</tr>
</tbody>
</table>

1.1.29.5 Storage Hard Disk Drive (HDD)

<table>
<thead>
<tr>
<th>Features</th>
<th>Minimum Configuration Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formatted capacity</td>
<td>6 TB</td>
</tr>
<tr>
<td>Form Factor</td>
<td>3.5 Inch</td>
</tr>
<tr>
<td>Advance Format (A/F)</td>
<td>Yes</td>
</tr>
<tr>
<td>RoHS compliant</td>
<td>Yes</td>
</tr>
<tr>
<td>Data transfer rate (max)</td>
<td>6 Gb/s</td>
</tr>
<tr>
<td>Buffer to host - Host to/from drive (sustained)</td>
<td>171 MB/s</td>
</tr>
<tr>
<td>Cache (MB)</td>
<td>64</td>
</tr>
<tr>
<td>Rotational speed (RPM)</td>
<td>IntelliPower</td>
</tr>
<tr>
<td>Features</td>
<td>Minimum Requirements</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Load/unload cycles</td>
<td>300,000</td>
</tr>
<tr>
<td>Non-recoverable read errors per bits read</td>
<td>&lt;1 in 10^14</td>
</tr>
<tr>
<td>Average power requirements (W)</td>
<td></td>
</tr>
<tr>
<td>Read/Write</td>
<td>5.9</td>
</tr>
<tr>
<td>Idle</td>
<td>4.9</td>
</tr>
<tr>
<td>Standby and Sleep</td>
<td>0.4</td>
</tr>
</tbody>
</table>

### 1.2 BOOM BARRIER & PARKING TICKETING SYSTEM

Automatic boom barriers are Bars, or a Pole pivoted to allow the boom to block vehicular access through a controlled point. They are counter weighted and tipped. The boom gates are paired either one to another end. This can also be provided with second arm for pivoting on links to allow the second arm to hang 300 to 400 mm below the upper arm.

#### 1.2.1 Indicative Solutions Features
Boom Barrier must be heavy duty and robust in design to cope with extensive use. It will have a smart card reader or IR (Infra-Red) reader to operate automatically for the daily users. Some of the features that is motioned below:

a) Manual Operation in Case Power Failure  
b) Heavy Duty, Weather Proof & Simple Design Housing  
c) Sine Lever Drive Mechanism Ensures Smooth Landing of Boom without Shaking

### 1.2.2 Boom Barriers Specifications

<table>
<thead>
<tr>
<th>Components</th>
<th>System Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing Dimension</td>
<td>350mm x 250mm x 1070mm</td>
</tr>
<tr>
<td>MTBF Duty Cycle</td>
<td>5 Million Operations</td>
</tr>
<tr>
<td>Power</td>
<td>AC 220-230V, 50/60 Hz</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>120 W</td>
</tr>
<tr>
<td>Opening Closing Time</td>
<td>3 to 4 Seconds</td>
</tr>
<tr>
<td>Maximum Boom Length</td>
<td>Up to 6 Mtrs.</td>
</tr>
<tr>
<td>In Case Power Failure</td>
<td>Open / Close Option with Mechanical Handle</td>
</tr>
<tr>
<td>IP Rating</td>
<td>Complaint to IP68 Standards</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-25 to + 55 Degree C</td>
</tr>
<tr>
<td>Humidity</td>
<td>10%-95%</td>
</tr>
<tr>
<td>Size (metre)</td>
<td>Up to 6 Mtr.</td>
</tr>
<tr>
<td>Type</td>
<td>Automatic</td>
</tr>
<tr>
<td>Power (W)</td>
<td>AC 220-230V, 50/60 Hz</td>
</tr>
<tr>
<td>Maximum Boom Length (mm)</td>
<td>Upto 6 Mtr.</td>
</tr>
<tr>
<td>Components</td>
<td>System Specifications</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------------------------------------------------</td>
</tr>
<tr>
<td>Housing</td>
<td>SS Steel or Mild Steel with Zinc Coating (Inside &amp; Outside) Plus Anti-Corrosion Treatment</td>
</tr>
<tr>
<td>Operative Options</td>
<td>IR Cards/Pass, Remote Control &amp; Push Button</td>
</tr>
<tr>
<td>Automation Grade</td>
<td>Automatic</td>
</tr>
</tbody>
</table>

### 1.2.3 Handheld POS (Point of Sale)

<table>
<thead>
<tr>
<th>Components</th>
<th>Parameters</th>
<th>Minimum Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware/Software/Mechanical</td>
<td>Items</td>
<td>Technology standard</td>
</tr>
<tr>
<td></td>
<td>CPU</td>
<td>SIM840W</td>
</tr>
<tr>
<td></td>
<td>Memory</td>
<td>Flash:8MB RAM:4MB</td>
</tr>
<tr>
<td></td>
<td>GSM modem</td>
<td>SIM840w</td>
</tr>
<tr>
<td></td>
<td>Display</td>
<td>128*64 pixels</td>
</tr>
<tr>
<td></td>
<td>Keyboard</td>
<td>21keys</td>
</tr>
<tr>
<td></td>
<td>Battery</td>
<td>1700mAh Li-ion battery, supports printing by battery supplied. Can be used for more than 96 hours in idle mode by battery supplied.</td>
</tr>
<tr>
<td></td>
<td>Developing Environment</td>
<td>OS of SIM840w for design</td>
</tr>
<tr>
<td></td>
<td>Dimensions</td>
<td>202mm<em>90mm</em>57mm</td>
</tr>
<tr>
<td></td>
<td>Weight</td>
<td>≈0.43kg</td>
</tr>
<tr>
<td>Power Supply</td>
<td>AC I/P Voltage</td>
<td>90V~250V AC</td>
</tr>
<tr>
<td></td>
<td>Power Adapter Output</td>
<td>DC 12V/2A</td>
</tr>
<tr>
<td>Application Environment</td>
<td>Operating Temperature</td>
<td>-15℃~55℃</td>
</tr>
<tr>
<td></td>
<td>Relative Humidity</td>
<td>10%~95%</td>
</tr>
<tr>
<td></td>
<td>Environment Noise</td>
<td>≤60dB(A)</td>
</tr>
<tr>
<td></td>
<td>Atmospheric Pressure</td>
<td>86~106kPa</td>
</tr>
<tr>
<td>GSM Parameters</td>
<td>RF Transmit Frequency</td>
<td>GSM850 824-849MHz, E-GSM900 880-915MHz, DCS1800 1710-1785MHz, PCS1900 1850-1910MHz</td>
</tr>
<tr>
<td></td>
<td>Frequency Stability</td>
<td>&lt;2.5ppm</td>
</tr>
<tr>
<td></td>
<td>Receiver Sensitivity</td>
<td>&lt;-104dBm</td>
</tr>
<tr>
<td>Components</td>
<td>Parameters</td>
<td>Minimum Specifications</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------</td>
<td>------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>GSM/3G/4G</td>
<td>ETSI GSM Phase 2+ , HSPA, LTE</td>
</tr>
<tr>
<td></td>
<td>Protocol</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transmit Power</td>
<td>&lt;2W(900MHZ), &lt;1W(1800MHZ)</td>
</tr>
<tr>
<td></td>
<td>SIM Card Interface</td>
<td>3V</td>
</tr>
<tr>
<td></td>
<td>Antenna</td>
<td>Internal, 50Ω impedance, 3dB gain</td>
</tr>
<tr>
<td>Micro Printer</td>
<td>Printing Method</td>
<td>Thermal-line dot method</td>
</tr>
<tr>
<td></td>
<td>Paper</td>
<td>Thermal roll paper (standard) 57*45mm</td>
</tr>
<tr>
<td></td>
<td>Effective Printing Area</td>
<td>48mm</td>
</tr>
<tr>
<td></td>
<td>Speed</td>
<td>Maximum 70mm/sec(480 dot line/sec)</td>
</tr>
<tr>
<td></td>
<td>Printing Resolutions</td>
<td>8 dots/mm</td>
</tr>
<tr>
<td></td>
<td>Character</td>
<td>12*24dots</td>
</tr>
<tr>
<td></td>
<td>Number of Columns</td>
<td>32columns/line</td>
</tr>
<tr>
<td></td>
<td>Printing Head Life</td>
<td>Pulse resistance: 100 million pulses/dot (under our standard conditions); Abrasion resistance: paper traveling distance 50km (print ratio: 25% or less)</td>
</tr>
</tbody>
</table>

### 1.3 BMI MACHINE

#### 1.3.1 Feature of BMI Machines

- Automatically measures weight, height & body mass index accurately & rapidly.
- Displays weight, height & Body Mass Index.
- It also displays, simultaneously, how much over / under weight you are.

**Accessories:**

Thermal Printer can print Date, Time, Weight, Height, BMI & amount of overweight / underweight

- Coin selector to operate the scale only on insertion of coin
- Voice (Audio) Output
1.3.2 Accessories-
- 24 col. Thermal printer / serial dot matrix printer.
- Can print Date, Time, Weight, Height, BMI & amount of overweight/underweight.
- Coin selector to operate the scale only on insertion of coin.
- Voice (Audio) Output.
- Closely knit sales and service network covering entire country.
- An ISO 9001-2000 certified company with customer centric approach
- Ensures complete customer satisfaction.

1.3.3 Product Specification

<table>
<thead>
<tr>
<th>Components</th>
<th>Minimum Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Park. Suitable for outdoor application (IP rating IP-55 or above)</td>
</tr>
<tr>
<td>Weight Capacity</td>
<td>200 Kgs</td>
</tr>
<tr>
<td>Height Range</td>
<td>50 to 200 cm</td>
</tr>
<tr>
<td>Self-height (machine)</td>
<td>Not More than - 250 cm</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0 to 50 Degree Celsius</td>
</tr>
<tr>
<td>Power supply</td>
<td>230 V A.C., + 1 0 % , - 20%, 50 Hz +/- 2%</td>
</tr>
</tbody>
</table>
1. **FIRE PROTECTION SYSTEM**

1.1 **PREAMBLE**

Rourkela smart city development embarked on a plan to design and develop Brahmani river front project at Rourkela, Odisha.

This document covers the design philosophy and scope of work related to fire protection system.

1.2 **SCOPE**

As the proposed area structures are 85 to 90 % open to sky (parking, walkway/footpath, green bay/landscape etc.), and other areas are with cafeterias/kitchen (in height its only ground floor and open with all 4 sides) portable fire extinguishers are considered for these areas.

Portable extinguishers to be provided to fight fire in incipient stage.

1.3 **Portable fire extinguisher**

a) Design of Portable Fire Extinguisher will be done as per IS: 2190-2010.

b) The classes of fires (as defined by the IS 2190) anticipated are as under
- Class A fire: fires in ordinary combustibles (like wood, paper, plastics, rubber and the like).
- Class B fire: fires in flammable liquids (like oil, paints, grease, solvents and the like).
- Class C fires: fires in gaseous substances under pressure including liquefied gasses.
- Fires in energized electrical equipment.

c) The portable extinguishers would be so located / placed that a person would not have to travel more than 15m to fetch an extinguisher. Also, every room/enclosure would be provided with minimum of one extinguisher.

  Note: - All Fire Extinguishers will be free of HALONS.

The proposed design/location for fire extinguisher shall as below:

- Kitchen areas and food courts
- Ticket counters
- Transformers
- Security gate.
- Pump room/house.
1.4 **Codes & standards**

The following codes and standards are referred:

<table>
<thead>
<tr>
<th>IS</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS 1641-1988</td>
<td>Code of Practice for fire safety of building</td>
</tr>
<tr>
<td>IS 9668-1990</td>
<td>Provision and Maintenance of water supplies for firefighting code of practice.</td>
</tr>
<tr>
<td>IS 2190-2010</td>
<td>Selection, Installation and Maintenance of First Aid Fire Extinguishers – Code of practice.</td>
</tr>
</tbody>
</table>

1.5 **Dry Chemical Powder Fire Extinguisher 6 Kg capacity**

Dry Chemical Powder Fire Extinguisher 6 Kg capacity. Minimum quantity - 40 nos

**Features**

- Height – 545 mm
- Dia – 150mm
- Working Pressure – 15 bar
- Fire rating – 144 B
- IS number – IS 15683: 2018

- Extinguishing Agent - Dry Powder (SBC)
- Propellant - Dry Nitrogen
- Color - Post office Red
- Operating Temp - -30 °C to +60 °C
- Test Pressure - 35 bar for 30 sec
- Burst pressure - 55 bar at body, 80 bar at weld
- Filling Tolerance - ± 2% by mass
- Powder coating - Pure Polyester corrosion resistant (Inside and Outside)

**Material**

- Cylinder body - Mild Steel, IS 513
- Control valve - Brass
- Dip Tube - PVC
- Nozzle - Plastic with Metallic thread insert
- Hose - EPDM
- Type and Batch Test - As per IS 15683:2018
- Marking - ISI marked as per IS 15683:2018
1.6  **Carbon dioxide (CO2) Fire Extinguisher 4.5 Kgs capacity**

Minimum quantity - 10 nos

**Features**

Height – 700 mm  
Dia – 140mm  
Working Pressure – 50 bar  
Fire rating – 55 B  
IS number – IS 15683: 2018

Extinguishing Agent - Carbon di-oxide  
▪ Purity of CO2 - Above 99.7% conforming to IS 15222  
▪ Color - Shade No 538 (PO Red) of IS 5  
▪ Operating Temp - -30 °C to +60 °C  
▪ Test Pressure - 250 bar for 30 sec  
▪ Filling Tolerance - 5% by mass  
▪ Painting - PU paint on outside surface  
▪ Material

✓ Cylinder body - Manganese Steel (37Mn)  
✓ Control valve - Brass of IS 319  
✓ Dip Tube - Aluminum  
✓ Hose - Metal braided Rubber hose  
✓ Collar pin - Aluminum  
✓ Horn - UV Resistant Plastic

▪ Batch and Type Test - As per IS 15683:2018

▪ Marking - As per IS 15683:2018
OPERATION AND MAINTENANCE
OPERATION AND MAINTENANCE

Scope of works includes Operation and maintenance of the entire developed area for a period of five years. However at end of each year, the employer will review and if felt necessary can foreclose the O&M period.

The entire operation and maintenance is classified into two categories based on the payment terms. One is fixed maintenance for which payment will be made as mentioned in the payment terms on regular basis. Another is variable maintenance. For this contractor will be reimbursed based on actual consumptions for electricity bills an fuels for operation of DG set.

1. Maintenance of Landscaping Works

   General

   i. The Contractor shall ensure that a senior qualified supervisor is made available for organizing and running the maintenance program. The Contractor shall also have available an experience foreman who can supervise the workers on a day-to-day basis. An adequately trained labour force of at least 3 workers must be available for routine work and they must be on site for at least half a working day, 5 days per week during the maintenance period. Additional grass cutting operators will be needed to ensure adequate cutting and cleaning.

   ii. The Contractor’s Supervisor shall inspect the site once per week during the maintenance period and shall prepare a brief schedule of operations required for the coming week. The format for the schedule of operations will cover each distinct areas of the site such as frontage, rear, courtyard, roof, interior, etc. The schedule shall describe the operations the Contractor intends to carry out in the coming week to cover the items listed in the specification and to ensure that the current weather conditions and growing performances, insect attack, etc. is taken into account.

   iii. A copy of this schedule is to be submitted to the Landscape Architect and Employer every week so that a running record of proposed operations can be checked at the maintenance inspections each month. If in the opinion of the Landscape Architect the maintenance works have not been satisfactorily carried out according to site conditions and the specifications, part of the monthly payment will be withheld until the works have been satisfactorily carried out.

   iv. The contractor shall carry out all necessary measures to ensure that all pot plants, trees and shrubs and other plants shall thrive and become established within this period. All landscape areas will be inspected monthly and lists of remedial works issued after each inspection. All items on the remedial lists are to be carried out by the time of the next inspection, i.e. within one month.
a. **Cleaning & Upkeepment**: This pertains to general cleanliness wherein the entire garden and wooded area has to be kept neat & clean and under presentable condition throughout the contract period. This includes keeping the garden/wooded areas free from any unwanted plants/grasses, papers, dry leaves, polythens, mucks, stones or debris etc.

b. **Disposal of the Garden wastes**: The waste materials like cut grasses, dry leaves dry out plant materials etc. has to be properly disposed off and shall required to be dumped in suitable places for decomposition. The waste materials like cut grasses, dry leaves dry out plant materials etc. has to be properly disposed off and shall required to be dumped in suitable places for decomposition.

c. **Mowing of grasses**: Mowing or cutting of the grass to be carried out regularly or as when required by keeping the height of the grass approx. not more than 2.5cm above the soil surface throughout the contract period.

d. **Watering**: Providing regular and continuous watering in adequate quantities to plantation and lawn areas including pot plants, seasonal flower beds from the water source points given inside garden area by client for the proper growth and development of all plants, seasonal plants, lawn grasses etc. throughout the contract period.

e. **Manureing of Plants**: Supply and application of manures to all plants, grasses, Rose plants, pot plants, seasonal flower beds in adequate quantity with well rotten cow dung manures or compost/as per the size and requirement of the plants twice in a year preferably once before the onset of monsoon and second during winter season.

f. **Application of Fertilizers & Other Nutrients**: Supply and application of DAP, MOP, Neem Oil Cake, Bone Meal, Oil Cake, Rally Meal etc twice in a year to all plants, Rose plants, lawn area including potted plants as per the need along with the cow dung manures.

g. **Termite Control**: Supply and application of anti-termite chemicals like Methyl Parathion or Chlopyriphos dust or Prorate 10G/Thimet or its equivalent substitute to control termite infestations. Flooding of Chloropyriphos in the lawn area or plant basin with adequate water is also advisable to control severe termite infestation.

h. **Pests Control**: Supply and application of insecticides/pesticides for pest control measures during the incidence of pests/insects infestation or as and when required by applying suitable pesticides in appropriate proportion.

i. **Disease Control**: Supply and application of fungicides/bactericides etc. for diseases control measures during the incidence of disease attack in plants or as and when required by applying suitable fungicides/bactericides in appropriate proportion.

j. **Weed Control**: De-weeding of all unwanted plants throughout the garden area at regular interval or as and when required with the help of suitable tools so as to keep the entire area free of weeds.
k. **Intercultural operations**: Intercultural operations like hoeing and weeding to be carried out with the help of suitable tools as and when required for proper aeration by loosening the soil and drying it for few days followed by watering.

l. **Pruning & Trimming**: Pruning and trimming of plants to be carried out at regular interval or as when required to keep all plants like shrubs, hedges, Rose plants, ground covers etc. under desired shape and size.

m. **Training**: Regular training of plants to be carried out for giving plants and hedges desired shape and structure.

n. **Top Dressing of Lawn Grasses**: Mixture consisting of materials namely sweet earth, fine river sand, Cow dung or sludge manure, DAP, Neem Oil and Methyl Parathion are to be prepared and spread in the grassing area after mowing of grass once in a year preferably during winter season or as and when required followed by adequate watering to boost the growth of grasses.

o. **Application of Urea**: Supply and application of Urea in lawn areas as and when required as additional nutrition and for quick growth and greening of grasses.

p. **Growing of Seasonal Flowering Plants**: Supply and growing of seasonal flowering plants of different varieties by maintaining colour harmony in the earmarked or specified flower beds and in earthen pots inside garden premises for different flowering seasons.

q. **Maintenance of Pot Plants**: Raising of adequate numbers of pot plants for decoration purposes and maintaining them under healthy condition during the entire maintenance period including re-potting, intercultural operations, manureing, watering and keeping it under clean and aesthetic condition.

r. **Plantation Work**: New plantation if required arises due absence of proper maintenance/watering.

s. **Security**: Provisioning of security personnel at entry, exist and inside the premises

2. **Water Supply and Landscape irrigation**

   Scope includes
   a. Regular cleaning Cleaning and Maintenance of toilets including providing of required cleaning materials, liquids, disinfects and manpower
   b. Maintenance of Pumping stations. Regular operation of pumps, wear & tear and replacement of parts as required
   c. Maintenance of Sprinkler system .
      - Checking and removal of debries, impurities, choked materia if any in the filter, pipe, fitting, nozels etc.
      - Leakage repire
      - Replacement of parts as required and direction of engineer if felt necessary.
      - Maintaining of required pressure in the system

3. **Electrical**
A. OPERATION & MAINTENANCE

- O&M shall be initiated from the next day of the issue of the completion certificate by RSCL.
- The CONTRACTOR shall be responsible for up-keeping/maintaining/ repair/ replacement, comprehensively, of all the Luminaires, LT panels, cable and earthing systems during the tenure of the contract of 5 years.
- During the Contract period, if any hardware needs to be replaced, the same will be replaced with same or better OEM and with same or higher configuration free of cost.
- The manpower and accessories required for O&M shall be provided by CONTRACTOR during relevant contract period. CONTRACTOR shall maintain a service team to take action immediately. The service team shall comprise of One Supervisor, One Electrician and one helper. The contractor shall be responsible for arranging replacement of manpower in case any of the team member is absent during the O & M period.
- The CONTRACTOR shall make provision for adequate number of minimum 3m high Self-Supporting Ladder with anti-skid pads at the footings along with sets of all the required tools and instruments, duly calibrated from NABL Accredited Laboratory, to meet the maintenance requirements as per service benchmark.
- The Non-availability of incoming power supply from WESCO shall be intimated by CONTRACTOR within 24 hours. CONTRACTOR shall coordinate with WESCO on behalf of RSCL and RSCL shall facilitate as and when required to expedite the response.
- Any failure of luminaire due to lack of earthing, SPD, connector and loose connections shall be replaced by CONTRACTOR free of cost.
- The CONTRACTOR shall take adequate insurance to cover themselves for the cost of O&M during the tenure of the contract including the ones due to theft.
- All the electrical parameters and illuminance level of the total stretch of 750mtr shall be monitored with calibrated Power Analyzer and Lux meter and documented for records and analysis at regular interval – Minimum Twice annually.
- Electricity charges and Connectivity charges shall be paid by Contractor to WESCO and reimbursed on actuals by RSCL.
- All the necessary modifications that are required to be carried out for the efficient working of the system and minimise the breakdowns and issues shall be carried out by CONTRACTOR from time to time at its own cost.
- CONTRACTOR shall develop training material for the RSCL technicians, impart them training from time to time as may be decided by the RSCL.
- All the responsibilities related to replacement of LED fixtures / cables / other accessories shall be borne by CONTRACTOR in respect of cost, managing the technical problems and other related aspect during the tenure of the project.
- The maintenance work shall be carried out without disturbing and damaging the surrounding area of the River Front and with proper consent to work from RSCL.

B Service Level Benchmark

A service Level Benchmark for evaluating the performance of the CONTRACTOR shall consist of the following:
a. **Resources** – The CONTRACTOR shall maintain O&M team, tools and calibrated measuring and verification instruments as specified from the day one of the contract. In case the required resources are not deployed on time, a penalty of Rs.5000/- per day shall be imposed for the first week and the same shall be doubled in the subsequent weeks till adequate resources are deployed.

b. **System Uptime** – The CONTRACTOR shall maintain sufficient resources and achieve minimum uptime of 95% on yearly basis (year period to be decided by RSCL) for the entire system, excluding the period of non-availability of power supply. The Uptime percentage shall be calculated based on the following formula;

\[
\text{Uptime \%} = \left(1 - \frac{\text{Downtime Hrs}}{\text{Total Operational Hrs}}\right) \times 100
\]

Total Operational Hrs is calculated based on lamp Burning Hrs per day - 12 Hrs.

Downtime Hrs = No of Operational Hrs. the Lamp is unavailable for operation from the time of Logging the Request by the consumer till the Request is closed in the system by the CONTRACTOR.

In Case the CONTRACTOR is not able to maintain the Uptime of the luminaires for Two Consecutive years, RSCL may consider termination of the Contract.

c. **Energy Consumption** – The energy consumed by the lamp shall not exceed more than as committed in the design report. CONTRACTOR shall guarantee the total energy consumption of the system for all the luminaires with respect to its design offered. The same shall be monitored and reported on regular basis as decided by RSCL. Any excess energy charges more than the guaranteed consumption shall be recovered from the CONTRACTOR. Any action required for mitigating the excess energy consumption may be immediately be taken up by the CONTRACTOR with the information to RSCL.

d. **Lux Level** – CONTRACTOR shall guarantee the Lux level based on Design output and offered Luminaire for each luminaire. There shall not be any reduction of the Lux level during the entire tenure of the contract period beyond the allowable depreciation curve. Illuminance of all luminaire shall be monitored regularly and reported to RSCL by measuring the Lux Levels of the Sample LED Luminaires from all the LOTs / Batches atleast once a year. Any reduction in the lux level shall be immediately investigated and corrective action shall be taken with information to RSCL.

In case a reduction in the Lux levels are established, all the Luminaires of the same LOT/ Batch offered in the project shall be investigated and rectified/ replaced if found faulty by the CONTRACTOR at its own cost within a period of time as may be agreed by RSCL.

4. **ICT**

**O&M OF CCTV & OTHER COMPONENTS**

Bidder shall be responsible of CCTV camera system & other component at Brahmuni Riverfront for the period of 5 Years after successful installations & commissioning and final acceptance testing of
the complete system in all respect. Bidder shall be responsible of interconnections of these equipment’s to centralized monitoring at ICCC in Rourkela One. Cabling & Interconnections to nearest joint-pits of MSI network PAN city OFC network is under bidder scope with will be not more than 200 meters from this location. Bidder can add this 200-meters interconnection work expenses under this project.

**ASSET OWNERSHIP & HANDOVER**

The successfully executing and running of this CCTV project in all aspect for a minimum period of 5 years from the date of go Live, there will be a provision to handovers it’s all HW, SW operations and control to RSCL. During the period of undertaking, the implementing agency will be responsible for the smooth working of the total system installed at the locations under this project and to ensure minimum uptime as per the SLAs (99.9%).

a) The hand holding support plan must be submitted with training need analysis and Standard Operation Procedures as phase 1 activity

b) Sanctity of Handholding support will be only valid post acceptance by the purchaser.

c) Hand Holding support should focus on Operations, Maintenance, technical, Supervisory and commercial aspects of running the control room.

d) Handholding support is required for entire period of the project.

e) At expiry of Contract: For smooth handing over/transfer of the system, at the time of expiry the contract, all the system with detailed diagrams and drawings (Software, Hardware, Connectivity, Control Room, Field Equipment, Components and subcomponents etc. used in the project) shall be fully functional.

All credentials of software should be provided by the implementing agency.