CIVIL WORKS TENDER OF GIRLS COMMON ROOM/GYM FOR

ENTREPRENEURSHIP DEVELOPMENT INSTITUTE OF INDIA (EDII)

BHAT, GANDHINAGAR

CLIENT:
Entrepreneurship Development Institute of India (EDII)
(Via Ahmedabad Airport & Indira Bridge)
P.O. Bhat 382 428 - Dist. Gandhinagar Gujarat - India
Phone: +91-79-6910 4900/4999/5000; Fax: +91 79 23969164

LEAD CONSULTANTS:
COLLABORATIVE DESIGN & AXEES CONSULTANT
613-614, PUSHTI HEIGHTS, NEAR SUBHASH CHOWK,
GURUKUL ROAD, MEMNAGAR, AHMEDABAD - 380052
NOTICE INVITING TENDERS

1. **Employer**: M/s. Entrepreneurship Development Institute of India (EDII) (Via Ahmedabad Airport & Indira Bridge) P.O. Bhat 382 428 - Dist. Gandhinagar Gujarat - India Phone: +91-79-6910 4900/4999/5000

   **Consultants**: Collaborative design & Axees consultants 613-614, Pushti heights, Near Subhash chowk, Gurukul Road, Memnagar, Ahmedabad – 380052

   **Site**: M/s. Entrepreneurship Development Institute of India (EDII) (Via Ahmedabad Airport & Indira Bridge) P.O. Bhat 382 428 - Dist. Gandhinagar Gujarat - India Phone: +91-79-6910 4900/4999/5000

2. Sealed tenders are invited on behalf of the Employer for **Construction of girl’s common room/gym for M/s. Entrepreneurship Development Institute of India (EDII) at Gandhinagar, Gujarat**. The works are required to be completed within **Four months** as per the terms of the contract conditions.

3. Tender papers, contract documents specifications and Schedule of Items/Quantities, etc. can be obtained from the website of the Entrepreneurship Development Institute of India ([https://www.ediindia.org/the-institute/tenders/](https://www.ediindia.org/the-institute/tenders/)) from 17.05.2023 from 10.00 am onwards. The duly filled tender document may be submitted along with a **Demand Draft of Rs. 2,000/- in favour EDI of India**. The Tender fee shall be non-refundable.

4. The Tender with a complete set of the tender documents shall be enclosed in a sealed cover super scribed with name of work, Consultant Name and sent through Registered Post/Courier/Hand delivery only, on or before **18:00 hrs. on 15.06.2023**. Late tenders, delayed tenders and ordinary post tenders shall not be opened and considered.

5. Tenders for the work shall remain open for the acceptance from **17.05.2023 to 15.06.2023**.

6. Before quoting the rates, every tenderer is expected to inspect the site of the proposed work and to have satisfied himself as to the nature of all works, all existing roads, water-way and other means of communication and access to and from the site and work and the building that may be required for temporary purposes in connection with the construction, completion and maintenance of the works and must make his own inquiries as to work, yard sites and depot and dumps and as to acquisition of such additional sites and areas as may be necessary for temporary purpose for constructing, completing and maintaining the works. He must ascertain the availability of space for storage of construction materials, water supply, electricity, means of access to the work, nature of work and acquaint himself with all local conditions. A tenderer shall be deemed to have full knowledge of all the relevant documents, samples, site, etc. whether he inspects them or not before submitting the tender.

7. Submission of a tender by a tenderer implies that he has read this notice and all other contract documents and has made himself aware of the scope and specification of the work to be done and of local conditions and other factors bearing on the execution of the works.

8. Persons tendering are informed that no erasures or alterations by them in the text of the document sent herewith shall be allowed and any such erasures or alterations shall be disregarded. If there is any error in writing, no overwriting should be done, the wrong word or figure should be struck out and the correct one written above or neat it in unambiguous way. Each correction should be initialed.

9. **CONTRACTORS TO PLEASE READ THIS CAREFULLY**
   a. The rate for items in **Schedule of Items/Quantities** must be given in words and figures. Amount of each item must also be entered in column and grand total of amount must be struck out by the tenderer.
b. If the tender is taken in favour of the company, a power of attorney in favour of the person who may have signed the tender for the company must accompany the tender.
c. The tender document should be initialed by the Contractor.
d. All corrections, erasures and overwriting should be initialed by the Contractor.
e. Discrepancies and Adjustment of Errors:

Any error in quantity or amount in Schedule of Items/Quantities showing item or work to be carried out shall be adjusted in accordance with the following rules:

a) In the event of a discrepancy between description in words and figures quoted by a tenderer in the rates column, the description in words shall prevail.
b) In the event of an error occurring in the “amount” column of the Schedule of Items/Quantities showing items of work, as a result of wrong multiplication of the unit rate and quantity, the unit rate shall be regarded as firm and multiplication shall be amended on the basis of the rate.
c) All errors in totaling in “amount” column in carrying forward total shall be corrected.
d) Any rounding of amount against “items” or in “totals” shall be ignored.

10. Employer/Architects reserve the right to reject any or all tenders without giving any reasons, and to waive any deviations which do not constitute a material modification in the tenders received. They also reserve the right to accept any tender and not only the lowest without giving any reasons. Not more than one tender shall be submitted by a Contractor or by a firm of Contractors. No two or more concerns in which an individual is interested as a proprietor and/or partner shall tender for the execution of the same works. If they do, all such tenders shall be liable to be rejected. A tenderer shall submit the tender which satisfies each and every condition laid down in this notice and tender documents, failing which, the tender shall be liable to be rejected.

In addition to the above, the tender shall also be liable to be rejected outright, if:

i) The tenderer proposes any alteration in the work specified or in the time allowed for carrying out the work or any condition or correction made in any code or mode of Schedule of Items/Quantities or Specifications, Conditions of Contract.
ii) Any of the page or pages of the tender is/are removed or replaced.
iii) All corrections, additions or pasted slips are not initialed by the tenderer.
iv) Any erasure is made by him in the tender, and
v) The tenderer or in the case of a firm, each partner or the person holding the power of attorney thereof does not sign or signature/s is/are not attested by a witness on the Articles of Agreement of the tender, in the space provided for the purpose.

11. This is an item rate tender only. Quantity variation shall be unlimited. A tenderer should quote in figures as well as in words the rate(s) tendered. The amount for each item should be worked out and the requisite totals given. Special care shall be taken to write rates in figures as well as in words and the amounts in figures only and in such a way that interpolation is not possible.

12. The tender documents shall have to be filled in either in ink or by ball pen.

13. This notice of tender shall form part of the contract documents.

For and on behalf of the Contractor

Date _______________  Signature _______________

Designation __________
FORM OF TENDER

Dear Sir,

Having examined the Contract conditions, specifications, designs and schedule of items/quantities relating to the works specified in the memorandum hereinafter set out and having visited and examined the site of the works specified in the said memorandum and having acquired the requisite information relating thereto as effecting the tender. I/We hereby offer to execute the works specified in the said memorandum within the time specified in the said memorandum at the rates mentioned in the attached schedule of items/quantities and in accordance in all respects with the specifications, designs, drawings and instructions in writing referred to in conditions of tender, the Articles of Agreement, Special Conditions, Schedule of Items/Quantities and conditions of Contract and with such materials as are provided for, by and in all other respects in accordance with such conditions so far as they may be applicable.

MEMORANDUM

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<th>CONTENTS</th>
<th>DESCRIPTION</th>
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<td>1</td>
<td>Description of Works</td>
<td>Construction of girls common room/gym for M/s. Entrepreneurship Development Institute of India (EDII), P.O. Bhat, Gandhinagar, Gujarat</td>
</tr>
<tr>
<td>2</td>
<td>Location</td>
<td>M/s. Entrepreneurship Development Institute of India (EDII) (Via Ahmedabad Airport &amp; Indira Bridge) P.O. Bhat 382 428 - Dist. Gandhinagar Gujarat - India Phone: +91-79-6910 4900/4999/5000</td>
</tr>
<tr>
<td>3</td>
<td>Possession of Site</td>
<td>Immediately on issuance of Letter of Intent.</td>
</tr>
<tr>
<td>4</td>
<td>Commencement day of Work</td>
<td>Immediately on issuance of Letter of Intent.</td>
</tr>
<tr>
<td>5</td>
<td>Earnest money</td>
<td>2% of the total value of the contract in the form of bank demand draft favoring M/s. Entrepreneurship Development Institute of India. And same shall be converted in to security deposit after award of the contract. [EMD will be return to unsuccessful bidder within 15 days period after award of the contractor]</td>
</tr>
<tr>
<td>6</td>
<td>Security Deposit</td>
<td>2.5% of Interim payment including tender and non tender items as retention money will be retained from each running account bill.</td>
</tr>
<tr>
<td>7</td>
<td>Release of Retention Money</td>
<td>100% Retention money shall be release upon completion of defect liability period [i.e 12 months from issuance of virtual completion certificate]</td>
</tr>
<tr>
<td>8</td>
<td>Time of Completion</td>
<td>Time Limit for completion of work by all means 04 months from the issuance of work order</td>
</tr>
<tr>
<td>9</td>
<td>Date and place for collection of Tender Document</td>
<td>Tender papers, contract documents specifications and Schedule of Items/Quantities, etc. can be obtained from the website of the Entrepreneurship Development Institute of India (<a href="https://www.ediindia.org/the-institute/tenders/">https://www.ediindia.org/the-institute/tenders/</a>) from 17.05.2023 from 10.00 am onwards. The duly filled tender document may be submitted along with a Demand Draft of Rs. 2,000/- in favour EDI of India. The Tender fee shall be non-refundable.</td>
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Collaborative Design & Axees Consultants

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<tbody>
<tr>
<td>10</td>
<td>Last date of receipt and place of submission of tender document by the bidder</td>
<td>The Tender with a complete set of the tender documents shall be enclosed in a sealed cover super scribed with name of work, Consultant Name and sent through Registered Post/Courier/Hand delivery only, on or before 18:00 hrs. on 15.06.2023. Late tenders, delayed tenders and ordinary post tenders shall not be opened and considered.</td>
</tr>
<tr>
<td>11</td>
<td>Defect liability period</td>
<td>12 months from the date of virtual completion.</td>
</tr>
<tr>
<td>12</td>
<td>Period for submitting of RA Bill</td>
<td>15 Days</td>
</tr>
<tr>
<td>13</td>
<td>Period for Submitting Final Bill</td>
<td>30 Days from the completion of works</td>
</tr>
<tr>
<td>14</td>
<td>Liquidated damages for Delay</td>
<td>0.5% per week, maximum up to 5% of the total project value of civil structural works carryout by the contractor</td>
</tr>
<tr>
<td>15</td>
<td>Grace Period</td>
<td>Due to any reason if commencement of works delayed after issuance of work order than same delayed time shall be granted to the contractor as a grace period and liquidated damages shall be applicable after grace period.</td>
</tr>
<tr>
<td>16</td>
<td>GST</td>
<td>Rate shall be exclusive of GST and CONSTRUCTION CESS and LABOUR CESS, BOCW CESS shall be inclusive.</td>
</tr>
<tr>
<td>17</td>
<td>Water Supply</td>
<td>One point of water source to be provided to the contractor. Further arrangement of its distribution for the construction works shall be under contractor’s scope. Charges for water supply will be recovered by 1% from every running bill.</td>
</tr>
<tr>
<td>18</td>
<td>Electricity Supply</td>
<td>One point of Electrical Supply to be provided to the contractor through Energy company and charges for electrical power supply utilized by the contractor as per actual electric rate to be deducted from Running Account Bill.</td>
</tr>
<tr>
<td>19</td>
<td>Site Office</td>
<td>Site office to be provided by the contractor at his own cost for consultant and client representative.</td>
</tr>
</tbody>
</table>

2. Should this tender be accepted, I/We hereby agree to abide by and fulfil the terms and provisions of the said conditions of Contract annexed hereto so far as they may be applicable or in default thereof to forfeit and pay to **M/s. Entrepreneurship Development Institute of India** the amount mentioned in the said conditions.

3. I/We have deposited a sum of **2% of the contract value [i.e Rs:_____________] as earnest money to M/s. Entrepreneurship Development Institute of India**, which amount shall not bear any interest. Should I/We fail to execute the contract when called upon to do so, I/We do hereby agree that this sum should be forfeited by me/us to **M/s. Entrepreneurship Development Institute of India**.

4. Till formal Agreement is executed, this tender together with written acceptances thereof, shall constitute a binding contract between the Employer and the Contractor.

5. We accept and agree to the fact that you are not bound to accept the lowest or any tender you may receive.

6. Our Bankers are:

i)
ii)

The names of Partners of our firm are:

i)

ii)

Name of the Partner of the firm OR

Person having Power of Attorney to sign the contract. (Certified true copy of the Power of Attorney should be attached.)

Yours faithfully

Signature of tenderer

Witnesses:

1) Name: Signature:
   Address:

2) Name: Signature:
   Address:

PLACE:

DATE:
DRAFT OF AGREEMENT

ARTICLES OF AGREEMENT made on the ___ day of ____ between M/s. Entrepreneurship Development Institute of India, having its Registered office at ____________________________, Ahmedabad (hereinafter called "the Employer") of the one part and ____________________________ (hereinafter called "the Contractor") of the other part.

WHEREAS the Employer is desirous of Construction of girls common room/gym for M/s. Entrepreneurship Development Institute of India and has caused drawings and specifications describing the works to be prepared by Collaborative design & Axees consultants.

AND WHEREAS the said specifications and the schedule of items/quantities have been signed by or on behalf of the parties hereto.

AND WHEREAS the Contractors has agreed to execute upon and subject to the conditions set forth herein and to the conditions set forth in the Special Conditions and in the schedule of items/quantities and conditions of contract (all of which are collectively hereinafter referred to as "the, said conditions") the works shown upon the said drawings and/or described in the said specification and included in the schedule of items/quantities at the respective rates therein set forth amounting to the sum as therein arrived at or such other sum as shall become payable thereunder (hereinafter referred to as "the said contract amount")

NOW THIS DEED WITNESSETH and it is hereby agreed and declared as follows :

1. The Contractor shall upon and subject to the said conditions execute and complete the work shown upon the said drawings and described in the said specifications and the schedule of items/quantities. In consideration of contractor carrying out the work, the Employer shall pay the Contractor the said contract amount or such other sum as shall become payable, at the times and in the manner specified in the said conditions.

2. The term 'the Consultants' in the said conditions shall mean the said Collaborative design & Axees consultants or, in the event of their ceasing to be the Architect for the purpose of this contract for whatever reason, such other person or persons as shall be nominated for that purpose by the Employer, not being a person to whom the Contractor shall object for reasons considered to be sufficient by the Employer Provided Always that no person or persons subsequently appointed to be Architect under this contract shall be entitled to disregard or overrule any previous decisions or approval or direction given or expressed in writing by the Architect for the time being.

3. The said conditions and Appendix hereto shall be read and construed as forming part of this Agreement, and the parties hereto shall respectively abide by, submit themselves to the said conditions and perform the Agreements on their part respectively in the said Conditions contained.

4. The conditions and documents mentioned herein shall form the basis of this contract.

5. This contract is neither a fixed lump sum contract nor a piece work contract but is a contract to carry out Construction of girls common room/gym to be paid according to actual measured quantities at the rates contained in the schedule of items/quantities and probable quantities or as provided in the said conditions.

6. The Contractor shall offer every reasonable facility for the carrying out of all works relating to civil works, installation of sanitary work and fittings, permanent water supply, electrical installations, fittings, lifts, telephone, air conditioning, and other ancillary works in the manner laid down in the said conditions, and shall make good any damages done to walls, floors, etc., after the completion of such works.

7. The contractor shall follow good construction practices.

8. The Employer reserves to itself the right of altering the drawings and nature of the work by adding to or omitting any items of work or having portions of the same carried out without prejudice to this contract.

9. Time shall be the essence of this contract and the Contractor hereby agrees to commence the work sooner from seventh day after the date of issue of formal works order as provided for in the said conditions and shall faithfully and honestly do, provide, perform, execute, fulfill, keep, discharge, carry out and complete the entire work upon the terms and conditions herein contained and those contained in Contract
Documents within **Four months** subject nevertheless to the provisions for extension of time.

10. All payments by the Employer under this contract shall be made only at **Ahmedabad**.

11. Legal and factual possession of site shall deemed to be with Employer. Permission is given to contractor only for construction work and no right of lien is created of the contractor over the site/construction work under the agreement.

12. Employer shall not be liable to the contractor for damages/compensation for breach of contract or otherwise to the contractor and the contractor shall not be entitled to raise any claims, compensation, and damages for breach of contract or otherwise by the employer.

13. All disputes arising out of or in any way connected with this Agreement shall be deemed to have arisen at **Ahmedabad and only courts in Ahmedabad** shall have jurisdiction to determine the same.

14. That the several parts of this contract have been read by the Contractor and fully understood by the Contractor.

*IN WITNESS WHEREOF* the Employer and the Contractor have set their respective hands to these presents and two duplicates hereof the day and year first hereinabove written.

IN WITNESS WHEREOF the Employer has its hands to these presents through its duly authorised official and the Contractor has caused its common seal to be affixed hereinto and the said two duplicates/has caused these presents and the said two duplicates hereof to be executed on its behalf, the day and year first hereinabove written.

SIGNED, SEALED AND DELIVERED FOR THE EMPLOYER BY the hand of Shri

(name and designation)
in the presence of

1)  
2)  

SIGNED, SEALED AND DELIVERED FOR THE CONTRACTOR by

in the presence of

1)  
2)  

THE COMMON SEAL OF ___________________________ was hereunto affixed pursuant to the resolutions passed by its Board of Directors at the meeting held on

in the presence of

1)  
2)
If the contractor signs under its common seal, the signature clause should tally with sealing clause in the Articles of Association. If the Contractors signing by the hand of power of attorney whether a company or individual.

Directors who have signed these tender present in token thereof, in the presence of

1) 
2) 

in the presence of,

1) 
2)
SPECIAL CONDITIONS OF CONTRACT

1. The following special conditions of contract shall supplement the General Conditions of Contract, whenever there is a conflict, the provision herein shall prevail over those in the general conditions of contract.

2. **Amount of Bid Security Earnest Money**: 2.0% of the total value of the contract in the form of bank demand draft favoring M/s. Entrepreneurship Development Institute of India and same shall be converted into security deposit after award of the contract.

3. **Security Deposit**: 2.5% of Interim payment including tender and non-tender items as retention money will be retained from each running account bill.

4. **Period for Completion of the Works**: The period of completion for the total work - 04 calendar Months from the date of signing of contract including mobilization period.

5. **Minimum value of work for certification payment**: 5% of Contract Value or Monthly running account bills of whichever is earlier.

6. **Period of honouring certificates**: Within 15 days after measurement verification by Consultant and Employer.

7. **Period for Final Measurement**: 45 days from issuance of final completion certificate.

8. **Defects Liability Period**: 12 months from the date of issuance of final completion Certificate.

9. **Equipment & Machinery on Work Site**

The contractor will be required to provide and maintain in working order the following power/diesel driven equipments till completion of work and shall produce calibration/test/performance certificate as desired by Site Engineer:

(a) Concrete mixer with weigh-batching machine of sufficient numbers and of adequate capacity.

(b) Mechanically operated hoists or lift, for materials to reach the highest level of building, powered by suitable machinery capable of lifting the bucket with a speed of 50 feet per minute.

(c) Immersion type and surface type vibrators for consolidation of concrete of any grade and at all stages.

(d) Sufficient quantity of steel plate or plywood shuttering material as well as wooden/steel rafters having required spans of required strength, adjustable clamps, turn buckles etc. Contractor shall have to submit the shop drawings for the enabling structures like staging, formwork etc. and get the approval thereof before execution.

(e) Testing equipments for testing to concrete sand, grit, gravel, mortar etc. as required including small compression testing machine. Adequate nos. of moulds for concrete and cement.

(f) Water pumps for dewatering from pits, trenches and equipments for supplying of curing water at every portions of buildings.

(g) Compressor, jack hammer, drilling bits, welding machine, loader for excavated materials, dumpers, caterpillar, bulldozer, road roller etc.

(h) Or any other tools/tackles/equipment necessary for the satisfactory and successful execution of the project, if necessary for the statutory requirements.
10. **Schedule of Materials**:

Rates to be quoted by the contractor shall be inclusive of the cost of cement and reinforcement steel as per given basic rate mentioned in the below mentioned table.

The total responsibility of unloading, storage, safe custody, accountability, testing etc. will be of the contractor. On each stage and at the time of completion of the work, contractor will have to submit a detailed reconciliation statement of cement & steel. Allowable wastage considerations and penalties for the reconciliation of cement and reinforcement steel shall be applicable as per Relevant IS Codes or Architect.

   a. No escalation shall be paid for any construction materials. (Cement, Steel, etc.)
   b. Quantity variation shall be paid as per the item rates.
   c. All invoices of the purchase of any construction materials needs to be submitted along with the running account bills for the record keeping.

11. Contractor shall also provide temporary office for the Owner’s staff at site, consisting of staff area with common toilet, wash basin & cooler point, project manager’s office, one meeting room and necessary electrical points and fittings etc. as per drawing. After completion of the project, all the materials used for the same, shall be contractor’s property. The design of the same shall be provided/approved by the Architect.

12.1 **Testing of Cement / Steel**

For the supply of cement and steel / structural steel, it shall be contractor's duty to arrange for the test samples of cement & steel/structural steel for every separate consignment that shall be received by the contractor at site or as directed by the Site Engineer. Contractor will not be reimbursed amount of such bills of test reports carried out at recognized technical institute or laboratories. Other sundry expenditure like transport, handing over of samples, packing and getting test results, even by deputing his personnel will be borne by the contractor.

12.2 **Material and Equipment**

<table>
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<tr>
<th>Material</th>
<th>Make</th>
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<tbody>
<tr>
<td>• Cement</td>
<td>OPC 53 either from Ultratech or Equivalent shall be used for all concrete works.</td>
</tr>
<tr>
<td>• Reinforcement</td>
<td>Reinforcement steel from Electrotherm, Sail and Vizag shall be used for all necessary reinforcement steel works related to concrete works. Binding wire shall be annealed 16 guage M.s Binding wire to be used [refer item specification]</td>
</tr>
<tr>
<td>• Structural Steel</td>
<td>All structural steel work at site will be carried out with either Tata, Jindal or equivalent make, and if not available than contractor need to submit the test report of equivalent brand before procurement and execution.</td>
</tr>
</tbody>
</table>

Contractor will have to use only good / fresh ply shuttering for all concrete element and standard ‘H’frames shuttering system to be used.

Contractor has to submit royalty slip against each of material like excavated earth, grit, kapachi and sand to the project engineer / owner.

All concrete of foundation, columns, beams, floor and structural slab or any other concrete element shall be done with weigh batchers of concrete mixer machine. The contractor has to submit design mix report prepared by qualified agency and same shall be approved by the consultant. If the contractor insists for RMC then he requires prior approval from the Architect / Consultant. RMC shall be Ultratech, Lafarge concrete or Equivalent vendor.
Contractor needs to main water cement ratio for concrete as per IS: 456:2000 [Table: 05]

12.3 Test and Test Certificate for Construction Materials and Construction works

Soil Test / Earth Filling by soil brought from outside: The contractor shall take prior approval of soil with test report from the Project Engineer before starting to soil filling works at site.

For site development and plinth area earth filling works, proctor density test shall be carried out as directed by the Consultant / Project Engineer, until the satisfactory values are achieved, further activities cannot be commenced.

The contractor will have to take six numbers of cubes from each batch of concrete during concreting for compressive strength of the contractor at 7 days and 28 days. If cube are fails or shows deficit than the contractor shall repair or re-cast the same element as per consultant’s instructions at his own cost.

The contractor have to perform NDT if suggested by the consultant. If the results are not confirmed then contractor will have to redo the works at his own cost.

Material Testing, concrete cube test and any other test inform by the consultant / architect shall be borne by the contractor, no extra shall be paid for such necessary construction testing.

13 The quantity for measurement will be actual quantity used in construction (which will be calculated on the basis of standard steel co-efficient). Rolling margin, invisible loss, wastage shall not be paid or billed.

i) The contractor shall bear all incidental charges for the storage and safe custody of the materials at site at his own responsibility.

ii) The contractor shall make arrangement at the site of works for safe custody of materials to protect from damage by rain, dampness, fire, theft etc.

iii) In case any materials get damaged the contractor shall replace the same at his own cost.

iv) The contractor shall furnish to Site Engineer sufficiently in advance a statement showing his requirements of quantities of materials to be supplied by Owner if any and the time when the same will be required by him.

v) A day to day account of the material supplied by Owner/Contractor shall be maintained by the contractor in the prescribed Performa like Pour Card etc.

vi) Only that quantity of steel and reinforcing steel, which is shown in the drawings as finished/fabricated steel, will be measured. No wastage, cutting margins, materials used as laps etc. shall be measured for payment. However, approved laps, chairs and spacers in reinforcing steel be measured.

vii) Rate of formwork shall be inclusive of desired size and shape. Rates are also inclusive of forming grooves of required size and shape, forming pattas, patterns, rendering etc. Exposed shuttering also includes finishing and rendering of the same and providing holes for conduits/pipes and other inserts.

13 Dewatering.

Rate quoted for various items in schedule of quantities, should include cost of dewatering by any means and at all stages which may be from underground or surface water sources. Contractor will not be paid anything extra for dewatering.

14 Application codes for Specification of Civil Works.

The following codes, standards are part of the specifications mentioned/covered under this contract. All standards, tentative specifications, codes of practice referred to herein shall be the latest edition including all applicable official amendments and revisions. Copy of same shall be made available at site all the time for reference.

In case of discrepancy between tender and those referred to herein, IS Specification shall govern.

<p>| IS 1077 | Common burnt clay building bricks. |
| IS 2502 | Code of practice for bending &amp; fixing of concrete reinforcement. |
| IS 1905 | Structural safety to building. |</p>
<table>
<thead>
<tr>
<th>IS 1786</th>
<th>Specification for cold twisted steel bars for concrete reinforcement.</th>
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</thead>
<tbody>
<tr>
<td>IS 3495</td>
<td>Methods of sampling &amp; testing clay building bricks. (Part I to IV)</td>
</tr>
<tr>
<td>IS 2212</td>
<td>Code of practice for brickwork.</td>
</tr>
<tr>
<td>IS 2394</td>
<td>Code of practice for application of lime plaster finish.</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 4021</td>
<td>Timber door, window and ventilator frames.</td>
</tr>
<tr>
<td>IS 2202</td>
<td>Wooden flush door shutters (solid care) Type Part I</td>
</tr>
<tr>
<td>IS 1003</td>
<td>Timber panelled and glazed shutters part I&amp;II</td>
</tr>
<tr>
<td>IS 4020</td>
<td>Methods of tests for wooden flush doors, Thpe test.</td>
</tr>
<tr>
<td>IS 1081</td>
<td>Code of practice for fixing and glazing of metal (steel &amp; aluminium) doors, windows and ventilators</td>
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<tr>
<td>IS 233</td>
<td>Code of practice for finishing wood and wood base materials (part)</td>
</tr>
<tr>
<td>IS 2395</td>
<td>Code of practice for painting concrete, masonry and plaster surface.</td>
</tr>
<tr>
<td>IS 1346</td>
<td>Code of practice for water proofing of roofs with bitumen felts.</td>
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<td>IS 783</td>
<td>code of practice for laying concrete pipes.</td>
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<tr>
<td>IS 1200</td>
<td>Method of measurement of building works.</td>
</tr>
<tr>
<td>IS 3764</td>
<td>Safety code for excavation work.</td>
</tr>
<tr>
<td>IS 2720</td>
<td>Part II Determination of moisture content.</td>
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<tr>
<td>IS 2720</td>
<td>Part VII Determination of moisture content dry density relation using light compaction.</td>
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<td>IS 2720</td>
<td>Part VIII Determination of moisture content dry density relation using heavy compaction.</td>
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<td>Part XXVIII Determination of dry density of soils, in place by the said replacement method.</td>
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<tr>
<td>IS 23856</td>
<td>Parts I to VIII methods of test for aggregates.</td>
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<td>IS 516</td>
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<td>IS 1199</td>
<td>Methods of sampling and analysis of concrete.</td>
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<tr>
<td>IS 432</td>
<td>Part I &amp; II Mild and Medium tensile steel bars and hard drawn steel wire, for concrete reinforcement.</td>
</tr>
<tr>
<td>IS 4990</td>
<td>Specification for plywood for concrete shuttering works.</td>
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<td>IS 2645</td>
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<td>IS 3370</td>
<td>Part I to IV code of practice for concrete structures for storage of liquids.</td>
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<td>Specification for admixtures for concrete.</td>
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<td>IS 3414</td>
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<td>IS 4014</td>
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<td>IS 2571</td>
<td>Code of practice for laying in site cement concrete flooring.</td>
</tr>
<tr>
<td></td>
<td>National Building code of India 1970 . (All Parts).</td>
</tr>
</tbody>
</table>
15 **Clearance of site on completion.**

On completion of the works, the contractor shall clear away and remove from the site, all constructional plant, surplus materials, rubbish and temporary works of every kind and leave the whole site and works clean and in workman like condition to the satisfaction of Owner at his own cost. If the contractor fails to clear the site within 15 days after virtual completion/ submission of final bill whichever is earlier, it shall forfeit all his claims and the owner may get the site cleared at contractor's cost.

16 **Additional Instruction to Bidder.**

The contractor shall make water pond at the site at his own cost for curing of cubes and for bricks using in masonry.

The contractor shall provide gunny bags in sufficient quantity for curing of any type of construction works and put water as per guideline / frequency decide by the project engineer.

The contractor shall provide sufficient infrastructure for dewatering from excavation of where ever it is applicable, any delay due to non availability of resources will not be acceptable.

The contractor shall not demolish, remove or alter the structure, tress or other facilities on the site without prior approval of the client / consultant.

The contractor will have to make provision of cement godowns at his own cost at suitable location in the site as suggested by project engineer / Client. Size of godown will be constructed minimum 18 x 5.5m and height of godown floor will be 0.6m above ground level with zero leakage from roof. After completion of works the contractor shall demolish and take away the debris and shall make good usable area for client as per instruction of client.

**Rate Difference :** The quotes are to be calculated as per the market rates. This will be a fixed rate contract. Hence, no escalation in price is allowed during the entire period.

No extra time will be granted if the works affected due to rain.

**Contractor to submit as built drawings in three sets after completion of the contract.**

**GENERAL CONDITIONS**

1. **Interpretations :**

   In constructing these Conditions, the Specifications, Schedule of Items/Quantities and Contract Agreement, the following words shall have the meanings herein assigned to them except where the subject or context otherwise requires.

   a) **"Owner/Employer"** Shall mean M/s. **Entrepreneurship Development Institute of India** and shall include its successors, legal representatives and assigns.

   b) **"Contractor"** Shall mean the tenderer (person or persons, firm or company), selected by the Owner for the performance of the work and shall include the successors, legal representatives and permitted assigns of the Contractor.

   c) **"Site"** shall mean the site of the contract works including any building and erections thereon and any other land (inclusively) as aforesaid allotted by Employer for the Contractor's use.

   d) **"This Contract"** shall mean the Articles of Agreement the General and Special Conditions, the Appendix, the Annexure, the Schedule of Items/Quantities and Specifications.
Part A  
General & Special Condition of Contract

attacked hereto and duly signed.

e) "Notice in Writing" or written notice shall mean a notice in written, typed or printed characters sent (unless delivered personally or otherwise proved to have been received) by registered post to the last known private or business address or registered office of the addressee and shall be deemed to have been received when in the ordinary course of post it would have been delivered.

f) "Act of Insolvency" shall mean any Act of Insolvency as defined by the Presidency Towns Insolvency Act or any Act amending such original.

g) "Net Prices" If in arriving at the contract amount the Contractor shall have added to or deducted from the total of the items in the Tender any sum either as a percentage or otherwise then the net price of any item in the tender shall be the sum arrived at by adding to or deducting from the actual figure appearing in the Tender as the price of that item a similar percentage or proportionate sum provided always that in determining the percentage or proportion of the sum so added or deducted by the Contractor the total amount of any Prime Cost items and provisional sums of money shall be deducted from the total amount of the tender. The expression "net rates" or "net prices" when used with reference to the contract or accounts shall be held to mean rates or prices so arrived at.

h) "Time limit/ Stipulated time/ Stipulated date" shall mean the period in which the construction work is stipulated to be completed.

2. General :

a. In the specifications "as directed"/"approved" shall be taken to mean "as directed"/"approved" by the Client and Architects.

b. Wherever a reference to any Indian Standard appears in the specifications, it shall be taken to mean as a reference to the latest edition of the same in force on the date of agreement.

c. The distance which constitutes lead shall be determined along the shortest practical route and not necessarily the route actually taken. The decision of the Site Engineer and Architects in this regard shall be taken as final. Where no lead is specified, it shall mean "all leads".

d. Lift shall be measured from plinth level.

e. Reference to specifications of materials as made in the detailed specification of the item of works is in the form of a designation containing the number of the specification of the material and prefix 'M' e.g. 'M-5'.

f. No materials shall be stored prior to, during and after execution of a structure in such a way as to cause or lead to damage or overloading of the various components of the structure.

g. All works shall be carried out in a workman like manner as per the best techniques for the particular item.

h. The mode, procedure and manner of execution shall be such that it does not cause damage or overloading of the various components of the structure during execution or after completion of the structure.

i. Special modes of construction not adopted in general Engineering practice, if proposed to be adopted by the Contractor, shall be considered only if the Contractor provides satisfactory evidence that such special mode of construction is safe, sound and helps in speedy construction and completion of work to the required strength and quality. Acceptance of the same by the Site Engineer shall not, however absolve the Contractor of the responsibility of any adverse effects and consequence of adopting the same in the course of execution for the completion of the work.

j. All installations pertaining to water supply and fixtures thereof as well as drainage lines and sanitary fitting shall be deemed to be completed only after tests of their satisfactory functioning have been carried out by the Contractor and the same have been approved by the Engineer-in-charge.
k. The Contractor shall be responsible for observing the rules and regulations imposed under the "Minor Minerals Act" and such other laws and rules prescribed by Government from time to time.

l. The testing charges of all materials shall be borne by the Contractor.

m. Approval to any of the executed items for the Work does not in any way relieve the Contractor of his responsibility for the correctness, soundness and strength of the structure as per the drawings and specifications.

3. Competency of the Tenderer: No contract shall be awarded except to responsible bidders capable of performing the class of work contemplated. Before the award of the contract, any bidder may be required to show that he has the necessary facilities, experience, ability and financial resources to perform the work in satisfactory manner within the time stipulated. Contractor may be required to furnish to the Employer, with a statement, as to their experience and their financial status.

4. Security Deposit: A security deposit (including earnest money deposit) totaling to 2.5% of the contract value shall be deducted from each running bill. (Total Retention = 2.5%). 100% retention amount shall be released after rectification of the defects, if any, pointed out during the defects liability period. The amount retained by the Employer shall not bear any interest. All compensation or other sums of money payable by the Contractor to the Employer under the terms of this contract may be deducted from his Earnest Money and Security Deposit. Unless such deposit has become otherwise payable, the Contractor within ten days shall make good in cash the amount so deducted.

5. Conditional tender shall not be accepted.

6. Scope of Contract: The Contractor shall carry out and complete all the work strictly, in every respect, in accordance with the Contract, drawings, specifications, details and with the directions of and to the satisfaction of the Architect and their Associate Consultants. The Architect may in his absolute discretion and from time to time issue further drawings (one month before execution) and/or written/verbal instructions, details, directions and explanations which are hereafter collectively referred to as "Architect's Instructions" in regard to:

   a. The variation or modification of the design, quality or quantity of works or the addition or omission or substitution of any work.

   b. Any discrepancy in the Drawings or between the Schedule of Items/Quantities and/or Drawings and/or Specification.

   c. The removal from the site of any materials brought thereon by the Contractor and the substitution of any other material therefor.

   d. The removal and/or re-execution of any defective works and opening up for inspection of any covered work executed by the Contractor.

   e. The dismissal from the works of any persons employed thereupon.

   f. In case of verbal instructions, directions and explanations given to the Contractor or his representatives upon the works by the Architect shall, if involving a variation, be confirmed in writing by the Contractor within Seven days, and if not dissented from in writing within a further seven days by Architect's such shall be deemed to be Architect's Instructions, within the scope of the Contract.

All work shall be in compliance with the requirements of the local public authorities. If in the opinion of the Architect and the Consultants, changes have to be made, the Contractor shall carry out the same without any extra charges. The Architect's decision in such cases shall be final and shall not be open to arbitration. No change in the drawings is permitted without Architect's written consent. The Contractor shall carry out and complete the said work in every respect in accordance with this Contract.

7. Tender document, Schedule of items/quantities and drawings: The Contractor shall be entitled to the certified copy of the accepted tender along with the work order, free of cost and shall also be entitled to receive, on request, two sets of contract and working drawings according to the progress of work as and
when needed, free of cost. The Contractor shall keep one copy of all the drawings on the works and the Architect or his representative shall have, at all times, access to the same.

The several documents forming the contract are essential parts of the contract and requirements occurring in one are a binding as through occurring in all. They are intended to be mutually explanatory and complementary and to describe and provide for a complete work. The contract shall remain in the custody of the Architect and shall be produced by him at his office when required by the Employer or the Contractor.

In the event of any discrepancy in the several documents forming the contract or in any one document, the following order of precedence should apply:

**Dimension and quantities** : (i) Drawings (ii) Schedule of Items/Quantities of the Tender form (iii) Specifications. On drawings, figured dimensions, unless obviously incorrect, shall be followed in preference to scaled dimensions.

**Description** : (i) Schedule of Items/Quantities of the Tender form; (ii) Drawings (iii) Specifications. In the case of defective description or ambiguity or any discrepancy in the item specifications or in absence of specifications for any items, the Architect and Site Engineer is entitled to issue further instructions directing in what manner the work is to be carried out or work shall be carried out as per specifications in the latest IS code. The Contractor cannot take any advantage of any apparent error or omission in drawings or specifications and the Architect and Site Engineer shall be entitled to make corrections and interpretations as necessary to fulfil the plans and specifications.

Before the issue of the final certificate to the Contractor, the Contractor shall forthwith return to the Architect, all documents, drawings and specifications.

8. **Contractor to provide everything necessary** : The Contractor shall provide at his cost everything necessary for the proper execution of the works according to the intent and meaning of the Drawings, Schedule of Items/Quantities and Specifications taken together whether the same may or may not be particularly shown or described therein provided that the same can reasonably be inferred therefrom, and if the Contractor finds any discrepancy in the Drawings or between the Drawings, Schedule of Items/Quantities and Specifications he shall immediately and in writing refer same to the Architect who shall decide which is to be followed.

9. **Work not to be sublet** : The Contractor shall not assign or sublet any portion of the contract except with the written consent of the Employer/Architect. In case of breach of these conditions, the Employer may cause the Architect to serve a notice in writing to the Contractor rescinding the contract whereupon the security deposit shall stand forfeited to the Employer, without any prejudice to his other remedies against the Contractor.

10. No alteration, omission or variation shall vitiate this contract but in case the Architect/Consultant thinks proper at any time during the progress of the works to make any alterations in, or additions to, or omissions from, the works or any alteration in the kind or quality of the materials to be used therein and shall give notice thereof in writing under his hand to the Contractor, the Contractor shall alter, add to, or omit from, as the case may, in accordance with such notice, but the Contractor shall not do any work extra to or make any alterations or additions to or omissions from the works or any deviation from any of the provisions of the Conditions of the contract, stipulation, specifications, Schedule of Items/Quantities or contract drawings without the prior consent in writing of the Architect and the value of such extras, alterations, additions or omissions shall in all case be determined by the Architect with the prior approval in writing of the Employer in accordance with the provisions of relevant clause, and the same shall be added to, or deducted from, the contract amount, as the case may be, accordingly.

Any error in description or in quantity or in omission of items from the Schedule of Items/Quantities shall not vitiate this contract but shall be rectified and the value thereof, as ascertained under relevant clause, shall be added to, or deducted from the contract amount(as the case may be) provided that no rectification of errors, if any, shall be allowed in the Contractor's schedule of rates.

11. A schedule of probable quantities in respect of each work and specifications accompany these special conditions. Quantities indicated in the Form of Schedules of Rates with respect to various items are only approximate and are intended merely as information without undertaking as to the correction thereof and
without any obligation upon the Owner. This schedule is liable to alteration by omission, deductions or additions at the discretion of the Employer/Architect and not subject to any discussions. The Contractor shall carry out any such items with variations in the quantities at the tender quoted rate. Each tender should contain not only the rates but also the value of each item of work entered in a separate column and all the items should be totalled in order to show the aggregate value of the entire tender. Every ‘blank’ in the form of the tender and in the schedule must be filled up by the tenderer and must return the document sent herewith.

12. The tenderer must obtain for himself at his own responsibility and expense all the information which may be necessary for the purpose of making a tender, for entering into a contract, examining the drawings and all matters appertaining thereto. The Contractors shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the prices stated in the Schedule of Items/Quantities, which rates and prices shall cover all his obligations under the Contract, and all matters and things necessary for the proper completion of the works.

The information given in the tender documents and the Plans and Drawings forming part thereof is merely intended as a general information without undertaking on the part of the Employer as to their accuracy and without obligation relating thereto upon the Employer. The tenderers are expected to conducted their own surveys and investigations prior to tendering.

The Contractor shall confirm to the provisions of any Act of the legislature relating to the works, and to the regulations and bye laws of any authority, and of any water, electric supply, other companies and/or authorities with whose systems the structure is proposed to be connected, and shall, before making any variations from the Drawings or Specifications that may be necessitated by so conforming, give to the Architect written notice, specifying the variation proposed to be made and the reason for making it and apply for instructions thereon. In case the Contractor shall not within ten days receive such instructions he shall proceed with the work confirming to the provisions, regulations, or bylaws in question, and any variation so necessitated shall be dealt with under relevant clause.

The Contractor shall bring to the attention of the Architect all notices required by the said Acts, regulations or bylaws to be given to any authority and pay to such authority, or to any public office all fees that may be properly chargeable in respect of the works, and lodge the receipts with the Architect.

The Contractor shall indemnify the Employer/Architect/ Consultants against all claims in respect of patent rights, and shall defend all actions arising from such claims, and shall himself pay all royalties, license fees, damages, cost and charges of all and every sort that may be legally incurred in respect hereof.

13. Supply of plants, equipment, formwork, centering, temporary roads, lighting etc.: The rates quoted in the tender shall include for cleaning of the site before commencement and after completion of the works, for the proper fencing, lighting, grading and taking of the necessary safety measures for all works comprised in the contract and for the proper provision of temporary road, way, foot-ways, guards, fences, caution notices etc., also for the accommodation of workmen, foot passenger or other traffic and of Employer/s and occupiers of adjacent property and the public and shall remain responsible for any accidents that may occur on account of his failure to take proper & timely precautions.

The Contractor shall not set fire to any standing jungle, trees, brushwood or grass without a written permit from the Architect, Site Engineer and Forest officer. When such permit is given, and also in all cases when destroying cut or dug up trees, brushwood, grass etc. by fire, the Contractor shall take necessary measures to prevent such fire spreading to or otherwise damaging surrounding property.

Contractor shall supply at his own cost all materials (except such special materials if any, as may, in accordance with the contract to be supplied by the Employer), plant, tools, appliances, implements, ladders, cordage, tackle, scaffolding and any temporary works which may be required for the proper execution of the work whether in the original, altered or substituted from and whether included in the specifications, or other documents forming part of the contract or referred to in these conditions or not and which may be necessary for the purpose of satisfying or complying with requirements of the Architect and Site Engineer as to any matter or to which under these conditions he is entitled to be satisfied or which he is entitled to required together with carriage therefore to and from the work.

Erection of all formwork, staging, timbering, shoring etc. as well as taking down and removal of the same when ordered to do so shall be included. The rates quoted shall be inclusive of fully reinstating and making

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good all matters and things disturbed during the execution of the work and to the satisfaction of the Architects.

All the arrangements made for fencing and lighting shall be maintained by the Contractor throughout the execution of the contract till the physical taking over of the work by Employer.

14. **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 Architect and Site Engineer at the expense of the Contractor and the expenses may be deducted from any money due to the Contractor under the contract or from his security deposit, or proceeds of sale thereof, or of a sufficient portion thereof.

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 Contractors shall submit to the Employer and Architects on the site plan recorded levels, contours, margins and the verifications of layout within seven days from the date of getting site layout from Architects/Employers.

If at any time any error in this respect shall appear during the progress of the works or within a period of one year from the completion of the works, the Contractor shall, if so required, at his own cost rectify such error to the satisfaction of the Architect. If however, such error is based on incorrect data supplied in writing by the Architect and Site Engineer, the expenses of rectifying the same shall be borne by the Employer.

The checking of any setting out or of any line or level by the Architect and Site Engineer or their representative shall not in any way relieve the Contractor of responsibilities, for the correctness thereof. The Contractor shall carefully protect and preserve all bench-marks, site nails, page and other things used in setting out of the work.

Necessary trial pits, of size 5’ x 5’ x 5’, at minimum two locations on the entire site, shall be done by the Contractors at their own expense and the report thereof showing different strata with respective bearing capacities and the same shall be submitted to Employers/ Architects/ Consultants. No extra charges shall be paid for the same.

15. **Item rate tender** : The Contractor should note that unless otherwise stated the tender is strictly on item rate basis and his attention is drawn to the fact that the rates for each and every item should be correct, workable and self supporting. Quantity variation shall be unlimited. The rates shall also be firm and not subject to exchange variations, labour conditions, fluctuations in railway freights or any conditions whatsoever. It shall exclude GST part and shall include other taxes/duty or other levy levied by the Central or State Governments or local authorities, sales tax on works contract if applicable. No claim in respect to the above mentioned shall be entertained by the Employer.

16. **Time limit** : Time shall be the essence of the contract. Time allowed for carrying out the work as mentioned in the memorandum shall be strictly observed by the Contractor and it shall be reckoned from the 7th day after written order to commence the work is issued. The tenderer shall, before commencing work, prepare a detailed work schedule which shall be approved by the Consultants and the Employer. This schedule shall be strictly followed by the Contractor. In the event of extension, it shall no be treated as waiver of this clause.

**Liquidated damages/Penalty/Bonus** : If the Contractor fails to complete the works by the date stated in the Appendix or within any extended time under relevant clause and if the Architect certifies in writing that in his opinion the same could be reasonably completed, the Contractor shall pay the Employer the sum named in the Appendix as "Liquidated Damages/ Penalty for delayed" for the period during which the said works shall so remain incomplete and the Employer may deduct such damages from any moneys due to the Contractor, in the following manner :

i) If the contractor fails to complete the work under contract by the stipulated date, he shall pay liquidated damages of 0.5 % of the contract value per week from the date of delaying the said work upto the date of completion and handing over to the Employer.
ii) However also, if the Contractor fails to complete any part of the work as designated in schedule of items/quantities, by the time indicated against such parts, he shall pay Liquidated damages per week, from the date of delaying the said part of the work, up to the date of completion of the said designated part, at the rate shown in the said schedule of the contract, till the said designated part is completed.

iii) The aggregate maximum of liquidated damages payable shall be 0.5% of contract value per week and shall be subject to the maximum amount of 5% of the contract amount.

iv) Delays for requiring payment of 5%, liquidated damages of the amount put to tender for performance shall be sufficient causes for termination of contract and forfeiture of security deposit.

If in the opinion of the Architect the works are delayed

(a) by force majeure or
(b) due to exceptionally inclement weather or
(c) due to delay in proceedings or any dispute with adjoining owners or public authorities arising otherwise than through the Contractor’s own fault or
(d) by delay in works of other Sub-contractors or tradesmen engaged/nominated by the Employer or the Architect and not referred to in the Schedule of Items/Quantities and/or Specification or
(e) by reason of Architect’s instructions as per relevant Clause or
(f) by reason of civil commotion, local combination of workmen or strike or lockout affecting any of the building trades or
(g) in case of the Contractor not receiving in due time necessary instructions from the Architect for which he has specifically applied in writing or
(i) due to delay in supply of materials by the Employer.

The Architect may, with the previous approval in writing of the Employer make a fair and reasonable extension of time for completion of the contract works. In case of such strike or lockout the Contractor shall give written notice to the Architect immediately. But the Contractor shall nevertheless constantly use his endeavours to prevent delay and shall do all that may be reasonably required to the satisfaction of the Architect to proceed with work. Such extension shall not entitle the contractor to claim escalation in the rate.

17. The Contractor shall furnish, within three days (unless extended by the Architect and Site Engineer) of the order to start the work, the progress schedule in quadruplicate indicating the date of starting, the monthly progress expected to be achieved and the anticipated completion date of each major item of work to be done by him also indicating dates of procurement and setting up the materials, plants and machinery. The Schedule should include a statement of proposed general and detailed arrangements for carrying out works, and of time, order and manner in which it is proposed that these shall be executed. Necessary reports endorsed by the Site Engineers consisting of the labour strength and the materials shall be regularly furnished to the Employer and Architects every week. The Contractor shall include the programme for the forth-coming week in the same report.

The schedule should be formed keeping in view the time limit and the achievement towards completion of the work within the time limit and of the particular items on the dates specified in the contract and shall have the approval of the Architect and Site Engineer. Further, the dates for the progress, as in this schedule shall be adhered to.

In case it is found necessary, at any stage, to alter the schedule, the Contractor shall submit in good time, a revised schedule incorporating necessary modifications proposed and get the same approved from the Architect and Site Engineer. No revised schedule shall be operative without such acceptance in writing. The Architect and Site Engineer in further empowered to ask for more detailed schedule or schedules, say, week by week, for any item or items and the Contractor shall supply the same as and when asked for.
The Architect and Site Engineer shall have, at all times, the right, without in any way vitiating this contract forming grounds for any claim, to alter the order of the work or any part thereof and the Contractor shall after receiving such direction, proceed in the order directed. The Contractor shall also revise the progress schedules accordingly and submit four copies of the revised schedule to the Architect and Site Engineer within seven days of the said Engineer's direction to alter the order of works.

The Contractor shall furnish sufficient plant, equipment and labour and shall work such hours and shifts as may be necessary to maintain the progress of the work as per approved progress-schedule. The working and shift hours shall comply with all Government regulations in force and shall be such, as may be approved by the Architect and Site Engineer and the same shall not be varied without the prior approval of Architect and Site Engineer.

The Contractor shall from time to time, as may be required by the Architect and Site Engineer, furnish the Architect and Site Engineer with a statement in writing of the arrangements he proposes to adopt for the execution of this contract and the Architect and Site Engineer may, if he considers necessary at any time advise alteration in the same, which the Contractor shall adopt on notice thereof.

The progress-schedule(s) shall be in the form of CPM/PERT, forms, statements and/or reports as may be approved by the Architect and Site Engineer. The Contractor shall submit four copies showing the progress of the work in the form of a chart etc. at periodical intervals as may be specified by Architect and Site Engineer.

The approval of the progress-schedules by the Site Engineer shall not relieve the Contractor of any of his duties and responsibilities under the contract. The adoption of any modification in the schedule required by the Architect and Site Engineer shall not entitle the Contractor to any extra payment.

Also three sets of black & white/colour photographs every month showing the progress of work duly endorsed by the site Engineer should be submitted with the report. On completion of the work 5 sets of colour photographs as directed by the Architects should be submitted.

If the Contractor after receipt of written notice from the Architect requiring compliance within ten days fails to comply with for further drawings/ instructions the Employer may employ and pay other persons to execute any such work that may be necessary to give effect thereto. All costs incurred in connection therewith shall be recoverable from the Contractor by the Employer on the certificate of the Architect as a debt or may be deducted by him from any moneys due to the Contractor.

**19. Default by Contractor**

If, the Contractor shall neglect or fails to proceed with the work with due diligence or if he violates any of the provisions of the Contract, the Architect and Site Engineer shall give the Contractor a notice, identifying deficiencies in performance and demanding corrective action. Such notice shall clearly state that it is given under the provision of this clause. After service of such notice, the Contractor shall not remove any plant, equipment and material from the site. The Employer shall have a legal claim on all such plant, equipment and material from the date of such notice till the said deficiencies have been corrected as mentioned in the said notice.

If the Contractor fails to take satisfactory corrective action within ten days after receipt of such notice, the Architect and Site Engineer on behalf of the Employer shall terminate the contract in whole. In case, the entire contract is terminated, the amount of security deposit, Earnest money deposit and Retention amount, if any, together with the value of the work done but not paid for, shall stand forfeited to the Employer. The plants equipment and material held under this clause shall then be at the disposal of the Employer to recover the amount equivalent to the liquidated damages and registration of the Contractor shall be kept in abeyance for three years from the date as fixed in all such cases.

The Architect and Site Engineer if necessary shall direct that a part or the whole of such plant, equipment and material be removed from the site within a stipulated period, if the Contractor fails to do so, the Architect and Site Engineer shall cause them or any part of them to be sold forfeited to the Employer. The proceeds of such sale to the credit of the Contractor. After settlement of accounts, the lien by the Employer on the Contractors remaining plant equipment and balance of material shall be released.

If the Contractor being an individual or a firm or a incorporate company, commits any "act of insolvency", or shall be adjudged as an insolvent or being an Incorporated Company shall have an order for
compulsory winding up, made against it or passed as an effective resolution for winding up voluntarily or subject to the supervision of the court and the official Assignee or the Liquidator in such acts of insolvency or winding up, as the case may be, shall be unable within seven days after notice to him requiring him to do so, to show up giving a satisfactory reason to the Architect that he is able to carry out and fulfil the contract and to give security therefor, if so required by the Architect.

Or if the Contractor (whether an individual, firm or incorporate Company) shall suffer execution or other process of court attaching property to be issued against the Contractor.

Or shall suffer any payment under this contract to be attached by or on behalf of any of the creditors of the Contractor.

Or shall assign or sublet this contract without the consent in writing of the Employer first had and obtained.

Or shall charge or encumber this contract or any payments due or which may become due to the Contractor hereunder.

Or if the Architect shall certify in writing to the Employer that the Contractor
i) Has abandoned the contract, or

ii) Has failed to commence the works, or has without any lawful excuse under these conditions suspended the progress of the works for fourteen days after receiving from the Architect notice to proceed, or

iii) Has failed to proceed with the works with such due diligence and failed to make such due progress as would enable the works to be completed within the time agreed upon, or,

iv) Has failed to remove materials from the site or to pull down and replace work for seven days after receiving from the Architect written notice that the said materials or work were condemned and rejected by the Architect under these conditions, or

v) Has neglected or failed persistently to observe and perform all or any of the acts, matters or things by this contract to be observed and performed by the Contractor for seven days after written notice shall have been given to the Contractor requiring the Contractor to observe or perform the same.

Then and in any of the said cases the Employer may, notwithstanding any previous waiver, after giving seven days notice in writing to the Contractor, terminate the contract, but without thereby affecting the powers of the Architect or the obligations and liabilities of the Contractor, the whole of which shall continue in force as fully as if the Contract had not been so terminated, and as if the works subsequently executed had been executed by or on behalf of the Contractor, And further, the Employer by his agents or servants may enter upon and take possession of the works and all plants, tools, scaffolding, sheds, machinery, steam and other power utensils and materials laying on the premises or the adjoining lands or roads, and use the same as his own property or may employ the same by means of his own servants and workmen in carrying on and completing the works or by employing any other Contractor or other person or persons to complete the works, and the Contractor shall not in any way interrupt or do any act, matter or thing to prevent or hinder such other Contractor or other person or persons employed for completing and finishing or using the materials and plant for the works. When the works shall be completed or as soon thereafter as convenient the Architect shall give a notice in writing to the Contractor to remove his surplus materials and plant, and should the Contractor fail to do so within a period of fourteen days after receipt thereof by him the Employer may sell the same by [Public auction], and give credit to the Contractor for the net amount realised. The Architect shall thereafter ascertain and certify in writing under his hand what (if anything) shall be due or payable to, or by the Employer, for the value of the said plant and materials so taken possession of by the Employer and the expenses or loss which the Employer shall have been put to in procuring the works to be completed, and the amount, if any, owing to the Contractor and the amount which shall be so certified shall thereupon be paid by the Employer to the Contractor or by the Contractor to the Employer, as the case may be, and the certificate of the Architect shall be final and conclusive between the parties.

If, at any time, after the acceptance of the tender, the Employer shall for any reasons whatsoever not require the whole or any part of the works to be carried out, the Architect shall give notice in writing to the Contractor who shall have no claim to any payment of compensation or otherwise whatsoever on account
of any profit or advantage which he might have derived from the execution of the whole works.

Without prejudice to any of the rights or remedies under this contract, if the Contractor, being an individual, dies, the Employer shall have the option of terminating the contract without incurring any liability for such termination.

Termination of the contract in whole shall be an adequate authority for the Architect and Site Engineer to demand discharge of the obligations from the guarantors of the security for the performance.

20. Notwithstanding any dispute, the contractor shall not stop the work claiming any dispute with the architect/employer or resolution of the dispute through arbitration or otherwise is pending. Contractor shall continue to work uninterruptedly despite any dispute whether or not resolved or referred to arbitration. If the employer is of the opinion that, contractor is not proceeding with the work because of any dispute the architect/employer shall be entitled to hold such and act of contractor as an abandonment of the contract.

In the event of the abandonment of the contract the employer shall be entitled to appoint other agency at the risk and cost of the contractor or to carry out the work departmentally and the contractor shall not obstruct employer, employer's agency in completion of the work/project. if the contractor creates any obstruction in completion of work/project, the employer shall be entitled to forcibly prevent him.

21. The Contractor shall not be entitled to any compensation for any loss suffered by him on account of delays in commencing or executing the work due to modifications, delays in connected subcontracts, procurement of government controlled or other building materials, obtaining water and power connections or for any other reasons whatsoever. The Employer shall not be liable for any claim in respect thereof nor accept any liability for any sum provided for therein.

22. **Extra works**: The Contractor may, when authorised, and shall, when directed, in writing by the Architects with the approval of the Employer add to, omit from, or vary the works shown upon the drawings, or described in the specification, or included in the Schedule of Items/Quantities, but the Contractor shall make no addition, omission or variation without such authorization or direction. A verbal authority or direction by the Architects shall, if confirmed by them in writing within seven days, be deemed to have been given in writing.

No claim for an extra shall be allowed unless it shall have been executed under provisions of its relevant clause or by the authority of the Architects with the concurrence of the Employer as herein mentioned. Any such extra as herein mentioned, is referred to as authorised extra and shall be made in accordance with the following provisions.

a) i. The net rates or prices in the original tender shall determine the valuation of the extra work where such extra work is of similar character and executed under similar conditions as the work priced therein.

ii. Rates for all items, wherever possible, should be derived out of the rates given in the priced Schedule of Items/Quantities, i.e. on pro-rata basis as far as possible.

b) Where the extra works are not of similar character and/or executed under similar conditions as aforesaid or where the omissions vary the conditions under which any remaining items of works are carried out or if the amount of any omissions or additions relative to the amount of the whole of the contract works or to any part thereof shall be such that in the opinion of the Architect the net rate of price contained in the Priced Schedule of Items/Quantities or tender or for any items of works involves loss or expense beyond that reasonably contemplated by the Contractor or is by reason of such omission or addition rendered unreasonably or inapplicable, the Architect shall fix such other rate or price as in the circumstances he shall think reasonable and proper, with the prior approval in writing of the Employer, on the basis of prevailing market rate of materials + Estimated cost of Labour + 1.5% Overhead cost of running plant/equipments and Tools [if applicable respect to execution of works then to be paid] + 15% for Contractor overhead & profit. Extra / Non Tender Items shall be executed only after approval of rate from Architect / Consultant. Architect / Consultant will issue order / certified copy of Non Tender Items for such extra works.

c) Where extra work cannot be properly measured or valued the Contractor shall be allowed day work prices as per the net rates considered at the time of quoting the tender or, if not so considered, then in
accordance with the local day work rates and wages for the district; provided that in either case vouchers
specifying the daily time (and if required by the Architect, the workmen's names) and materials employed
be delivered for verification to the Architect or his representative at or before the end of the week following
that in which the work has been executed.

The measurement and valuation in respect of the Contract shall be completed within the "Period of final
measurements" stated in the Appendix or if not stated then within six months of the completion of the
Contract works as defined in relevant clause.

23. The Contractor shall submit in advance a statement of extra items with supporting vouchers/invoices/other
necessary supporting documents to Architect's/consultant for approval and certification. Only on approval
/certification, he is bound to carry out any extra items of work, necessary for the completion of the job
even though the items may not be included in the Schedule of Items/quantities. Schedule of instructions in
respect of such additional items and their approximate quantities shall be issued in writing by the
Architects.

24. Sub-contracts: For the provisional items/sums indicated in the tender, if the work is awarded
directly/separately to a specialized agency. All Specialists, Merchants, Tradesmen and others employed
thus to execute any work of provisional items/sums included in the Schedule of Items/Quantities and/or
Specifications who may be nominated or selected by the Architect are hereby declared to be Sub-Contractors employed by the Contractor and are herein referred to as nominated Sub-Contractors.

No nominated Sub-Contractors shall be employed in connection with the works against whom the
Contractor shall have reasonable objection or (save where the Architect and Contractor shall otherwise
agree) who shall not enter into a Contract providing:

a) That the nominated Sub-Contractor shall indemnify the Contractor against the same obligations in
respect of the Sub- Contract as the Contractor is under in respect of this contract.

b) That the nominated Sub-Contractor shall indemnify the Contractor against claims in respect of any
negligence by the Sub-Contractor, his servants or agents or any misuse by him or them of any
scaffolding or other plant, the property of the Contractor or under any workmen's compensation Act in
force.

c) Payment shall be made to the nominated Sub-Contractor within fourteen days of his receipt of the
Architect's certificate. Also, before any such certificate is issued the Contractor shall upon request
furnish proof to the Architect that all nominated Sub-Contractors accounts included in previous
certificates have been duly discharged; in default whereof the Employer may pay the same upon a
certificate of the Architect and deduct the amount thereof from any sums due to the Contractor. The
exercise of this power shall not create privity of contract as between Employer and Sub-Contractor.

25. The Contractor must co-operate with other Contractors appointed by the Employer so that the work shall
proceed smoothly with the least possible delay and to the satisfaction of the Architects.

26. Materials, its sample approval, its procurement and storage: The Contractor should make his own
arrangement to obtain all materials required for the work, except otherwise stated. All materials shall, so
far as procurable, be of the respective kinds described in the Schedule of Items/Quantities and/or
specifications and in accordance with the Architect's instructions, and the Contractor shall upon the
request of the Architect furnish him with all invoices, accounts, receipts and other vouchers to prove that
the materials comply therewith. The Contractor shall maintain proper records of materials and other inputs. It shall be periodically reported to the Site Engineer or Architects/Consultant. Contractor shall submit the copy of material inventory along with every R.A. Bill for records and certification.

Approval of the samples of various materials given by the Site Engineer and Architects shall not absolve
the Contractor from the responsibility of replacing defective material brought on site or materials used in the work found defective at a later date. The Contractor shall have no claim to any payment or compensation whatsoever on account of any such materials being rejected by the Site Engineer and Architects. No collection of material shall be made before it is approved by the Site Engineer and Architects.

The Architect shall, during the progress of the works, have to order in writing from time to time the removal from the works, within a period specified in the order, of any materials which in his opinion are not in accordance with the specifications or his instructions, the substitution of proper materials, and the removal and proper re-execution of any work executed with materials or workmanship not in accordance with the drawings, specifications or instructions; and the Contractor shall forthwith carry out such order at his own cost. In case of default on the part of the Contractor to carry out such order, the Employer shall have the power to employ and pay other persons to carry out the same; and all expenses consequent thereon, or incidental thereto, as certified by the Architect shall be borne by the Contractor, or may be deducted by the Employer from any monies due, or that may become due, to the Contractor.

27. **Authorised permissions**: The Contractor shall approach, directly to the Municipal and other authorities for obtaining the type of permission required by law.

    All fees for the supply of good quality water, including obtaining municipal connection and drainage connection for his labour shall be borne by the Contractor and fees if any payable for permanent connections shall be initially paid by the Contractor and the Employer shall reimburse the amount on production of the receipts.

28. **Electricity**: Employer shall give power supply to the contractor at one point. The Contractor shall install and maintain at its own cost, an electric meter (Electric board supplier/Electric supply Authority, approved and sealed), cables, switches, ELCB branch connection earthing, protective and safety devices etc., approved by Owner/Electrical Consultant for distribution and measurement of the electrical consumption. The Contractor shall also arrange for necessary permission for all electrical installation, cabling etc.

    The Contractor shall be responsible for providing and maintaining the whole of the installation on the load side of supply, as well as all safety aspects covered under I.E. act/I.E. rules, National Electric Code etc. All necessary/safety precaution must be taken and the Contractor’s electrical installation shall be subject to the approval by the Owner/Engineer in-charge and must comply with the requirement of the appropriate statutory authorities. Contractor shall not use welding sets for cutting works. Three phase welding machine is preferred.

    All charges towards temporary connection shall be paid by the contractor and same shall not be reimbursed. All charges towards permanent connection shall be initially paid by the contractor and the Employer shall reimburse the amount on production of the receipts.

    An Energy meter to be installed at site by Power Provider agency for recording the power consumed by the contractor and same shall be recovered at the prevailing rate of electricity by the power provider agency on the basis of actual billing on a monthly basis.

    If any point of time, during the period of contract, the energy meter is found to be faulty, the electricity charges shall be recovered from the Running Account Bills of the contractor at 0.5% of the value of work done during the particular period if in case of power failure the contractor will be liable to arrange alternative arrangement by way of installing DG set & for the same at no additional charges will be paid.

    The Contractor's rate and prices shall be deemed to be inclusive of all such charges and costs in respect of supplying and maintaining electrical installation. The Contractor shall not have any claim whatsoever on account of failure of power supply.

    If contractor desires, then he can give power connection in the labour colony. Contractor shall not increase the electrical load unless it is approved by Site Engineer. Contractor is responsible for safety of his personnel, and the third party, working in the area of Contractor's work site.

    Owner shall have right to disconnect, the power supply for any irregularities observed in the above conditions, and no claim of the Contractor for cost over run shall be entertained, for loss of time due to the same.
Contractor shall provide licensed Electrical Supervisor/ Electrician for operation and maintenance of his electrical installation.

30. **Water supply**: Employer shall supply water from one point at the site. The Contractor shall arrange at his own cost the required distribution lines. The Contractor shall not have any claim whatsoever on account of failure of water supply at any time. The Contractor's rates and prices shall be deemed to be inclusive of all such charges and costs. Charges for water supply will be recovered by 1% from every running bill.

    The Contractor shall arrange for sufficient storage of water to ensure continuity of work. If municipal water is not available and should it be necessary bring water from outside by tankers, the Employer shall not be liable to pay any charges in connection therewith.

31. **Adhere to the Safety code**: The Contractor shall strictly comply with the provisions of safety code annexed hereto as well as all laws pertaining to labour etc.

32. **Insurance**: The Contractor has to take full insurance for Workmen’s compensation, Third party and Contractor’s all risks (CAR) indemnifying the Employers, Architects and Consultants against all losses and damages arising out of any mishap on site, or any claims whatsoever. Insurance policy has to be approved by Site Engineer or architect. Contractor will have to submit all insurance policies before starting of work at site. Necessary warning signs shall have to be put up by the Contractor.

33. **Rolling margin for steel**: For rolling margin of steel bars, no allowances shall be given to the Contractor and the same shall be measured as per standard weight.

34. **Testing**: Necessary cube tests, mix design and steel tests shall be done by the Contractors at their own expense and the report thereof showing different strength, compressive and tensile respectively, shall be submitted to Employer, Architect & Consultants. No extra charges shall be paid for the same.

    Contractor has to arrange for cube testing machine at site or get it tested from outside laboratory as approved by Site Engineer or Architects, for regular cube tests as per the requirements of consultant and I.S. specifications. Register in the prescribed Performa as per consultant or Architects, showing test result of materials and work tests shall be maintained at the site of work by the Contractor and every entry thereof shall invariably be signed by the Contractor or his authorised representative in token of its correctness. This register should be submitted at every month along with bill.

35. **Project-in-charge**: The Contractor shall employ full-time technically qualified staff during the execution of the work. Details of probable staff to be appointed at the time of execution shall be submitted at the time of submission of Bid document.

    The staff employed for the work must have sufficient experience to handle the work independently. They shall have to stay at the site of work and shall not be entrusted with any other duty except of this work. The Contractor shall inform the Employers/ Architects/ Consultants about the name of the qualified Project-in-charge for necessary co-ordination, discussions, site meetings, and smooth execution of the job.

36. **Measurements**: All works shall be measured net by standard measure and according to the rules and customs of the Mode of Measurement, IS : 1200, without reference to any local custom.

    The Consultant from time to time shall intimate the Contractor and the Employer that he requires the works to be measured. The Contractor shall forthwith attend to or send qualified personnel to assist, in all respects, the Consultant’s personnel and Employer’s Site Engineer, in taking such measurements and calculations.

    In "Mode of Measurement" in the specifications wherever a dispute arises in the absence of specific mention of particular point or aspect, the provisions on these particular points or aspects in the relevant Indian Standards shall be referred to.

    All measurements and computations, unless otherwise specified, shall be carried out nearest to the following limits;
1) Length, width and depth (height/thickness)---------------- 0.01 m.

2) Areas------------------------------------------------------------- 0.01 m²

3) Cubic Contents---------------------------------------------------- 0.01 m³

In recording dimensions of work, the sequence of length, width and height (depth) or thickness shall be followed.

Billing for the entire work shall be in the computerized form or a conventional hard copy to be submitted. The Architects shall give the format for the same. 60% adhoc payment shall be made on the amount certified by the Site Engineer within seven days from the date of submission of bill.

A bill, on a soft copy as well with a hard copy, signed by the Site Engineer/Project Engineer, on each page, shall be submitted by the Contractor each month on or before the date fixed by the Architect and Site Engineer for all works executed in the previous month and the Architect and Site Engineer shall take requisite measurement for the purpose of having the same verified and the claim, so far as it is admissible, shall be adjusted, if possible, within ten days from presentation of the bill.

The Contractor shall, on submitting a monthly bill therefore, be entitled to receive payment proportionate to the part of the work then approved and passed by the Architect and Site Engineer, whose certificate of such approval and passing of the sum so payable shall be final and conclusive against the Contractor. All such intermediate payments shall be regarded as payments by way of advance against the final payments only and not as payments for work actually done and completed and shall not preclude the Architect and Site Engineer from required bad, unsound, imperfect or unskilled work to be removed and taken away and reconstructed, or re-erected, nor shall any such payment be considered as an admission of the due performance of the contract or any part thereof in any respect or the accruing of any claims, nor shall it conclude, determine, or affect in any way the power of the Architect and Site Engineer as to the final settlement and adjustment of the accounts or otherwise or in any other way very or effect the contract.

The rates for items of works shall be valid only when the item concerned is accepted as having been completed fully according to the sanctioned specifications. In cases where the items of work are accepted as not so completed, the Architect and Site Engineer may make payment on account of such items at such reduced rates as he may consider reasonable in preparation of final or "on account bill". The charges to be made in the bills shall always be entered at the rates specified in the agreement or at the part/reduced rates subject to the approval by the Architect and Site Engineer in case of items not completed/ executed as per agreements or in case of any extra work ordered in pursuance of these conditions and not mentioned or provided for in the tender, at the rate hereinafter provided for such work. The copy of the corrected and certified bill, on the soft copy and in hard copy wherever changes/errors are indicated shall be returned to the Contractor, for his own scrutiny and record. The changes/errors indicated, shall be highlighted in the hard copy, for easy pinpoint of the same.

The Contractor shall be paid by the Employer from time to time by installments under Interim certificates issued by the Architect to the Contractor on account of the works executed in accordance with this contract. The certificates, in the opinion of the Architect, works to an approximate value named in the Appendix as "Value of work for Interim certificates" (or less at the reasonable discretion of the Architect) has been executed, subject however, to a retention of the percentage of such value named in the Appendix hereto as "Retention percentage for Interim certificates" until the total amount retained shall reach the sum named in the Appendix as "Total Retention Money" after which the Installments shall be up to the full value of the work subsequently so executed and fixed in the building. The Architect may in his discretion include in the Interim certificate such an amount, as he may consider proper on account of materials delivered upon the site by the Contractor for use in the works. Once the works have been virtually completed and the Architect have certified in writing that they have been completed, the Contractor shall be paid by the Employer in accordance with the certificate issued by the Architect specifying the sum of money named in the Appendix as "Installment after Virtual Completion" being a part of the said Total Retention Money. The Contractor shall be entitled to the payment of the Final Balance in accordance with the Final Certificate issued in writing by the Architect at expiration of the period referred to as "the Defects Liability Period" in the Appendix hereto from the date of virtual completion or soon after the expiration of such period as the works shall have been finally completed and all defects made good according to the true intent and meaning hereof whichever shall last happen. The issue of such a certificate by the Architect during the progress of the works or at or after their completion shall not relieve...
the Contractor from his liability under relevant clauses nor relieve the Contractor of his inability in cases of fraud, dishonesty, or fraudulent concealment relating to the works or materials or to any matter dealt with in the certificate, and in case of all defects and insufficiencies in the works or materials which a reasonable examination would not have disclosed. No certificate of the Architect shall of itself be conclusive evidence that any works or materials to which it relates are in accordance with the contract neither shall the Contractor have a claim for any amounts which the Architect might have certified in any interim bill and paid by the Employer and which might subsequently be discovered as not payable and in this respect the Employer’s decision shall be final and binding.

The Architect shall have power to withhold any certificate if the works or any parts thereof are not being carried out to his satisfaction.

Contractor should not stop the works at site due to delay from Site Engineer or architect regarding certification of monthly bill.

The Architect may in any certificate make any correction, may it be a certificate, previously certified and issued by him.

The Architect shall issue no certificate of payment if the Contractor fails to insure the works and keep them insured till the issue of the Virtual Completion Certificate.

Payments upon the Architect's certificate shall be made within the periods named in the Appendix as "Period for honour of certificates" after such certificates has been delivered to the Employer.

If payment of the amount payable by the Employer certified by the Architect shall be in arrears and unpaid for thirty days even after a notice in writing requiring payment, have been given by the Contractor to the Employer, or if the Employer interferes with or obstructs the issue of any such certificate, or if the Employer shall repudiate the contract, or if the works be stopped for three months under the order of the Architect or the Employer or by any injunction or other order of any court of law, then in any of the said cases the Contractor shall be at liberty to determine the contract by notice in writing to the Employer, through the Architect, and he shall be entitled to recover loss he may sustain upon any plant or materials supplied or purchased or prepared for the purpose of the contract.

In arriving at the amount of such payment the net rates contained in the Contractor’s original tender shall be followed, or where the same may not apply, valuation shall be made in accordance with relevant clause.

The final bill shall be submitted by the Contractor within forty-five days of the completion of the work, otherwise the Architect and Site Engineer’s certificate of the measurements and of the total amount payable for the work shall be final and binding on all parties.

The Employer shall have a right to cause a technical examination of the works and the final bill of the Contractor including all supporting vouchers, abstracts, invoices, material conciliation etc. to be made at the time of payment of the final bill. If as a result this examination or otherwise any sum is found to have been overpaid or over certified it shall be lawful for the Employer to recover the sum.

All payment to the contractor shall be subject to TDS under income tax act and other statutory deduction as applicable form time to time.

38. Escalation: No escalation shall be given under any circumstances during contract/ extended period for any reason whatsoever.

39. Work to be covered up : As soon as the work is completed, the Contractor shall give a notice of such completion to the Architect and Site Engineer and on receipt of such notice, the Architect and Site Engineer shall inspect the work, and if he is satisfied that the work is completed in all respects.

40. Defects Liability : Any defect, shrinkage, settlement or other faults which may appear within the “Defects Liability Period” stated in the Appendix here-to or, if non stated, then within twelve months after the virtual completion of the works, arising in the opinion of the Architect from materials or workmanship not in accordance with the contract, shall upon the directions in writing of the Architect, and within reasonable time as shall be specified therein, amended and made good by the Contractor, at his own cost and in case
of default the Employer may employ and pay other persons to amend and made good such defects,
shrinkage, settlements or other faults, and all damages, loss and expenses consequent thereon or
incidental thereto shall be made good and borne by the Contractor and such damage, loss and expenses
shall be recoverable from him by the Employer or may be deducted by the Employer, upon the Architect's
certificate in writing from any money due or that may become due to the Contractor, or the Employer may
in lieu of such amending and making good by the Contractor, deduct from any moneys due to the
Contractor, a sum, to be determined by the Architect equivalent to the cost of amending such work and in
the event of the amount retained under relevant clause being insufficient, recover the balance from the
Contractor, together with any expenses the Employer may have incurred in connection therewith. Should
any defective work have been done or material supplied by any Sub-Contractor employed on the works
who has been nominated or approved by the Architect as provided in relevant Clause, the Contractor shall
be liable to make good in the same manner as if such work or material had been done or supplied by the
Contractor and been subject to the provisions of this Clause and relevant clause. The Contractor shall
remain liable under the provisions of this Clause notwithstanding the signing of any certificate or the
passing of any accounts, by the Architect.

41. **Damages**: The Contractor shall provide all necessary fencing and lights required to protect the public
form accident and shall also be bound to bear expenses of defence of every suit, action or other legal
proceeding at law that may be brought by any person for all injury to persons, animals or things & for all
structural and decorative damage to property arising out of negligence/ carelessness, accident or any
other cause by the Contractor or any of the nominated Sub-Contractor or any employee of either. Any
damages and costs which may be awarded in any such suit, action or proceedings to any such person, or
which may, with the consent of the Contractor, be paid, on any claim put up by any such persons, shall be
borne by the Contractor.

This clause shall also include for any damage to buildings, whether immediately adjacent or otherwise, any
damage to roads, streets, footpaths, bridges or ways as well as all damage caused to the buildings and
works forming the subject of this contract by frost, rain, wind or any other adverse weather conditions.

The Contractor shall indemnify the Employer/ Architect/ Consultants and not hold against for any
expenses arising from injury or damage to persons or property as aforesaid, for any claim made in respect
of injury or damage under any Acts of any legislature or otherwise and also in case of any award of
compensation or damages consequent upon such claim.

The Contractor shall reinstate all damages of every sort mentioned in this clause, so as to deliver up the
whole of the contract works complete and perfect in every respect and so as to make good or otherwise
satisfy all claims for damage to the property of third parties.

The Contractor shall indemnify the Employer against all claims which may be made against the Employer
by any member of the public or other third party in respect of anything which may arise in connection to the
works or in consequences thereof and shall at his own expense arrange to effect and maintain until the
virtual completion of the contract, with an approved office a policy of insurance in the joint names of the
Employer and the Contractor against such risks and deposit such policy or policies with the Architect from
time to time during the currency of this contract.

The Contractor shall be responsible for any liability which may be excluded from the insurance policies
above referred to and also for all other damages to any person, animal or property arising out of the
incidental to the negligent or defective carrying out of this contract. He shall also indemnify the Employer
in respect of any costs, charges or expenses arising out of any claim or proceedings and also in respect of
any award of compensation or damages, arising therefrom.

The Employer shall with the concurrence of the Architect be entitled to deduct the amount of any damage,
compensation, costs, charges and expenses arising or accruing from, or in respect of, any such claims or
damage from any or all sums due or to become due to the Contractor, without prejudice to the Employer's
other rights in respect thereof.

Compensation for all damage done intentionally or unintentionally by Contractor's labours whether in or
beyond limits of the Employer's property including any damage caused by the spreading of fire mentioned
in the relevant clause, shall be estimated by the Architect and Site Engineer, and the estimates of the
Architect and Site Engineer shall be final and the Contractor shall be bound to pay the amount of the
assessed compensation of demand, failing which the same shall be recovered from the Contractor, as
damages, deducted by the Architect and Site Engineer from any sums that may be due or become due to
the Employer, of the Contractor under this contract or otherwise.

The Contractor shall bear the expenses of defending any action or other legal proceedings that may be
brought by any person for injury sustained by him owing to neglect of precautions to prevent the spread of
the fire and he shall also pay the damages and cost that they may be awarded by the court in
consequence.

The Contractor shall be responsible for and shall pay the expenses of providing medical aid to any
workmen who may suffer a bodily injury as a result of an accident. If such expenses are incurred by
Government, the same shall be recoverable from the Contractor forthwith and be deducted, without
prejudice to any other remedy of Government, from any amount due or that may become due to the
Contractor.

The Contractor shall provide all necessary personal safety equipment and first-aid apparatus available for
the use of the persons employed on the site and shall maintain the same in suitable condition for
immediate use at any time and shall comply with the following regulations in connection therewith.

(a) The workers shall be required to use the equipment so provided by the Contractor and the Contractor
shall take adequate steps to ensure proper use of the equipment by those concerned.
(b) When works is carried out in proximity to any place where there is a risk of drowning, all necessary
steps shall be taken for the prompt rescue of any person in danger.
(c) Adequate provision shall be made for prompt first-aid treatment of all injuries likely to be sustained
during the course of the work.

42. **Workmen's Compensation Act** : If, for any reason, the Employer is obliged, by virtue of the provisions of
the workmen's compensation Act, 1923 or any statutory modification or re-enactment thereof to pay
compensation to a workmen employed by the Contractor in execution of the works, the Employer shall be
entitled recover from the Contractor the amount of compensation so paid, and without prejudice to the
rights of the Employer under the said Act. The Employer shall be at liberty to recover such amount or any
part thereof by deducting it from the security deposit or from any sum due by the Employer to the
Contractor under this contract or otherwise. The Employer shall not be bound to contest any claim made
against it under the said Act, except on the written request of the Contractor and upon his giving to the
Employer full security to the satisfaction of the Employer for all costs for which the Employer might
become liable in consequence of contesting such claim.

The Contractor shall also similarly indemnify the Employer against all claims which may be made upon the
Employer whether under the workmen's compensation Act or any other statute in force during the currency
of this contract or at common law in respect of any employee of the Contractor or any Sub-Contractor and
shall at his own expense effect and maintain, until the virtual completion of the contract, with an approved
office a policy of insurance in the joint names of the Employer and the Contractor against such risks and
deposit such policy or policies with the Architect from time to time during the currency of the contract.

43. **Arbitration** : Any dispute/difference arising/relating to or out of the contract between the employer and
contractor shall be resolved through arbitration. It is clarify that certificate of architect/Site Engineer with
regards to work done shall be binding on the parties and shall not be questioned in the arbitration.
Certificate issued by the architect in respect of quality and quantum of work approved by Site Engineer
shall be final and binding on the parties.

In case of disputes, the party concerned is required to bring to the notice of the Site Engineer in writing and
if not resolved with in 30 days from the date of notice, in that case only, the parties shall be at liberty to
evoke arbitration clause by 15 days notice.

Such written notice shall specify the matters which are in dispute or difference of which such written notice
has been given and no other shall be and is hereby referred to the arbitration and final decision of an
arbiter to be agreed upon and appointed by both the parties or, in case of disagreements as to the
appointment of a single arbiter, to the appointment of two arbitrators, one to be appointed by each party,
which arbitrators shall, before taking upon themselves the burden or reference, appoint an Umpire. The
venue for such arbitration shall be at Ahmedabad.

44. The Contractor shall on the request of the Architect/Employer immediately dismiss from the works any
person employed thereon by him who may, in the opinion of the Architect, be incompetent or misconduct himself and such persons shall not be again employed on the works without the permission of the Architect.

45. **Site open for inspection**: The Employer, Architect and their respective representatives shall at all reasonable times have free access to the work and/or to the workshops, factories or other places where materials are lying or from which they are being obtained and the Contractor shall give every facility to the Employer, Architect and their representatives necessary for inspections and examination and test of the materials and workmanship. No person not authorised by the Employer or Architect except the representatives of public authorities shall be allowed on the works at any time.

All works under or in course of execution or executed in pursuance of the contract shall, at all times, be open to the inspection and supervision of the Architect and Site Engineer and his subordinate and the Contractor shall at all times during the usual working hours, and at all other times at which reasonable notice of the intention of the Architect and Site Engineer or his subordinate to visit the works shall have been given to the Contractor, either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing present for that purpose. Orders given to the Contractor's duly authorised agent shall be considered to have the same force and effect as if they had been given to the Contractor himself.

46. The term "Site Engineer/C.O.W." shall mean the person appointed and paid by the Employer and acting under the orders of the Architect to inspect the works in the absence of the Architect. The Contractor shall afford the Site Engineer/C.O.W. every facility and assistance for inspecting, checking and measuring the works and materials. Neither the Site Engineer/C.O.W. nor any representative of the Architect shall have power to set out works or to revoke, alter, enlarge or relax any requirements of the contract, or to sanction any day work, additions, alterations, deviations or omissions, or any extra work whatever except that such authority may be specially conferred by the order of the Architect with the prior concurrence in writing of the Employer.

The Site Engineer/C.O.W. or any representative of the Architect, or the Employers shall have power to give notice to the Contractor or to his representative of non approval of any work or materials and such work shall be suspended or the use of such materials shall be discontinued until the decision of the Architect is obtained. The work shall from time to time be examined by the Architect, the Site Engineers/C.O.W. or the Architect's representative but such examination shall not in any way exonerate the Contractor from the obligation to remedy any defects which may be found to exist at any stage of the works or after the same is completed. Subject to the limitation of this clause the Contractor shall take instructions only from the Architect.

47. The Contractor shall submit three sets of AS BUILT drawings as per progress.

48. **Treasure trove**: In the event of the discovery by the Contractor or his employees during the progress of the work, of any treasure trove, fossils, minerals or other articles or things of interest, the Contractor shall immediately give notice thereof, to the Architect and Site Engineer and forthwith hand over the same to them. Such treasure or other things shall be the property of the Department.

49. Contractor shall observe compliance of all laws including laws applicable to labour and shall maintain required records and register and submit returns, forms etc. regularly to competent authority/authorities. The contractor furnishes notified/certified true copy of all such records and returns alongwith-running bill. The contractor shall discharge pecuniary and other liabilities under the labour laws and furnish the proof thereof. The contractor shall permit access to such records, register and returns maintained pertaining to labour to the employer and/or his representative whenever required. The contractor shall preserve the records at least for 3 years after completion of works or such further time required by the employer. The contractor shall indemnify and keep indemnified employer against pecuniary and/or other liabilities for breach of/ non compliance of any labour/ any other laws and shall defend litigation/actions at his cost and consequences in this regards.
50. Priority List : The priority list for approval of the materials for all the items of works shall be as follows :

   a. As approved by the Consultant.
   b. ISI marked.
   c. Conforming to IS.
   d. As per the make specified in the relevant item of work.
   e. Equivalent to the make specified.
SAFETY CODE

1. Suitable scaffolds, of sound material, having adequate strength and in proper condition, shall be provided for workmen for all works that cannot be safely done from the ground or from solid construction except such short period work as can be done safely from ladders. When a ladder is used an extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well, suitable footholds and handhold shall be provided on the Ladder and the ladder shall be given an inclination not steeper than $\frac{1}{4}$ to 1 (¼ horizontal and 1 vertical). Scaffolds shall not be overloaded and so far as practicable the load shall be evenly distributed. Before installing the lifting gear on scaffolds, special precaution shall be taken to ensure strength and stability of the scaffolds. Scaffolds shall be periodically inspected by competent person. Before allowing a scaffold to be used by his workman, the Contractor shall, whether the scaffold has been erected by his workmen or not, take steps to ensure that is complies fully with the regulations herein specified.

2. Scaffolding or staging more than 3.25 meters above the ground or solid construction, swung or suspended from an overhead support or erected with stationary support, shall have a guard rail properly attached, bolted, braced and otherwise secured at least 1 meter high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.

3. Working platform, gangways, and stairways shall be so constructed that they do not sag unduly or unequally, and if height of a platform or gangway or stairways is more than 3.25 meters above ground level or solid construction, it shall be closely boarded, have adequate width and be suitably fenced, as described in 2 above.

4. Every opening in floor of a building or in a working platform shall be provided with suitable means to prevent fall of persons or materials by providing suitable fencing or railing with a minimum height of 1 meter.

5. Safe means of access shall be provided to all working platform and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 meters in length. Width between side rails in a rung ladder shall in no case be less than 30 cm. for ladders upto and including 3 meters in length. For longer ladders this width shall be increased at least 6 mm. for each additional 30 cm. of length. Uniform step spacing shall not exceed 30 cm.

Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites shall so stacked or placed as to cause danger or inconvenience to any person or the public. The Contractor shall provide all necessary fencing and lights to protect public from accidents and shall be bound to bear expenses of defence of every suit, action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and costs which may be awarded in any such suit, action or proceedings to any such person or which may with the consent of the Contractor be paid to compromise any claim by any such person.

6. **Excavation and Trenching**: All trenches, 1.5 meters or more in depth, shall at all times be supplied with at least one ladder for each 30 meters in length or fraction thereof. Ladder shall be extended from bottom of trench to at least 1 meter above surface of the ground. Sides of a trench which is 1.5 meters or more in depth shall be stepped back to give suitable slope, or securely held by timber bracing so as to avoid the danger of sides collapsing. Excavated material shall not be placed within 1.5 meters of edge of trench or half of depth of trench, whichever is more. Cutting shall be done from top to bottom. Under no circumstances shall undermining undercutting be done.

7. **Demolition**: Before any demolition work is commenced and also during the process of the work
   a) All roads and open areas adjacent to the work site shall either be closed or suitably protected.
   b) No electric cable or apparatus which is liable to be a source of danger over a cable or apparatus used by operator shall remain electrically charged;
c) All practical steps shall be taken to prevent danger to persons employed, from risk or fire or explosion or flooding. No floor, roof, or other part of a building shall be so overloaded with debris or materials as to render it unsafe.

8. All necessary personal safety equipment as considered adequate by the Site Engineer shall be available for use of persons employed on the site and maintained in a condition suitable for immediate use; and the Contractor shall take adequate steps to ensure proper use of equipment by those concerned.

   a) Workers employed on mixing asphaltic materials, cement and lime mortars/concrete shall be provided with protective footwear and protective goggles.

   b) Those engaged in handling any material which is injurious to eyes shall be provided with protective goggles.

   c) Those engaged in welding works shall be provided with welder's protective shields.

   d) Stone breakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.

   e) When workers are employed in sewers and manholes, which are in use, the Contractor shall ensure that manhole covers are opened and manholes are ventilated at least for an hour before workers are allowed to get into them. Manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to public.

   f) The Contractor shall not employ men below the age of 18 and women on the work of painting with products containing lead in any form. Whenever men above the age of 18 are employed on the work of lead painting, the following precautions shall be taken:

      i) No paint containing lead or lead products shall be used except in the form of paste or ready.

      ii) Suitable face masks shall be supplied for use by workers when paint is applied in the form of spray or a surface having lead paint dry rubbed and scraped.

      iii) Overalls shall be supplied by the Contractor to workmen and adequate facilities shall be provided to enable working painters to wash during and on cessation of work.

9. When work is done near any place where there is risk of drowning, all necessary equipment shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

10. Use of hoisting machines and tackle including their attachments, anchorage and supports shall confirm to the following:

   a) i. These shall be of good mechanical construction, sound material and adequate strength and free from patent defects and shall be kept in good repair and in good working order.

      ii. Every rope used in hoisting or lowering materials or as a means suspension shall be of durable quality and adequate strength, and free from patent defects.

   b) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years shall be in charge of any hoisting machine including any scaffold winch or give signals to operator.

   c) In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or lowering or as means of suspension, safe working load shall be ascertained by adequate means. Every hoisting machine and all rear referred to above shall be plainly marked with safe working load. In case of a hoisting machine having a variable safe working load, each safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or of any gear referred to above in this paragraph shall be loaded beyond safe working load except for the purpose of testing.
d) In case of a departmental machine, safe working load shall be notified by the Engineer-in-charge. As regards Contractor's machines the Contractor shall notify safe working load of each machine to the Site Engineer whenever he brings it to site of work and get it verified by the Site Engineer.

11. Motors gearing, transmission, electric wiring and other dangerous parts of hoisting appliances shall be provided with efficient safeguards; hoisting appliances shall be provided with such means as shall reduce to the minimum risk of accidental decent of load adequate precautions shall be taken to reduce to the minimum risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energised, insulating mats working apparel such as gloves, sleeves and boots as may be necessary, shall be provided. Workers shall not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

12. All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in a safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities shall be provided at or near places of work.

13. These safety provisions shall be brought to the notice of all concerned by display on a notice board at a prominent place at the work spot. Persons responsible for ensuring compliance with the safety code shall be named therein by the Contractor.

14. To ensure effective enforcement of the rules and regulations relating to safety precautions, arrangements made by the Contractor shall be open to inspection by the Site Engineer or his representatives and the Inspecting Officers.

15. Notwithstanding the above conditions 1 to 14 the Contractor is not exempted from the operation of any other Act or Rule in force.

16. In addition to the above, the Contractor shall abide by the safety code provisions as per C.P.W.D. safety code framed from time to time.

17. The Contractor shall also arrange to obtain valid gate passes for his men and equipment from the concerned authorities of the project.

18. No man/material/equipment not covered by valid passes shall be permitted within the project area and no material/equipment shall be permitted to be taken out of the project area, unless the written permission of the Architect/Engineer in-charge.

19. When persons are employed on a roof where there is danger of falling from a height exceeding 3.25 m. (to be prescribed) suitable precaution shall be taken to prevent the fall of persons or material. Suitable precautions shall be taken to prevent persons being struck by articles which might fall from scaffolds or other working places.

20. The Contractor shall comply with the following regulations as regards the Hoisting Appliances to be used by him:

   (a) Hoisting machines and tackle, including their attachments, anchorage and supports shall:
       (i) be of good mechanical construction, sound material and adequate strength and free from patent defect; and:
       (ii) be kept in good repair and in working order.

   (b) Every rope used in hoisting or lowering materials or as a means of suspension shall be of suitable quality and adequate strength and free from patent defect.

   (c) Hoisting machines and tackle shall be examined and adequately tested after erection on the site and before use and be re-examined in position at intervals to be prescribed by Architect and Site Engineer.

   (d) Every chain, ring, hook, shackle, swivel and pulley block used in hoisting or lowering materials or as a means of suspension shall be periodically examined.

   (e) Every crane driver or hoisting-appliance-operator shall be properly qualified.
(f) No person who is below age of 15 years shall be in control of any hoisting machine, including any scaffold, nor shall give signals to the operator.

(g) In the case of every hoisting machine and of every chain, ring, hook, shackle, swivel and pull by block used in hoisting or lowering or as a means or suspension, the safe working load shall be ascertained by adequate means.

(h) Every hoisting machine and all gears referred to in preceding regulation shall be plainly marked with the safe working load.

(i) In the case of hoisting machine having a variable safe working load, each safe working load and conditions under which it is applicable shall be clearly indicated.

(j) No part of any hoisting machine or any gear referred to in regulation `g' above shall be loaded beyond the safe working load except for the purpose of testing.

(k) Motors, gears, transmissions, electric wiring and other dangerous parts of hoisting appliance shall be provided with sufficient safeguards.

(l) Hoisting appliances shall be provided with such means as shall reduce to a minimum the risk of the accidental descent of the load.

(m) Adequate precautions shall be taken to reduce to minimum the risk of any part of a suspended load becoming accidentally displaced.
M-1 Water:

1.1 Water shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil and injurious alkalies salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause efflorescence or attack the steel in RCC container for transport, storage and handling of water shall be clean. Water shall conform to the standards specified in IS : 456.

1.2 If required by the Engineer-in-charge and Architects it shall be tested by comparison with distilled water. Comparison shall be made by means of standard cement tests for soundness, time of setting and mortar strength as specified in IS : 269. Any indication of unsounding change in time of setting by 30 minutes or more or decrease of more than 10 per cent in strength of mortar prepared with water sample when compared with the results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.

1.3 Water for curing mortar, concrete or masonry should not be too acidic or too alkaline. It shall be free of elements which significantly affect the hydration reaction or otherwise interfere with the hardening of mortar or concrete during curing or those which produce objectionable stains or other unsightly deposits on concrete or mortar surfaces.

1.4 Hard and bitter water shall generally be found unsuitable for curing mortar or concrete.

1.5 Potable water shall be generally found suitable for curing mortar and concrete.

Testing Standards:

A. Chemical Analysis:

Sampling: Test shall be carried out only once for one particular source.

Results:
- a) TDS - 3000 mg/lit.
- e) Carbonic contents - 200 mg/lit.
- b) Sulphates - 5000 mg/lit.
- f) Non-carbonic contents - 3000 mg/lit.
- c) pH values - 6 to 8
- d) Chlorides
  - P.P.C - 2000 mg/lit.
  - R.C.C - 1000 mg/lit.

M-2 Lime:

2.1 Lime shall be hydraulic lime as per IS : 712. Necessary test shall be carried out as per IS : 6932 (Parts I to X).

2.2 The following fields tests for limes are to be carried out:

(1) A very rough idea can be formed about the type of lime by its visual examination i.e. fat lime bears pure white colour, lime in form of Porous lumps of dirty white colour indicates quick lime, and solid lumps are the unburnt lime stone.

(2) Acid test for determining the carbonate contents in lime. Excessive amount of impurities and rough determination of class of lime.

2.3 Storage shall comply with IS : 712. The slaked lime, if stored, shall be kept in a weather proof and damp-proof shed with impervious floor and sides to protect it against rain, moisture, weather and extraneous materials mixing with it. All lime that has been damaged in any way shall be rejected and all rejected materials shall be removed from site of work.

2.4 Field testing shall be done according to IS : 1624 to show the acceptability of materials.
Cement:

3.1 Cement shall be ordinary Portland slag cement, grade 33, as per IS : 269, grade 43, as per IS : 8112 and grade 53, as per IS : 12269 or Portland slag cement as per IS : 455.

Testing Standards:

A. Setting time:
   Sampling:
   (i) From a lot of 50 tones of cement, 2% of bags shall be picked out at random, from which one sample of 15 kg. shall be taken.
   (ii) For a lot of 50 to 100 tones - 2 samples
   (iii) For a lot of 100 to 200 tones - 3 samples
   (iv) For a lot of 100 to 200 tones - 3 samples
   (v) For a lot of 200 to 300 tones - 4 samples
   (vi) For a lot of 300 to 500 tones - 5 samples
   (vii) For a lot of 500 to 800 tones - 6 samples
   (viii) For a lot of 800 to 1300 tones - 7 samples
   Results:
   (a) Initial setting time - not less than 30 minutes
   (b) Final setting time - not more than 100 minutes

B. Fineness test by Sieving:
   Sampling:
   Using any 5 samples, made as above, one test is carried out, using IS sieve no. 90 microns.
   Results:
   90% or more should pass through the above mentioned IS sieve.

C. Fineness test by determination of specific surface:
   Sampling:
   Using any 5 samples, made as above, one test is carried out.
   Results:
   For O.P.C, the surface area shall be 225 cm$^2$/gm. or more.
   For P.P.C, the surface area shall be 3000 cm$^2$/gm.

D. Consistency test:
   Sampling:
   Sampling shall be as in A.
   Results:
   Consistency in all samples shall be about 30%.

E. Compressive strength:
   Sampling:
   Sampling shall be as in A.
   Results:
   On 2nd day, compressive strength must be 160 Kg/cm$^2$, for O.P.C
   On 7th day, compressive strength must be 220 Kg/cm$^2$, for O.P.C
   On 28th day, compressive strength must be 310 Kg/cm$^2$, for O.P.C

F. Chemical composition (IS : 4032):
   Sampling:
   Using any 5 samples, made as above, one test is carried out.
   Results:
   a. Magnesium oxide - less than 6%.
   b. Sulphur as Sulphuric anhydride - less than 2.75%.
   c. Loss on ignition - upto 5%.
   The above is for ordinary Portland cement.
Part -B  Material Specification - Civil Works

M-3A  Rapid Hardening Cement (RHC) :

3A.1 Rapid hardening cement shall be from source like Gujarat High Tech, Ambuja, Birla or equivalent as approved by the Architect and Engineer-in-charge. It shall conform to IS : 8041. Test certificates showing that the cement complies to the specifications must be submitted to the Architect.

3A.2 It shall have strength in one day equal to that of OPC in 3 days. It shall be used for products like hume pipes, tiles, sleepers, poles, prestressed and precast concrete members. It shall also be used for foundations, bridges, culverts, causeways etc. where quick construction activity is required however, prior permission of the Architect and Engineer-in-charge shall be taken before use.

3A.3 It shall capable of giving required workability, final strength and better surface finish.

M-3B  Sulphate Resistant Cement (SRC) :

3B.1 Sulphate resistant cement shall be from source like Gujarat High Tech or equivalent as approved by the Architect and Engineer-in-charge. It shall conform to relevant IS code or BS-4027 & ASTM C-150 Type-II. Test certificates showing that the cement complies to the specifications must be submitted to the Architect.

3B.2 It shall be used for structures in or near sea water, where the soil conditions are aggressive, where repeated cycles of drying and wetting are occur, and also for structures which are exposed to Sulphate attack & salty weather like foundations, bridges, dams, tunnels, industrial drains, sewage pipes.

3B.3 It should possess low heat of hydration, more compressive strength at 3, 7 and 28 days than OPC. It should be capable of withstanding attack of aggressive substances which damage concrete structure like Sulphates of Sodium, Magnesium, Calcium etc. It should have low co-efficient of expansion.

M-4  White Cement :

4.1 The white cement shall conform to IS : 8042-E

M-5  Coloured Cement :

5.1 Coloured cement shall be with white or grey Portland cement mixed with pigments as specified in the item of the work.

5.2 The pigments used for coloured cement shall be of approved quality and its quantity shall not exceed 10% of the cement used in the mix. The mixture of pigment and cement shall be properly ground to have a uniform colour and shade. The pigments shall have such properties as to provide for durability for colour under exposure to sunlight and weather.

5.3 The pigment shall have the property such that it is neither affected by the cement nor detrimental to it.

M-6  Sand :

6.1 Sand shall be medium/coarse natural sand, clean, well graded, hard, strong, durable and gritty. Sand particles should be free from injurious amounts of dust, clay, kankar nodules, soft or flaky particles of shale, alkali, salts, organic matter loam, mica or other deleterious substances and shall be got approved from the Engineer-in-charge and Architects. The sand shall not contain more than 8% of silt as determined by field test and 3% by laboratory test, if necessary the sand shall be washed to make it clean. All sand to be used for plaster, brickwork, concrete shall be strictly sieved by 4.75 mm sieve.

Testing Standards :

A. Silt Content :
   Sampling :
Test shall be carried out for every 150 m$^3$ of sand. The sample taken for testing shall weigh 10 Kg.

Results:
Permissible content shall be 3% in laboratory test & 8% in field test.

B. Fineness Modulus:
Sampling:
Sampling shall be as in A.
Results:
Fine sand: 2.2 to 2.6 shall be used as earth filling in plinth, zari, etc.
Medium sand: 2.6 to 2.9 shall be sued for Brickwork and plaster.
Coarse sand: 2.9 to 3.2 shall be used for concrete.

In general, the fineness modulus of sand shall not be less than 2.5 and shall not exceed 3.0. A sand having a fineness modulus more than 3.2 will be unsuitable for making satisfactory concrete.

C. The sieve analysis of sand shall be as under

<table>
<thead>
<tr>
<th>IS Sieve Designation</th>
<th>% By weight Passive sieve</th>
<th>IS Sieve Designation</th>
<th>% By Weight passive sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.75 mm</td>
<td>100</td>
<td>600 Micron</td>
<td>30-100</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>90-100</td>
<td>300 Micron</td>
<td>5-70</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>70-100</td>
<td>150 Micron</td>
<td>0-50</td>
</tr>
</tbody>
</table>

M-7 Stone Dust:
7.1 This shall be obtained from crushing hard black trap or equivalent. It shall not contain more than 8% of silt as determined by field test with measuring cylinder. The method of determining silt contents by fields test is given under:

7.2 A sample of stone dust to be tested shall be placed without drying in 200 mm. measuring cylinder. The quantity of the sample shall be such that it fills the cylinder up to 100 mm. mark. Then clean water shall be added up to 150 mm. mark. The mixture shall be stirred vigorously and the contents allowed to settle for 3 hours.

7.3 The height of silt visible as settled layer above the stone dust shall be expressed as percentage of the height of the stone dust below. The stone dust containing more than 8% silt shall be washed so as to bring the content within the allowable limit.

7.4 The fineness modulus of stone dust shall not be less than 1.80.

M-8 Stone Grit:
8.1 Grit shall consist of crushed or broken black trap stone and be hard, strong, dense, durable clean of proper gradation and free from skin or coating likely to prevent proper adhesion of mortar. Grit shall generally be cubical in shape and as far as possible flaky elongated pieces shall be avoided. It shall generally comply with the provisions of IS: 383 Unless special stone of particular quarries is mentioned, grit shall be obtained from the best black trap or equivalent hard stone as approved by the Engineer-in-charge and Architects. The grit shall have no deleterious reaction with cement.

8.2 The grit shall conform to the following gradation as per sieve analysis:

<table>
<thead>
<tr>
<th>IS Sieve Designation</th>
<th>% passing Through sieve</th>
<th>IS Sieve Designation</th>
<th>% Passing Through sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.50 mm.</td>
<td>100%</td>
<td>4.75 mm.</td>
<td>0-20%</td>
</tr>
<tr>
<td>10.00 mm.</td>
<td>85-100%</td>
<td>2.36 mm.</td>
<td>0-5%</td>
</tr>
</tbody>
</table>

8.3 The crushing strength of grit will be such so as to allow the concrete in which it is used to build up the
specified strength of concrete.

8.4 The necessary tests for grit shall be carried out as per the requirements of IS : 2386 (parts I to VIII) , as per instructions of the Engineer-in-charge and Architect. The necessity of test will be decided by the Engineer-in-charge and Architect.

M-9 Cinder :

9.1 Cinder is well burnt furnace residue which has been fused or centered into lumps of varying sizes.

9.2 Cinder aggregates shall be well burnt furnace residue obtained from furnace using coal fuel only. It shall be sound clean and free from clay, dirt ash or other deleterious matter.

9.3 The average grading for cinder aggregates shall be as mentioned below:

<table>
<thead>
<tr>
<th>IS Sieve Designation</th>
<th>% Passing</th>
<th>IS Designation</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 mm.</td>
<td>100</td>
<td>4.75 mm.</td>
<td>70</td>
</tr>
<tr>
<td>10 mm.</td>
<td>86</td>
<td>2.36 mm.</td>
<td>52</td>
</tr>
</tbody>
</table>

M-10 Lime mortar :


10.2 Proportion of mix:

10.2.1 Mortar shall consist of such proportions of slaked lime and sand as may be specified in item. The slaked lime and sand shall be measured by volume.

10.3 Proportion of mortar:

10.3.1 Lime mortar shall be prepared by wet process as per IS : 1625. Power driven mill shall be used for preparation of lime mortar. The slaked lime shall be placed in the mill in an even layer and ground for 180 revolutions with a sufficient water. Water shall be added as required during grinding (care being taken not to add more water) that will bring the mixed material to a consistency of stiff paste. Thoroughly wetted sand shall then be added evenly and the mixture ground for another 180 revolutions.

10.4 Storage:

10.4.1 Mortar shall always be kept damp, protected from sun and rain till used up, covering it by tarpaulin or open sheds.

10.5 Use :

10.5.1 All mortar shall be used as soon as possible after grinding. It should be used on the day on which it prepared. But in no case, mortar made earlier than 36 hours shall be permitted for use.

M-11 Cement Mortar :


11.2 Proportion of Mix:

11.2.1 Cement and sand shall be mixed to specified proportion, sand being measured by measuring boxes. The proportion of cement will be by volume on the basis of 50Kg/Bag of cement being equal to 0.0342 m³. The mortar may be hand mixed or machine mixed as directed.

11.3 Proportion of Mortar :

11.3.1 In hand mixed mortar, cement and sand in the specified proportions shall be thoroughly mixed dry on a clean impervious platform by turning over atleast 3 times or more till a homogeneous mixture of uniform colour is obtained. Mixing platform shall be so arranged that no deleterious extraneous material shall get mixed with mortar or mortar shall flow out. While mixing, the water shall be gradually added and thoroughly mixed to form a stiff plastic mass of uniform colour so that each particle of sand shall be completely covered with a film of wet cement. The water cement ratio shall be adopted as directed.
11.3.2 The mortar so prepared shall be used within 30 minutes of adding water. Only such quantity of mortar shall be prepared as can be used within 30 minutes.

M-12 Stone Coarse Aggregate For Nominal Mix Concrete:

12.1 Coarse aggregate shall be of machine crushed stone of black trap and be hard, strong, dense, durable, clean and free from skin and coating likely to proper adhesion of mortar.

12.2 The aggregate shall generally be cubical/round in shape. Unless special stones of particular quarries are mentioned aggregates shall be machine crushed from the black trap or equivalent black hard stone as approved. Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement concrete and ordinary reinforced cement concrete shall generally be as per the table given below. However, in case of reinforced cement concrete, the maximum limit may be restricted to 6 mm. less than the minimum lateral clear distance between bars or 6 mm. less the cover, whichever is smaller.

**TABLE**

<table>
<thead>
<tr>
<th>IS Sieve</th>
<th>% passing for single size</th>
<th>IS Sieve</th>
<th>% passing for single size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designation aggregates of Nominal Size</td>
<td>40 mm</td>
<td>20 mm</td>
<td>16 mm</td>
</tr>
<tr>
<td>80 mm.</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>63 mm.</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>40 mm.</td>
<td>100</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>20 mm.</td>
<td>0-20</td>
<td>85-100</td>
<td>100</td>
</tr>
<tr>
<td>16 mm.</td>
<td>-</td>
<td>-</td>
<td>85-100</td>
</tr>
</tbody>
</table>

**Note:** This percentage may be varied some what by the Engineer-in-charge when considered necessary for obtaining better destiny and strength of concrete.

12.3 The grading test shall be taken in the beginning and at the change of source of materials. The necessary tests indicated in IS : 383 and IS : 456 shall have to be carried out to ensure the acceptability. The aggregate shall be stored separately and handled in such a manner as to prevent the intermixing of different aggregates. If the aggregates are covered with dust they shall be washed with water to make them clean.

**Testing Standards:**

**A. Flakiness Index:**

**Sampling:**
For every 200 m³. of aggregates, one test shall be carried out.

**Results:**
The Flakiness index is taken as the total weight of the aggregates passing through the various thickness gauges, expressed as a percentage of the total weight of the sample taken.

Permissible is not more than 35% for aggregates used in concrete for wearing surfaces.

**B. Impact value:**

**Sampling:**
For every 100 m³. of aggregates, one test shall be carried out.

**Results:**
The impact value shall not be more than 45% by weight for aggregates used for concrete other than wearing surfaces.
For aggregates used for concrete to be used as wearing surface, the impact value shall not be more than 30%, by weight.
C. Abrasion Value:
   Sampling:
   Sampling shall be as in B.
   Results:
   The percentage of wear shall not be more than 35%.

**M-13 Black Trap or Equivalent Hard Stone Coarse Aggregates for Design Mix Concrete:**

13.1 Aggregate for Design Mix Concrete: Coarse aggregate shall be machine crushed stone of black trap or equivalent hard stone and hard, strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

13.2 The aggregates shall generally be cubical in shape. Unless special stones of particular quarried are mentioned, aggregates shall be machine crushed from the best black trap or equivalent hard stones as approved. Aggregates shall have no deleterious reaction with cement.

13.3 The necessary tests indicated in IS : 383 and IS : 456 shall have to be carried out to ensure the acceptability of the material.

13.4 If the aggregates are covered with dust, they shall be washed with water to make them clean.

**M-14 Brick Bats Aggregates:**

14.1 Brick bat aggregate shall be broken from well burnt or slightly over burnt and dense bricks. It shall be homogeneous in texture, roughly cubical in shape, clean and free from dirt or any other foreign material. The brick bats shall be less than 40 mm. size, unless otherwise specified in the item. The under-burnt or over-burnt brick bats and brick dust shall not be allowed.

14.2 The brick bats shall be hand measured by suitable boxes or as directed.

**M-15 Bricks:**

15.1 The bricks shall be of **first quality** hand or machine moulded and made from suitable soils and kiln burnt. They shall be free from cracks, flaws and modules of free lime. They shall have smooth rectangular faces with sharp corners and shall be of uniform in colour. The bricks shall be moulded with a frog of size 100 mm. x 40 mm., and 10 mm. to 20 mm. deep on one of its flat sides. The bricks shall not break when thrown on the ground from a height of 1 m.

15.2 The size of modular bricks shall be 190 mm. x 90 mm. x 90 mm.

15.3 The size of the conventional bricks shall be (9"x4.5" x 3") 230 mm. x 110 mm. x 76.5 mm.

15.4 Only bricks of one standard size shall be used on a particular work site. The following tolerances shall be permitted in the conventional size adopted in a particular work site.
   Length : + 1/8"(3.0 mm.). Width : + 1/6" (1.50 mm.). Height : + 1/6"(1.50 mm.).

15.5 The crushing strength of the bricks shall not be less than 50 Kg./cm². No unburned/over burnt bricks shall be used for any structure. The bricks should have dimensional stability as per IS standards. The average water absorption shall not be more than 20% by weight. Necessary tests for crushing strength and water absorption etc. shall be carried out as per IS : 3495 (Part I to IV).

**Testing Standards:**

A. Efflorescence:
   Sampling:
   Test of 20 bricks is carried out from a stock of 20,000 bricks.
   Results:
   Moderate.
B. Water Absorption:
   Sampling:
   Test of 32 bricks is carried out from a stock of 35,000 bricks.
   Results:
   Absorption shall not be more than 20%.

C. Compressive Strength:
   Sampling:
   Test of 50 bricks is carried out from a stock of 1,00,000 (1 Lac) bricks.
   Results:
   On average the compressive strength shall not be less than 50 Kg/cm². And every result shall not be less
   than 20% of the IS standards.

M-15A First Class Bricks for Exposed brickwork:
15A.1 First class bricks are those which strictly conform to the standard size of modular bricks, i.e. 19 cm. x 19
   cm. x 9 cm. actual size, such that ten layers of brick laid in mortar shall form masonry of 1 m. height.
   Conventional bricks should have quality standard as per modular brick except size.

15A.2 These bricks are manufactured from good quality plastic earth, which is free from saline deposits. They
   are of good uniform colour. They are well burnt, giving a hard ringing sound when two bricks are struck
   together.

15A.3 They should have straight edges and even surfaces. They are free from cracks, chips, flaws and modules
   of lime.

15A.4 When immersed in water for an hour, they do not absorb water more than 1/6th of their weight. On drying,
   these bricks do not show any sign of efflorescence.

M-15B Calcium Silicate Bricks:
15B.1 The bricks shall be machine moulded and made from good quality and clean silicious sand, lime and
   flyash (maximum content upto 30% in raw material composition). They shall be free from cracks, flaws,
   clay, free lime. They shall have smooth rectangular faces with sharp corners and shall be uniform in size,
   colour and shape.

15B.2 The size of bricks shall be 228 mm. x 110 mm. x 72 mm. or as approved by the Architect. The
   compressive strength of bricks shall be minimum 150 kg/m² and the bricks shall have very high strength
to weight ratio. The bricks shall have very good resistant capacity to atmospheric conditions, optimum
building properties in relation to heat insulation, sound insulation, absorption of water and fire protection.

15B.3 Calcium silicate products shall conform to the appropriate IS standards and there shall be no change
required in civil application techniques while using such products in the place of traditional clay bricks.

M-15C Glass Brick:
15C.1 It shall be from Imperial or equivalent as approved by the Architect and Engineer-in-Charge.

15C.2 It shall be free from any defects like, cracks, air bubbles, uneven surface, breaks etc. During handling and
   laying, its edges shall not be damaged. All edges and corners of all faces shall be sharp and well shaped.
   It shall be of size and colour as specified in the item or as approved by the Architect. The glass bricks
   shall be of uniform size and tolerance of +2 mm. shall only be allowed in dimensions of glass brick. Spots
   of colour other than that of bricks or in bricks shall not be allowed. The weight of each brick shall be about
   2.75 kg.

15C.3 The transmission of direct light through brick shall not be less than 40%. The glass brick shall have good
thermal insulation. It shall be sound proof and vibration absorber having adequate compressive strength. If bricks with groove or projections shall be used, the groove or projections shall be uniform and regular in size & shape.

**M-16 Stone:**

16.1 The stone shall be of specified variety such as Granite/Trap Stone/Quartz or any other type of good hard stones. The stones shall be obtained only from the approved quarry and shall be hard, sound, durable and free from defects like cavities, cracks, sand holes, flaws, injurious veins, patches of loose or soft materials etc. and weathered portions and other structural defects or imperfections tending to affect their soundness and strength. The stone with round surface shall not be used. The percentage of water absorption shall not be more than 5% of dry weight, when tested in accordance with IS : 1124. The minimum crushing strength of the stone shall be 200 Kg/cm², unless otherwise specified.

16.2 The samples of the stone to be used shall be got approved before the work is started.

16.3 The Khanki facing stone shall be dressed by chisel as specified in the item for Khanki facing in required shape and size. The face of stone shall be so dressed that the bushing on the exposed face shall not project by more than 40 mm. from the general wall surface and on face to be plastered it shall not project by more than 19 mm. nor shall it have depressions more than 10 mm. from the average wall surface.

**M-17 Laterite Stone:**

17.1 Laterite stone shall be obtained from the approved quarry. It shall be uniform in texture, sound, durable and free from soft patches. It shall have a minimum crushing strength of 100 Kg./cm². in its dry condition. It shall not absorb water more than 20% of its own weight, when immersed for 24 hours in water. After quarrying, the stone shall be allowed to weather for some time before using in work.

17.2 The stone shall be dressed into regular rectangular blocks so that all faces are free from waviness and unevenness, edges true and square.

17.3 Those type of stones in which white clay occurs should not be used.

17.4 Special corner stone shall be provided where so directed.

**M-18 Mild Steel Bars:**

18.1 Mild steel bars reinforcement for RCC work shall conform to IS : 432 (Part-II) and shall be of tested quality. It shall also comply with relevant part of IS : 456.

18.2 All the reinforcement shall be clean and free from dirt, paint, grease, mill scale or loose or thick rust, at the time of placing.

18.3 For the purpose of payment, the bar shall be measured correct up to 10 mm. length and weight payable worked out at the rate specified below:

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Rate (Kg/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0.22</td>
</tr>
<tr>
<td>8</td>
<td>0.39</td>
</tr>
<tr>
<td>10</td>
<td>0.62</td>
</tr>
<tr>
<td>12</td>
<td>0.89</td>
</tr>
<tr>
<td>14</td>
<td>1.21</td>
</tr>
<tr>
<td>16</td>
<td>1.58</td>
</tr>
<tr>
<td>18</td>
<td>2.00</td>
</tr>
</tbody>
</table>

For 20 to 40 mm diameter:

<table>
<thead>
<tr>
<th>Diameter (mm)</th>
<th>Rate (Kg/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>2.47</td>
</tr>
<tr>
<td>22</td>
<td>2.98</td>
</tr>
<tr>
<td>25</td>
<td>3.85</td>
</tr>
<tr>
<td>28</td>
<td>4.83</td>
</tr>
<tr>
<td>32</td>
<td>6.31</td>
</tr>
<tr>
<td>36</td>
<td>7.99</td>
</tr>
<tr>
<td>40</td>
<td>9.86</td>
</tr>
</tbody>
</table>

18.4 Procurement of Steel should be from authorised/approved rolling mills and test certificates should be submitted with each lot.

**Testing standards:**
Part - B
Material Specification - Civil Works

Sampling:
For every 40 tonnes of steel, at least one test shall be done.

Results:

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Ultimate Tensile strength</th>
<th>Chilled state</th>
<th>% Elongation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 20 mm.</td>
<td>42 Kg/cm²</td>
<td>26 Kg/cm².</td>
<td>23</td>
</tr>
<tr>
<td>20 - 40 mm.</td>
<td>42 Kg/cm²</td>
<td>24 Kg/cm².</td>
<td>23</td>
</tr>
<tr>
<td>40 mm. &amp; more</td>
<td>42 Kg/cm²</td>
<td>24 Kg/cm².</td>
<td>23</td>
</tr>
</tbody>
</table>

M-19 A High Yield Strength Steel Deforms Bars:

19.A.1 High yield strength steel deformed bars be either cold twisted or hot rolled shall conform to IS : 1739 and IS : 1139 respectively.

19.A.2 Other provision and requirements shall conform to M-18 for Mild steel bars.

M-19 B Thermo-mechanically Treated Bars (TMT)

19.B.1 TMT bars shall conform to IS: 1786

19.B.1 Procurement of Steel should be from authorized dealer and test certificates should be submitted with each lot.

M-19 C Corrosion Resisting Steel (CRS)

19.C.1 CRS bars shall conform to IS: 1786

19.C.1 Procurement of Steel should be from authorized dealer and test certificates should be submitted with each lot.

M-20 High Tensile Steel Wire:

20.1 The high tensile wires for the use in prestressed concrete work shall conform to IS : 2090.

20.2 The tensile strength of the high tensile steel bars shall be as specified in the item. In absence of the given strength, the minimum strength shall be taken as per para 6.1 of IS : 1785. Testing shall be done as per IS requirements.

20.3 The high tensile steel shall be free from loose mill scale, rust oil, grease, or any other harmful matter. Cleaning of steel bars may be carried out by immersion in solvent solution, wire brushing or passing through a pressure box containing carborundum.

20.4 The high tensile wire shall be obtained from manufactures in coil having diameter not less than 350 time the diameter of wire itself, so that wire springs back straight on being uncoiled.

Testing standards:
Sampling:
For every 40 tonnes of steel, at least one test shall be done.

Results:

<table>
<thead>
<tr>
<th>Thickness</th>
<th>Ultimate Tensile strength</th>
<th>Chilled state</th>
<th>% Elongation</th>
</tr>
</thead>
<tbody>
<tr>
<td>For all sizes</td>
<td>49.5 Kg/cm²</td>
<td>42.5 Kg/cm².</td>
<td>14.5</td>
</tr>
</tbody>
</table>
M-21  Mild Steel Binding Wire:
21.1 The mild steel wire shall be of 1.63 mm. or 1.22 mm. (16 or 18 gauge) diameter and shall conform to IS: 280.
21.2 The use of black wire will be permitted for binding reinforcements bars. It shall be free from rust, oil paint, grease, loose mill scale or any other undesirable coating which may prevent adhesion of cement mortar.

M-22  Structural Steel:
22.1 All structural steel shall conform to IS: 226. The steel shall be well and cleanly rolled to the dimensions and weight specified by the IS, subject to the permissible tolerances as per IS: 1852. The finished materials shall be reasonably free from cracks, surface flaws, laminations, rough and imperfect edges and all other harmful defects mentioned in IS: 229 and shall have a smooth finish. The material shall be free from loose mill scale, rust pits or other defects affecting the strength and durability. River bars shall conform to IS: 1148. The decision of the Engineer-in-charge regarding rejecting any steel section on account of any of the above defects shall be final and binding to the Contractor.
22.2 Structural steel shall conform to the following requirements. The mechanical and chemical properties shall be as below:

MECHANICAL COMPOSITION OF STEEL

<table>
<thead>
<tr>
<th>Steel designation</th>
<th>Class of Nominal steel product</th>
<th>Nominal thickness in mm.</th>
<th>Tensile strength min. Kg/mm²</th>
<th>Yield stress in Kg/mm²</th>
<th>% elongation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST-42 W &amp; Plates,</td>
<td>Below 6 mm.</td>
<td>Bend test only shall be required.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST-42 S flats,</td>
<td>upto 20 &amp; Vc</td>
<td>42 to 5426.0</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Over 20 &amp; Vc 40</td>
<td>42 to 5424.0</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Below 10 &amp; Vc</td>
<td>Bend test only shall be required.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 upto 20 &amp; Vc</td>
<td>42 to 5428.0</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Over 20</td>
<td>42 to 5424.0</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST-42 O Plates,</td>
<td>Below 6 sections, flats, Over 6</td>
<td>Bend test only shall be required.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Below 10</td>
<td>42 to 5428.0</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10 &amp; above</td>
<td>42 to 5428.0</td>
<td>23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CHEMICAL COMPOSITION OF STEEL

<table>
<thead>
<tr>
<th>Steel designation</th>
<th>Maximum percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carbon</td>
</tr>
<tr>
<td>ST-42 W</td>
<td>0.23</td>
</tr>
<tr>
<td>ST-42 S</td>
<td>0.25/0.28</td>
</tr>
<tr>
<td>ST-42 O</td>
<td>0.07</td>
</tr>
</tbody>
</table>
22.3 The following variety of steel shall be used for structural purposes:

**ST-42S** : It shall be used for all types of structure (riveted or bolted), including those subjected to dynamic loading and where fatigue, wide fluctuations of stresses, reversal of stresses and great restraint are involved. It shall be suitable for welded structures, provided that the thickness of the material does not exceed 20 mm.

22.4 When the steel is supplied by the Contractor, test certificate of the manufacture shall be obtained according to IS : 226 and other relevant Indian Standards.

**M-23 Galvanised Iron Sheets** :

23.1 The galvanised iron sheets shall be from Tata or equivalent of approved zinc coating class, as approved by the Architect and Engineer-in-charge. It shall be plain or corrugated, of gauge as specified in item. The GI sheets shall conform to IS : 277. The sheets shall be undamaged in carriage and handling either by rubbing off of zinc coating or otherwise, they shall have clean and bright surface and shall be free from dents, holes, rust or white powdery deposit.

23.2 The width of GI sheet shall be as directed, as per site condition.

**M-23.A GI Valleys gutter ridges** :

23.A.1 The GI ridge and hips shall be of plain galvanised sheets, class-3, of the thickness, as specified in item. These shall be 600 mm. in width and properly bent up to the shape without damage to the sheets, in process of bending.

23.A.2 Valleys, gutters and flashing shall also be of galvanised sheet, of thickness, as specified in item. Valleys shall be 900 mm. wide overall and flashing shall be 380 mm. wide overall. They shall be bent to the required shape without damage to the sheet in the process of bending.

**M-24 Asbestos Cement Sheets** :

24.1 Asbestos cement sheets plain, corrugated or semi corrugated and curved shall be from Everest or equivalent, as approved by the Architect or Engineer-in-charge. It shall conform to IS : 459. The thickness of the sheet shall be as specified in the item. The sheet shall be free from all defects such as cracks, holes, deformation, chipped edge or otherwise damaged.

24.2 It shall manufactured by reinforcing Asbestos in cement, in such a manner that every fibre is covered with fine particles of cement to ensure maximum strength. It shall be alkali resistance and anti corrosive. It should not break during transportation, handling, laying etc. and should be non-destructible, non-inflammable and non-organic. It shall have high tensile strength and high slenderness ratio.

24.3 The minimum nominal thickness of sheets shall be 6 mm., having covering efficiency of about 90% and weight 1518 kg/cm². The sheet shall be free from all defects such as cracks, holes, deformation, chipped edge or otherwise damaged. The permissible bending stress shall be 130 kg/cm².

24.4 The accessories shall be same thickness that of AC sheets. They shall be suitable for all the types of sheets and locations. They also shall be from approved manufacturer and shall be free from any defects. The fixing of AC sheets and accessories shall conform to IS : 730.

24.5 Ridges & Hips :

24.5.1 Ridges and hips shall be of same thickness as that of AC sheets. The different types of ridges shall be suitable for its corresponding type of sheets and locations.

24.5.2 Other accessories to be used in roof such as flashing piece, caves, filler pieces, valley gutters, north light and ventilator curves, barge boards etc. shall be from standard manufacture and shall be suitable for the different types of sheets and location.
M-25  Mangalore Pattern Roof Tiles :

25.1 The mangalore pattern tiles shall conform to IS : 654 for Class AA or Class A type, as specified in the item. Samples of the tiles to be provided shall be got approved from the Engineer-in-charge and Architect. Necessary tests shall be carried out as directed.

M-26  Shuttering :

M-26A  Timber/Wooden planking :

26A.1 The shuttering shall be either of wooden planking of 30 mm. minimum thickness with or without steel lining or steel plates stiffened by steel angles. The shuttering shall be supported on battens and beams and props of vertical ballies properly cross braced together, so as to make the centering rigid. In place of ballie props, brick pillar of adequate section built in mud mortar may be used.

26A.2 The form work shall be sufficiently strong and shall have camber, so that it assumes correct shape after deposition of the concrete and shall be able to resist forces caused by vibration, live load of men working over it and other incidental loads associated with it. The shuttering shall have smooth and even surface and its joints shall not permit leakage of cement grout.

26A.3 If at any stage of work, during or after placing concrete in the structure, the form work sags or bulges out beyond the required shape of the structure, the concrete shall be removed and work redone with fresh concrete and adequately rigid form work. The complete form work shall be got inspected by and got approved from the Engineer-in-charge and Architect, before the reinforcement bars are placed in position.

26A.4 The props shall consist of ballies having 100 mm. minimum diameter, measured at mid length and 80 mm. at thin end and shall be placed as per design requirement. These shall rest squarely on wooden sole plate 40 mm. thick and minimum bearing area of 0.10 m². laid on sufficiently hard base.

26A.5 Double wedges shall further be provided between the sole plate and the wooden props so as to facilitate tightening and easing of shuttering without jerking the concrete.

26A.6 The timber used in shuttering shall not be so dry as to absorb water from concrete and swell or bulge nor so green or wet as to shrink after erection. The timber shall be properly sawn and planned on the sides and surface coming in contact with concrete. Wooden form work with metal sheet lining or steel plates stiffened by steel angles shall be permitted.

26A.7 As far as possible, clamps shall be used to hold the forms together and use of nails and spikes shall be avoided.

26A.8 The surface of timber shuttering that would come on contact with concrete shall be well wetted and coated with soap solution before the concreting is done. Alternatively coat of raw linseed oil or oil of approved manufacture may be applied in place of soap solution. In case of steel shuttering, either soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface. Under no circumstances, black or burnt oil shall be permitted.

26A.9 The shuttering for beams and slabs shall have camber of 4 mm. per meter (1 in 250) or as directed by Engineer-in-charge and Architect, so as to offset the subsequent deflection. For cantilevers, the camber at free end shall be 1/50 of the project length or as directed by the Engineer-in-charge and Architect.

M-26B  Concrete Shuttering Plywood :

26B.1 It shall be made from strong and selected hard-woods. It shall be bonded with high quality Phenol Formaldehyde synthetic resin adhesive, hot pressed and then shall be further treated with a permanent type of preservative by vacuum-cum-pressure impregnation.

26B.2 Due to the bonding with Phenol Formaldehyde, it shall be moisture and weather proof. The use of selected hard-woods render hard and wear-resistant faces and thereby it shall be reusable several times. It shall be highly resistant to rot, termites and other wood inhabiting insects. Due to complete penetration
of the preservative, it shall be exceedingly durable.

26B.3 It shall have high impact strength and therefore shall be used successfully in place of timber planks and steel sheets. It shall protect the concrete from rapid temperature changes and shall provide optimum conditions for setting of the concrete. As it shall possess remarkable design flexibility, it shall be ideal for curved formwork.

26B.4 Besides it shall be used as centering, shuttering and formwork of concrete columns, beams, slabs, walls, tanks, bridges, fly-overs, silos etc. It shall also be used for structural applications like external walling, roofing, flooring, curtain walls, work-site offices, in cabins of trucks, rail coaches etc.

M-26C Steel Sheeting and Steel Plates:

26C.1 Steel sheeting and steel plates should be free from clinks, twists, offsets, warps, etc. Their surface should be neat, clean and smooth. Before placing concrete, steel forms shall be thoroughly cleaned off of all rust, dust and loose materials. Colourless oil or grease of approved quality shall be applied before placing steel.

26C.2 The size of angles used for framing and bracing of steel plates should be sufficient to withstand the weight of concrete without forming clinks, twists, offsets, warps, etc. in the steel plates. Also, the gauge of steel sheeting used should not be higher than 14 G.

26C.3 Minimum two bracing angles should be provided along with angle framing while making the steel plates. It should be riveted or welded to suit the requirement of finish concrete surface. Minimum two rivets should be provided at all Four Corners and at junction of angle framing and bracing.

26C.4 If the plates are to be welded, steel sheet and angle framing/bracing should be welded from sides and at back. Welding on sides should be buffed to make the sides smooth. Also, intermittent welding should be done to keep steel sheet and angle framing/bracing in one plane.

M-27 Expansion Joints-Premoulded Filler:

27.1 The item provides for expansion joints in RCC frame structure, for internal joints as well as exposed joints, with the use of premoulded bituminous joint filler.

27.2 Premoulded bituminous joint filler, i.e. preformed strip of expansion joint filler shall not get deformed or broken by twisting, bending or other handling pressures, when exposed to atmospheric condition. Pieces of joint filler that have been damaged shall be rejected.

27.3 Thickness of the pre-moulded joint filler shall be 25 mm., unless otherwise specified.

27.4 Premoulded bituminous joint filler shall conform to BE : 1838.

M-28 Expansion Joints-Copper Strips & Hold fasts:

28.1 The item provided for expansion joints in RCC frame structure, for internal joint as well as for exposed joints, with the use of necessary copper strip and holdfasts.

28.2 Copper sheet shall be 1.25 mm. thick and 1.25 mm. wide and shall be of `U' shape, in the middle. Copper strip shall have holdfast of 3 mm. diameter copper rod, fixed to the plate, soldered on the strip at intervals of about 30 cm. or as shown in the drawing or as directed. The width of each flange (horizontal side) of the copper plate, to be embedded in concrete work shall be 25 mm. Depth of `U' to be provided in the expansion joint, in copper plate shall of 25 mm.

M-29 Teak Wood:

29.1 The teak wood shall be of superior quality as required for the item to be executed. The kind of wood specifically mentioned as BURMA, MARSOVA, CP, CHILL or SAG teak wood, as approved by the Architect or Engineer-in-charge, shall be used. These teakwood, as mentioned above, shall be from specified sources/origins, as approved by the Architect.
29.2 Teak wood shall generally be free from large, loose, dead or cluster knots, flaws, shades, warps, twists, bends or any other defects. It shall generally be uniform in substance and of straight fibres, as far as possible. It shall be free from knot, decay, harmful fungi and other defects of harmful nature, which will affect the strength, durability and its usefulness for the purpose for which it is required. The colour shall be uniform, as far as possible. Any efforts like painting, using any adhesive or resins materials, made to hide the defects, shall render the pieces labile to rejection by the Engineer-in-charge and Architect.

29.3 All scantling, planks etc. shall be sawn in straight lines and planes, in the direction of grains and shall be of uniform thickness.

29.5 First class teak wood:

29.5.1 First class teak wood shall have no individual hard and sound knots, more than 6 cm\(^2\) in size and the aggregate area of such knots shall not be more than 1% of the area of the piece. The timber shall be closed grained.

29.6 Second Class Teak Wood:

29.6.1 No individual hard and sound knots shall be more than 15 cm\(^2\) in size and the aggregate area of such knots shall not exceed 2% of the area of the piece.

M-29.A Non-teak wood:

29A.1 The non-teak-wood shall be chemically treated, seasoned as per IS specifications and shall be of good quality. The type of wood shall be got approved before collecting the same on site. Fabrication of wooden members shall be started only after the necessary approval.

29A.2 For this purpose, wood of Bio, Kalali, Siras, Behda, Jamun, Siso will be used for door-frames, where as only Kalali, Siras, Halda, Kalam etc. will be permitted for preparation of shutters, after proper seasoning and chemical treatment.

29A.3 The non-teak wood shall be free from large, loose, dead or cluster knots, flows, shakes, warps, bends or any other defect. It shall be uniform in substance and of straight fibres, as far as possible. It shall be free from knots, decay, harmful fungi and other defects of nature which will affect the strength, durability or its usefulness for the purpose for which it is required. The colour of wood shall be uniform, as far as possible. The scantling, planks etc. shall be sawn in straight lines and planes in the direction of grain and shall be of uniform thickness. The Client will ask the agency to produce certificate from the Forest Department, in event of dispute and the decision of the Client shall be final and binding to the Contractor.

M-29B Processed Rubber Wood:

29B.1 The processed rubber wood shall be like Borotik, Silver teak or equivalent, as approved by the Architect and Engineer-in-Charge. It shall conform to IS : 401. The wood shall be made from best quality logs of rubber trees, by treating freshly sawn wood with boron base, timber preservative, as per IS : 401, and drying them uniformly in vacuum, to result into uniform texture and low moisture content wood.

29B.2 It shall be used for manufacturing furniture and furniture components, wall panelling, A.C grills, venetian blinds, wood carvings and handicrafts. It shall be suitably used for production of Door and Window shutters and panels. It shall be available in standard sizes, rough sawn, as listed below:

<table>
<thead>
<tr>
<th>Length (in Ft.)</th>
<th>Section(W x T, in inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2, 3 and 4</td>
<td>2 x 1, 3 x 1, 4 x 1, 1.5 x 1.5, 2 x 1.5, 3 x 1.5, 4 x 1.5, 2 x 2 3 x 2, 4 x 2, 2.5 x 2.5</td>
</tr>
<tr>
<td>5, 6 and 7</td>
<td>2 x 2, 3 x 2, 4 x 2</td>
</tr>
</tbody>
</table>

29B.3 The moisture content of the processed rubberwood is 8 to 10% for furniture lengths upto 48 inches, in maximum section 3" x 2". For lengths of 48 to 84 inches, in maximum section 4" x 2.5", the moisture content is 10 to 12%. Its other properties are similar to rubberwood.
29B.4 Processed rubber wood, is easy to re-saw and for planning, boring, turning etc. It is also suitable for lacquering, painting and resin or melamine finish. Gluing or jointing shall be done with PG, UF, RF resins and PVAC glues. Butt joints and edge joints are possible and along with its property of hardness, it is suitable material for parquet flooring, staircase steps, door and window shutters and panel inserts.

M-30 Wooden Flush Door Shutters (Solid Core):

30.1 The solid core type (water proof/Commercial) flush door shutters shall be of decorative face or non-decorative face type, as specified in the drawing. The size and thickness of the shutter shall be as specified in drawings or as directed. The timber species for core shall be used as per IS : 2202-(Part-I). The timber shall be free from decay and insect attack. Knots and knot holes less than half the width of cross-section of the members in which they occur, may be permitted. Pitch pockets, pitch streaks and harmless pin holes shall be permissible except in the exposed edges of the core members. The commercial plywood, cross-bands shall conform to IS : 303. And waterproof plywood shall confirmed to IS 710.

30.2 The solid core shall be of wood laminate, prepared from battens of well seasoned and treated good quality wood, having straight grains. The battens shall be of uniform size of about 2.5 cm. width. These shall be properly glued and machine pressed together, with grains of each piece reversed from that of the adjoining one. The longitudinal joints of the battens shall be staggered and no piece shall be less than 50 cm. in length. Edges of the core shall be lipped internally with 1st class teak wood battens of 4 cm.(1-1/2") minimum width, glued and machine pressed along with the core.

30.3 The core surface shall then have two or three veneers firmly glued on each face. The first veneer (called cross hand) shall be laid with its grains at right angles to those of the core and the second and the third veneers with their grains parallel to those of the core.

30.4 The face panel of the shutters shall be formed by gluing, by the hot press process on both faces of the core with either plywood or cross-bands and face veneers. The lipping, reveting, opening of glazing, venation etc. shall be provided if specified in the drawing.

30.5 All edges of the door shutters shall be square. The shutters shall be free from twist or warp in its plane. Both faces of the shutters shall be sand papered to make smooth even texture.

30.6 The shutters shall be tested for -

(1) End immersion test : The test shall be carried out as per IS : 2202 (part-I). There shall be no delamination at the end of the test.

(2) Knife test : The face panel when tested in accordance with IS : 1659 shall pass the test.

(3) Glue Adhesion test : The flush door shall be tested for glue adhesive test in accordance with IS :2202 (Part-I). The shutters shall be considered to have passed the test if no delamination occurs in the glue lines in the plywood and if no single delamination more than 80 mm. in length & more than 3 mm. in depth has occurred in the assembly glue lines between the plywood face and the style and rail. Delamination at the corner shall be measured continuously around the corner. Delamination at the knots, knot holes and other permissible wood defects shall not be considered in assessing the sample.

30.7 The tolerance in size of solid core type flush door shall be as under:

In Normal thickness +1.2 mm. In Normal height +3 mm.

30.8 The thickness of the shutters shall be uniform throughout, with a permissible variation of not more than 0.8 mm. when measured at any two points,

M-31 Aluminium Doors, Windows, Ventilators:

31.1 Aluminium alloy used in the manufacture of extruded window sections shall conform to IS designation HEA-WP of IS : 733 and also to IS designation WVG-WP of IS : 1285. The section shall be as specified in the drawing and design. The fabrication shall be done as directed.

31.2 The hinges shall be cast or extruded Aluminium hinge of same type as in window but of larger size.
31.3 The hinges shall normally be of 50 mm., openable/projecting type. Non-projecting type of hinges may also be used, if directed. The handles of the door shall be of specified design. A suitable locks for the door, operable either from outside or inside shall be provided. In double shutter door, the first closing shutter shall have concealed aluminium alloy tower bolt at top and bottom.

**M-32**
**Rolling Shutters**:

32.1 The rolling shutters shall conform to IS: 6248. Rolling shutters shall be supplied of specified type, with accessories. The size of the rolling shutters shall be as specified in the drawings. The shutters shall be constructed with interlocking lath sections formed from cold rolled steel strips not less than 0.9 mm. thick and 80 mm. wide, for shutters upto 3.5 m. width and not less than 1.25 mm. thick and 80 mm. wide, for shutters 3.5 m. in width and above, unless otherwise specified.

32.2 Guide channels shall be of mild steel, deep channel section and roll pressed or built-up (fabricated), with jointless construction. The thickness of the sheet used shall not be less than 3.15 mm.

32.3 Hood covers shall be made of MS sheets, not less than 0.90 mm. thick. For shutters having width of 3.5 m. and above, the thickness of MS sheet for the hood cover shall be not less than 1.25 mm.

32.4 The spring shall be of best quality and shall be manufactured from tested high tensile spring steel wire or strip of adequate strength to balance the shutters in all positions. The spring pipe shaft etc. shall be supported on strong MS or malleable CI brackets. The brackets shall be fixed on or under the lintel as specified with rawlplugs and screws bolts, etc.

32.5 The rolling shutters shall be of self rolling upto 8 m². clear area, without ball bearing and upto 12 m². clear area, with ball bearing. If the rolling shutters are of large area, then gear operated type shutters shall be used.

32.6 The locking arrangement shall be provided at the bottom of shutter at both ends. The shutters shall be opened from outside.

32.7 The shutters shall be completed with door suspension shafts, locking arrangements, pulling hooks, handles and other accessories.

**M-33**
**Collapsible Steel Gate** :

33.1 The collapsible steel gate shall be in one or two leaves and size as per approved drawings or as specified. The gate shall be fabricated from best quality mild steel channels, flats etc. and either steel pulleys or ball bearings shall be provided in every double channel, unless otherwise specified. The particulars of collapsible gate shall be as under:

(a) Pickets: These shall be of 20 mm. MS channels of heavy section, unless otherwise shown on drawings. The distance, center to center of pickets shall be 12 cm. with an opening of 10 cm.

(b) Pivoted MS flats shall be 20 mm. x 6 mm.

(c) Top and bottom guides shall be from tee or flat iron of approved size.

(d) The fittings like stoppers, fixing hold fasts, locking cleats, brass handles and cast iron rollers shall be of approved design and size.

**M-34**
**Welded Steel Wire Fabric** :

34.1 Welded steel wire fabric for general purpose shall be manufactured from cold drawn steel wire "as drawn" or galvanised steel conforming to IS : 226 with longitudinal and transverse wire securely connected at every intersection by a process of electrical resistance welding and conforming to IS : 4948. It shall be fabricated and finished in workmanlike manner and shall be free from injurious defects and shall be dust proof. The type of mesh shall be oblong or square, as directed. The mesh sizes and sizes of wire for square as well as oblong, welded steel wire fabric shall be as directed. The steel wire fabric in panels shall be in one whole piece, in each panel, as far as stock sizes permit.
Part -B  Material Specification - Civil Works

M-35  Expanded Metal Sheets :

35.1 The expanded metal sheets shall be free from flaws, joints, broken strands, laminations and other harmful surface defects. Expanded metal steel sheet shall conform to IS : 412 except that blank sheets need not be with guaranteed mechanical properties. The size of the diamond mesh of expanded metal and dimensions of strands (width and thickness) shall be as specified. The tolerance on nominal weight of expanded metal sheets shall be of ± 10%.

35.2 Expanded metal in panels shall be in one whole piece, in each panel, as far as stock sizes permit. The expanded metal sheets shall be coated with suitable protective coating to prevent corrosion.

M-36  Mild Steel Wire (Wire Gauze Jali) :

36.1 Mild steel wire may be galvanised, as indicated. All finished steel wire shall be well sawn to the dimensions, and the size of the wire shall be as specified in item. The wire shall be sound, free from splits, surface flaw, rough, jagged and imperfect edges and other harmful surface defects and shall conform to IS : 280.

M-37  Plywood :

37.1 The plywood for general purpose shall conform IS : 303.

Plywood is made by cementing together thin boards or sheets of wood into panels. There are always an odd number of layers, 3,5,7,9 ply etc. The plies are placed so that grain of each layer is at right angles to the grain in the adjacent layer.

37.2 The chief advantages of plywood over a single board of the same thickness is that, plywood offers more uniform strength, along its length and width and also offers greater resistance to cracking and splitting with change in moisture content.

37.3 Usually synthetic resins are used for gluing, phenolic resins are usually cured in a hot press which compresses and simultaneously heats the plies between hot plates, which maintain a temperature of 90°C to 140°C and a pressure of 11 to 14 Kg/cm², on the wood. The time of heating may be anything from 2 to 60 minutes depending upon the thickness.

37.4 When water glues are used the wood absorbs so much water that the finished plywood must be dried carefully. When synthetic resins are used as adhesive, the finished plywood must be exposed to an atmosphere of controlled humidity until the proper amount of moisture has been absorbed.

37.5 According to IS : 303, the plywood for general purpose shall be of the grades namely BWR, WWR and CWR, depending upon the adhesives used for bonding the veneers, and it will be further classified into six types namely AA, AB, AC, BB, BC and CC based on the quality of the two faces, each face being of three kinds namely, A,B and C. After pressing, the finished plywood should be reconditioned to a moisture content not less than 8% and not more than 16%.

37.6 Thickness of plywood boards:

<table>
<thead>
<tr>
<th>Board</th>
<th>Thickness</th>
<th>Board</th>
<th>Thickness</th>
<th>Board</th>
<th>Thickness</th>
<th>Board</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 ply</td>
<td>3 mm.</td>
<td>5 ply</td>
<td>5 mm.</td>
<td>7 ply</td>
<td>9 mm.</td>
<td>9 ply</td>
<td>16 mm.</td>
</tr>
<tr>
<td></td>
<td>4 mm.</td>
<td></td>
<td>6 mm.</td>
<td></td>
<td>13 mm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 mm.</td>
<td></td>
<td>8 mm.</td>
<td></td>
<td>16 mm.</td>
<td>11 ply</td>
<td>19 mm.</td>
</tr>
<tr>
<td></td>
<td>6 mm.</td>
<td></td>
<td>9 mm.</td>
<td>9 ply</td>
<td>13 mm.</td>
<td></td>
<td>22 mm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25 mm.</td>
</tr>
</tbody>
</table>

Types of plywood :

M-37A  Water Proof (Weather Proof) Plywood :

37A.1 The plywood shall be from Kitply, Wonder Wood, Anchor Board or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to IS : 710 and to the relevant Defence and Navy...
37A.2 Plywood shall be made from veneers of hard wood timbers and bonded with high quality BWP type Phenol Formaldehyde Synthetic Resin Adhesive and hot pressed at high temperature and pressure, and further treated with a fixed type of preservative by vacuum-cum-pressure impregnation, to produce thin boards or sheets of wood panels. There are always an odd number of layers. The plies shall be placed, so that, grain of each layer is at right angles to the grain in the adjacent layer.

37A.3 Plywood shall be waterproof, weather proof, boilproof, and highly durable even against strenuous vulnerable uses. It shall resist the attack of termites, cockroaches, wood burrowers, fungus, mould, rot, decay and other wood destroying insects and marine organisms.

37A.4 The tensile strength of the plywood shall be minimum 600 kg/cm² and bending strength above 400 kg/cm². The swelling of plywood in water should be almost negligible. Specific gravity of plywood should be 0.7 to 0.75, having screw and nail holding strength normal to face, atleast 250 kg. and 60 kg., respectively.

37A.5 The moisture content shall be less than 10% and the plywood shall have high fire resistance and shall be free from any cracks, wraps, split etc., and shall have uniform strength all over the panel surface. It shall be used for marine structures, leather tanning tables, wall panelling, and underlayment for kitchen and other furniture, subjected to heat and moisture.

M-37B Commercial Ply:

37B.1 The plywood shall be from Mafatlal Plywood Industries Ltd. or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to IS 303.

37B.2 Plywood shall be made from hard wood timbers, finished with selected species of timber, suitable for veneers and bonded with strictly controlled and evenly spread adhesives.

37B.3 It shall be smooth and strong and shall be free from warping, cupping and twisting.

M-37C Prelaminated - Standard and Veneered:

37C.1 Decorative Plywood:

37C.1.1 It shall be obtained from manufacturer as approved by the Architect and Engineer-in-charge. It shall conform to relevant IS Code.

37C.1.2 Plywood shall be made from hard wood timbers, finished with selected species of timber, suitable for veneers and bonded with strictly controlled and evenly spread adhesives. It shall be smooth and strong and shall be free from warping, cupping and twisting.

37C.2 Decorative Veneers:

37C.2.1 Decorative veneered plywood shall be manufactured using veneers of the best quality timbers like Teak, Rosewood, Walnut, Laurel, White Cedar and many others.

37C.2.2 They shall be available in flitch form as well as in lay-on form, in sizes suitable to the furniture industry. They shall be available either flat or quarter sliced, varying in thickness from 0.2 mm. to 1.5 mm. Lengths shall vary upto 4 m.

M-37D Block Boards:

37D.1 They shall be manufactured from well-selected and seasoned hardwood timbers, used in sturdy construction. They shall be usually bonded with Urea Formaldehyde, however against specific requirements, Phenol Formaldehyde bonded boards shall also be available.

37D.2 They shall be strong, weather and water proof and shall be ideally used for high quality furniture and exterior applications.
Part -B  Material Specification - Civil Works

M-38  Glass :

38.1 All glass shall be of the best quality, free from specks, bubbles, smokes, veins, air holes, blisters, and other defects. The kind of glass to be used shall be as mentioned in the item or specification or in the special provisions or as shown in detailed drawings. Thickness of the glass panels shall be uniform. The specifications for different kinds of glass shall be as under:

38.2 Sheet Glass :

38.2.1 In absence of any specified thickness or weight in the item or detailed specifications of the item of work, sheet glass shall be weighing 7.5 Kg/m². for panes upto 600 mm. x 600 mm.

38.2.2 For panes larger than 600 mm. x 600 mm. and upto 800 mm. x 800 mm., the glass weighing not less than 8.75 Kg/m². shall be used. For bigger panes upto 900 mm. x 900 mm., glass weighing not less than 11.25 Kg/m². shall be used.

38.2.3 Sheet glass shall be patent flattened glass of best quality and for glazing and framing purposes shall conform to IS : 1761. Sheet glass of the specified colours shall be used, if so shown on the detailed drawings or so specified for important buildings and for panes with any dimensions over 900 mm., plate glass of specified thickness shall be used.

38.3 Plate Glass :

38.3.1 When plate glass is specified, it shall be ‘Polished patent plate glass’ of best quality. It shall have both the surface ground flat and parallel and polished to obtain clear undisturbed vision and reflection. The plate glass shall be of thickness mentioned in the item or as shown in the detailed drawing or as specified. In absence of any specified thickness, the thickness of plate glass to be supplied shall be 6 mm. and a tolerance of 0.20 mm. shall be admissible.

38.4 Obscured Glass :

38.4.1 This type of glass transmits light so that vision is partially or almost completely obscured. Glass shall be plain rolled, figure, ribbed or fluted, or frosted, as may be specified or as required. The thickness and type of glass shall be as per details on drawings or as specified or as directed.

38.5 Wired Glass :

38.5.1 Glass shall be with wire netting embedded in a sheet of plate glass. Electrically welded 13 mm. Georgian square mesh shall be used. Thickness of glass shall not be less than 6 mm. Wired glass shall be of the type and thickness as specified.

38.6 Double Glazed units :

38.6.1 Double glazed unit shall comprise of two glasses, of appropriate thickness and absolutely machine-cleaned on both sides, with an air gap of 12 mm. in-between. The space between the two glasses is kept totally dry, avoiding any condensation by sealing the space with elastomeric sealant. Thus in all, it is an insulating glass unit of around 20mm. thickness.

38.6.2 It shall be suitably used for any kind of Doors and Windows, in all areas of work and residences. It shall be absolutely and clearly transparent, giving the following advantages :

1) Total light penetration, but with dust and heat insulation.
2) Noise insulation.
3) 25% saving in electricity due to heat insulation.
4) Crystal clear transparency.

M-39  Acrylic Sheets :

39.1 Acrylic sheets shall be of thickness as specified in the item and of specified shape and size, as the case may be. Panels may flat or curved. It should be light in weight. It shall be colourless or coloured or
opaque, as specified in the item. Colourless sheet shall be as transparent as the finest optical glass. Its light transmission rate shall be about 95%. Transparency shall not be affected for the sheets of larger thickness. It shall be extremely resistant to sunlight, weather and low temperatures.

39.2 It shall not show any significant yellowing or change in physical properties or loss of light transmission over a longer period of use. The sheet shall be impact resistant also, sheets should be of such quality that they can be cut, bent and jointed, as desired. Solution for the joints shall be used as per the requirement of manufacturer.

M-40 Particle Board:

40.1 The particle board used for face panels shall of best quality free from any defects. The particle boards shall be made with phenolmaldehyde adhesive. The particle boards shall conform to IS : 3087 "Specifications for wood particle board for general purpose". The size and the thickness shall be as indicated.

40.2 Particle board shall be made completely from Teakwood and shall be bonded with BWP type Phenol Formaldehyde synthetic resin to give a flat, strong and homogenised panel.

40.3 It shall be durable and shall have smooth surface so as to take any type of surface treatment, like polishing, painting, laminating or veneers. It shall be fire resistant, weather resistant, termite and insect resistant. It shall be dimensionally stable, structurally strong and acoustically superior.

40.3 It shall be available in all standard sizes as that of the plywood.

40.4 Particle board may also be available in veneered form.

M-41 Expanded Polystyrene or Framed Styroper Slabs:

41.1 The expanded polystyrene ceiling boards and tiles shall be of approved make and shall be of sizes, thickness, finish and colour, as indicated. They shall be of high density and suitable for use as insulating material. The insulating material shall be like slab of Thermocole etc.

M-42 Resin Bonded Fibre Glass:

42.1 The resin bonded fibre glass tiles or rolls shall be of approved make and shall be of sizes, thickness and finish, as indicated.

42.2 For test of mineral wool thermal insulation blanket, IS : 3144 shall be followed.

42.3 Insulation wool blanket shall be with the following coverings on one or both sides, as indicated.
   (1) Bituminised hessain Kraft paper suitable for use in position where moisture has to be excluded.
   (2) Hessian cloth or Kraft paper, for keeping out dust.
   (3) GI wire netting, suitable for surfaces to be plastered over.

M-43 Fixtures and Fastenings:

43.1 General:

43.1.1 The fixtures and fastenings, that is butt, hinges, tee and strap hinges, sliding door bolts, tower bolts, door latch, bath-room latch, handles, door stoppers, casement window fasteners, casement stays and ventilators catch shall be made of the metal, as specified in the item or its specification.

43.1.2 They shall be of iron, brass, aluminium, chromium plated iron, chromium plated brass, copper oxidised iron, copper oxidised brass or anodised Aluminium, as specified.
43.1.3 The fixtures shall be heavy types. The fixtures and fastenings shall be smooth finished and shall be such as will ensure ease of operations.

43.1.4 The samples of fixtures and fastenings shall be got approved by Engineer-in-charge and Architect, as regards its quality and shape before fixing them in position.

43.1.5 Brass and anodised aluminium fixtures and fastenings shall be bright finished.

43.2 **Holdfasts** :
43.2.1 Holdfasts shall be made from mild steel flat 30 cm. length and one of the holdfasts shall be bent at right angle and two nos. of 6 mm. diameter holes, shall be made in it for fixing it to the frame with screws. At the other end, the holdfast shall be forked and bent at right angles in opposite directions.

43.3 **Butt hinges** :
43.3.1 Railway standard heavy type butt hinges shall be used when so specified.

43.3.2 Tee and strap hinges shall be manufactured from MS Sheet.

43.4 **Siding door bolts (Aldrops)** :
43.4.1 Thealdrops as specified in the item shall be used and shall be got approved.

43.5 **Tower bolts (Barrel type)** :
43.5.1 Tower bolts as specified in the item shall be used and shall be got approved.

43.6 **Door Latch** :
43.6.1 The size of door latch shall be taken as the length of latch.

43.7 **Bathroom Latch** :
43.7.1 Bathroom latch shall be similar to tower bolt.

43.8 **Handle** :
43.8.1 The size of the handles shall be determined by the inside grip length of the handles. Handles shall have a base plate of length 50 mm. more than the size of the handle.

43.9 **Door Stoppers** :
43.9.1 Door stoppers shall be either floor door stopper type or door catch types. Floor stopper shall be of overall size as specified and shall have a rubber cushion.

43.10 **Door Catch** :
43.10.1 Door catch shall be fixed at a height of about 900 mm. from the floor level such that one part of the catch is fitted on the inside of the shutter and the other part is fixed in the wall with necessary wooden plug arrangements for appropriate fixing. The catch shall be fixed 20 mm. inside the face for the door for easy operation of catch.

43.11 **Wooden Door Stop with Hinges** :
43.11.1 Wooden door stop of size 100 mm. x 60 mm. x 40 mm. shall be fixed on the door frame with a hinge of 75 mm. size and at a height of 900 mm. from the floor level. The wooden door stop shall be provided with 3 coats of oil paint.

43.12 **Casement Window Fastener** :
43.12.1 Casement window fastener for single leaf window shutter shall be left or right handed as directed.

43.13 **Casement Stays (Straight Peg Stay)** :
43.13.1 The stays shall be made from a channel section having three holes at appropriate position so that the window can be opened either fully or partially, as required. Size of the stay shall be 250 mm. to 300 mm., as directed.

43.14 **Ventilator Catch** :
43.14.1 The pattern and shape of the catch shall be as approved.

43.15 **Pivot** :
43.15.1 The base and socket plate shall be made from minimum 3 mm. thick plate, and projected pivot shall not be less than 12 mm. in diameter and 12 mm. in length and shall be firmly riveted to the base plate, in case of iron pivot and in single piece base plate, in the case of brass pivot.

M-44 Paints:

M-44A Oil Paints:

44A.1 Oil paints shall be of the specified colour and shade and as approved. The ready mixed paints shall only be used. However, if ready mixed paint of specified shade or tint is not available white ready mixed paint with approved stainer shall be allowed. In such a case, the Contractor shall ensure that the shade of the paint so allowed shall be uniform.

44A.2 All the paints shall meet with the following general requirements:
   (i) Paint shall not show excessive setting in a freshly opened full can and shall easily be redispersed with a paddle to a smooth homogeneous state. The paint shall show no curdling, levering, caking or colour separation and shall be free from lumps and skins.
   (ii) The paint as received shall brush easily, possess good levelling properties and show no running or sagging tendencies.
   (iii) The paint shall not skin within 48 hours in a three quarters filled closed container.
   (iv) The paint shall dry to a smooth uniform finish free from roughness grit, unevenness and other imperfections.

44A.3 Ready mixed paint shall be used exactly as received from the manufacturers and generally according to their instructions and without any admixtures, whatsoever.

M-44B Enamel Paints:

44B.1 The enamel paint shall satisfy all general requirements in specification of oil paints. Enamel paint shall conform to IS : 2933. It shall be from Nerolac, Berger, Asian Paints or equivalent. It shall offer variety of finishes like Glossy, Semi-glossy, Pearl lustre and Matt.

44B.2 It shall be applied either by brush, roll or spray. It shall have a covering capacity of 13 to 18 m² per coat, depending on the surface to be painted. It shall be used both on metal and wood surfaces.

44B.3 It shall have a viscosity of application of 60 to 65 seconds, if brush or rollers are used and 30 to 40 seconds, if spraying is done. It shall have flash point at above 30 °C. The drying time shall however vary with the ambient temperature and humidity.

M-44C Heritage Wall Finish:

44C.1 It shall be from Bakelite Hylam Ltd. or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to relevant IS Codes. It shall be granules, flakes, granite-flakes and granules and flakes mix.

44C.2 It shall be a two component finish. It shall be easily applicable using trowels and no special tools and training shall be required for application. The single coat application thickness shall be 1.5 mm. thick, of colour and texture, as approved by the Architect. It shall be weather and fade resistant, water and damp resistant, durable and highly washable. It shall be acid and alkali resistant, high abrasion resistant, non-toxic and shall be capable to taking any shape. It can be applied on wide variety of surface like cement mortar, plywood, plaster board, AC sheet, Asbestos board, gypsum plaster or any other materials, to get homogenous layer.

44C.3 It shall be water thinnable to avoid water contamination, incombustible and flexible. It shall be good fire resistant, anti-fungal, good impact resistant having adhesion strength more than 8 kg/cm². There shall not be any development of hair line cracks and no peeling off shall occur, after the maximum drying time of 4 hours and curing period of 2 days.

M-44D Polyurethane Coatings:
44D.1 It shall be from MRF Durodec or equivalent, as approved by the Architect and Engineer-in-charge.

44D.2 It shall be a three-coat application, using a brush, spray or a roller. It shall be available in variety of decorative finishes, i.e. in almost all shades and in glossy and matt finishes. It shall offer the following properties:

1) Adhesion to concrete surfaces.
2) Sealing effect against heavy rain.
3) Good water vapour diffusion.
4) Weather resistance, colour stability, gloss retention and chalk resistance.
5) Resistance to disinfectants, chemical, fire, radiation, acid gases, abrasion and wear.
6) Low soil adhesion.

44D.3 It shall be ideal for concrete, floor toppings, on calcium silicate brickwork, glass fibre reinforced concrete, and wood fibre. plaster board, fibre reinforced plasterboard. It shall absorb UV radiation and shall be easily cleaned of radioactive contamination. The ultraviolet part of the solar radiation shall not affect the coating and thereby shall be long lasting.

M-44E Armor Quartz:

44E.1 It shall be from Jenson & Nicholson or equivalent, as approved by the Architect and Engineer-in-charge.

44E.2 It is used for exterior surfaces and shall give a thick rich opaque matt finish. It shall be easily applicable using a flat brush well moistened before use. No special tools or training shall be required for application. A single coat application is enough to render a smooth, well prepared surface, in the colour and texture, approved by the Architect. It shall be weather and fade resistant, water and damp resistant, durable. It shall resist fungi and algae. It can be applied on wide variety of surface like cement mortar, plywood, plaster board, AC sheet, Asbestos board, gypsum plaster or any other absorbent material to get homogenous layer. It shall touch dry within 20 minutes and covers 20% more area than other fine textured exterior finishes.

44E.3 It shall be water thinnable, thinned with 5 to 10% of water by volume. It shall require no primer. On a well prepared surface, it shall be applied, in single coat, after one coat of Robbiacem Super cement paint. On a previously painted surface, it shall be applied, in single coat, after one coat of Armor Quartz, diluted 1:1 with water is applied before the final coat of Armor Quartz, thinned with 5 to 10% of water by volume. It shall be formulated to last for atleast 10 years.

M-44F Acrylic Emulsion:

44F.1 It shall be from Nerolac, Asian Paints, ICI, Berger or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS Codes.

44F.2 It shall be used on both interiors and exteriors, on all different types of plaster, wooden surfaces, stone, brickwork, asbestos cement sheets, hard and soft boards, etc. It shall render rich smooth finish and shall provide a tough film that forms a suitable protection against all elements.

44F.3 It shall be water thinnable. It shall require no primer. On a well prepared surface, it shall be applied, after one coat of cement primer, in case it is an interior surface and waterproof cement coating, in case it is an exterior surface. On a new but highly absorbent surface, a thin coat of the same shall be applied by adding two parts of water by volume to two parts of Acrylic Emulsion by volume. On previously painted surfaces, one coat of the same shall be applied by thinning four parts of the emulsion with one or two parts of water. It shall be applied by brush, roller or spray. It shall have a covering capacity of 25-30 m²/lit., depending on the surface and shade used. It can be washed to remove the day-to-day dirt, after the surface has been painted, minimum for a month.

M-44G Water Bound Distemper:

44G.1 It shall be from Berger, Nerolac, ICI, Asian Paints or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS Codes.

44G.2 It shall be available in dry powder form and shall be prepared by adding preferably warm water, in the
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manner and proportion, as described by the manufacturer. It shall be applied by the conventional
distemper brush to all plastered walls, ceilings and woodwork. It shall generally not require any primer,
but if found necessary, a size coat made by an experienced painter from glue, soap, warm water and
distemper powder shall be applied. It shall offer a covering capacity of 13-16 m² per Kg, depending on the
surface and shade used.

M-44H Cement Paints :

44H.1 It shall be from Berger, ICI, Asian Paints or equivalent, as approved by the Architect and Engineer-in-
charge. It shall conform to the relevant IS Codes.

44H.2 It shall be manufactured from selected range of raw materials and a special cement, so the it shall be
suitable for both indoors and outdoors. It shall be suitably used on concrete renderings, cement/sand
renderings, cement/lime/sand renderings, asbestos sheets, fibre boards, brickwork, etc. It shall offer matt
finish. It shall require no primer and shall be water thinnable. It shall offer a covering capacity of 6-8 m²
per Kg., depending on the surface and shade used. It shall preferably not be applied under direct sunlight
to avoid patchy effect.

M-45 French Polish:

45.1 The French polish of required tint and shade shall be prepared with the below mentioned ingredients and
other necessary materials.
(i) Denatured spirit of approved quality (ii) Chandras (iii) Pigment.

45.2 The French polish so prepared shall conform to IS : 348.

M-45A Laquar Polish
45A.1 Laquar polish of ASIAN or TARALAC with thinner of same company shall be used. Surfaces to be
polished shall be properly grinned with sandpaper and all grains of the wood shall be filled by sealer coat
over that multiple layers of approved company's Laquar to be applied up to hot water resistance.

M-45B Wax Polish :

45B.1 The Wax polish of required tint and shade shall be prepared with the below mentioned ingredients and
other necessary materials.
(i) 2 parts Bees wax conforming to IS : 1504-1968 with 1.5 parts boiled linseed oil conforming to IS : 75
and 1 part of Turpentine conforming to IS : 83 and 0.5 part Varnish conforming to IS : 337.

45B.2 Pure bees wax free paraffin or bees adulterants shall be used. The polish shall be prepared from mixture
of bees wax, linseed oil, turpentine and varnish in proportion 2 : 1.5 : 1 : 0.5 by weight. The bees wax and
boiled linseed oil shall be heated over a slow fire. When the wax is completely dissolved the mixture shall
be cooled till it is just warm and turpentine and varnish added to it in the required proportions and entire
mixture shall be well stirred.

M-45C Melamine Polish:

45C.1 The melamine polish shall be of best quality and make such as Asian Paints or equivalent, as approved
by the Architect and Engineer-in-charge. It shall be transparent or opaque, as specified by the Architect.

45C.2 It shall give silken, smooth finish. The Melamine polish shall have shade and shine, either satin or glossy,
as approved by the Architect. It shall be two component polish consisting of a base and hardener. It shall be
able of protecting wood from moisture, heat, cold, scratches, stains, cigarette burns etc. It shall have
excellent covering capacity. It shall be applicable to all wooden surface of every shape. It shall be
applied using brush or spray gun. It shall require lesser time to dry and there shall be no cracks or pealing
off of the polish. There shall not be any undulation on the finished surface nor cracks at joints. It shall be
of any desired shade as approved by the Architect. It shall have excellent colour, shall be free flowing and
shall have good levelling properties. It shall be durable and flexible to absorb cracks. It shall have
resistant to scrubs, light rays, heat etc.
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M-45D  Acrylic Wood Polish:

45D.1 Acrylic wood polish shall be of the best quality and make such as Nebula Chemicals Pvt. Ltd. or equivalent, as approved by the Architect and Engineer-in-charge. It shall be made from the best ingredients to give a consistent quality. It shall be water resistant, heat resistant and scratch resistant.

45d.2 It shall offer a silky smooth wood finish. It shall offer any desired shade like rosewood, amber, mahogany, walnut etc. It shall have excellent covering capacity. It shall be applied to all wooden surfaces, of every shape. It shall give a tough and durable surface. It shall require lesser time to dry and shall cover a wider area. On application, it shall form a layer of acrylic which eliminates sanding the surface and therefore helps to reduce time and labour. It shall not require any special equipment to apply.

M-46  Marble Chips for Marble Mosaic Terrazzo:

46.1 The marble chips shall be of approved quality and shades. It shall be hard, sound dense and homogenous in texture with crystalline and coarse grains. It shall be uniform in colour and free from stains, cracks, decay and weathering.

46.2 The size of various colours of marble chips ranging from the smallest upto 20 mm. shall be used where the thickness of top wearing layer is 6 mm. size. The marble chips of approved quality and colours only as per grading as decided by the Engineer-in-charge and Architect shall be used for marble mosaic tiles or works.

46.3 The marble chips shall be machines crushed. They shall be free from foreign matter, dust etc., except as above, the chips shall conform to IS : 2114.

M-47  Flooring Tiles:

M-47A  Plain Cement Tiles:

47A.1 The plain cement tiles shall be of general purpose type. For these tiles, no pigments are used, in their manufacture. Cement used in the manufacture of the tiles shall be as per IS

47A.2 The tiles shall be manufactured from a mixture of cement and natural aggregates, using pressure process. During the manufacture, the tiles shall be subjected to a pressure of not less than 140 Kg/cm². The proportion of cement to aggregate, in the backing of the tiles shall be not less than 1:3, by weight. The wearing face, though the tiles are of plain cement, shall be provided with stone chips of 1 to 2 mm. size. The proportion of cement to aggregate, in the wearing layer of the tiles shall be three parts of cement to one part chips, by weight. The minimum thickness of wearing layer shall be 3 mm. The colour and texture of the wearing layer shall be uniform throughout its face and thickness. On removal from mould, the tiles shall be kept in moist condition, continuously atleast for 7 days and subsequently, if necessary, for such long period, as would ensure their conformity to requirements of IS : 1237, regarding strength, resistance to wear and water absorption.

47A.3 The wearing face of the tiles shall be plane, free from projections, depressions and cracks and shall be reasonably parallel to the backing of the tile. All angles shall be right angles and all edges shall be sharp and true.

47A.4 The tiles shall generally be square in shape, with a size of 30 cm. x 30 cm. The thickness of the tiles shall be 25 mm.

47A.5 Tolerance of length and breadth shall be ± 1 mm. Tolerance of thickness shall be ± 5 mm.

47A.6 The tiles shall satisfy the test as regards transverse strength, resistance to wear and water absorption as per IS : 1237.

Testing Standards:
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A. Water Absorption :
   Sampling :
   6 tiles out of every 3000 tiles are taken for testing.
   Results :
   Absorption permissible, shall be at the most 10%.

B. Transverse strength test :
   Sampling :
   12 tiles out of every 3000 tiles are taken for testing.
   Results :
   When wet :- 80 Kg/cm².
   When dry :- 120 Kg/cm².

C. Abrasion test :
   Sampling :
   6 tiles out of every 3000 tiles are taken for testing.
   Results :
   Average abrasion shall not be more than 3.5 mm.

M-47B Plain Coloured Tiles :

47B.1 These tiles shall have the same specifications as plain cement tiles, as in 47A above except that they shall have a plain wearing surface, wherein pigments are used. They shall conform to IS : 1237.

47B.2 The pigments used for colouring cement shall not exceed 10% by weight of cement used in the mix. The pigments, synthetic or otherwise, used for colouring tiles shall have permanent colour and shall not contain materials detrimental to concrete.

47B.3 The colour of the tiles shall be specified in the item or as directed.

M-47C Marble Mosaic Tiles :

47C.1 These tiles have the same specifications as plain cement tiles except for the requirements stated below:

47C.2 The marble mosaic tiles shall conform to IS : 1237. The wearing face of the tiles shall be mechanically ground and filled. The wearing face of tiles shall be free from projections, depressions and cracks and shall be reasonably parallel to the backing of the tiles. All angles shall be right angles and all edges shall be sharp and true.

47C.3 Chips used in the tiles shall be of the smallest size upto 20 mm. size. The minimum thickness of the wearing layer of tiles shall be 6 mm. For pattern of chips required on the wearing face, a few samples with or without their full size photographs, as directed shall be presented to the Engineer-in-charge and Architect, for approval.

47C.4 Any particular sample, if found suitable shall be approved by the Engineer-in-charge and Architect, or he may ask for a few more samples to be presented. The samples shall have to be made by the Contractor till a suitable sample is finally approved for use in the work. The Contractor shall ensure that the tiles supplied for the work shall be in conformity with the approved sample only, in terms of its dimensions, thickness of the backing layer and wearing surface, materials, ingredients, colour shade, chips distribution, etc. required.

47C.5 The tiles shall be prepared from cement conforming to IS or coloured Portland cement, generally depending upon the colour of tiles to be used or as directed.

M-47D Chequered Tiles :

47D.1 Chequered tiles shall be plain cement tiles or marble mosaic tiles. The former shall have the same specification as per 47A above, and the latter as per marble mosaic tiles as per 47C, except as
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mentioned below:

47D.2 The tiles shall be of nominal size of 250 mm. x 250 mm. or as specified. The center to center distance of chequer, shall not be less than 25 mm. and not more than 50 mm. The overall thickness of the tile shall be 22 mm.

47D.3 The grooves in the chequers shall be uniform and straight. The depth of the grooves shall not be less than 3 mm. The chequered tiles shall be plain, coloured or mosaic, as specified. The thickness of the upper layer measured from the top of the chequers shall not be less than 6 mm. The tiles shall be given the first grinding, with machine, before delivery to site.

47D.4 Tiles shall conform to IS : 1237.

M-47E Chequered Tiles for Stair Cases:

47E.1 The requirements of these tiles shall be the same as chequered tiles, as per 47D above, except in the following respects:
1. The length of a tile including note, shall be 330 mm.
2. The minimum thickness shall be 28 mm.
3. The nosing shall also have the same wearing layer as that at the top.
4. The nosing edge shall be rounded.
5. The front portion of the tile, for a minimum length of 75 mm. from and including the nosing, shall have grooves running parallel to the nosing and at center not exceeding 25 mm. Beyond that the tiles shall have normal chequer pattern.

M-48 Rough Kotah Stone:

48.1 The kotah stones shall be hard, even, sound and regular in shape and generally be uniform in colour. The colour of the stone shall generally be green. Brown coloured stones shall not be allowed for use. The stones shall be without any soft veins, cracks or flaws.

48.2 The size of the stones to be used for flooring shall be of size 600 mm. x 600 mm. and or size 600 mm. x 450 mm., as directed. However, smaller sizes will be allowed to be used to the extent of maintaining required pattern. Thickness shall be, as specified.

48.3 Tolerance of -30 mm., on accounts of chisel dressing of edges shall be permitted for length as well as breadth. Tolerance in thickness shall be +3 mm.

48.4 The edges of the stones shall be truly chiselled and table rubbed with coarse sand before paving. All angles and edges of the stones of shall be true, square and free from chipping and the surface shall be true and plain.

48.5 When machine cut edges are specified, the exposed edges and the edges at joints shall be machine cut. The thickness of the exposed machine cut edges shall be uniform.

M-49 Polished Kotah Stone:

49.1 Polished kotah stone shall have the same specification as Rough kotah stone, except as mentioned below:

49.2 The stones shall have machine polished surface. When brought on site, the stone shall be single polished or double polished, depending upon its use. Single polished kotah stone shall have single face of the stone polished whereas, double polished kotah stone shall have both the faces polished. The stones for paving shall generally be single polished. The stones to be used for dado, skirting, sink, veneering, sills, steps, etc., where machine polishing after the stones are fixed in situ, is not possible, shall be polished more than once for the desired finish, before fixing.

49.3 When brought at site, the colour of the stone shall be fairly uniform. It shall be ensured that the stones to be used in a particular work, shall not differ much in shade or tint, from the approved sample.
### M-50  Dholpur Stone :

50.1 Dholpur sand stone shall be of best quality, as approved by the Architect and Engineer-in-charge. The stone slab shall be without any veins, cracks and flaws. The stone slab shall be even, sound and durable, regular in shape and of uniform colour.

50.2 The size of the slab shall be as specified in the item or detailed drawing or as approved by the Architect and Engineer-in-charge. The thickness of the stone shall be as specified in the item of work, with the permissible tolerance of ± 2 mm.

50.3 The stones shall have machine polished surface. When brought on site, the stone shall be rough, single polished or double polished, depending upon its use and as specified in the item or detailed drawing. The stones for paving shall generally be single polished. The stones to be used for sills, steps, brackets, coping, facias, bands, pillars, fabricated railings, jali work etc., where machine polishing after the stones are fixed in situ, is not possible, shall be double polished or polished more than once, as required.

50.4 All angles and edges of the stone slab shall be fine chiselled or polished, as specified in the item of work and all the four edges shall be machine cut. All angles and edges of the face of the stone slab shall be true and plane.

50.5 The sample of stone shall be got approved by the Engineer-in-charge and Architect, for a particular work. It shall be ensured that the stones to be used in a particular work shall not differ much in shade or tint, from the approved sample. No white, black or any other colour spots shall be there. Cheetah or tiger skinned stones shall not be allowed under any case.

### M-50A  Cobbler Stones (Interlock Pavers) :

50A.1 Cobbler stones shall be of best quality, as approved by the Architect and Engineer-in-charge and shall be obtained from reliable source. The make will be approved by the Architect and the source of supply shall not be changed without prior approval of the Architect. The stone shall be without any veins, cracks and flaws. The cobbler stones shall be even, sound, durable and regular in shape and of uniform colour.

50A.2 The size of the cobbler stone shall be as specified in the items or detailed drawing or as approved by the Architect and Engineer-in-charge. The thickness of the stone shall be as specified in the item of work, with permissible tolerance of ± 2 mm.

50A.3 The stone shall have machine polished surface. When brought on site the stone shall be single polished or double polished, depending upon its use and as specified in the item or detailed drawing. The cobbler stones to be used for walkways, roadways, parking, floors, docks, roofs, public squares etc., where machine polishing after the fixing of stones, is not possible, the stones to be fixed shall be double polished or polished more than once, as required. All angles and edges of the cobbler stone shall be true and plane.

### M-51  Marble Slab :

51.1 Marble slab shall be white or of any other available colour and of best quality, as approved by the Engineer-in-charge and Architect.

51.2 Slabs shall be hard, close, uniform and homogeneous in texture. They shall have even crystalline grain and shall be free from defects and cracks. The surface shall be machine polished to an even and perfect plane surface and edges machine cut, true and square. The rear face shall be rough to provide key for the mortar.

51.3 Marble slabs with natural veins, if selected, shall have to be laid as per the pattern given by the Engineer-in-charge and Architect. Size of the slab shall be minimum 450 mm. x 450 mm. and preferably 600 mm. x 600 mm. However, smaller sizes will be allowed to be used to the extent of maintaining required pattern.

51.4 The slab shall not be thinner than the specified thickness, at its thinnest part. A few specimen of the finished slab to be used, shall be deposited by the Contractor in the office, for reference.
51.5 Except as above, the marble slabs shall conform to IS : 1130.

**M-51A Blended Marble tile/slab :**

51A.1 It shall of the best quality like Carara, Marbella or equivalent, as approved by the Architect and Engineer-in-charge.

51A.2 It shall be predominantly a marble tile/slab, composed of 80% to 95% of finest grains of quality selected marble aggregates, bonded together with 4% to 8% special resins, along with palette of colourants. It shall therefore offer a wide range of colour compared to natural marble. It shall be manufactured so, that its design goes right through the tile, insuring lasting designs.

51A.3 It shall be available in pre-cut, pre-polished, chamfered and grooved upto sizes of 600 mm. x 600 mm. Sizes upto 2400 mm. x 1200 mm. shall also be supplied. It shall have indispensable mechanical strength,

<table>
<thead>
<tr>
<th>Test</th>
<th>Dry</th>
<th>Wet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive strength</td>
<td>1340</td>
<td>1317</td>
</tr>
<tr>
<td>in Kg/cm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexural strength</td>
<td>308</td>
<td>453</td>
</tr>
<tr>
<td>in Kg/cm²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modulus of Rupture</td>
<td>462</td>
<td>453</td>
</tr>
<tr>
<td>in Kg/cm²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It shall offer flexibility, high wear resistance, impact resistance and on testing shall be 1.5 kgcm/cm., hardness on the Moh's scale shall be 3 to 4, abrasive wear index shall be 22 and total water absorption shall be around 0.13%. It shall not be easily affected by the freeze and thawing cycling.

51A.4 It shall be non-porous and shall be used in all types of weather. It shall be used for internal and external surfaces. It shall be easily cut with a normal hand cutting machine, if required and shall be laid in the same manner as natural marble stone or with latex-based glues.

**M-52 Granite Stone :**

52.1 Granite shall be of approved colour and quality. It shall be got approved by the Engineer-in-charge and Architect, prior to procurement. The stone shall be hard, even, sound and regular in shape and generally uniform in colour. It shall be without any soft veins, cracks or flaws.

52.2 The thickness of the stone shall be as specified in the item.

52.3 All exposed faces shall be double polished to render truly smooth and even reflecting surface. The exposed edges and corners shall be rounded off, as directed. The exposed edges shall be machine cut and shall have uniform thickness.

**M-53 PVC / Vinyl Flooring :**

53.1 PVC sheets/tiles for PVC/ Vinyl floor covering shall be of the best quality like Wonderfloor, Indag or equivalent, as approved by the Architect and Engineer-in-charge. It shall be of homogeneous flexible type, conforming to IS : 3462. The PVC covering shall neither develop any toxic effect while put to use nor shall give off any disagreeable odour.

53.2 Thickness of flexible type covering tiles shall be as specified in the description of the item. The flexible type shall be backed with hessain or other woven fabric. It shall be available in form of tiles, size upto 600 mm. x 600 mm. or rolls of 1.5 m. width, continuous length of 20 m. The thickness shall be approx. 1.5 to 2 mm. The dimensional stability shall be 0.3%. The following tolerance shall be applicable on the nominal dimensions of the rolls or tiles :

(a) Thickness : + 0.15 mm.

(b) Length or Width :

1.300 mm. Square tiles, + 0.20 mm.
3.900 mm. Square tiles, + 0.60 mm
2.600 mm. Square tiles, + 0.40 mm
4 Sheets and roll, + 0.10 %

53.3 It shall offer colour fastness to daylight as per the relevant IS : 3462. Allowance for curling shall be 0.6 mm. It shall be flexible and shall not break, crack or show any signs of failure.

53.4 It shall offer above average resistance to mild and diluted acids, alkalis, soaps and detergents. It shall have high abrasion resistance. At normal temperature, it shall develop an indent of 0.15 mm., after one minute and 0.20 mm., after ten minutes. It shall offer insulation resistance as per the IS : 2259. It shall have a sound reduction factor of 3db for 2 mm. thickness and 2db for 1.5 mm. thickness. It shall have self extinguishing property and water absorption at room temperature for 24 hrs. shall be 0.1%.

53.5 It shall be available in various designs and shall be recommended for floors and walls, in homes, institutions, commercial establishments, clinics and hospitals.

53.6 Adhesive:

53.6.1 The adhesive for PVC flooring shall be of the type and make recommended by the manufacture of PVC sheets/tiles.

M-54 Facing Tiles:

54.1 The facing tiles (burnt clay facing bricks) shall be free from cracks and nodules and of free lime. They shall be thoroughly burnt and shall have plane rectangular faces with parallel sides and sharp straight right angle faces. The texture of the finished surface that will be exposed when in place shall conform to an approved sample consisting not less than four stretcher bricks each representing the texture desired. The facing tiles shall have a pleasing appearance, sufficient resistance to penetration by rain and greater durability than common bricks. The tiles shall conform to IS : 2691.

54.2 The standard size of facing brick tiles shall be 19 cm. x 9 cm. x 4 cm. The facing brick tiles shall be provided with frog which shall conform to IS : 1077-1976.

54.3 The permissible tolerance in dimensions specified above shall be as follows:

<table>
<thead>
<tr>
<th>Size</th>
<th>1st Class Brick</th>
<th>2nd Class Brick</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 cm.</td>
<td>+ 6 mm.</td>
<td>+ 10 mm.</td>
</tr>
<tr>
<td>9 cm.</td>
<td>+ 3 mm.</td>
<td>+ 7 mm.</td>
</tr>
<tr>
<td>4 cm.</td>
<td>+ 1.5 mm</td>
<td>+ 2 mm.</td>
</tr>
</tbody>
</table>

54.4 The tolerance for distortion or warpage of face or edges of individual brick from a plane surface and from a straight line, respectively, shall be as follows:

<table>
<thead>
<tr>
<th>Facing dimensions</th>
<th>Permissible tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. below 19 cm.</td>
<td>Max. 2.5 mm.</td>
</tr>
<tr>
<td>- do - above 19 cm.</td>
<td>Max. 3.0 mm.</td>
</tr>
</tbody>
</table>

54.5 The average compressive strength obtained as a sample of five tiles when tested in accordance with the procedure laid in IS : 1077 shall not be less than 175 Kg/cm². The average compressive strength of any individual bricks shall be not less than 160 Kg/cm².

54.6 The average water absorption for five bricks tiles shall not exceed 12% of average weight of brick before testing. The absorption for each individual bricks shall not exceed 25%.
54.7 The brick tiles when tested in accordance with IS : 1077, the rate of efflorescence shall not be more than ‘Slightly effloresced’.

M-55 White Glazed Tiles :

55.1 The tiles shall be of best quality, as approved by the Engineer-in-charge and Architects. They shall be flat and true to shape. They shall be free from cracks, crazing spots, chipped edges and corners. The glazing shall be of uniform shade.

55.2 The tiles shall be nominal size of 150 mm. x 150 mm., unless otherwise specified. The maximum variation from the stated sizes, other than the thickness of tile shall be ± 1.5 mm. The thickness of tile shall be 6 mm. Except for the above, the tiles shall conform to IS : 777.

M-55A Coloured Glaze Tiles :

55A.1 They shall be similar to white glazed tiles mentioned above, in all respects, except that they shall be available in variety of colours and shades, from Johnson & Johnson or equivalent, as approved by the Architect and Engineer-in-charge.

M-56 Ceramic Tiles :

56.1 Ceramic tiles shall be of 1st quality such as Romano, Regency, Spartek, Stiles or equivalent, as approved by the Architect and Engineer-in-charge. They shall adequately meet the relevant IS

56.2 They shall be light weight, with thickness varying between 6 to 8 mm., depending on the manufacturer. Therefore, they require thinner floor bedding compared to mosaic/stone flooring. On laying, they require no further polishing making the floor ready to live in and use. They shall be suitably used for residences, offices, hotels, hospitals, auditoriums, restaurants, canteens, commercial complex and such other public places. They shall be extremely strong, breaking strength of the tile being 350 Kg/cm² and flexural strength of 350 Kg/cm². They shall offer good resistance to abrasion, i.e. can withstand upto 5000 grindings. They shall be scratch resistance, their hardness on the Moh’s scale shall be 6.8 to 7. They shall be resistant to all acids and alkalis except hydrofluoric acid. In addition, they shall be bacteria free and fire proof, as they are fired at @ 1160°C. They shall have very high acoustic damping factor and their specific gravity shall be 0.12, making them good insulators. Their resistance to thermal shocks shall be upto 10 cycles and their co-efficient of linear thermal expansion shall be 9 from ambient temperature to 100°C.

56.3 They shall be available in various sizes, 8”x4”, 8”x8”, 8”x12”, 12”x12” and 12”x16”. They shall have a size tolerance of ± 0.4% to 0.75%, in length and width and ± 5% in thickness. Allowable warpage shall be ± 0.5%. Allowable squareness wedging shall be ± 0.4 to 0.5%. The allowable straightness of edges shall be ± 0.5% and allowable flatness shall be ± 0.4 to 0.5%. Their water absorption rate shall be less than 5%.

56.4 Ceramic tile for Industrial purposes, shall have a hardness of 8.6 on the Moh’s scale and shall be non-skid, hard wearing, long lasting and acid and alkali resistant. They shall adequately meet the IS : 4457.

M-57 Vitrified Floor Tiles :

57.1 Vitrified floor tiles shall be of best quality like Granamite or equivalent, as approved by the Architect and Engineer-in-charge. They shall conform to the relevant IS Codes.

57.2 They shall be monolithic and available in smooth, mirror-polished and anti-skid finishes, in sizes 12”x12”, 8”x8” and 8”x4”. They shall have a size tolerance of ± 0.5%, in length and width and ± 5% in thickness. Allowable warpage shall be ± 0.2%. Allowable squareness wedging shall be ± 0.5%. Their water absorption rate shall be less than 0.5%. They shall offer hard-working and hard-wearing floors for homes, public buildings, apartments and airports. The tiles shall be of ASTM or DIN standards.

57.3 They shall be extremely strong, breaking strength of the tile being 1600 Kg/cm², flexural strength, 200 Kg/cm² and bonding strength of 2500 Kg/cm². They shall offer good resistance to abrasion, i.e. greater than 100. They shall be scratch resistance, their hardness on the Moh’s scale shall be min. 7. They shall be able to resist thermal shock upto 10 cycles. They shall have a bond strength of 2500 Kg/cm² and shall have a density of greater than 2.2 gm/cc. They shall have 0.60 co-efficient of friction for
polished/unpolished surfaces.

M-58 Red Mandana Stone:

58.1 Red mandana stone shall be of best quality, as approved by the Architect and Engineer-in-charge. The stone shall be without any veins, cracks and flaws. The stone shall be even, sound and durable, regular in shape and of uniform colour.

58.2 The size of the stone shall be as specified in the item or detailed drawing or as approved by the Architect and Engineer-in-charge. The thickness of the stone shall be as specified in the item of work, with the permissible tolerance of ± 2 mm.

58.3 The stones shall have machine polished surface. When brought on site, the stone shall be rough, single polished or double polished, depending upon its use and as specified in the item or detailed drawing. The stones for paving shall generally be single polished.

58.4 All angles and edges of the stone shall be fine chiselled or polished, as specified in the item of work and all the four edges shall be machine cut. All angles and edges of the face of the stone shall be true and plane.

58.5 The sample of stone shall be got approved by the Engineer-in-charge and Architect. It shall be ensured that the stones to be used shall not differ much in shade or tint, from the approved sample.

M-59 Jesalmer Stone:

59.1 Jesalmer stone shall be of best quality, as approved by the Architect and Engineer-in-charge. The stone shall be without any veins, cracks and flaws. The stone shall be even, sound and durable, regular in shape and of uniform colour.

59.2 The size of the shall be as specified in the item or detailed drawing or as approved by the Architect and Engineer-in-charge. The thickness of the stone shall be as specified in the item of work, with the permissible tolerance of ± 2 mm.

59.3 The stones shall have machine polished surface. When brought on site, the stone shall be rough, single polished or double polished, depending upon its use and as specified in the item or detailed drawing. The stones for paving shall generally be single polished.

59.4 All angles and edges of the stone shall be fine chiselled or polished, as specified in the item of work and all the four edges shall be machine cut. All angles and edges of the face of the stone shall be true and plane.

59.5 The sample of stone shall be got approved by the Engineer-in-charge and Architect, for a particular work. It shall be ensured that the stones to be used in a particular work shall not differ much in shade or tint, from the approved sample. No white, black or any other colour spots shall be there. Cheetah or tiger skinned stones shall not be allowed under any case.

M-60 Shon Tiles:

60.1 They shall be of best quality and from manufacturer like Shon Mosaics or equivalent, as approved by the Architect and Engineer-in-charge. They shall conform to the relevant IS

60.2 They shall be available in the form of sheet pasted on paper for easy fixing. They shall be non-slippery, non-porous, non-sensitive and non-conductive. They shall offer good resistance to temperature changes, chemical effects, impact and pressure and surface abrasion. They shall be weatherproof and 100% fire proof. They shall be light weight and so suitable for cladding on high rise buildings. They shall be available in wide selection of colours and shall be permanent in colour. They shall be stable in form and dimension. They shall be anti-static and easy to clean.

M-61 Sintered Tiles:
Part -B  

Material Specification - Civil Works

61.1 Sintered unglazed tiles shall be of the best quality from Kera or equivalent, as approved by the Architect and Engineer-in-charge. It shall adequately meet the IS : 4457 specification.

61.2 It shall be available in 7 mm., 12 mm. and 20 mm. thickness and shall be used in domestic and industrial applications. It shall be available as heavy duty and acid resistant tiles, as per individual requirement.

61.3 It shall have a very high load bearing capacity, with cold crushing strength as 1500 Kg/cm². and shall withstand a load of 3000 Kg/cm². in the compression strength test. The tiles shall have extremely low porosity, because of their monolithic body structure. The water absorption shall be less than 1% and the tiles shall remain free of stains due to lubricants, oils, grease etc. The tiles shall be non-glazed and anti-skid, having a matt finish. They shall be available in special ribbed surface, also. The tiles shall be tough, have high surface hardness, 9 on the Moh's scale and shall offer extremely high resistance to wear and abrasion. They offer good resistance to acids and when tested, the loss of weight shall be around 0.25%.

M-62 Rubber Floorings :

62.1 It shall be of the best quality such as Flora or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS specifications.

62.2 It shall be available in 6 different colours with special colours supplied on minimum order and in square and round pattern. It shall have a thickness of 2.5 mm., 3 mm., 3.5 mm. and 4 mm. and sizes of 600 mm. x 600 mm. It shall be able to withstand the heaviest traffic and shall have exceptional abrasion resistance, chemical resistance, flame resistance and cigarette burn resistance. It shall have good load bearing capacity, sound deadening characteristics and anti-slip surface. It shall be easy to clean and maintain.

62.3 It shall be successfully used in Hospitals, Airports, Computer rooms, Hotels and Restaurants, Laboratories, Office and Shopping complexes, Lifts, Buses, Cinema halls and Residences.

M-63 Admixtures for Tile/Stone Cladding :

M-63A Waterproof Adhesive :

63A.1 Waterproof adhesive, shall be of best quality and from manufacturer like Feb Roffe or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code. It shall be in powdered state, complying with BS : 5980 Type 2, class AA and BS : 5385 Part 1. It shall comprise of selected Portland cements, graded sand and synthetic additives.

63A.2 It is useful for permanent adhesion of ceramic tiles, stone and marble cladding to surfaces that may be subjected to extreme weather conditions. It shall provide good tensile adhesion and shear adhesive strength, after application, in thick/thin layer beneath the tile/stone cladding. Its application and coverage shall be as specified by the manufacturer.

M-63B Rainbow Tile Mate :

63B.1 Rainbow tile mate, shall be of best quality and from manufacturer like Feb Roffe or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

63B.2 It shall be a special high grade compound, formulated with organic additives and special blend of high grade cement filling compound. It shall be available in various colours to match all types of glazed/ceramic tile. The organic colouring pigment, added in the compound shall not fade over the period of time.

63B.3 There shall be close adhesion of particle in the compound which imparts water-resistant qualities to the compound and allows to render the joints permanently water-tight, i.e. no seepage and no cracking of joints. It shall have strong bonding property so that the joint in the tiling shall never wear out.
Part -B  Material Specification - Civil Works

M-64  Selected Earth :

64.1 The selected earth shall be that obtained from excavated material or shall have to brought from outside, as indicated in the item. If item does not indicate anything, the selected earth shall have to be brought from outside.

64.2 The selected earth shall be good yellow soil and shall be got approved from the Architect and Engineer-in-charge. In no case, Black cotton soil or similar expansive and shrinkable soil shall be used. It shall be clean and free from all rubbish and perishable materials, stones, or brick bats. The clods shall be broken to a size of 50 mm. or less. Contractor shall make his own arrangement, at his own cost, for land for borrowing selected earth. The staking of the material shall be done as directed by Architect and Engineer-in-charge, in such a way as not to interfere with any constructional activities and in proper stacks.

64.3 When excavated material is to be used, only selected stuff got approved from the Architect and Engineer-in-charge shall be used. It shall be stacked separately and shall comply with all requirements of selected earth mentioned above.

M-65  Barbed Wire :

65.1 The barbed wire shall be of galvanised steel and it shall generally conform to IS : 278. The barbed wire shall be of type-I, whose nominal diameter for line wire, shall be 2.5 mm. and for point wire, shall be 2.24 mm. The nominal distance between two barbs shall be 75 mm., unless otherwise specified in the item. The barbed wire shall be formed by twisting together two line wires, one of them containing the barbs. The size of line and point wires and barbs spacing shall be as specified above. The permissible deviation from the nominal diameter of the line wire and point wire shall not exceed ± 0.08 mm.

65.2 The barbs shall carry four points and shall be formed by twisting two point wires, each two turns, lightly round one line wire, making altogether four complete turns. The barbs shall be so finished that the four points are set and locked at right angle to each other. The barbs shall have a length of not less than 13 mm. and not more than 18 mm. The points shall be sharp and cut at an angle not greater than 35° of the axis of the wire, forming the barbs.

65.3 The line and point wires shall be of circular section, free from scale and other defects and shall be uniformly galvanised. The line wire shall be in continuous length and shall not contend any weld other than those in the rod before it is drawn. The distance between two successive splices shall not less than 15 m.

65.4 The length per 100 Kg. of barbed wire, IS type-I, shall be as under:
Nominal 1000 m.
Minimum 934 m.
Maximum 1066 m.

M-66  PVC Waterstops :

66.1 The PVC waterstop shall be of approved make, as approved by the Architect and Engineer-in-charge.

66.2 It shall have optimum resilience, high elasticity & stretch strength, immune to corrosion, excellent weather resistance. They shall be manufactured to safeguard against hydrostatic pressure, water seepage, expansion or contraction of joints and to take care of any deflection or displacement arising due to change in temperature or settlement of foundation to eliminate danger of cracks.

66.3 They shall be effective in tropical climate having high mechanical strength, good ageing, longer life, shall be unaffected by acids, alkalies, metal salts and other chemicals. It shall not be hazardous and shall have fire retardant properties. It shall absorb less water than rubber, shall work as water tight seal but shall allow safe passage of seepage water and shall withstand high hydrostatic pressure. It shall be easily welded and can be installed easily, having high tensile strength and shall be capable of bearing heavy shocks arising due to turbines, earthquakes, floods etc.

66.4 It shall withstand a minimum hydrostatic pressure of 30 m. high column of water.
66.5 The selection criteria of waterstop depends upon the hydrostatic pressure, however the following points should be kept in mind:
1) Where substantial expansion/contraction of joints takes place, Dumb Bell type shall be used.  
2) Where a firm grip in concrete is desired, Serrated types should be used.  
3) The overall width of the waterstop should not be greater than the thickness of concrete.  
4) The distance from the face of the concrete to the waterstop must not be less than half the width of the waterstop.  
5) The width of the waterstop must be at least 6 times the largest aggregate used for satisfactory compaction.

66.6 The prior approval of selected size and type of waterstop shall be taken from the Architect and Engineer-in-charge, before use.

M-67 Admixtures for Mass Concrete and Mortar:

M-67A Joint Sealant:

67A.1 The sealant shall be of best quality and from manufacturer like CICO, MC-BAUCHEMIE, PIDILITE, HMP or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

67A.2 It shall be a two component polysulphide rubber joint sealant, based on a low molecular weight polymer. It should not contain chlorides or other corrosive substances.

67A.3 It shall be used for sealing joints in water retaining structures, roofs, external walls, cladding, floors, partitions, ceilings etc. It shall have excellent property to adhere most of building materials like Aluminium, Stainless Steel, Glass, Concrete, Marble, Stone, Brick, Masonry block, Plaster, Ceramic and quarry tiles, Timber etc. The modulus of elasticity of the sealant shall be less than 0.16 MPa, +10% at 100% elongation. The shore "A" hardness of the sealant shall be 22+3 @ 25°C. The operating temperature range for the sealant shall be -25°C to 800°C. The permanent dynamic movement capability of the sealant shall be ±25%. The tensile strength of the sealant shall not be less than 0.4 MPa. The optimum width/depth ratio shall be 2:1. The Sp.gr. of the sealant shall be 1.6 kg/lit. The sealant should be capable to resist attack of water, sunlight, oxidation, corrosive fumes, oils, petrol, diluted acids and alkalies, salt spray, aliphatic and aromatic solvents and shall not contain tar or bituminous ingredients.

67A.4 It shall possess the properties like 550% elongation at break, non-toxicity when fully cured, no staining and shrinkage less than 1%. The trafficable strength shall be achieved within 24 hours and full at 7 days (at 25°C & 250% RH). It shall possess excellent coverage capacity and more strength at low dry temperatures.

M-67B Abrasion Resistant Industrial Flooring Aggregate:

67B.1 The flooring aggregate, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

67B.2 The flooring aggregate shall be a factory processed and specially graded non-oxidising, non-magnetic and chemically inert metallic flooring aggregate, free from oil and grease.

67B.3 It shall be used as a surface hardener to concrete floors. It is recommended for Factory floors, Warehouses, Hangers, Car parks and such other areas, subjected to heavy vehicular traffic. It shall also be used on open and continuously wet surfaces. The flooring aggregate shall build in wear resistance and shall produce high abrasion resistant floor surface. It shall impart extreme surface density and shall offer resistance to oil and water penetration. It shall provide a non-rusting floor surface which is easy to maintain.

67B.4 It shall be used with cement in the ratio, as per the manufacturer's instructions and spread evenly on the
surface to be treated, at the rate depending on the type of floor. The flooring aggregate shall be spread when the surface of the concrete floor is still fresh, i.e. as soon as the surface water has evaporated and then trowled, in stages, to bring about an uniform and smooth finish.

M-67C Concrete Hardener and Dustproofer:

67C.1 The Concrete hardener and dustproofer, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

67C.2 It shall have a specific gravity of 1.18 and shall be applied on concrete floors, at the rate of at least 25 l/s per 100 m² per coat. A total of three coats shall be applied for permanently hardened concrete floor, with increased abrasion resistance, increased surface density, increased resistance to chemical attack and to eliminate dust accumulation. Drying time of 4-6 hours for each coat shall be allowed before the floor is put to use or is applied with another coat of the product. Precautions shall be taken while using the product, to avoid contact with eyes and open wounds and to work in good ventilation. After application, the affected parts shall be washed copiously. It shall not be stored for a period of more than 2 months before use.

M-67D Water Repellent Coating:

67D.1 The Water repellent coating, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

67D.2 Water repellent coatings for exterior exposed surfaces shall be acrylic resin based, having a Flash point of approx. 40°C and specific gravity of 0.95.

67D.3 It shall be suitably used for concrete, brick, stone and plastered surfaces preventing moisture penetration and thus any damage to the interiors. It shall be quick acting, long lasting, invisible i.e. colourless so as to maintain the original colour of the surface treated. It shall impart sealing characteristics so that the treated surface becomes stain and dust free. The coating itself shall not darken or turn yellow with age.

M-67E Accelerating, Water Reducing Admixture and Plasticiser:

67E.1 The Accelerating, Water reducing admixture and plasticiser, shall be of best quality and from manufacturer like CICO or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

67E.2 It shall be in liquid state with a specific gravity of 1.30 and complying with ASTM C-494 Type E, IS : 9103 & IS : 2645. It shall accelerate the setting and hardening of the concrete mix, thereby achieving higher early age strength. It shall reduce the water content of the concrete without affecting its workability. It is useful for pre-cast/pre-stressed works, structural concrete works, floors, roads, runways, paving etc. It shall be used at the rate instructed by the manufacturer, with cement, depending on the amount of acceleration of hardening required. It should be compatible to all types of cement.

M-67F Retarding, Water Reducing Admixture and Plasticiser:

67F.1 The Retarding, water reducing admixture and plasticiser, shall be of best quality and from manufacturer like CICO, Feb Roffe or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

67F.2 It shall be in liquid state with a specific gravity of 1.22 and complying with ASTM C-494 Type B & D, IS : 9103, CRD-C87 Type B & D, BS 5075 Part 1. It shall be added to the concrete mix during the mixing process, at the same time as the water or the aggregates. No extension of normal mixing time is necessary. It shall extend the period of time as to placing the concrete and compacting, i.e. delay the initial and final setting time. It shall help to spread the heat of hydration over a longer period of time. It shall give a highly workable concrete with a low W/C ratio. It shall be used at the rate instructed by the manufacturer, with cement, depending on the amount of acceleration of hardening required. It should be
compatible to all types of cement.

M-67G Water & Weather Proof Compound:

67G.1 The water & weather proof integral cement admixture shall be of best quality and from manufacturer like Feb Roffe's Roff Hyseal, Roff hyproof, Algiproof or equivalent, as approved by the Architect and Engineer-in-charge. The prior approval for the source shall be taken from the Architect. It shall conform to the relevant IS Code.

67G.2 It shall be used as an excellent cement admixture in all types of concrete/plaster mortars, pointing mortars, masonry works, guniting works and pressure grouting works. It shall improve resistance of concrete surfaces to weathering and chemical attack. It shall be non-toxic so as to use for waterproofing water tanks, reservoirs, bio-gas tank, leaking ceiling, basements, tunnels, lift wells etc.

67G.3 It shall be mixed to concrete or plaster mortar, while mixing. First, water is added and then the admixture, at the rate instructed by the manufacturer. For use of the admixture, precaution shall be taken to use clean materials for preparation of mortar.

M-67F Plaster Admixture:

67F.1 An admixture which gives the plaster workability, durability and quality at an economical rate shall be of best quality from manufacturer like Feb Roffe (product name - Roff plaster master) or equivalent, as approved by the Architect or Engineer-in-charge. It shall comply to the relevant IS Codes.

67F.2 It shall keep the plastering mortar plastic for a longer time, giving higher strength on prolonged curing. It shall provide cohesiveness, workability and eliminate efflorescence. It shall reduce shrinkage, cracking and crazing to the minimum.

M-68 Asbestos Septic Tank:

68.1 It shall be from Everest or equivalent, as approved by the Architect and Engineer-in-charge. It shall be of required size as shown in detailed drawing or as per specified in the item. It shall be of single piece in width and length but if required to match the specified size in depth, not more than four compartments shall be allowed (which includes top and bottom pieces and extension pieces). It shall be made from finest raw materials.

68.2 It shall be free from any joints in side walls, bottom piece, top cover and baffle walls. It shall be of two compartments separated by a baffle wall in a horizontal section. No leakage should be there from joints between pieces, depth wise. The side walls shall be capable of withstanding the earth pressure and the top cover shall be designed to carry the traffic load and surface covering load.

68.3 It shall be air tight and designed to disintegrate the sewage by bacterial action in absence of oxygen gas. It shall contain two inlets (one for regular connection and other for alternative connection) and one outlet. The inlet shall be of 100 mm. dia. and the outlet shall be of 75 mm. dia. All such connection shall be leakproof. Rejected materials shall not be used.

M-69 Asbestos Cement Building Boards:

69.1 Asbestos Cement boards shall be from Everest or equivalent, as approved by the Architect and Engineer-in-charge. It shall be made from blend of high quality asbestos mineral fibre and cement. It shall conform to IS : 2098, amended 1981.

69.2 It shall be light weight, easily workable using ordinary carpentry tools and it shall be strong enough, so as not to be broken or chipped during handling. It shall be durable, flexible, free from rot, rust and shall be termite proof, impervious to weather. It shall not sag, wrap, swell or crack and also satisfy the fireproof requirements. The thermal conductivity value ‘k’ shall be @ 0.214 kcal/hr.m°C. It shall have adequate properties of acoustics, having absorption co-efficient between 0.01 to 0.14 and noise resistance co-efficient @ 0.03.
69.3 It shall be easily jointed using open or butt joint. Its surface shall be easily painted. It shall be of uniform thickness, as specified in detailed drawings or as approved by the Architect.

M-70 Expanded Polystyrene:

70.1 The Expanded Polystyrene shall be from Thermocole, Cooline or equivalent, as approved by the Architect and Engineer-in-charge.

70.2 It shall be processed from styropor expandable polystyrene beads. It shall have lower thermal conductivity, excellent shock absorption, better mechanical strength and high resistance to the moisture. It shall possess good acoustic properties, snow white appearance, and lightness. It shall easily be cut to any shape, size and can be fixed by any mechanical means or adhesives. It shall be painted easily.

70.3 It shall have high, dynamic load bearing capacity, excellent resistance to water vapour. The density of Polystyrene shall be 20-25 kg/m³, having thermal conductivity value 0.025 Kcal/hr m°C. The service temperature range shall be -150°C to +80°C. When soaked in water for 7 days, it shall not absorb water more than 2% by volume. The co-efficient of resistance to water vapour diffusion shall be 40 to 100.

70.4 The compressive strength at 10% deformation and cross breaking strength shall not be less than 1.0 kg/cm² and 1.6 kg/cm² respectively. It shall have resistance to soaps, bleaching agents, dilute acids, alkalies, silicone oil, fresh & sea water, alcohol, liquid paraffin, petroleum jelly etc.

M-71 Phenotherm:

71.1 Phenotherm shall be from Bakelite Hylam or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to BS : 4370 and BS : 3927, wherever applicable.

71.2 It shall have superior fire resistance and thermal conductivity. There shall be no deterioration of K value on ageing, no emission of toxic fumes in an event of fire. It shall have good adhesion to facings and there shall be no shrinkage. It shall conform to the highest fire rating, Class ‘I’ for surface spread of flame, Class ‘P’ for ignitability and Class ‘O’ for building regulations.

71.3 It shall not be flammable and shall retain its shape, during and after fire. It shall generate negligible smoke, so the obscuration shall remain less than 5% and shall emit non-toxic fumes during fire. It shall have K value less than 0.016 Kcal/hr m°C and the working range of temperature shall be -196°C to +130°C. It shall easily be used on LSHS, fuel oil, low pressure steam and hot water lines for containers.

71.4 It shall have the closed cell content not less than 90% to result in very low water absorption, very low water vapour transmission and reduce condensation. It shall be unaffected by most aromatic and aliphatic solvents. It shall be odourless, non-colour absorbent. It shall not attract rodents/insects, resist fungal and bacterial growth, most organic solvents and chemicals. It shall be anti-corrosive, non-abrasive and hydrophobic. It shall possess good acoustical properties and electrical insulation. The density of the Phenotherm shall be 40-50 kg/m³.

M-72 Exfoliated Vermiculite:

72.1 The Vermiculite shall be from Bharat Heat Insulating & Refractory Industries or equivalent, as approved by the Architect and Engineer-in-charge.

72.2 It shall be hydrated laminar natural mineral having, Aluminium-Iron, Magnesium Silicates as content and shall consist of thin flat flakes, containing innumerable microscopic voids and layers. It shall have physical properties like chemical inertness, light weight, fire and rot proofness, porosity, non-abrasive nature, flakiness etc.

72.3 It shall have sintering temperature and melting point about 2300°F and 2400°F, respectively. The specific heat and specific gravity of minerals shall be 0.2 and 2.6, respectively. The mineral should possess pH value of 7.0 and cation exchange rate 90 to 100 milli equivalent per 100 grams. The thermal conductivity K shall be 0.43-0.45 Btu.

72.4 The mineral should be incombustible and capable to withstand temperature upto 1100°C to give effective
insulation. It shall be insoluble and inert to organic solvents having cold crushing strength atleast 250 Psi. The air contraction at maximum service temperature shall be less than 1%.

M-73 Cement Concrete Hollow Blocks :

73.1 Hollow concrete blocks shall be of size such that they can be bonded with brick masonry, if necessary. The blocks are generally referred by their nominal sizes which include the block and an allowance for joints. The nominal sizes are:
   a) 39 x 30 x 19 cm.
   b) 39 x 20 x 19 cm.
   c) 39 x 10 x 19 cm.

The block shall have one or more large holes or cavities which either pass through the block or do not effectively pass through (in case of closed cavity) and shall have the total solid material between 50 to 75% of the total volume of the block, calculated from the overall dimensions. In case of solid blocks, the solid material shall not be less than 75% of the total volume of the block.

73.2 The shell thickness of the blocks shall be not less than 65 mm., in any part, however based on the strength requirements, the thickness can be varied between 20 mm. to 50 mm., as follows:

<table>
<thead>
<tr>
<th>Nominal block face width.</th>
<th>Shell thickness minimum.</th>
<th>Web thickness minimum.</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 or less</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Over 100 to 150</td>
<td>25</td>
<td>25</td>
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<tr>
<td>Over 150 to 200</td>
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<td>25</td>
</tr>
<tr>
<td>Over 200</td>
<td>35</td>
<td>30</td>
</tr>
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</table>

All the above dimensions are in mm.

73.3 The volume of concrete shall not be less than half the gross volume of the block. The total width of the cavities shall not be less than 2/3rd of the overall thickness of the block. The maximum variation in the length of the blocks shall not be more than ± 5 mm. and maximum variation in height and width shall not be more than ± 3 mm.

73.3 Hollow blocks are manufactured by special machines. Casting is done in a single operation. Concrete shall be thoroughly compacted in the moulds with blunt end steel rods or vibrators or by using vibrating tables. Ordinary concrete mix 1:2:4 of very low water/cement ratio is used and shall be mixed as described in the section no. 2.00 of plain and reinforced concrete. Additives or admixtures shall be used such as a) Accelerating, water-reducing and air-entraining admixtures, b) Water-proofing agents, etc. High compressive strength and very dry consistency enables to remove the blocks for curing, immediately after casting. In case of manual compaction, the mixture shall be placed into the mould, in layers of about 50 to 75 mm. and each layer is thoroughly tamped until the whole mould is filled up and struck off level with a trowel. In case of mechanical compaction, the mould shall be filled up to overflow, vibrated or mechanically tamped and struck off level. Steel wire may be embedded in each block while casting. Rapid hardening cement may be used. After demoulding, the blocks shall be protected until they are sufficiently hardened to permit handling without damage. The blocks shall be thoroughly cured for atleast 14 days and shall be dried out for a period of 4 weeks, before placing. They shall be stacked with voids horizontal to facilitate thorough passage of air. The blocks shall be allowed to complete their initial shrinkage before placing. Water absorption shall not be more than 10% by mass.

73.4 Hollow blocks have better thermal properties than solid blocks. Further hollow blocks made from light weight concrete have still better insulation against heat. They shall conform to the following three grades:

Grade A - They shall be used as load bearing units and shall have a min. block density of 1500 Kg/m³. They shall possess min. average compressive strength of 35, 45, 55 and 70 Kg/cm² respectively, for its sub-category, at 28 days.

Grade B - They shall be used as load bearing units and shall have block density less than 1500 Kg/m³, but not less than 1000 Kg/m³. They shall possess min. average compressive strength of 20, 30 and 50 Kg/cm² respectively, for its sub-category, at 28 days.
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Grade C - They shall be used as non-load bearing units and shall have block density less than 1500 Kg/m³, but not less than 1000 Kg/m³. They shall possess min. average compressive strength of 15 Kg/cm². at 28 days.

Grade D - Solid Concrete Blocks - They shall be used as load bearing units and shall have block density not less than 1800 Kg/m³. They shall possess min. average compressive strength of 40 and 50 Kg/cm², respectively, for its sub-category, at 28 days.

73.5 They shall have a variety of surface textures ranging from very fine close texture to a coarse open texture, by proper selection, grading and proportioning of the aggregates. Further the texture shall be developed by treating the surface while the units are still green. Colour shall be rendered by adding non-fading mineral pigments.

73.6 Well made units shall not require plaster, in case of unimportant buildings. Two or three coats of cement paint shall be sufficient to render the masonry resistant to rain water. However, if plaster is intended, the unit shall have a sufficiently rough surface to afford good key to the plaster. Water-proofing admixtures shall be used in the plaster.

M-74 Silicone paint :

74.1 It shall be of the best quality, like Hydroseal - Siliconate Epoxy or equivalent, as approved by the Architect and Engineer-in-charge. It shall conform to the relevant IS Codes.

74.2 It shall be prepared by mixing Silicone and Epoxy. It shall be applied on dry as well as damp surfaces. It shall be non-toxic and odourless, so shall be suitable for drinking water structures also. It shall render the surface impervious to water and shall prevent water penetration. It itself shall penetrate into the structure and shall form a strong film on the pores of the structure surface, making the surface water-tight, non-toxic and erosion free.

74.3 It shall be water thinnable. Before use, the hardener of the Siliconate Epoxy shall be mixed with resin and thinned with water, in the proportions described by the manufacturer. It shall be applied with a suitable spray gun with a fine nozzle. An overlap of 25 to 30 cm. shall be preferred. It shall be semitransparent but on drying it shall become transparent.
1.01.a Excavation in all type of soil and soft rock such as earth, marine clay, running sand, garbage, murrum, rock boulders with pic axe & shovel or mechanical means like hydraulic excavator [by manual or mechanical means] as directed by engineer in charge.
   a. Excavation for Depth 0.0 to 1.5m Depth
   b. Excavation for Depth 1.5 to 3.0 m Depth
   c. Excavation for Depth 3.0 to 4.5m Depth
   d. Excavation for Depth 4.5m to 7.0 m Depth

1.0 General Scope:

1.1 This specification covers the general requirements of earth work in excavation in different materials, site grading, filling in areas as shown in drawing, filling back around foundations and disposal of surplus spoils or stacking them properly as shown on the drawings and as directed by Engineer-In-charge and all operations covered within the intent and purpose of this specification.

1.2 For carrying out earth work excavation in different material, conveyance and disposal of surplus spoils or stacking them properly, contractor shall furnish all tools, plants, instruments, qualified supervisory personnel, labour, materials, any temporary works. Consumables, any and everything necessary, whether or not such items are specifically stated herein for completion of the job in accordance with specification requirements.

1.3 Contractor shall carry out the survey of the site before excavation and set properly all lines and establish levels for various works such as earthwork in excavation for grading, basement, foundations, plinth fillings, roads, drains, cable trenches, pipelines etc. such survey shall be carried out by taking accurate cross sections of the area perpendicular to established reference/grid lines at a 6 metres intervals or nearer as determined by the Engineer-In-charge based on ground profile. These shall be checked by the Engineer-In-charge and therein after properly recorded.

1.4 The excavation shall be done to correct lines and levels. This hall also include, wherever required, proper shoring to maintain excavation and also the furnishing, erecting and maintaining of substantial barricades around excavated areas and warning lamps at night for ensuring safety.

1.5 The rates quoted shall also include for dumping of excavated materials in regular heaps, bunds, and riprap with regular slope as directed by the Engineer-In-charge within the lead specified and leveling the same so as to provide natural drainage. Rock/s soil excavated shall be stacked properly as directed by the Engineer-In-charge. As a rule, all softer material shall be laid along the centre of the heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Rock shall be stacked separately.

2.0 Applicable Codes:

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to.

<table>
<thead>
<tr>
<th>Sr No</th>
<th>IS Code No</th>
<th>Description of IS Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IS : 965</td>
<td>Equivalent metric units for scale, dimensions and quantities in general construction work.</td>
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<tr>
<td>2</td>
<td>IS : 1200 [Part-1]</td>
<td>Method of measurement of building work (Earth work).</td>
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<td>3</td>
<td>IS :2720 [Part-2]</td>
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<td>5</td>
<td>IS :2720 [Part-8]</td>
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<td>8</td>
<td>IS :2720 [Part-29]</td>
<td>Method of test for determination of dry density of Soils by the core cutter method</td>
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</table>
2.1 Clearing the Site:

2.2 The site on which the structure is to be built shall be cleared and all obstructions, loose stones, materials and rubbish of all kind, bush, wood and all type trees shall be removed, as directed. The materials so obtained shall be the property of the Client and shall be conveyed and stacked as directed, within premises as directed by Engineer in Charge. The roots of the trees coming in the sides of the trenches shall be cut and coated with hot asphalt.

2.3 All types of trees, woods etc. which requires prior permission of Govt./Forest Authority, before cutting shall be cut after obtaining such permission from them. It shall be the Contractor's responsibility to obtain such permission from the respective authorities.

2.4 The rate of site clearance is deemed to be included in the rate of earthwork, for which no extra will be paid.

3.0 Setting out:

3.1 After cleaning the site, the centerlines will be given by the Architect and Engineer-in-charge. The Contractor shall assure full responsibility for alignment, elevation and dimension of each and all parts of the work. Contractor shall supply labours, materials, etc. required for setting out the reference marks and bench marks and shall maintain them as long as required and directed.

4.0 Excavation:

4.1 The excavation in the foundation shall be carried out in true line and level and shall have the width and depth, as shown in the drawings or as directed. The Contractor shall do the necessary shoring and strutting or shall provide necessary slopes to a safe angle or steps, as required or directed, at his own cost. No extra payment shall be made for such precautionary measures, taken. The bottom of the excavated area shall be leveled both longitudinally and transversely, as directed, by removing excess soil and watering, as required. No earth filling will be allowed for bringing it to level, if by mistake or any other reason, excavation is made deeper or wider than shown on the drawings or as directed. The extra depth or width shall be made up with concrete of the same proportion, as specified for the foundation concrete, at the cost of the Contractor. The excavation up shall be measured under this item as per given depth classification.

4.2 The Contractor shall at his own expense and without extra charge make provision of supporting all utility services, lighting the trenches, separating and stacking serviceable materials neatly, shoring, timbering, strutting, bailing out water either sub-soil or rainwater, including pumping at any stage of the work. Trenches shall be kept free of water while masonry or concrete works are in progress and till the Architect and Engineer-in-charge considers it necessary, i.e. till the concrete is sufficiently set.

4.3 The rates for excavation items shall include for clearing of site, surface dressing, making layout of building, fixing permanent grid points with MS angle iron posts and embedding them in C.C. 1:2:4, placed sufficiently away from the building lines, establishing bench marks etc. complete.

5.0 Disposal of the Excavated Stuff:

5.1 The excavated stuff of the selected type shall be used in filling the trenches and plinth or leveling the ground in layers, including ramming and watering etc. complete.

5.2 The Contractor shall remove the balance of the excavated quantity from the site of work, to a place, as directed by Engineer in charge.
6.0 Mode of Measurement and Payment :

6.1 The measurement of excavation in trenches for foundation shall be made according to the sections of trenches shown on the drawing or as per sections given by the Architect and Engineer-in-charge. No payment shall be made for surplus excavation made in excess of above requirements or due to stepping and sloping back as found necessary, on account of conditions of soil and requirements of safety.

6.2 The rate shall include for clearing the site, surface dressing, making layout of the building, fixing permanent grid points with MS iron posts, embedded in C.C. 1:2:4, placed sufficiently away from the building and establishing bench marks etc.

6.3 The rates shall include for necessary shoring, timbering and strutting for protection of sides of the excavated trenches and pits, pumping out rain or surface water at any stage of construction so as to keep the trenches/pits dry, to the satisfaction of the Architect/Engineer-in-charge.

6.4 The rate shall include leveling and ramming the bottoms of excavations to receive concrete, etc. including trimming to slope wherever necessary etc. complete.

6.5 In filling and refilling, clods bigger than 50 mm. shall not be allowed. Only consolidated measurements of filling shall be paid. Consolidation to be done by mechanical compactor as per item no. 1.07.

6.6 The rate shall be for a unit of one m³.

1.01.b Excavation in soft rock not requiring blasting complete, as directed.

1.0 Workmanship :

1.0 The relevant specification of item no. 1.01.a shall be followed except that the excavation shall be carried out for foundation as per given lead and lift in soft rock not requiring blasting.

1.1 The excavation in soft or disintegrated rock shall be carried out by crowbars, pickaxes or pneumatic drills or any other suitable means.

1.2 If the Contractor desires to resort to blasting, he can do so after obtaining prior permission from the relevant authorities, Architect and Engineer-in-charge but nothing extra shall be paid to him.

1.3 The materials available from soft rock excavation shall be properly stacked within premises as directed by client and shall be the property of the Client only.

1.4 The classification of strata of the foundation soil shall be done by the Architect and Engineer-in-charge and shall be acceptable to the Contractor.

1.5 However, this shall include the type of rock and boulder, which may quarried or split with crowbars. Laterite and conglomerate also come under this category.

1.01.c Excavation in hard rocks, using blasting and drilling complete, as directed.

1.0 Workmanship :

1.1 The relevant specification of item no. 1.01.a shall be followed except that the excavation for foundation work shall be carried out in hard rock, excluding refilling the trenches.

1.2 Excavation shall be done by blasting to the dimensions shown in the drawings or as directed. Unless otherwise specified, IS: 4081, safety code for blasting and relevant code for drilling operations shall be followed. As far as possible all blasting shall be completed prior to the commencement of construction. At all stages of excavation, precautions shall be taken to preserve the rock below and beyond the lines specified for excavation, in the soundest possible condition. The blasting shall be carried out only with written permission of
the Architect and Engineer-in-charge. The Contractor shall obtain license from Public/District authorities for carrying out the blasting work. All the laws, regulations etc., pertaining to the precautions, acquisition, transport, storage, landing and use of explosives shall rigidly be followed. The rules of explosive 1940 revised from time to time, shall be followed strictly for obtaining and handling the explosive and undertaking the blasting work. Explosives shall be kept dry and shall not be exposed to direct sunrays. Only the required quantity of explosive shall be brought to the site of blasting and the excess left after filling the holes shall be taken back to the magazine. In no case blasting shall be allowed closer than 30 m. to any structure or to locations where concrete has just been placed. In the latter case, the concrete must be at least 7 days old.

1.3 The Contractor shall be responsible for damage to property, workmen and public, due to any accident on use of explosives and blasting operations. The quantity and strength of the explosive used shall be such as will neither damage nor crack the rock outside the limits of excavation.

1.4.0 Precautions:

1.4.1 The blasting operation shall remain in charge of competent and experienced supervisor and workmen of the Contractor, per set of operation, who are thoroughly acquainted with the details of handling explosives and blasting operations. The blasting shall be carried out during fixed hours of the day, preferably during the mid-day/lunch hours or at the close of the work, as ordered in writing by the Architect and Engineer-in-charge. The hours of blasting shall be notified in advance to the people in the vicinity. The engineer in charge shall prepare all the charges only.

1.4.2 Red danger flags shall be displayed prominently in all directions before the blasting operations.

1.4.3 People except those who actually light the fuse shall be prohibited from entering into this area. The flag shall be stationed as much as 200 m. away from the firing site, in all directions and all persons, including workmen shall be excluded from the flagged area, at least 10 minutes before the firing warning whistle being sounded for this purpose.

1.4.4 During excavation in rock by blasting, the lowest 15 cm. of the strata shall be blasted with light charges so as not to shatter or weaken the underlying rock on which the foundation will actually be laid. If excavation in rock is done to larger width and length than those shown on the drawings or as directed, no payment shall be made for such overbreak. If excavation is done to depth greater than shown on the drawings or as directed, excess depth shall be made up with foundation grade concrete, as directed, at the Contractor's cost.

1.4.5 The charged hole shall be drilled to the required depth with pneumatic drills. The drilling pattern shall be such that the rock pieces after blasting shall be suitable for handling without secondary blasting. In dry weather and normal dry excavation, ordinary low explosive like gunpowder may be used. In damp rocks, high explosive like gelatin, dynamite with detonator and fuse wire may be used. Under water or in rocks with substantial accumulated seepage water, electric detonator shall be used. When blasting is done with powder, the fuse shall be cut to the required length and shall be inserted in the holes and the powder dropped in. The powder shall be gently tamped with copper rod with rounded ends or wooden tamping rod with a flat end. The explosive powder shall then be covered with trapping materials, which shall be tamped lightly but firmly. When blasting is done with dynamite and other high explosive, dynamite/explosive cartridges shall be prepared by inserting the square cut ends of fuse into the detonator and finished with dippers at the open ends. The detonator should be gently pushed into the primer leaving 1/3rd of the copper exposed outside. The primer shall be housed into the explosive. Bore holes shall be of such size that the cartridges can be easily passed down. The holes shall be cleared of all debris before the explosive is inserted. A space of about 20 cm. above the charge shall then be gently filled with dry clay, pressed home and the rest of the tampering is firmed with any convenient materials gently packed with a wooden cover.

1.4.6 At a time, not more than 20 nos. of such charges shall be prepared and fired. The man in charge shall blow a whistle, in a recognized manner, for cautioning the people. All the people shall then be required to move at safe distances. The charges shall be lighted, preferably electrically, by the engineer-in-charge only. The man in charge shall count the number of explosions. He shall satisfy himself that all the charges have been exploded before allowing the workmen to go to the work site.

1.4.7 The Contractor shall be fully responsible to strictly follow the prevailing rules and procedures regarding blasting procedures. When blasting is done near any existing building or any other property, it shall be done under cover and the Contractor shall make all necessary muffling arrangements. Covering may be preferably
done with MS plate with adequate dead weight over them. Blasting shall be done with small charges only and where directed, a trench shall have to be cut by chiseling prior to the blasting operation, separating the area under blasting from the existing structures.

1.4.8 When excavation has almost reached the desired level, hand trimming shall be done for dressing the surface to the desired level. Any rock excavation beyond the limit of 75 mm. shall be filled up as directed by the Engineer-in-charge, with concrete of grade not less than M-150. The cost for the same shall be borne by the Contractor. Stepping in rock shall be done by hand trimming.

1.5 Misfire:

1.5.1 In case of a misfire, the following procedure shall be observed.

1.5.1.1 Sufficient time shall be allowed to account for the delayed blast. The man in charge shall inspect all the charges and determine the missed charge.

1.5.1.2 If it is the blasting powder charge, it shall be completely flooded with water. A new hole shall be drilled at about 45 cm. away from the misfired bore. This should blast the old charge. If it will not blast the old charge, then the above procedure shall be repeated till the old charge is blasted.

1.5.1.3 In case of charge of gelatin, dynamite etc., the man in charge shall gently remove the tamping and the primer with detonator. A fresh detonator and primer shall then be used to blast the charge. Alternatively, the hole may be cleared off for one foot of tamping and the direction of it shall then be ascertained by placing a stick in the hole. Another hole shall then be drilled 15 cm. away and parallel to it. This hole shall then be charged and fired so that the misfired hole should explode at the same time. The man in charge shall report to the office at once for all cases of misfire, the cause of the same and what steps were taken in connection therewith.

1.5.1.4 If a misfire has been found due to a defective detonator or dynamite, the whole quantity in the box from which defective article was taken must be sent to the authority, as directed for inspection to ascertain whether all the remaining materials in the box are also defective or not.

1.6 Accidents: The Contractor shall be solely responsible for any accident during the entire procedure of handling explosive and blasting and shall pay necessary compensation to persons affected or damage to lands or property etc., due to the blasting without extra claims on the Client.

1.7 Account: A careful and day-to-day account of explosive shall be maintained by the Contractor, in an approved manner and shall be open to inspection of the Architect and Engineer-in-charge, at all times. Surprise visit may also be paid by the Architect and Engineer-in-charge, to the storage and in case of any unaccountable shortage or unsatisfactory accounting, the Contractor shall be liable to be penalized by forfeiture of part or whole of his security deposit or by cancellation of tender in which case he shall not be entitled for any compensation.

1.8 Disposal of Excavated Materials:

1.8.1 No materials excavated from foundation trenches of whatever kind they may be, are to be placed even temporarily nearer than 1.5 m. from the distance prescribed by the Architects or engineer-in-charge, from the outer edge of excavation. All materials excavated shall remain the property of the Client. The rate for excavation includes sorting out of useful materials and stacking them separately as directed within the specified lead. Materials suitable and useful for back filling or other use shall be stacked in convenient places but not in such a way as to obstruct free movement of men, animals and vehicles or encroach upon the area required for constructional purpose. The site shall be left clean of all debris on completion.

1.8.2 Disposal of excavated materials is subject to the following:

1.8.2.1 Unsuitable materials obtained from clearing site and excavation shall be disposed off within a lead of 50 m., as directed. Useful materials obtained from clearing site and excavation shall be stacked within a lead of 50 m., beyond the building, as directed. Materials suitable for back filling shall be stacked at convenient places within a lead of 50 m. from the structure for reuse. Useful stones from rock excavation shall be stacked neatly within a lead of 50 m. and will be allowed to be used by the Contractor, on payment at rates laid down in the contract or if not so paid down, at a mutually agreed rates.
1.8.3 If surplus materials are required to be conveyed beyond 50 m., conveyance will be paid for under a separate item.

2.0 Mode of Measurements and Payment:

2.1 The work shall be measured for the work limited to the dimensions shown on drawings or as directed. Excavation to dimensions in excess of the above will not be measured or paid for and if so ordered by the Architect or Engineer-in-charge, the Contractor shall have to fill up the excess depth with cement concrete specified for foundation, without extra payment.

2.2 Driving of sounding bards, drill holes to explore the nature of substratum up to a total length of meter, distributed in two or three places, in each foundation, if necessary, will be considered incidental work and will not be paid for separately. Shoring and strutting shall be provided, as demanded by the site conditions.

2.3 Removal of slips and blows in the foundation trenches will not be measured or paid for.

2.4 If it is necessary in the opinion of the Architect or Engineer-in-charge, to carry the foundation below the levels shown on the plans, the excavation for the first 1.5 m. of additional depth will be included in the quantity for the particular classification and will be paid for as extra work, at rate to be decided under the general conditions of contract, unless the Contractor is willing to accept the payment at tendered rates.

2.5 The rate shall be for an unit of one m$^3$.

1.02 Providing and Filling with selected good quality murrum soil brought from outside for trenches, sides of the foundations, plinth & plot etc.

1.0 Workmanship:

1.1 Murrum or selected earth brought from outside shall be clean, of good binding quality and of approved quality obtained from approved pots/quarries of disintegrated rocks which contain silicones materials and natural mixture of clay of calcareous origin. The size of murrum shall not be more than 20 mm. and shall be approved by the Engineer-in-charge, before use. It shall conform to M-64.

1.2 As soon as the work in foundation has been completed and measured, the sides of foundation shall be cleared of all debris, brick bats, mortar dropping etc. and filled with earth in layers not exceeding 15 cm. Each layer shall be adequately watered, rammed well and consolidated before the succeeding layer is laid. The earth shall be rammed with mechanical rammer of different capacity as per site condition.

1.3 The plinth shall be similarly filled with earth in layers not exceeding 20 cm., adequately watered and consolidated by ramming with iron rammers. When filling reaches finished level, the surface shall be flooded with water for atleast 24 hours and allowed to dry and then rammed and consolidated.

1.4 The finished level of filling shall be kept to shape and gradient, intended to receive any floor finish.

1.5 In case of large heavy duty flooring like factory flooring, the consolidation may be done by power rollers, where so specified or as directed. The extent of consolidation required shall also be as specified or as directed.

1.6 The excavated stuff of the selected type only shall be allowed to be used for filling the trenches and plinths. Under no circumstances, black cotton soil shall be used for filling the plinths.

2.0 Mode of Measurements and Payment:

2.1 The payment shall be made for filling in plinth and sides of foundations. No deductions shall be made for shrinkage or voids, if considered as instructed above. Only consolidated measurements shall be paid.

2.2 The rate includes the cost of mechanical compaction by compactors.
2.3 The rate shall be for an unit of one m$^3$.

1.03 Filling / Backfilling with Excavated Earth

1.1 All fill material will be subjected to the approval of Engineer-In-charge. If any material is rejected by the Engineer-In-charge the contractor shall remove the same forthwith from the site at no extra cost to the owner. Surplus fill material shall be deposited / disposed off as directed by the Engineer-In-charge after the fill work is complete.

1.2 No earth fill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with as directed by the Engineer-In-charge.

1.3 To the extent available selected surplus spoils from excavated materials shall be used as backfill. Fill material shall be free from clods, salts, sulphates, organic or other foreign material. All clods of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150 mm size, mixed with properly graded fine material consisting of murrum or earth to fill up the mixture used for filling.

1.4 If any selected fill material is required to be borrowed, contractor shall make arrangements for bringing such material from outside borrow pits. The material and source shall be subject to prior approval of the Engineer-In-charge. The approved borrow pit area shall be cleared of all bushes, roots of trees, plants, rubbish etc. Top soil containing salts/ sulphates and other foreign material shall be removed. The materials so removed shall be burnt or disposed off as directed by the Engineer-In-charge. The contractor shall make necessary access roads to borrow areas and maintain the same at his own cost if such access road does not exist.

1.5 As soon as the work in foundations has been accepted and measured the spaces around the foundations, structures, pits, trenches etc. shall be cleared of all debris and filled with selected/ approved earth in layers not exceeding 150 mm each layer being watered, rammed and properly consolidated before the succeeding one is laid. Each layer shall be consolidated to the full satisfaction of the Engineer-In-charge. Filled earth shall be rammed with approved compaction method. Usually no manual compaction shall be allowed unless the Engineer-In-charge is satisfied that in some cases manual compaction by tampers cannot be avoided. The final back-fill surfaces shall be trimmed and leveled to proper profile as directed by the Engineer-In-charge of indicated on the drawings.

1.6 Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipes and drains have been tested and approved by the Engineer-In-charge. The backfilling material shall be properly consolidated by watering and ramming taking due care that no damage is caused to the pipes.

1.7 Where the trenches are excavated in soil the filling from the bottom of the trench to the level of the centre line of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 80 mm. Backfilling above the level of the centre line of the pipe shall be done with selected earth by hand compaction or other approved means in layers not exceeding 150 mm.

1.8 In case of excavation of trenches in rock the filling upto a level 300 mm above the top of the pipe shall be done with fine materials such as earth, murrum etc. The filling upto the level of the centre line of the pipe shall be done by hand compaction in layers not exceeding 80 mm whereas the filling above the centre line of the pipe shall be done by hand compaction or approved means in layers not exceeding 150 mm. The filling from a level 300 mm above the top of the pipe to the top of the trench shall be done by hand or other approved mechanical methods with broken rock filling of size not exceeding 150 mm mixed with fine material as available to fill up the voids.

1.9 The filling in the trenches shall be carried out simultaneously on the sides of the pipe to avoid unequal pressure on the pipes.

1.10 Plinth filling shall be carried out with approved material as described hereinbefore in layers not exceeding 150 mm watered and compacted mechanically. The Engineer-In-charge may however permit manual compaction by hand tampers in case he is satisfied that mechanical compaction is not possible. When filling reaches the finished level the surface shall be flooded with water for at least 24 hours unless otherwise directed by the Engineer-In-charge. The surfaces shall then be allowed to dry and again compacted as specified above to avoid settlements at the later stage. The finished level of the filling shall be trimmed to specified the level, slope etc.

1.11 Site grading shall be carried out as indicated in the drawings and as directed by the Engineer-In-charge. Any excavation/ filling for site grading shall be carried out as specified in the specifications given above unless otherwise indicated below.
1.11.a If no compaction is called for the fill may be deposited to the full height in one operation and leveled. If the fill has to be compacted, it shall be placed in layers not exceeding 225 mm and leveled uniformly and compacted as indicated in the specifications given above before the next layer is deposited.

1.11.b To ensure that the fill has been compacted as specified, if required field and laboratory tests shall be carried out by owner.

1.11.c Field compaction test shall be carried out at different stages of filling and also after the fill to the entire height has been completed. This shall hold good for embankment as well.

1.11.d The contractor shall protect the earth fill from being washed away by rain or damaged in any other way. If any slip occurs the contractor shall remove the affected material and make good the slip at his own cost.

1.11.e The fill shall be carried out to such dimensions and levels as indicated on the drawings after the stipulated compaction. The fill will be considered as incomplete if the desired compaction has not been obtained.

1.11.f If specifically permitted by the Engineer-In-charge compaction can be obtained by allowing loaded trucks conveying fill or other material to ply over the fill area. Even if such a method is permitted, it will be for contractor to demonstrate that the desired/ specified compaction has been obtained. In order that the fill may be reasonably uniform throughout the material should be dumped in place in approximately uniform layers. Traffic over the fill shall then be so routed to compact the area uniformly throughout.

1.11.g If so specified the rock as obtained from excavation may be used for filling and leveling to indicate grades without further breaking. In such event filling shall be done in layers not exceeding 500 mm approximately. After rock filling to the approximate required level the void in the rocks shall be filled with finer material such as earth, broken stone etc. and area flooded so that be taken to ensure that the finer fill material does not get washed out. Over the layer so filled a 100 mm thick mixed layer of broken material and earth shall be laid and consolidated to the full satisfaction the Engineer-In-charge.

1.04 Filling, in foundation and plinth (under floors), with good quality sand, obtained from outside, including watering, ramming well, consolidating and dressing etc. complete, as directed.

1.0 Materials: Sand shall conform to M-6.

2.0 Workmanship:

2.1 The relevant specification of item no. 1.07 shall be followed except that sand shall be filled in foundations and in plinth, under floors, including watering, ramming well, consolidating and dressing etc., complete.

2.2 At some of the places backfilling may have to be carried with local sand if directed by the Engineer-In-charge. The sand used shall be clean, medium grained and free from impurities. The filled in and sand shall be kept flooded with water for 24 hours to ensure maximum consolidation. Any temporary work required to contain sand under flooded condition shall be to the contractor's account. The surface of the consolidated sand shall be dressed to required level or slope.

3.0 Mode of Measurements and Payment:

3.1 The relevant specification of item no. 1.07 shall be followed.

3.2 The rate includes cost of collecting, carting good quality sand, with all lead, lift and labour for filling the same in foundations and in plinth, mechanical compaction.

3.3 The rate shall be for an unit of one m³.

1.05 Filling, with good quality cinder concrete of 1:4:8 (1 cement, 4 sand, 8 concrete), as and where directed by the Architect and Engineer-in-charge, in sunks in layers of 15 cm. thickness, including watering, ramming well etc. complete, as directed.

1.0 Materials:

1.1 Cinder shall be of best quality and shall conform to latest relevant IS specifications.
1.2 All relevant specification of item no. 1.07 shall be followed same except that cinder shall be used instead of excavated earth.

1.06 Providing and laying rubble soling, 23 cm. Thick (compacted), in plinth and for plinth protection, using 100 to 150 mm. cut size stones, covering and leveling the surface with a layer of murrum after filling the voids with smaller sized stones 20-40mm, 40-63mm, 63-90mm, 90-150 mm (i.e. Graded stone) size of stone/metals or stone chips, including watering, ramming well and consolidating each layer by roller.

1.0 Materials:

1.1 Stone and stone chips shall conform to M-16 and Murrum brought from outside shall be clean, of good binding quality, and of approved quality obtained from approved pots/quarries of disintegrated rocks which contain silicones materials and natural mixture of clay of calcareous origin. The size of murrum shall not be more than 20 mm. and shall be approved by the Engineer-in-charge. It shall conform to M-64.

2.0 Workmanship:

2.1 The relevant specification of item no. 1.02 shall be followed except that first layer of stone, of average size 100 to 150 mm. shall be laid in plinth and for plinth protection. Thereafter, the voids between the stones laid in the first layer shall be filled by hand packing the stones of smaller size or stone chips of the same stones, as directed. The voids shall be filled with 20-40mm, 40-63mm, 63-90mm size of stones. The layers then shall be rammed well and consolidated.

2.2 The surface of the stone layer then shall be covered and leveled with a layer of murrum. This shall then be watered and well consolidated using power driven rammers or rollers, as directed. The consolidated thickness of the above layers, totally, should be average 15 cm. thick.

3.0 Mode of Measurements and Payment:

3.1 The relevant specification of item no. 1.02 shall be followed.

3.2 The rate includes the cost of collecting, carting stones and murrum, with all leads, lifts and labour for laying, hand packing and consolidating the same in plinth.

3.3 The rate shall be for an unit of one m³.

1.07 PRE CONSTRUCTIONAL ANTI TERMITE TREATMENT

1.0 Scope:
The specification covers the general requirement of Anti Termite Treatment constructional Measures, chemical treatment of soils for the protection of buildings from attack by subterranean termites, chemicals to be used with their minimum rates of application and procedure to be followed while the building is under construction.

2.0 Applicable Codes and Specification

The relevant I.S specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all applicable amendments, revisions and additional publications. In case of discrepancy between this specification and those referred to herein, this specification shall govern.

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3.0 General:

3.1 Pre-constructional anti-termite treatment is a process in which soil treatment is applied to a building in early stages of its construction. The purpose of anti-termite treatment is to provide the building with a chemical barrier against the subterranean termites.

3.2 Anti-termite treatment being a specialized job, calls for thorough knowledge of the chemicals, soils, termite to be dealt with and the environmental conditions. In order to give effective treatment and lasting protection to the properly underground treatment. It is, therefore, imperative that the works of anti-termite treatment should be got executed through specialized agencies only. The specialized agency should be preferably a member of the Indian Pest Control Association and shall have sufficient experience of carrying out similar works of magnitude envisaged in this tender.

3.3 The pre-constructional soil treatment is required to be applied during the construction stages of the sub-structure up to plinth level. The contractor has to be watchful of the various stages of sub-structure works and arrange to carry out the soil treatment in time after proper co-ordination with department and other contractors if any, working at site.

3.4 Contractor shall furnish all tools, plants, instruments, qualified supervisory personnel, materials, any temporary works, consumables and everything necessary whether or no such items are specifically stated herein for completion of the job in accordance with the specification requirements.

3.5 Contractor shall take shall all necessary precautions to prevent any accident in connection with the performance of the works.

3.6 On final completion of all works, contractor shall leave the entire premises within the site of his operation clean and free from all rubbish resulting from his operation.

3.7 No work shall be carried out under unsuitable weather conditions i.e when railing or when the soil is wet due to rain or sub soil weather.

3.8 Chemical shall be brought to site of work in sealed containers. The material shall be brought in, at a time, in adequate quantity to suffice for the works. The material shall be kept in cool and locked stores. The empties shall not be removed from the site till the relevant item of work has been completed and permission granted by the owner / Engineer.

3.9 Chemicals available in concentration forms with concentration indicated on the sealed containers only shall be used. Chemicals shall be diluted in the water in required quantity before use, using graduated containers to achieve the desired percentage of concentration.

3.10 Unless otherwise stipulated, the anti-termite treatment will be carried out as per I.S 6313 (Part-II) and / or as per direction of the Engineer-in-Charge.

4.0 Site Preparation:

4.1 In order to ensure uniform distribution of the chemical emulsion and to assist penetration, the following site preparation shall be carried out:

4.1.1 Remove all trees, stumps, logs or roots from the building site

4.1.2 Remove all concrete formwork if left anywhere, leveling pegs, timber off cuts and other building debris from the area to be treated.

4.1.3 If the soil is to be treated is sandy or porous, preliminary moistening will be required to fill capillary spaces in and in order to prevent the loss of emulsion through piping or excess percolations.
4.1.4 In the event of water logging of foundation, the water shall be pumped out before application of chemical emulsion and it should be applied only when the soil is absorbent.

4.1.5 All sub-floor leveling and grading should be completed, all cutting, trenches and excavation should be completed with backfilling in place. Borrowed fill must be free from organic debris and shall be well compacted. If this is not done, supplementary treatments should be made to complete the barrier.

5.0 Chemical to Be Used:

The effectiveness of chemical depends upon the choice of the chemical, the dosage adopted and the thoroughness of application. The chemical solutions or emulsions are required to be spread uniformly in the soil and to the required strength so as to form an effective chemical barrier that is lethal and repellent to termites.

6.0 Mode and Rate of Application:

The chemical emulsion as stated above will be applied uniformly by spraying at the prescribed rates as detailed below in all the states of the treatment.

6.1 Treatment in Foundation Trenches

6.1.1 In case of normal wall load bearing structure, column pits, wall trenches and basement, the treatment shall be @ 5 (five) liters per square metre of surface area of the bottom and sides to a height of at least 300 mm. After the foundation works, the sides shall be treated @ 15 (fifteen) liters per square metre at vertical surface of sub-structure on each side.

6.1.2 After the earth filling is done, treatment shall be done by rodding the earth at 150 mm center to center close to wall surface and spraying the chemical with the above dose i.e., 15 (fifteen) litres per square metre. In case of framed structure, the treatment shall start at a depth of 500 mm below ground level. From this depth the backfill around the columns, beams and R.C.C basement walls shall be treated @ 15 (fifteen) litres per square metre of the vertical surface and @ 5 (five) litres per square metre for the horizontal surface at the bottom in the trenches/pits.

6.2 Treatment on Top Surfaces of Plinth Filling:

6.2.1 The chemical treatment shall be carried out when the surface is quite dry. Chemical treatment shall not be carried out when it is raining or when the soil is wet with rain water or sub soil water. The top surface of the filled earth within plinth walls shall be treated with chemical emulsion at the rate of 5 (five) litres/square metre of the surface area before sub-base to floor is laid. If filled earth has been well rammed and the surface does not allow the emulsion to seep through; holes up to 50 mm to 75 mm deep 150mm centre to centre both ways shall be made with crowbars on the surface to facilitate saturation of the soil with the emulsion.

6.3 Treatment on Junction of Walls and Floors:

6.3.1 Special care shall be taken to establish continuity of the vertical chemical barrier on the inner wall surfaces from the finished ground level (or from level where the treatment had stopped) up to the level of the filled earth surface. To achieve this a small channel 30 x 30 mm shall be made at all the junctions of wall / column with floor (before laying sub-grade) and rod holes made in the channel up to the finished ground level at 150 mm apart and the iron rod moved backward to forward to break the earth and chemical emulsion poured along the channel @ 15 (fifteen) litres (or as recommended quantity) per square metre of the vertical wall / column surfaces so as to soak the soil right up to the bottom. The soil shall be tamped back into place after this operation.

7.0 Precaution During Treatment:

7.1 Utmost care shall be taken to see that the chemical barrier is complete and continuous. Each part of the area shall receive the prescribed dosage of chemical emulsion.

7.2 The treatment should not be carried out when it is raining or when the soil is wet with rain or sub-soil water.

7.3 Once formed, the treated soil barrier shall not be disturbed. If by chance, treated soil barriers are disturbed,
immediate steps shall be taken to restore the continuity and completeness of the barrier system.

8.0 Precaution For Health Hazards and Safety Measures:

8.1 All the chemicals mentioned above are poisonous and hazardous to health. These chemicals can have an adverse effect upon health when absorbed through the skin, inhaled as vapors or spray mist or swallowed. Persons handling or using these chemicals should be warned of these dangers and advised that absorption through the skin is the most likely source of accidental poisoning. They should be cautioned to observe carefully the safety precautions given below particularly when handling these chemicals in the form of concentrates.

8.2 These chemicals are usually brought to the site in the form of emulsifiable concentrates. The containers should be clearly labeled and should be stored carefully so that children and pets cannot get at them. They should be kept securely closed.

8.3 Particular care should be taken to prevent skin contact with concentrates. Prolonged exposure to dilute emulsions should also be avoided. Workers should wear clean clothing and should wash thoroughly with soap and water especially before eating and smoking. In the event of severe contamination, clothing should be removed at once and the skin washed with soap and water. If chemicals splash into the eyes, they shall be flushed with plenty of soap and water and immediate medical attention should be sought.

8.4 The concentrates are oil solutions and present a fire hazard owing to the use of petroleum solvents. Flames should not be allowed during mixing.

8.5 Care should be taken in the application of soil toxicants to see that they are not allowed to contaminate wells or springs, which serve as sources of drinking water.

9.0 Form Of Guarantee Bond

9.1 "I/We ......................(Contractor) hereby guarantee that work will remain unaffected and will not be in any way damaged by termite or any other germs of similar types, for a period of 10 years after completion of the work of anti-termite, as per the terms and conditions of the contract and the Contractor hereby indemnifies and agrees to save the Client from any loss and or damage that might be caused on account of termite and or other similar type of germs and hereby guarantees to make good any loss or damages suffered by the Client and further guarantees to redo the affected work without claiming any extra cost."

9.2 This guarantee shall remain force for the period of 10 years, from the completion of the work under the contract and it shall remain binding to the Contractor for period of 10 years.

9.3 The deposit at the rate of 50% of the cost of this item from the running and final bills shall be recovered and retained for the first one year after virtual completion of the work.

10.0 Mode of Measurements and Payment:

10.1 The payment will be made on the basis of plinth area measurements at ground floor only for all the stages of treatment in square metre rounded off to two places of decimals.

10.2 Rate includes the cost of materials, labour and all tools, consumables, spares for complete operation.
2.01.a SPECIFICATION FOR BORED CAST-IN-SITU R.C.C PILES

1.0 Scope:
1.1 This specification covers construction of load bearing concrete bored cast-in-situ piles of appropriate diameter which can transmit the load of the structure to the soil by both resistance developed at the tip by end bearing and along the surface of the pile shaft by friction.

1.2 Tenderer shall be responsible for the construction of the entire pile foundation system as proposed by the Department in its tender drawing and schedule and shall guarantee the stability of the pile foundation system offered against the risks of settlement and other type of damage to the structure.

1.3 The Tenderer shall submit his offer as per Department's schedule of work, specifications and drawings.

2.0 Equipment and Accessories:
2.1 The equipment and accessories shall depend on the type of bored cast-in-situ piles chosen for the job and shall be selected giving due consideration to the sub-soil strata, ground water conditions, type of founding materials and the required penetration, manner of operation etc. For Bored cast-in-situ piles percussion boring by suitable drilling rigs using direct mud circulation (DMC) methods is to be adopted and the size of the cutting tool shall not be less than the diameter of the pile by more than 75 mm. Bentonite shall be used as drilling mud and its basic properties shall conform to Appendix - 'A' of I.S. 2911 (Part/Section-2) (LR). Tremie shall be used for placing concrete into the bore holes.

3.0 General Consideration:
3.1 The construction of pile foundation shall be in such a way that the load from the structure it supports, can be transmitted to the soil without causing any soil failure & without causing such settlement, differential or total under permanent transient loading as may result in structural damage and/or functional distress to the buildings.

3.2 When working near the existing structures, any damage to such structures shall be made good at no extra cost to the Department. The contractor shall, therefore, take adequate care to avoid any damage to the existing structures.

3.3 In case of deep excavations adjacent to piles proper shoring or other suitable arrangement shall be done at no extra cost to the Department to guard against the lateral movement of soil or releasing the confining soil stress.

3.4 As per loading details. piles will be required to withstand vertical load axial or otherwise and horizontal load associated with moments. Axial load from a pile should be transmitted to the soil through skin friction along the shaft and end-bearing at its tip. A horizontal load shall be transmitted to the sub-soil by horizontal sub-grade reaction generated in the upper part of the pile shaft.

3.5 Coarse Aggregate Fine Aggregate & Water:
3.5.1 Coarse aggregate fine aggregate and water shall conforming to IS 456 (L.R) and I.S 383 (L.R).

3.5.2 Concrete: Concrete to be used for the pile shaft shall be as specified. Materials and method of manufacture for cement concrete shall, in general, be in accordance with the method of concrete under the condition of pile installation. Consistency of concrete mix for cast-in-situ piles shall be suitable to the method of installation of piles. Concrete mix shall be so designed as to have a homogeneous mix having a flowable character consistent with the method of concreting of pile. The slump of concrete shall range between 150 to 180 mm depending on the method/manner of concreting. Minimum cement content shall be 400 kg per cubic metre. In case of piles where concreting is done under water or drilling mud using methods other than tremie 10% extra cement over that required for the design grade of concrete at specified slump shall be used subject to minimum quantities of cement specified above. Cost of excess cement over the minimum quantity specified shall be borne by the contractor. For mix design, manufacture, placing etc. specification for cement concrete given hereinafter shall be referred.
4.0 Workmanship:

4.1 Control of piling installation: Bored cast-in-situ piles shall be installed by employing suitable drilling rigs using a combination of bailer and a suitable chisel with DMC method. Bore hole shall be stabilized by bentonite as drilling mud and concreting shall be done by use of tremie only.

4.2 Control of Alignment: Piles shall be installed as accurately as possible as per the designs and drawings. Greater care should be exercised in respect of installation of single pile or piles in two pile groups. The piles shall be installed vertically with tolerance as stipulated by IS: 2911 (Part-1/Section-2) (Latest revision). Piles shall not deviate by more than 75 mm or D/6 whichever is less in case of piles having diameter less than 600 mm, 75 mm or D/10 whichever is more in the case of piles having diameters more than 600 mm from their designed positions at the working level. In the case of a single pile in a column, positional tolerance should not be more than 50 mm or D/6 whichever is less (100 mm in case of piles having diameter more than 600 mm). In case of piles deviating beyond these limits, contractor shall carry out necessary remedial measures duly approved by the Department at no extra cost. Piles that are deviated to such an extent that the resulting eccentricity cannot be taken care of by redesign of the pile cap or plinth beams, the piles should be replaced or supplemented by one or more additional piles at no extra cost to the Department.

4.3 A minimum length of two/three metres of temporary guide casing up to piling platform shall be inserted in each bored pile after completion of bailer driving. Additional length or temporary casing may be used depending on the condition of the strata, ground water level etc.

4.4 Founding level: The bore hole shall be advanced by chisel and direct mud circulation method after installation of guide casing till the required founding level is reached. The founding level shall be as per the drawings and as directed by the Engineer-in-Charge.

4.4.1 In case, drilling mud within the hole stabilizes a bored pile, the bottom of the hole shall be cleaned very carefully before concreting work is taken up. The cleaning of the hole shall be ensured by careful operation of boring tool and/or flushing of the drilling mud through the bottom of the hole by tremie for half an hour minimum.

4.4.2 In case, a hole is bored by use of drilling mud, the specific gravity of the mud suspension near about the bottom of the hole shall, wherever practicable, be determined by suitable, slurry sampler and recorded. Consistency of the drilling mud suspension shall be controlled throughout the boring as well as concreting operations in order to keep the hole stabilized as well as to avoid concrete getting mixed up with the thicker suspension of the mud. The concreting operations should not be taken up when the specific gravity of Bentonite slurry is more than 1.2.

4.4.3 In addition to the normal precautions to be taken in tremie concreting, the following requirements shall be applicable to the use of tremie concrete in piles:

4.4.3.1 The concrete should be coherent, rich in cement (not less than 400 kg/cum) & of slump not less than 150mm.

4.4.3.2 When concreting is carried out under water, a temporary casing should be installed to the full depth of the bore hole or 2 to 3 M into the top stratum, so that fragments of ground cannot drop from the sides of the hole into the concrete as it is placed.

4.4.3.3 The hopper & tremie should be a closed system embedded in the placed concrete, through which water can’t pass.

4.4.3.4 The first charge of concrete should be placed with a sliding plug pushed down the tube ahead of it 01 with a steel plate of adequate charge to prevent mixing of concrete and water. However, the plug should not be left in the concrete as a lump.

4.4.3.5 The tremie pipe should always penetrate well into the concrete with an adequate margin of safety against accidental withdrawal of the pipe is surged to discharge the concrete.

4.4.3.6 The pile should be concreted wholly by tremie and the method of deposition should not be changed part way up the pile, to prevent the laitance from being entrapped within the piles.
4.4.3.7 All tremie tubes should be scrupulously cleaned after use.

4.4.3.8 Normally concreting of the piles should be uninterrupted. In the exceptional case of interruption of concreting, but which can be resumed within 1 or 2 hours, the tremie shall not be taken out of the concrete. Instead it shall be raised and lowered slowly, from time to time to prevent the concrete around the tremie from setting. Concreting should be resumed by introducing a little richer concrete with a slump of about 200 mm for easy displacement of the partly set concrete.

4.4.3.9 If the concreting cannot be resumed before final set of concrete already placed, the pile so cast may be rejected.

4.4.3.10 In case of withdrawal of tremie out of the concrete either accidentally or to remove a choke in the tremie may be reintroduced in the following manner to prevent impregnation of laitance or scum lying on the top of the concrete already deposited in the bore.

4.4.3.11 The tremie shall be gently lowered on to the old concrete with very little penetration initially. A vermiculite plug should be introduced in the tremie. Fresh concrete of slump between 150mm and 175 mm should be filled in the tremie, which will push the plug forward and will emerge out of the tremie displacing the laitance/scum. The tremie will be pushed further in steps making fresh concrete sweep away laitance/scum in its way. When tremie is buried by about 60 to 100 cm, concreting may be resumed.

4.4.3.12 During installation bored cast-in-situ piles, the convenience of installation may be taken into account while determining the sequence of piling in a group.

4.4.3.13 The top of concrete in a pile shall generally be brought above the cut-off level, up to ground level to permit removal of all laitance and weak concrete before capping and to ensure good concrete at the cut-off level for proper embedment into the pile cap. When concrete is placed by tremie method, concrete shall be cast to the piling platform level at ground level to permit overflow of concrete for visual inspection.

4.5 Defective Pile: In case defective piles are formed, they shall be removed or left in place whichever is convenient without affecting, performance of the adjacent piles or the cap as a whole without any extra cost to the Department. Additional piles shall be provided to replace them as directed.

4.5.1 Any deviation from the designed location alignment or load capacity of any pile shall be noted and adequate measures taken well before the concreting of the pile cap and plinth beam if the deviations are beyond the permissible limit.

4.5.2 During chipping of the pile top manual chipping maybe permitted after three days of pile casting, pneumatic tools for chipping shall not be used before seven days after pile casting.

4.5.3 After concreting the actual quantity of concrete shall be compared with the average obtained from observations actually made in the case of a few piles initially cast. If the actual quantity is found to be considerably less, special investigations shall be conducted and appropriate measures taken.

5.0 Routine Load Test:

5.1 The contractor shall be required to carry out routine load tests as directed by the Engineer-in-charge on an individual pile or on a group of piles or on both. The routine load tests shall be carried out generally as per IS 2911 (part-IV) - 1985. Report on routine load tests shall be submitted in an approved format for Department’s approval at no extra cost. In case the tests on the routine piles reveal safe capacity less than specified, the contractor shall, at his own cost, provide suitable modifications to the pile or other remedial measures after obtaining approval of the Engineer-in-Charge. In case of an unsatisfactory results being revealed on any routine tests it shall be the contractor’s responsibility to carry out additional routine tests, at his own cost till the criteria laid down are fulfilled.

5.2 Rate for routine load test shall be inclusive of providing ken ledges, making other arrangements for the test loading platforms, providing tools and plants, equipments like hydraulic jack, dial gauges etc. other measuring instruments and all labour involved in carrying out tests. Cost of pile shall, however, be paid for by the Department at the rates accepted in the tender since the piles are working piles.

6.0 Pile Integrity Test:

6.1 General:
6.1.1 Pile Integrity Testing (PIT) is a Non-Destructive integrity test method for foundation piles. It is a “Low Strain” Method (since it requires the impact of only a small hand-held hammer). The evaluation of PIT records is conducted either according to the Pulse-Echo (or SonicEcho —a time domain analysis) or the Transient Response (frequency domain analysis) Procedure. This test is standardized by ASTM D5882 Standard Test Method for Low Strain Impact Integrity Testing of Deep Foundations.

6.2 Description of Method:

6.2.1 Low Strain Integrity Testing may be applied to any concreted pile (e.g. concrete piles, drilled shafts, augured cast-in-place piles, concrete filled pipe piles). The test requires the impact of a small hand held hammer on the shaft top and the measurement of the shaft top motion (acceleration or velocity). The input compression wave from the hammer is reflected from pile toe (or a change in cross sectional area or pile material quality) and returns to the pile top at a time related to the speed of travel of the wave in the pile material.

6.2.2 The pile top velocity is displayed as a function of time with an exponentially increasing magnitude such that the pile toe reflection is enhanced. The averaged, amplified velocity, averaged for several impacts, is the standard result of the Pulse Echo Method. The force as a function of time, if available, provides additional information as to the pile quality near the pile top.

6.2.3 The Transient Response Method result shows the ratio of velocity to force transforms for all relevant frequencies in a plot called Mobility. It should be shown together with the related low frequency pile stiffness. Transient Response requires that hammer force is measured.

6.3 Test Preparation:

6.3.1 For cast in place piles, integrity testing shall not be performed until the concrete has cured for a minimum of seven (7) days unless otherwise approved by the engineer. The pile head shall be free from water, dirt or other debris. The concrete at the pile top surface must be relatively smooth and provide sufficient space for attaching the motion sensing device and for the hammer impact area.

6.3.2 Contractor shall perform test of all piles shall be integrity tested. The location of piles for designated for integrity testing shall be specified by the engineer ____ (after, prior to) pile installation. If less than 100% of piles are initially tested, additional piles may be selected for testing at the discretion of the engineer if circumstances either during or after pile installation should make a piles’ integrity suspect, or if the initial tests reveal major defects.

6.4 Result Preparation:

6.4.1 The testing engineer shall present a report within ___ (2, 5, 10) working days after performing the field test to provide the final test results and integrity evaluation. For each pile tested, the averaged, amplified velocity versus time record shall be included in the report, with a table summarizing results and conclusions. Additional plots and analyses can be included as required or suggested by the testing engineer.

6.5 Acceptance and Rejection:

6.5.1 Shafts with no significant reflections from locations above the pile toe and with a clear pile toe reflection may be accepted. Where no clear toe reflection is apparent, the experienced test engineer shall state to which shaft depth the test appears to be conclusive. Where reflections from locations with significant reductions in pile area or pile material strength or stiffness above the pile toe are observed, the pile has a serious defect. If the record is complex, the results may be deemed inconclusive. Construction records (concrete usage, grout pressure records, soil borings) may be valuable in result interpretations or additional numerical analysis modeling may be used to quantify the record. The decision to reject and replace, or repair, any defective shaft
is at the sole responsibility of the engineer-of-record for the foundation.

6.6 Remedial Action:

6.6.1 Rejected or questionable piles may be replaced. Questionable piles may also be subjected to further testing, e.g., static load testing, dynamic load testing, core drilling, ultra-sonic logging, etc. Remedial action may include pressure grouting through core holes. If the pile top appears questionable, further pile top cut-off and retesting may be advisable. If a majority of piles diagnose as "inconclusive", partial or even complete pile excavation or another test method may be necessary for pile acceptance.

7.0 Dynamic Load Test:

7.1 General:

7.1.1 These methods are based on monitoring the response of a pile subjected to hammer blows applied at the pile head. The measured response parameters are subsequently analyzed to give predictions of the soil resistance that would be mobilized by the pile under static load conditions, based on stress wave theory.

7.1.2 The analytical models of the pile/soil interaction have been further developed to provide prediction of the load/settlement performance of the tested pile.

7.1.3 Developed initially for use with driven piles and now universally accepted, dynamic load testing of cast in place piles is now quite widely used to predict the static soil resistance and the load/settlement behavior. The test method is similar to that used on driven piles with the monitoring of hammer blows and subsequently analyzing the pile response to the stress wave propagation. A separate hammer or drop weight is usually brought to site to allow the dynamic load to be applied to a cast in place pile.

7.1.4 Due to the very high rate of applied loading, dynamic load testing cannot take into account time-related effects such as consolidation, relaxation or creep; consequently care should be exercised in reviewing the results of tests carried out in soils which may exhibit these features. However, the use of dynamic testing after calibration within a particular geological profile will allow more comprehensive testing at low cost in comparison to static testing. Typically a dynamic test will take about 15 minutes to perform on a precast concrete pile using the piling rig hammer to 30 minutes on a bored cast in place pile requiring the use of a separate drop weight.

7.2 Method of Testing:

7.2.1 In order to carry out this method of testing an impact hammer is required. The hammer should ideally be sufficiently large to fully mobilize and therefore characterize the dynamic pile capacity without damaging the pile. Dynamic load testing of bored cast-in-place will generally require the use of a separate hammer or drop weight.

7.2.2 Dependent upon the method employed, electronic gauges are attached to the pile. The gauges measure the acceleration of the pile (and therefore indirectly velocity with a knowledge of the pile properties) and strain within the pile just below the head as the hammer strikes the pile. The information is then recorded in the associated site computer. A variation of the method involves deflection measurement directly by laser theodolite.

7.2.3 In addition to access for the piling hammer/drop weight only minimal access is required to attach the gauges, provided that the pile shaft protrudes at least 2 to 3 pile widths/diameters above ground level; this safeguards the gauges and allows the propagation of a uniform stress wave.

7.2.4 A large number of piles can be tested in the course of one day using dynamic load testing methods.
2.01.a REINFORCED CONCRETE AND ALLIED WORKS

1.0 General:

The quality of materials, method, control of manufacture and transportation of all concrete work in respect of mix whether reinforced or otherwise shall conform to the applicable portion of these specification.

The Engineer-In-Charge shall have the right to inspect the source of materials, the layout and operation of procurement and storage of materials, the concrete batching and mixing equipments and the quality control system. Such an inspection shall be arranged by the contractor and the Engineer-In-Charge’s approval shall be obtained prior to starting of concrete work.

2.0 Scope:

2.1 This specification covers the general requirements for concrete to be used on jobs using on-site production facilities including requirements in regard to the quality, quantity, handling, storage of ingredients, proportioning, batching, mixing, and testing of concrete and also requirements in regard to the quality, storage, cutting, bending and fixing of reinforcement in position. This also covers the transportation of concrete from mixer to the place of final deposit and placing, curing, protecting, repairing and finishing of concrete.

3.0 Applicable Codes and Specification:

3.1 The following specifications, standards and codes are made a part of this specification. All standards, tentative specifications, codes of practices referred to herein shall be the latest edition including all applicable official amendments, revisions and additional publications. In case of discrepancy between this specification and those referred to herein this specification shall govern.

3.2 List of Indian Standards

<table>
<thead>
<tr>
<th>Sr No</th>
<th>IS Code No</th>
<th>Description of IS Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IS : 269</td>
<td>Specification for ordinary, rapid hardening and low heat Portland cement</td>
</tr>
<tr>
<td>2</td>
<td>IS : 383</td>
<td>Specification for coarse &amp; fine aggregate from natural source or concentrate</td>
</tr>
<tr>
<td>3</td>
<td>IS : 456</td>
<td>Code of practice for plain and reinforced concrete</td>
</tr>
<tr>
<td>6</td>
<td>IS : 516</td>
<td>Method of test for strength of concrete.</td>
</tr>
<tr>
<td>7</td>
<td>IS : 650</td>
<td>Specifications for standard sand for testing of cement.</td>
</tr>
<tr>
<td>8</td>
<td>IS : 1199</td>
<td>Method of sampling and analysis of concrete.</td>
</tr>
<tr>
<td>10</td>
<td>IS : 1791</td>
<td>Specification for batch type concrete mixers.</td>
</tr>
<tr>
<td>14</td>
<td>IS : 2386 [Part-IV]</td>
<td>Method of test for aggregates for concrete: Mechanical properties</td>
</tr>
<tr>
<td>18</td>
<td>IS : 2386 [Part-VIII]</td>
<td>Petrographic examination of aggregates</td>
</tr>
<tr>
<td>19</td>
<td>IS : 2438</td>
<td>Specification for roller pan mixer.</td>
</tr>
<tr>
<td>20</td>
<td>IS : 2505</td>
<td>Specification for immersion type concrete vibrators.</td>
</tr>
</tbody>
</table>
4.0 Material for Standard Concrete:

4.1 The ingredients to be used in the manufacture of standard concrete shall consist solely of a standard type Portland cement; clean sand, natural coarse aggregate, clean water, ice, an admixture, if specifically called for on drawings or schedule of quantities.

4.1.1 Cement:

4.1.1.1 Unless otherwise specified or called for by the Engineer-In-Charge cement shall be ordinary Portland cement / Portland Pozzolana cement (Fly ash based meeting the 28 day strength requirement of OPC 43/53 grade cement) in 50 kg bags. The use of bulk cement will be permitted only with the approval of the Engineer-In-Charge. Changing of brand or type of cement within the same structure will not be permitted. In case it is required to change the brand of cement in the same structure, prior permission shall be obtained from the Engineer-In-Charge.

4.1.1.2 If demanded a certified report attesting to the conformity of the cement to I.S. specifications by the cement manufacturer’s chemist shall be furnished to the Engineer-In-Charge.

4.1.1.3 The contractor will have to make his own arrangements for the storage of adequate quantity of cement. Cement in bulk may be stored in bins or silos, which will provide complete protection from dampness, contamination and minimize cracking and false set. Cement bags shall be stored in dry enclosed shed (storage under tarpaulins will not be permitted), well away from the outer walls and insulated from the floor to avoid contact with moisture from ground and so arranged as to provide ready access. Damaged or reclaimed or partly set cement will not be permitted to use and shall be removed from site. The storage bins and storage
arrangements shall be such that there is no dead storage. Not more than 12 bags shall be stacked in any tier. The storage arrangement shall be approved by the Engineer-In-Charge. Consignment of cement shall be stored as received and shall be consumed in the order of their delivery.

4.1.1.4 Cement held storage for a period of Ninety (90) days or longer shall be tested before use in work. Should at any time the Engineer-In-Charge have reason to consider that any cement is defective, then irrespective of its origin and/or manufacturer’s test certificate, such a cement shall be tested immediately at a National Test Laboratory / Departmental Laboratory or such approved laboratory and until the result of such test are found satisfactory, it shall not be used in any work.

4.1.2 Aggregates:

4.1.2.1 Aggregate in general designates both fine and coarse inert materials used in the manufacture of concrete. Fine Aggregate is aggregate most of which passes through 4.75 mm I.S. sieve. Coarse Aggregate is aggregate most of which retained on 4.75 mm I.S. sieve.

4.1.2.2 All fine and coarse aggregate proposed for use in the work shall be subjected to Engineer-In-Charge’s approval and after specific materials have been accepted the source of supply of such materials shall not be changed without prior approval of the Engineer-In-Charge.

4.1.2.3 Aggregates shall consist of natural sand, crushed stone and gravel from source known to produce satisfactory aggregate for concrete and shall be chemically inert, strong, hard, durable against weathering, of limited porosity and free from deleterious materials that may cause corrosion of the reinforcement or may impair the strength and/or durability of concrete. The grading of aggregate shall be such as to produce a dense concrete of specified strength and consistency that will work readily into position without segregation and shall be based on the “mixed design” and preliminary test on concrete specified herein after.

4.1.3 Sampling and Testing:

4.1.3.1 Samples of the aggregates for mixed design and determination of suitability shall be taken under the supervision of the Engineer-In-Charge and delivered to the laboratory, well in advance of the scheduled placing of concrete. Records of tests, which have been made on proposed aggregates and on concrete made from this source of aggregates, shall be furnished to the Engineer-In-Charge in advance of the work for use in determining the aggregate suitability.

4.1.4 Storage of Aggregates:

4.1.4.1 All coarse and fine aggregates shall be stacked separately in stock piles in the material yard near the work site in bins properly constructed to avoid inter mixing of different aggregates. Contamination with the foreign materials and earth during storage and while heaping the materials shall be avoided. The aggregate must be specified quality not only at the time of receiving at site but more so at the time of loading into mixer. Rakers shall be used for lifting the coarse aggregates from the bins or stock piles. Coarse aggregate shall be piled in layers not exceeding 1.20 metres in height to prevent coning or segregation. Each layer shall cover the entire area of the stock pile before succeeding layers are started. Aggregates that have become segregated shall be rejected. Rejected material after re-mixing may be accepted, if subsequent tests demonstrate conformity with required gradation

4.1.5 Specific Gravity:

4.1.5.1 Aggregate having a specific gravity below 2.60 (saturated surface dry basis) shall not be used without special permission of the Engineer-In-Charge.

4.1.6 Fine Aggregate:

4.1.6.1 Fine aggregate except as noted above and for other than lightweight concrete shall consist of natural river sand (suitable for concrete), crushed stone sand or crushed gravel sand stone dust confirming to I.S. 383. The sand shall be clean, sharp, hard, durable, chemically inert and free from dust, vegetable substances, adherent coating, clay, organic matter, alkalis, mica, salt or other deleterious substances which can be injurious to the setting qualities/ strength/ durability of concrete. No creek / sea sand shall be allowed.

4.1.6.2 Machine made sand will be acceptable provided the constituent rock/ gravel composition is sound, hard,
4.1.6.3 Sand shall be prepared for use by such screening or washing or both as necessary to remove all objectionable foreign matter while separating the sand grains to the required size fractions. Sand with silt content more than 3% will not be permitted for use unless the same is washed and silt content is brought within 3% by weight.

4.1.6.4 Unless otherwise directed or approved, the grading of sand shall be within the limits indicated hereunder:

<table>
<thead>
<tr>
<th>Sr No</th>
<th>IS Sieve Designation</th>
<th>Zone – I</th>
<th>Zone – II</th>
<th>Zone – III</th>
<th>Zone – IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10mm</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>4.75mm</td>
<td>90-100</td>
<td>90-100</td>
<td>90-100</td>
<td>95-100</td>
</tr>
<tr>
<td>3</td>
<td>2.36mm</td>
<td>60-95</td>
<td>75-100</td>
<td>85-100</td>
<td>95-100</td>
</tr>
<tr>
<td>4</td>
<td>1.18mm</td>
<td>30-70</td>
<td>55-90</td>
<td>75-100</td>
<td>90-100</td>
</tr>
<tr>
<td>5</td>
<td>600 Micron</td>
<td>15-34</td>
<td>35-59</td>
<td>60-79</td>
<td>80-100</td>
</tr>
<tr>
<td>6</td>
<td>300 Micron</td>
<td>5-20</td>
<td>8-30</td>
<td>12-40</td>
<td>15-50</td>
</tr>
<tr>
<td>7</td>
<td>150 Micron</td>
<td>0-10</td>
<td>0-10</td>
<td>0-10</td>
<td>0-15</td>
</tr>
</tbody>
</table>

4.1.6.5 Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 micron I.S. sieve by total amount not exceeding 5% (five percent), it shall be regarded as falling within the grading zone. This tolerance shall not be applied to percentage passing the 600-micron I.S. sieve or to percentage passing any other sieve size on the coarser limit of Grading Zone-I or the finer limit of Grading Zone-IV. Fine aggregates confirming to Grading Zone-IV shall not be used unless mix designs and preliminary tests have shown its suitability for producing concrete of specified strength and workability.

4.1.6.6 The sand shall have a fineness modulus of not less than 2.2 or more than 3.2. The fineness modulus is determined by adding the cumulative percentage retained on the I.S. sieve (4.75 mm, 2.36 mm, 1.18mm, 600 micron, 300 micron and 150 micron) and dividing the sum by 100.

4.1.7 Coarse Aggregate:

4.1.7.1 Coarse aggregate for concrete except as noted above and for other than lightweight concrete shall confirm to I.S. 383. This shall consist of natural or crushed stone and gravel, and shall be free from elongated, flaky or laminated pieces, adhering coatings, clay lumps, coal residue, clinkers, slag, alkalis, mica, organic matter or other deleterious matter.

4.1.7.2 The coarse aggregate and fine aggregate shall be tested from time to time as required by the Engineer-In-Charge to ascertain its suitability or use in construction and the charges for testing aggregate shall be born by the contractor as specified herein after.

4.1.7.3 Crushed rock shall be screened and/or washed for the removal of dirt or dust coating if so demanded by the Engineering-In-Charge.

4.1.7.4 Coarse aggregates shall be either in single size or graded. In both cases grading shall be within the following limits:

4.1.7.4.1 Table :01

<table>
<thead>
<tr>
<th>Sr No</th>
<th>IS Sieve Designation</th>
<th>40 mm</th>
<th>20 mm</th>
<th>16 mm</th>
<th>12.5 mm</th>
<th>10 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>63mm</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>40mm</td>
<td>85-100</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>20mm</td>
<td>0-20</td>
<td>85-100</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>16mm</td>
<td>-</td>
<td>-</td>
<td>85-100</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>12.5mm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>85-100</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>10mm</td>
<td>0-5</td>
<td>0-20</td>
<td>0-30</td>
<td>0-45</td>
<td>85-100</td>
</tr>
<tr>
<td>7</td>
<td>4.75mm</td>
<td>-</td>
<td>0-5</td>
<td>0-5</td>
<td>0-10</td>
<td>0-20</td>
</tr>
<tr>
<td>8</td>
<td>2.36mm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0-5</td>
</tr>
</tbody>
</table>
4.1.7.4.2 Table:02 Percentage Passing for Graded Aggregate of mentioned Nominal Size

<table>
<thead>
<tr>
<th>Sr No</th>
<th>IS Sieve Designation</th>
<th>40 mm</th>
<th>20 mm</th>
<th>16 mm</th>
<th>12.5 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>63mm</td>
<td>100</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>40mm</td>
<td>95-100</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>20mm</td>
<td>30-70</td>
<td>95-100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td>16mm</td>
<td>-</td>
<td>-</td>
<td>90-100</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>12.5mm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>90-100</td>
</tr>
<tr>
<td>6</td>
<td>10mm</td>
<td>10-35</td>
<td>25-55</td>
<td>0-30</td>
<td>40-85</td>
</tr>
<tr>
<td>7</td>
<td>4.75mm</td>
<td>0-5</td>
<td>0-10</td>
<td>0-10</td>
<td>0-10</td>
</tr>
<tr>
<td>8</td>
<td>2.36mm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

4.1.7.5 The pieces shall be angular in shape and shall have granular or crystalline surfaces. Friable, flaky and laminated pieces, mica and shale if present shall be only in such quantities that will not in the opinion of Engineer-In-Charge affect adversely the strength and/or durability of concrete. The maximum size of coarse aggregate shall be the maximum size specified above but in no case greater than ¼ of the minimum thickness of the member provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of form. Plums above 160 mm and up to any reasonable size can be used in plain mass concrete work of large dimensions up to a maximum limit of 20% by volume of concrete when specially approved by the Engineer-In-Charge. For heavily reinforced concrete members the nominal maximum size of the aggregate shall be 5 mm less than the minimum clear distance between the main reinforcing bars or 5 mm less than the minimum cover to the reinforcement whichever is smaller. The amount of fine particles occurring in the Free State or as loose adherent shall not exceed 1% when determined by laboratory sedimentation tests as per I.S. 2386. After 24 hours immersion in water, a previously dried sample shall not have gained more than 10% of its oven dry weight in air as determined by I.S. 2386.

4.1.8 Water:

4.1.8.1 Water used for both mixing and curing shall be free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. Potable water is generally satisfactory for mixing and curing of concrete. In case of doubt the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in I.S. 456. The sample of water taken for testing shall be typical for the water proposed to be used for concrete, due account being paid to seasonal variation. The sample shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.

4.1.8.2 Average 28 days compressive strength of at least three 150 mm size concrete cubes prepared with water to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water. The cubes shall be prepared, cured and tested in accordance with the requirements of IS: 516.

4.1.8.3 The initial setting time of test block made with the appropriate test cement and the water proposed to be used shall not be less than 30 minutes and shall not differ by more than ±30 minutes from the initial setting time of control test block prepared with the appropriate test cement and distilled water. The block shall be prepared and tested in accordance with the requirements of IS: 4031 (Part 5).

4.1.8.4 Where water can be shown to contain an excess of acid, alkali, sugar or salt, Engineer-In-Charge may refuse to permit its use.

4.1.8.5 P.H. value of water shall generally be not less than 6.

5.0 Design of Mix Concrete:

5.1 All reinforced concrete in the work shall be “Design Mix Concrete” as defined in IS: 456 considering as ‘severe’ environment and cost of design mix shall be included in the item rate and no separate payment shall be made on account of this. All “Design Mix Concrete” work to be carried out under these specifications shall
be in grades designated as per table below.

Use of mineral admixtures like fly ash, GGBFS, etc. shall not be permitted in the design mix unless otherwise special permission is given by the Engineer-in-Charge. Cement shall be Ordinary Portland Cement – 53 grade or Portland Pozzolana Cement (Fly ash based meeting the 28 day strength requirement of OPC 53 grade cement) only.

<table>
<thead>
<tr>
<th>Group</th>
<th>Grade Designation</th>
<th>Specified Characteristic Compressive Strength of 150 mm Cube at 28 days in N/mm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary Concrete</td>
<td>M-10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>M-15</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>M-20</td>
<td>20</td>
</tr>
<tr>
<td>Standard Concrete</td>
<td>M-25</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>M-30</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>M-35</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>M-40</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>M-45</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>M-50</td>
<td>50</td>
</tr>
<tr>
<td>High Strength Concrete</td>
<td>M-55</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>M-60</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>M-65</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>M-70</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>M-75</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>M-80</td>
<td>80</td>
</tr>
</tbody>
</table>

Note:

a. The Characteristic strength is defined as the strength of material below which not more than 5% of the test results are expected to fall.

b. In the designation of a concrete mix, letter 'M' refers to the mix and the number to the specified characteristic compressive strength of 150 mm size cube at 28 days in N/mm².

c. The mix shall be designed to produce the grade of concrete having the required workability and characteristic strength not less than appropriate value given in the table above.

5.2 Mix Design:

5.2.1 This is to investigate the grading of aggregates, water cement ratio, workability and the quantity of cement required to give works cubes of the characteristic strength specified. The proportions of the mix shall be determined by weight. Adjustment of aggregate proportions due to moisture present in the aggregate shall be made. Mix proportioning shall be carried out according to I.S. 10262.

5.2.2 Since different cements and aggregates of different maximum size, grading, surface texture, shape and other characteristics may produce concretes of different compressive strength for the same free water cement ratio, the relationship between strength and free water cement ratio should preferably be established for the materials actually to be used. In the absence of such data, the preliminary free water cement ratio (by mass) corresponding to the target strength at 28 days may be selected from the relationship shown in Fig.1 of I.S. 10262 at page 7.

5.2.3 Alternately, the preliminary free water cement ratio (by mass) corresponding to the target average strength may be selected from the relationship in Fig. 2 of I.S. 10262 page at 8, using the curve corresponding to the 28 days cement strength to be used for the purpose. Other relevant items to the used with design of mix should strictly confirm to the relevant clauses and appendices of I.S. 10262. The calculated mix proportions shall be checked by means of trial batches. The contractor should refer to the item No.4 at page 12 and the Appendix ‘D’ (clause No. 4.1) of I.S. 10262 for neat illustration. The contractor may refer Appendix ‘C’ (clause 3.8) at page 16 of I.S. 10262 for an example illustrating the mix design of M-20. The free water cement ratio
selected as above should be checked against the limiting water cement ratio for the requirement of durability and the lower of the two values should be adopted.

5.2.4 Whenever there is a change either in required strength of concrete or water cement ratio or workability or the source of aggregates and/or cement fresh tests shall be carried out to determine the revised proportion of the mix to suit the altered conditions. While designing mix proportions over wet mixes shall always be avoided.

5.2.5 While fixing the value for water cement ratio for ‘Design Mix’ assistance may be derived from the standard graph showing the relationship between the 28 days compressive strength of concrete mixes with different water cement ratios and the 7 days compressive strength of cement tested in accordance with I.S. 269 and I.S. 8112.

5.2.6 It will be contractor’s sole responsibility to establish the concrete mix designs for different grades of concrete specified in the work consistent with the workability required for nature of work and also taking into consideration the assumed standard deviation which will be expected at site or by establishing the standard deviation based on 30 test results at site for each grade of concrete so as to produce concrete of required strength, durability and surface finish. The materials and proportions used in making the tests to be carried out either at site or under laboratory, conditions shall be similar in all respects to those to be actually employed in the works as the object of these tests is to determine the proportions of cement, aggregates and water necessary to produce the concrete of the required consistency to give such specified strength.

5.2.7 For design mix concrete, the mix shall be designed as per any of four method given in SP: 23 to provide the grade of concrete having the required workability and characteristics strength not less than appropriate values given in IS : 456. The design mix shall in addition be such that it is cohesive and does not segregate during placement and should result in dense and durable concrete capable of giving the specified finish. The contractor shall exercise great care while designing the concrete mix and executing the works to achieve the desired result.

5.2.8 The minimum grade of concrete shall be as per Table No: 05 of IS :456 for various exposure conditions of concrete. For various environment conditions, refer Table :03 IS :456.

5.2.9 The minimum cementitious content for Design Mix Concrete shall be as per Table 5 of IS :456 or given below, whichever is higher. In case of OPC with flyash addition at site flyash content shall not exceed 20%. For concrete with such cement the minimum cementitious content shall be as per table below.

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Grade of Concrete</th>
<th>Minimum Cement Content in Kg/ Cu.m of Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M20</td>
<td>300</td>
</tr>
<tr>
<td>2</td>
<td>M25</td>
<td>320</td>
</tr>
<tr>
<td>3</td>
<td>M30</td>
<td>340</td>
</tr>
<tr>
<td>4</td>
<td>M35</td>
<td>360</td>
</tr>
<tr>
<td>5</td>
<td>M40</td>
<td>380</td>
</tr>
<tr>
<td>6</td>
<td>M45</td>
<td>400</td>
</tr>
</tbody>
</table>

5.3 Standard Deviation :

5.3.1 Standard deviation of concrete of each grade shall be determined separately. When results of sufficient number of tests (at least 30) are not available, then the value of standard deviation given in the table below may be assumed for design mix in the first instance. As soon as the results of the samples are available, actual calculated standard deviation shall be used and the mix designed properly.

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Grade of Concrete</th>
<th>Assumed Standard Deviation in N/mm2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M-10</td>
<td>3.5</td>
</tr>
<tr>
<td>2</td>
<td>M-15</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>M-20</td>
<td>4.0</td>
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<tr>
<td>4</td>
<td>M-25</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>M-30</td>
<td>5.0</td>
</tr>
</tbody>
</table>
Note: the above values correspond to the site control having proper storage of cement; weigh batching of all materials; controlled addition of water; regular checking of all materials; aggregate grading and moisture content; and periodical checking of workability and strength. Where there is deviation from the above, the values given in the above table shall be increased by 1 N/mm²

5.4 Proportioning:

5.4.1 The proportions which shall be decided by conducting preliminary tests shall be by weight. These proportions of cement, fine and coarse aggregates shall be maintained during subsequent concrete batching by means of weigh batchers confirming to I.S. 2722, capable of controlling the weights within one percent of the desired value. Except where it can be shown to the satisfaction of the Engineer-In-Charge that supply of properly graded aggregate of uniform quality can be maintained over the period of work, the grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions. The different sizes shall be stacked in separate stock piles. The grading of coarse and fine aggregates shall be checked as frequently as possible, as determined by the Engineer-In-Charge, to ensure maintenance of grading in accordance with samples used in preliminary mix design. The material shall be stock piled well in advance of use.

5.4.2 The cement shall be measured by weight for design mix. Every facility should be provided to the Engineer-In-Charge for sampling and inspection of stored cement at site of work.

5.4.3 Only such quantity of water shall be added to the cement and aggregate in the concrete mix as to ensure dense concrete, specified surface finish, and satisfactory workability, consistent with strength stipulated for each class of concrete. The water added to the mix shall be such as not to cause segregation of materials or the collection of excessive free water on the surface of the concrete.

5.4.4 The water cement ratio (W/C) is defined as the weight of water in mix (including the surface moisture of the aggregate) divided by the weight of cement in the mix. The actual water cement ratio to be adopted shall be determined in each instance by the contractor and approved by the Engineer-In-Charge.

5.4.5 The water cement ratio specified for use by the Engineer-In-Charge shall be maintained. The contractor shall determine the water content of the aggregate as frequently as directed by the Engineer-In-Charge as the work progresses and as specified in I.S. 2386 (Part-III) and the amount of mixing water added at the mixer shall be adjusted as directed by the Engineer-In-Charge so as to maintain the specified water cement ratio. To allow for the variation in their moisture content, suitable adjustments in the weights of aggregates shall also be made.

5.5 Consistency and Slump:

5.5.1 Concrete shall be of a consistency and workability suitable for the conditions of the job. After the amount of water required is determined the consistency of mix shall be maintained throughout the progress of the corresponding parts of the work and approved tests e.g. slump tests, compacting factor test etc. in accordance with I.S. 1199, shall be conducted from time to time to ensure the maintenance of such consistency.

5.5.2 The following tabulation gives a range of workability which shall generally be used for various types of construction unless otherwise instructed by the Engineer-In-Charge:

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Placing Conditions</th>
<th>Degree of Workability</th>
<th>Value of Workability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Blinding concrete’ shallow sections, pavements using pavers</td>
<td>Very Low</td>
<td>0.75-0.80 compacting factor</td>
</tr>
<tr>
<td>2</td>
<td>Mass concrete; lightly reinforced sections in slabs, beams</td>
<td>Low</td>
<td>Slump of 25-</td>
</tr>
</tbody>
</table>
5.6 **Batching and Mixing of Concrete:**

5.6.1 The material and proportions of concrete ingredients as established by the preliminary tests for the mix design shall be rigidly followed for all concrete works on the project and shall not be changed except when specifically permitted by Engineer-In-Charge/ Structural Consultant.

5.6.2 Concrete shall be produced only by weigh batching the ingredients. The mixer and weigh batcher shall be maintained in clean serviceable condition. The accuracy of weigh batcher shall be periodically checked. They shall be set up on level on a firm base and the hopper shall be loaded evenly. The needle shall be adjusted to zero when the hopper is empty. Fine and coarse aggregates shall be weighed separately unless otherwise stated.

5.6.3 Volume batching will not be permitted. However Engineer-In-Charge may permit volume batching by subsequent conversion of weights of ingredients into their equivalent volumes in respect of their bulk densities only in the case of small and less important pours involving concrete of not more than 0.25 cubic metre on the day when other pours involving weigh batching are not likely to be taken up.

5.6.4 The concrete shall be of strength as stipulated in the respective items. All concrete shall be mixed in mechanically operated batch mixers complying with I.S. 1791 and of approved make with suitable provision for correctly controlling the water delivered to the drum.

5.6.5 The quantity of water actually entering the drum shall be checked with the reading of the gauge or valve setting when starting a job. The test should be made while the mixer is running.

5.6.6 The volume of the mixed material shall not exceed the manufacturer’s rated mixer capacity. The batch shall be charged into the mixer so that some water will enter the drum in advance of cement and aggregate. All water shall be in the drum by the end of the first 15 seconds of the specified mixing time. Each batch shall be mixed until the concrete is uniform in colour for a minimum period of two minutes after all ingredients are in the drum.

5.6.7 The entire contents of the drum shall be discharged in one operation before the raw materials for the succeeding batches are fed into the drum.

5.6.8 Each time the work stops the mixer shall be cleaned out and when next commencing the mixing the first batch shall have 10% addition cement to allow for sticking in the drum.

6.0 **Sampling and Testing of Concrete:**

6.1 The concrete test cubes will be tested at Department’s or site laboratory. The contractor shall make all arrangements to cure, store of concrete cubes and transport the same to the laboratory at his own cost as directed by the Engineer-In-Charge.

6.2 **Sampling and Strength Test of Concrete**

6.2.1 The samples from fresh concrete shall be taken as per I.S. 1199 and cubes shall be made, cured and tested at 28 days in accordance with I.S. 516.

6.2.2 In order to get a relatively quicker idea of the quality of concrete optional test on beams for modulus of rupture at 72 (+/-)2 hrs. or at 7 days or compressive strength tests at 7 days may be carried out in addition to 28 days compressive strength tests. For this purpose the value given in table below may be taken for general
guidance in case of concrete made with ordinary Portland cement. In all cases, the 28 days compressive strength specified shall alone be the criterion for acceptance or rejection of the concrete. If however, from test carried out in particular job over a reasonably long period, it has been established to the satisfaction of the Engineer-In-Charge that a suitable ratio between 28 days compressive strength and the modulus of rupture at 72 (+/-)2 hrs. or 7 days or compressive strength at 7 days may be accepted. The Engineer-In-Charge may suitable relax the frequency of 28 days compressive strength, provided the expected strength values at the specified early age are consistently met.

6.2.3 Optional Test Requirement of Concrete

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Grade of Concrete</th>
<th>Minimum Compressive Strength on 150mm Cube</th>
<th>Minimum Modulus of Rupture By Beam Test at 72 (+/-) 2 Hrs.</th>
<th>7 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M-10</td>
<td>7.00 N/mm²</td>
<td>1.20 N/mm²</td>
<td>1.70 N/mm²</td>
</tr>
<tr>
<td>2</td>
<td>M-15</td>
<td>10.00 N/mm²</td>
<td>1.50 N/mm²</td>
<td>2.10 N/mm²</td>
</tr>
<tr>
<td>3</td>
<td>M-20</td>
<td>13.5 N/mm²</td>
<td>1.70 N/mm²</td>
<td>2.40 N/mm²</td>
</tr>
<tr>
<td>4</td>
<td>M-25</td>
<td>17.00 N/mm²</td>
<td>1.90 N/mm²</td>
<td>2.70 N/mm²</td>
</tr>
<tr>
<td>5</td>
<td>M-30</td>
<td>20.00 N/mm²</td>
<td>2.10 N/mm²</td>
<td>3.00 N/mm²</td>
</tr>
<tr>
<td>6</td>
<td>M-35</td>
<td>23.50 N/mm²</td>
<td>2.30 N/mm²</td>
<td>3.20 N/mm²</td>
</tr>
<tr>
<td>7</td>
<td>M-40</td>
<td>27.00 N/mm²</td>
<td>2.50 N/mm²</td>
<td>3.40 N/mm²</td>
</tr>
</tbody>
</table>

6.2.4 Frequency of Sampling:

6.2.4.1 A random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested, i.e. the sampling should be spread over the entire period of concreting and cover all mixing units.

6.2.4.2 The minimum frequency of sampling of concrete of each grade shall be in accordance with the following:

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Quantity of Concrete</th>
<th>Number of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00 to 5.00 Cu.m Concrete</td>
<td>One</td>
</tr>
<tr>
<td>2</td>
<td>6.00 to 15.00 Cu.m of Concrete</td>
<td>Two</td>
</tr>
<tr>
<td>3</td>
<td>16.00 to 30.00 Cu.m of Concrete</td>
<td>Three</td>
</tr>
<tr>
<td>4</td>
<td>31.00 to 50.00 Cu.m of Concrete</td>
<td>Four</td>
</tr>
<tr>
<td>5</td>
<td>51.00 Cu.m and above</td>
<td>Four Plus one additional sample for each additional 50 m³ part thereof.</td>
</tr>
</tbody>
</table>

At least one sample shall be taken from each shift. Where concrete is produced at continuous production unit, such as ready-mixed concrete plant, frequency of sampling may be agreed upon mutually by suppliers and purchasers.

6.2.4.3 Three test specimens shall be made from each sample for testing at 28 days. Additional cubes may be required for various purposes such as to determine the strength of concrete at 7 days or at the time of striking the formwork or to determine the duration of curing or to check the testing error. Additional cubes may also be required for testing cubes cured by accelerated methods as described in I.S. 9013. The specimen shall be tested as described in I.S. 516.

6.2.4.4 The test strength of the samples shall be the average of the strength of three specimens. The individual variation should not be more than (+/-) 15 percent of the average.
6.2.4.5 Slump test shall be carried out as often as demanded by the Engineer-In-Charge and invariably from the same batch of concrete from which the test cubes are made. Slump test shall be done immediately after sampling.

7.0 Admixtures:

7.1.1 Admixture may be used in concrete only with the approval of the Engineer-In-Charge based upon evidence that with the passage of time neither the compressive strength nor its durability reduced. Calcium chloride shall not be used for accelerating set of the cement for any concrete containing reinforcement or embedded steel parts. When calcium chloride is permitted to be used such as in mass concrete works it shall be dissolved in water and added to the mixing water in an amount not exceed 1.5 percent of the weight of the cement in each batch of concrete. When admixtures are used the designed concrete mix shall be corrected accordingly. Admixtures shall be used as per manufacturer's instructions and in the manner and with the control specified by Engineer-in-Charge. The cost of admixtures shall be included in the item rate and no extra amount shall be paid on this account.

7.1.2 Where specified and approved by Engineer-In-Charge neutralized vinsol resin or and other approved air entraining agent may be used to produce the specified amount of air in the concrete mix and these agents shall conform to the requirements of ASTM standard 6-260 air entraining admixture of concrete. The recommended total air content in the concrete is 4% + 1%. The method of measuring air content shall be as per I.S. 1199.

7.1.3 Retarding Admixtures:

7.1.3.1 Where specified and approved by the Engineer-In-Charge retarding agents shall be added to the concrete mix in quantities specified by Engineer-In-Charge

7.1.4 Water Reducing Admixtures:

7.1.4.1 Where specified and approved by Engineer-In-Charge water reducing admixture shall be added in quantities specified by Engineer-In-Charge. The admixtures shall be added in the form of a solution.

7.1.5 Other Admixtures:

7.1.5.1 Engineer-In-Charge may at his discretion instruct contractor to use any other admixture in the concrete.

8.0 Inspection and Testing of Structures:

8.1.1 Immediately after stripping the form work all concrete shall be carefully inspected and any defective work or small defects either removed or made good before the concrete has thoroughly hardened as instructed by the Engineer-In-Charge.

8.1.2 In case of doubt regarding the grade of concrete used either due to poor workmanship or based on results of cube strength tests the contractor may be asked to carry out compressive strength test of concrete on the basis of core test, ultrasonic test and/or load test.

8.1.3 In case of results of cube strength are observed to be lower than the required designed strength at 28 days as per specifications, ultrasonic test shall be carried out by the digital ultrasonic concrete tester by an approved agency at the cost of the contractor.

8.1.4 In case the ultrasonic test do not satisfy the requirement as above the department will be at liberty to reject the concrete and the contractor has to dismantle and redo the same or carry out such remedial measures as approved by the department at the contractor's own cost.

8.1.5 The unit rate for concrete shall be all inclusive of making preliminary mix design and test cubes, works cubes, testing them as per specifications, slump test, optional tests etc. However, the department will test the same departmentally the contractor will have to make arrangement for transportation of the cubes to the departmental laboratory.

8.1.6 In case cube tests give unsatisfactory results the contractor should also conduct conclusive tests such as ultrasonic pulse test, core test etc. to prove the suitability of concrete. The cost of the conclusive tests shall have to be borne by the contractor.
8.1.7 If the results of any test prove unsatisfactory or the structure shows signs of weakness, undue deflection or faulty construction the contractor shall remove and rebuild the member(s) involved or carry out such other remedial measures as may be required by the Engineer-In-Charge. The contractor shall bear the cost of so doing unless the failure of the member(s) to fulfill the test conditions is approved to be solely due to faulty design. The cost of all tests shall be borne by the contractor.

9.0 Preparation Prior to Concrete Placement, Final Inspection and Approval:

9.1.1 Before the concrete is actually placed in position the insides of formwork shall be inspected to see that they have been cleaned and oiled. Temporary openings shall be provided to facilitate inspection especially at bottom of columns and wall forms to permit removal of saw dust, wood shavings, binding wire, rubbish, dirt etc. Such openings/holes shall be later suitably plugged.

9.1.2 The various traders shall be permitted ample time to install drainage and plumbing lines, floor and trench drain, conduits, hangers, anchors, inserts, sleeves, bolts frames and other miscellaneous embedment to be cast in the concrete as indicated on the drawing or as necessary for the proper execution of the work. All such embedment shall be correctly positioned and securely held in the forms to prevent displacement during depositing and vibrating of concrete.

9.1.3 Slots, openings, holes, pockets etc. shall be provided in concrete work in the positions indicated in the drawings or as directed by the Engineer-In-Charge.

9.1.4 Reinforcement and other items to be cast in concrete shall have clean surfaces that will not impair bond.

9.1.5 Prior to concrete placement all works shall be inspected and approved by the Engineer-In-Charge and if found unsatisfactory concrete shall not be poured until all defects have been corrected at contractor’s cost.

9.1.6 Approval of Engineer-In-Charge for any and all materials and work as required herein shall not relieve contractor from his obligations to produce finished concrete in accordance with the drawings and specifications.

9.1.7 Rain or Wash Water:

9.1.7.1 No concrete shall be placed in wet weather or on a water covered surface. Any concrete that has been washed by heavy rains shall be entirely removed if there is any sign of cement and sand having been washed away from the concrete mixture.

9.1.7.2 Before leaving unattended the work shall be covered with tarpaulins immediately after the concrete has been placed and compacted to safeguard against damages, which may be caused by rain.

9.1.7.3 Any water accumulating on the surface of the newly placed concrete shall be removed by approved means and no further concrete shall be placed thereon until such water is removed. To avoid flow of water over/around freshly placed concrete suitable drains and sumps shall be provided.

9.1.8 Bonding Mortar:

9.1.8.1 Immediately before concrete placement begins prepared surfaces except formwork which will come in contact with the concrete to be placed shall be covered with a bonding mortar of the same strength of concrete.

9.1.9 Transportation:

9.1.9.1 All buckets, containers or conveyers used for transport the concrete shall be mortar tight. All means of conveyance shall be adopted to deliver the concrete of the required consistency and plasticity without segregation or loss of slump whatever method for transportation is employed.

9.1.9.2 Chute shall not be used for transport of concrete without the written permission of the Engineer-In-Charge and concrete shall not be re-handled before placing.

9.1.10 Contaminated Concrete:

9.1.10.1 Concrete must be placed in its final position before it become too stiff to work.
9.1.10.2 On no account water shall be added after the initial mixing.

9.1.10.3 Concrete which has become stiff or has been contaminated with foreign materials and which has not been placed within half an hour of mixing water with cement shall be rejected and disposed off as directed by the Engineer-In-Charge.

9.1.10.4 All equipments used for mixing, transporting and placing of concrete shall be maintained in clean condition. All pans, buckets, hoppers, chutes, pipe lines and other equipments shall be thoroughly cleaned after each period of placement.

10.0 Procedure for Placing of Concrete

10.1.1 Before any concrete is placed the entire placing programme consisting of equipment, layout, proposed procedures and methods shall be submitted to Engineer-In-Charge for approval if so demanded by the Engineer-In-Charge and no concrete shall be placed until Engineer-In-Charge’s approval has been obtained. Equipment for conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete during depositing without segregation of materials considering the size of the job and placement location.

10.1.2 Concrete shall be placed in its final position before the cement reaches its initial set and concrete shall normally be compacted in its final position within 30 minutes of leaving the mixer and once compacted it shall not be disturbed.

10.1.3 In all cases the concrete shall be deposited as nearly as practicable directly in its final position and shall not be re-handled or caused to flow in a manner which may cause segregation, loss of materials, displacement of reinforcement, shuttering or embedded inserts or impair its strength. For locations where direct placement is not possible and in narrow forms contractor shall provide suitable drop and Elephant Trunks to confine the movement of concrete. Special care shall be taken where concrete is dropped from a height especially if reinforcement is in the way particularly in columns and thin walls.

10.1.4 Except when otherwise approved by Engineer-In-Charge concrete shall be placed in the shuttering by shovels or other approved implements and shall not be dropped from a height more than one metre or handle in a manner which will cause segregation.

10.1.5 The following specification shall apply when placing of concrete by use of mechanical equipment is specifically called for while inviting bids or is warranted considering the nature of work involved:

10.1.6 Concrete placed in restricted forms by borrows, buggies, cars, sort chutes or hand shoveling shall be subjected to the requirement for vertical delivery of limited height to avoid segregation and shall deposited as nearly as practicable in it’s final position.

10.1.7 Concreting once started shall be continuous until the pour is completed. Concrete shall be placed in successive horizontal layers of uniform thickness ranging from 150 mm to 900 mm as directed by the Engineer-In-Charge. These shall be placed as rapidly as practicable to prevent the formation of cold joints or planes of weakness between each succeeding layers within the pour. The thickness of each layer shall be such that it can be deposited before the previous layer has stiffened. The bucket loads or other units of deposit shall be spotted progressively along the face of the layer with such overlap as will facilitate spreading the layer to uniform depth and texture with a minimum of shoveling. Any tendency to segregation shall be corrected by shoveling stones into mortar rather than mortar onto stones. Such a condition shall be corrected by redesign of mix or other means as directed by Engineer-In-Charge.

10.1.8 The top surface of each pour and bedding planes shall be approximately horizontal unless otherwise instructed.

11.0 Compaction:

11.1 Concrete shall be compacted during placing with approved vibrating equipment until the concrete has been consolidated to the maximum practicable density, is free of pockets of coarse aggregate and fits tightly against all form surfaces, reinforcement and embedded fixtures. Particular care shall be taken to ensure that all concrete placed against the form faces and into corners of forms or against hardened concrete at joints is free from voids or cavities. The use of vibrators shall be consistent with the concrete mix and caution is to be exercised not to over vibrate the concrete to the point that segregation results.
11.2 When placing in layers, which are advancing horizontally as the work progresses great care shall be exercised to ensure adequate vibration, blending and melding of the concrete between the successive layers.

11.3 The immersion vibrator shall penetrate the layer being placed and also penetrate the layer below while the under layers is still plastic to ensure good bond and homogeneity between the two layers and prevent the formation of cold joints.

11.4 Care shall be taken to prevent contact of immersion vibrators against reinforcement steel. Immersion vibrators shall not be allowed to come in contact with reinforcement steel after start of initial set. They shall also not be allowed to come into contact with forms or finished surfaces.

11.5 Formation of stone pockets or mortar pondages in corners and against faces of forms shall not be permitted. Should these occur they shall be dug out, reform and refilled to a sufficient depth and shape for thorough bonding as directed by Engineer-In-Charge.

11.6 Bleeding or free water on top of concrete being deposited into the forms shall be caused to stop the concrete pour and the condition causing this defect corrected before any further concreting is resumed.

12.0 Construction Joints and Keys:

12.1 Concrete shall be placed without interruption until completion of the part of the work between predetermined construction joints as specified therein after. Time laps between the pouring of adjoining units shall be as specified in the drawings or as directed by the Engineer-In-Charge.

12.2 If stopping of concreting becomes unavoidable anywhere a properly formed construction joints shall be made where the work is stopped.

12.3 Joints shall be either vertical or horizontal unless otherwise shown on drawing. In case of an inclined or curved member the joints shall be at right angles to the axis of the member. Vertical joints in walls shall be kept to a minimum.

12.4 Vertical joints shall be formed against a stop board and horizontal joints shall be level and wherever possible arranged so that the joint lines coincide with the architectural features of the finished work.

12.5 Batten shall be nailed to the form work to ensure a horizontal line and if directed shall also be used to form a grooved joint. For tank walls and similar work joints shall be formed as per I.S. 3370.

12.6 Concrete that is in the process of setting shall not be disturbed or shaken by traffic either on the concrete itself or upon the shuttering.

12.7 Horizontal and vertical joints and shear keys shall be located and shall confirm in details to the requirements of the plans unless otherwise directed by the Engineer-In-Charge

12.8 Column Joints:

12.8.1 In a column joints shall be formed 75 mm below the lowest soffit of the beam including haunches if any. In flat slab construction the joint shall be 75 mm below the soffit of column capital. At least 2 hours shall elapse after depositing concrete in columns, piers or walls before depositing in beams, girders or slabs supported thereon.

12.9 Beam and Slab Joints:

12.9.1 Concrete in beam shall be placed throughout without a joint but if the joint is unavoidable the same shall be vertical and at the centre or within the middle third of the span unless otherwise shown on drawings. Where a beam intersects a girder the joints in the girder shall be offset a distance equal to twice the width of the beam and additional reinforcement provided for shear. The joint shall be vertical throughout the full thickness of the concrete member. A joint in a slab shall be vertical and parallel to the principal reinforcement. Where it is unavoidably at right angles to the principal reinforcement the joint shall be vertical and at the middle of the span.

12.9.2 Vertical construction joints in water tight construction will not be permitted unless indicated on the
drawings. Where a horizontal construction joint is required to resist water pressure special care shall be taken in all phases of its construction to ensure maximum water tightness.

13.0 Dowels:
13.1 Dowels for concrete works not likely to be taken up in the near future shall be wrapped in tar paper and burlap.

14.0 Mass Foundations:
14.1 Mass foundation shall be poured in lifts not exceeding 1.5 m in height unless otherwise indicated on the drawings or approved by Engineer-In-Charge.

15.0 Treatment of Construction Joints on Resuming Concrete:
15.1 A dryer mix shall be used for the top lift of horizontal pours to avoid laitance. All laitance and loose stones shall be thoroughly and carefully removed by wire brushing/ hacking and surface wash.
15.2 Just before concreting is resumed the roughened joint surface shall be thoroughly cleaned and loose matter removed and then treated with a thin layer of cement grout of proportion specified by Engineer-In-Charge and worked will into the surface. The new concrete shall be well worked against the prepared face before the grout mortar sets. Special care shall be taken to obtained thorough compaction and to avoid segregation of the concrete along the joint plane.

16.0 Curing, Protecting, Repairing and Finishing:
16.1 All concrete shall be cured by keeping it continuously damp for a period of time required for complete hydration and hardening to take place. Preference shall be given to the use of continuous sprays or by ponding of water, continuously saturated coverings of sacking, canvas, hessian (especially on vertical structural members) or other absorbent materials or approved effective curing compounds applied with spraying equipment capable of producing a smooth even textured coat. Extra precautions shall be exercised in curing concrete during cold and hot weather as outlined hereinafter.

16.2 Certain type of finish or preparation for overlaying concrete must be done at certain stages of the curing process and special treatment may be required for specific concrete surface finish.

16.3 Curing with Water:
16.3.1 Fresh concrete shall be kept continuously wet for a minimum period of 10 days from the date of placing of concrete following a lapse of 10 to 12 hours after laying of concrete in normal weather and in hot weather not more than lapse of 4 hours. Date of casting shall have to be marked, as directed by Engineer-in-Charge, on the exposed surfaces of the concrete so as to enable easy monitoring of the curing period.

16.3.2 The curing of horizontal surface exposed to the drying winds shall be however begin immediately after the concrete has hardened. Water shall be applied to unformed concrete surfaces within one hour after concrete has set. Water shall be applied to formed surface immediately upon removal of forms. Quantity of water applied shall be controlled so as to prevent erosion of freshly placed concrete.

16.3.3 The quality of curing water shall be the same as that used for mixing concrete.

16.3.4 Curing shall be assured by use of an ample water supply under pressure in pipes with all necessary appliances of hose, sprinklers and spraying devices. Continuous fine moist spraying or sprinkling shall be used unless otherwise specified or approved by the Engineer-In-Charge.

16.3.5 For curing of concrete in pavements, side-walks, floors flat roofs or other level surfaces the ponding method of curing is preferred. The method of containing the ponded water shall be approved by the Engineer-In-Charge. Special attention shall be given to edges and corners of the slab to ensure proper protection to these areas. The ponded areas shall be kept continuously filled with water during the curing period.

16.3.6 All equipments and materials required for curing shall be on and ready for use before concrete is placed.

17.0 Finishing of Concrete:
17.1 This specification is intended to cover the treatment of concrete surface for all structures. Areas requiring special finish not covered by this specification shall be clearly indicated on the drawings and special specification shall be furnished.

17.2 When specified on the drawings an integral cement concrete finish of specified thickness for floors and slabs shall be applied either monolithic or bonded as specified on the drawings and as per I.S. 2571.

17.3 The surface shall be compacted and then floated with a wooden float or power floating machine. The surface shall be tested with a straight edge and any high and low spots eliminated.

17.4 Floating or trowelling of the finish shall be permitted only after all surface water has evaporated. Dry cement or a mixture of dry cement and sand shall not be sprinkled directly on the surface of the concrete finish to absorb moisture or to stiffen the mix.

17.5 A rubbed finish shall be provided only on exposed concrete surfaces as specified on the drawings.

17.6 Upon removal of forms all fins and other projections on the surfaces shall be carefully removed, offsets leveled, voids and/or damaged sections immediately saturated with water and repaired by filling with concrete or mortar of the same composition as was used in the concrete.

17.7 The finished surfaces shall present a uniform and smooth appearance.

17.8 All concrete shall be protected against damage until final acceptance by the Engineer-In-Charge.

18.0 Mode of Measurement:

18.1 The concrete as actually done shall be measured for payment. Any work done excess over the specified dimensions for the section shown in the drawing or as required by the Engineer-In-Charge shall not be measured for payment.

18.2 Dimensions of length, breadth and thickness shall be measured correct to nearest centimeters except for the thickness of slab, which shall be measured to nearest 1 mm.

18.3 Areas shall be worked out to nearest 0.01 square metre and the cubic contents of consolidated concrete shall be worked out to nearest 0.001 cubic metres.

18.4 For the purpose of measurements and payments for all concrete works I.S. 1200 (Part-II) shall be referred.

2.01.b PLAIN CEMENT CONCRETE FOR GENERAL WORKS

1.0 General:

For plain cement concrete work, the specifications for materials viz., cement, sand, fine and coarse aggregates and water shall be the same as that specified in reinforced work specification.

But the proportion of mix will be nominal and the ratio of fine and coarse aggregate may be slightly adjusted with in limits keeping the total volume of aggregates to a given volume cement constant, to suit the sieve analysis of the aggregates. Cement shall on no account be measured by volume, both it shall always be used directly from the bags (i.e., 50 Kg/bag).

The proportion of cement, sand, aggregate for concrete of proportion 1:4:8, 1:3:6, 1:2:4 by volumes shall generally consist of quantities as given below:

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Proportions of ingredients</th>
<th>Quantity of materials used per bag of Cement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cement</td>
</tr>
<tr>
<td>1</td>
<td>1:4:8</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1:3:6</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1:2:4</td>
<td>1</td>
</tr>
</tbody>
</table>
The quantity of water used shall be such as to produce concrete of consistency required by the particular class or work and shall be decided by the use of slump cone. Sufficient care should be taken to see that no excess quantity of water is used. The final proportion of the aggregates and the quantity of water shall be decided by the Engineer on the basis of test in each case. The slump shall be specified for each class of work and shall in general be as follows:

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Type of Concrete</th>
<th>Max Slump (Millimeter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mass Concrete</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>Roads and pavements, hand finished</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>Roads and pavements, machines finished</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>Floor paving</td>
<td>50</td>
</tr>
</tbody>
</table>

All plain concrete shall be preferably mixed in a drum type power driven machine with a loading hopper, which will permit the accurate measure of various ingredients. If hand mixing is authorized, it should be done on a watertight platform.

The mixing of each batch in the concrete mixer shall continue for not less than 2 minutes after the materials and water are in the mixer. The volume of mixed materials per batch shall not exceed the manufacturer’s rated capacity of the mixer. The mixer shall rotate at a peripheral speed of about 60 metres per minute.

Concrete shall be poured and consolidated in its final position within half an hour of mixing. The re-tempering of concrete, which has partially hardened, that is remixing with or without additional cement, aggregate or water shall not be permitted. Concrete in c.c. 1:2:4 will be required to be vibrated if specified and directed by the Engineer. In case if the thickness of concrete is more than 150 mm in thickness, it may be vibrated if directed by the Engineer.

The concrete shall be cured for 10 days in ordinary weather and 15 days in cold weather. Measurements for the work done shall be exact length, breadth and depth shown or figured on the drawings or as instructed by the Engineer and after the concrete is consolidated. No extra shall be paid for excess quantity resulting from faulty workmanship.

2.01.a READY MIXED CONCRETE

1.0 Scope:
The supply of ready-mixed concrete shall be as specified in IS: 4926-1976. The strength of RCC design mix shall be specified in the item.

2.0 Terminology:
2.1 For the purpose of this standard the definitions in 2.2 to 2.5 shall apply.
2.2 Ready-mixed Concrete – Concrete delivered at site in plastic condition and requiring no further treatment before being placed in the position in which it is to set and harden.
2.3 Agitation – The process of continuing the mixing of concrete at a reduced speed during transportation to prevent segregation.
2.4 Agitator – Truck mounted equipment designed to agitate concrete during transportation to the site of delivery.
2.5 Truck – Mixer – A mixer generally mounted on a self-propelled chasis capable of mixing the ingredients of concrete and of agitating the mixed concrete during transportation.

3.0 Type of Mixing:
3.1 For the purpose of this standard, the ready-mixed concrete shall be of the following type, according to the method of production and delivery as specified in 3.2
3.2 Centrally Mixed Concrete – Concrete produced by completely mixing cement, aggregates, admixtures, if any and water at a central mixing plant and delivered in containers fitted with agitating devices.

4.0 Material:
4.1 Materials such as cement, coarse & fine aggregates, water & admixture, etc. shall confirm to the
specifications mentioned in the RCC works. Use of mineral admixtures like fly ash, GGBFS, etc. shall not be permitted unless otherwise specifically permitted by Engineer-in-charge. Cement shall be Ordinary Portland Cement – 53 grade (Fly ash based meeting the 28 day strength requirement of OPC 53 grade cement) only.

5.0 Basis of Supply:

5.1 The ready-mixed concrete shall be manufactured and supplied on the following basis:

5.1.1 Specified strength based on 28 days compressive strength of 15 cm cubes tested in accordance with IS: 456-2000.

5.2 The responsibility for the design of mix shall be that of the manufacturer and the concrete shall confirm to the requirements as specified in 7.

6.0 General Requirement:

6.1 The ready-mixed concrete shall generally comply with the requirements of IS: 456 considering as ‘severe’ environment.

6.2 Minimum quantity of cement and the details regarding proportionary works control shall be in accordance with IS: 456.

6.3 The concrete shall be delivered to the site of work and discharge shall be complete within ½ hour (when the prevailing atmospheric temperature is above 20o C) and within 2 hours (when the prevailing atmospheric temperature is at or below 20o C) of adding the mixing water to the mix of cement and aggregate or of adding the cement to the aggregate whichever is earlier.

6.4 Sampling and Testing:

6.4.1 Adequate facilities shall be provided by the manufacturer for purchaser to inspect the materials used, the process of manufacture and methods of delivery of concrete. He shall also provide adequate facilities for the purchaser to take samples of the materials used.

6.4.2 Sampling and Testing – The sampling and testing of concrete shall be done in accordance with the relevant requirements of IS: 456-2000, IS: 1199-1959 and IS: 516-1959.

6.4.3 Consistency or Workability – The tests for consistency or workability shall be carried out in accordance with the requirements of IS: 1199-1959 or by such other method as may be agreed to between the purchaser and the manufacturer.

6.4.4 Strength Test – The compressive strength and flexural strength tests shall be carried out in accordance with requirements of IS: 516-1959 and the acceptance criteria for concrete supplied on the basis of specified strength shall conform to the requirements of IS: 456.

6.4.5 Cost of Testing – The cost of the tests carried out in accordance with requirements of this specification shall be borne by the contractor.

6.4.6 Manufacturer’s Records and Certificates - The manufacturer shall keep batch records of the quantities by mass of all solid materials, of total amount of water used in mixing and of the results of all tests. If required by the purchaser, the manufacturer shall furnish certificate, at agreed intervals, giving this information.

7.0 Concrete Manufactured And Supplied On The Basis Of Specified Strength:

7.1 The manufacturer shall supply the following information for guidance of the supplier for approval:

a) The type of cement to be used.

b) The maximum size and type of aggregates.

c) The type of admixtures to be used.

d) The minimum accepted compressive strength or flexural strength or both, determined from samples of plastic concrete taken at the place and time of delivery, in accordance with requirements of IS: 456-2000.

e) The slump or compacting factor or both, or other requirement for consistency or workability at the place and time of delivery of the concrete.

f) The ages at which the test cubes or beams are to be tested and the frequency and number of tests to be made shall be as required by the purchaser.

7.2 Tolerances – The concrete shall be deemed to comply with the requirements of this specification, if the results of the tests where applicable, lie within the tolerances specified in 7.2.1.
7.2.1 Consistency or Workability – The slump (average of two tests) shall not differ from the specified value by + 10 mm for a specified slump of 75 mm or less and + 25 mm when the specified slump is greater than 75 mm. The compacting factor average of two tests shall be within + 0.03 of the value specified. The test for consistency or workability shall be completed within 15 minutes of the time of receipt of the ready-mixed concrete at site.

8.0 Placing of Concrete:

8.1 The ready-mixed concrete shall be placed in the required location/position, level, heights, etc. by using pumping arrangement method/mechanically as directed by the Engineer—in-Charge.

2.01.b SPECIFICATION FOR STEEL REINFORCEMENT

1.0 General:

1.1 Steel reinforcement bars, if supplied or arranged by the contractor, shall be either plain round mild steel bars grade – I or medium tensile steel bars as per IS: 432 or hot rolled mild steel and medium tensile deformed as per IS: 1139 or Thermo-mechanically treated (TMT) bars - high yield strength deformed bars as per IS: 1786 as shown and specified on the drawings and shall be as per Approved Make list only and shall be rolled from their own plants and from virgin material. Materials manufactured by their authorized conversion agents and re-rollers shall not be accepted. Documentary evidence of purchasing steel produced from these manufacturers and their manufacturing test certificate shall be submitted. The third party test shall be carried out as directed in line with the relevant Indian standards and cost of which shall be included in the item rate and no separate payment shall be made on account of this.

1.2 Wire mesh or fabric shall be in accordance with IS: 1566.

1.3 Substitution of reinforcement will not be permitted except upon written approval from Engineer—in-Charge.

2.0 Scope:

2.1 This specification covers the general requirements for quality, storage, bending and fixing of reinforcement.

3.0 Applicable Codes and Specification:

3.1 The relevant IS specification, standards and codes given below are made a part of this specification. All standards, specifications, code of practices refer to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

<table>
<thead>
<tr>
<th>Sr No</th>
<th>IS Code</th>
<th>IS Particulars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IS :432 (Part-I)</td>
<td>Mild Steel and Medium Tensile Steel bars and Hard drawn Steel wires for concrete reinforcement</td>
</tr>
<tr>
<td>2</td>
<td>IS :432 (Part-II)</td>
<td>Mild Steel and Medium Tensile Steel bars and Hard drawn steel wires for concrete reinforcement</td>
</tr>
<tr>
<td>3</td>
<td>IS :1139</td>
<td>Specification for Hot Rolled Mild steel, Medium steel and HYSO bars for concrete reinforcement</td>
</tr>
<tr>
<td>4</td>
<td>IS :1200 (Part-VIII)</td>
<td>Method of Measurement of Building and Civil Engineering work (Steel and Iron works)</td>
</tr>
<tr>
<td>5</td>
<td>IS :1566</td>
<td>Hard drawn Steel Wire fabric for concrete reinforcement</td>
</tr>
<tr>
<td>6</td>
<td>IS :1599</td>
<td>Method of Bend Test</td>
</tr>
<tr>
<td>7</td>
<td>IS :1608</td>
<td>Method of Tensile Testing of Steel Products</td>
</tr>
<tr>
<td>8</td>
<td>IS : 1786</td>
<td>High Strength Deformed Steel and Wires for concrete reinforcement</td>
</tr>
<tr>
<td>9</td>
<td>IS :2502</td>
<td>Code of Practice for Bending and Fixing of Bars for concrete reinforcement</td>
</tr>
</tbody>
</table>

4.0 Storage:
4.1 The reinforcement shall not be kept in direct contact with the ground but stacked on top of an arrangement of timber slippers or the like. The reinforcement shall be coated with cement wash before stacking to prevent scale and rust. Fabricated reinforcement shall be carefully stored to prevent damage, distortion, corrosion and deterioration.

5.0 Quality:

5.1 All steel shall be of grade-I quality unless specifically permitted by the Engineer-In-Charge. No re-rolled material will be accepted. Contractor shall submit the manufacturer's test certificate for steel.

5.2 Random test on steel supplied by the contractor may be performed by owner as per relevant IS. All cost incidental to such tests shall be at the contractor's expenses. Steel not conforming to the specifications shall be rejected.

5.3 All reinforcement shall be clean, free from grease, oil, paint, dirt, loose mill scale, loose rust, dust, bituminous material or any other substance that will destroy or reduce the bond. All rods shall be thoroughly cleaned before being fabricated.

5.4 Pitted and defective rods shall not be used. All bars shall be rigidly held in position before concreting. No welding of rods to obtain continuity shall be allowed unless approved by the Engineer-in-charge. If welding is approved the work shall be carried out as per IS: 2751, according to best modern practices and as directed by the Engineer-in-charge.

5.5 In all cases of important connections, test shall be made to prove that the joints are of the full strength of the bar welded. Special precaution as specified by the Engineer-in-charge shall be taken in the welding of cold work reinforcing bars and bars other than mild steel.

6.0 Lap:

6.1 Laps and splices for reinforcement shall be as shown on the drawings. Splices and adjacent bars shall be staggered and the location of all splices except those specified on the drawings shall be approved by the Engineer-in-charge. The bars shall not be lapped unless the length required exceeds the maximum available length required of bars at site.

7.0 Bending:

7.1 All bars shall be accurately bent according to the size and shape shown on the detail working drawing / bar bending schedule. They shall be gradually bent by machine or approved means.

7.2 Reinforcing bars shall not be straightened and re-bend in the manner that will injure the material. Bars containing cracks and splits shall be rejected. They shall be bent cold except bars above 25 mm in diameter which may be bent hot, if specifically approved by Engineer-in-charge.

7.3 Bars which depend for their strength on cold working shall not be bent hot. Bars bent hot shall not be heated beyond cherry-red color (not exceeding 645 °C) and after bending shall be allowed to cool slowly without quenching.

7.4 Bars incorrectly bent shall be used only if the means used for straightening and re-bending be such as shall not in the opinion of the Engineer-in-charge injure the material.

7.5 No reinforcement bars shall be bent when in position in the work without approval, whether or not it is partially embedded in hardened concrete. Bars having kinks or bends other than those required by the design shall not be used.

8.0 Fixing:

8.1 The reinforcement shall accurately be fixed by any approved means and maintained in the correct position as shown in the drawing by use of blocks, spacers and chairs as per IS: 2502 to prevent displacement during placing and compaction of concrete.

8.2 Bars intended to be in contact at crossing point shall be securely bound together at all such points with 1.6 mm diameter annealed soft iron wire.

8.3 The vertical distance required between successive layers of bars in beams or similar members shall be maintained by provision of mild steel spacer bars at such intervals that the main bar do not perpetually sag between adjacent spacer bars.

9.0 Cover To Reinforcement:

9.1 Unless indicated otherwise on the drawing, clear concrete cover for reinforcement (exclusive of plaster or decorative finish) shall be as per the provisions of IS: 456.
10.0 Inspection:
10.1 Erected and secured reinforcement shall be inspected and approved by the Engineer-in-charge prior to placement of concrete.

11.0 Mode of Measurement:
11.1 The actual quantity of reinforcement bars embedded in concrete as specified in the drawing and as approved by the Engineer-in-charge irrespective of the level or height at which the reinforcement bars are placed shall be measured for payment.

11.2 The reinforcement bars shall be measured in length nearest to a centimeter for different diameters and their weight shall be calculated based on the standard weights as per Indian Standard.

11.3 Wastage, unauthorized overlap and annealed steel binding wires shall not be measured for payment.

11.4 Pins, chairs and spacers wherever required shall be provided as directed by the Engineer-in-charge and measured separately and paid for.

11.5 The rate for reinforcement item shall include the cost of labour and materials required for all operations described above including transportation, cleaning, straightening, cutting, bending, placing in position and binding of reinforcement bars and wastage, etc.
** SPECIFICATION OF CENTERING AND FORMWORKS **

** 1.0 Scope :  
1.1 The formwork shall consists of shores, bracings, side of beams and columns, bottom of slabs, etc. including ties, anchors, hangars, inserts, etc. complete which shall be properly designed and planned for the works.  
1.2 The formwork shall be so constructed that up and down vertical adjustments can be made smoothly. Wedges may be used at top or bottom of shores, but not at both the ends to facilitate vertical adjustment for dismantling of the formwork.**

** 2.0 Applicable Codes and Specification  
2.1 The relevant IS specification, standards and codes given below are made a part of this specification. All standards, specifications, code of practices refer to herein shall be the latest edition including all applicable amendments, revisions and additional publications.**

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<table>
<thead>
<tr>
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<th></th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>IS: 303</td>
<td>Plywood for general purpose</td>
</tr>
<tr>
<td>2</td>
<td>IS : 1200 (Part- V)</td>
<td>Method of Measurement of building and civil engineering work (Form work)</td>
</tr>
<tr>
<td>3</td>
<td>IS : 2750</td>
<td>Specification for steel scaffolding</td>
</tr>
<tr>
<td>4</td>
<td>IS :3696</td>
<td>Safety code for scaffolds and ladders</td>
</tr>
<tr>
<td>5</td>
<td>IS : 4014 (Part- I)</td>
<td>Code of Practice for steel tubular scaffolding</td>
</tr>
<tr>
<td>6</td>
<td>IS : 4014 (Part- II)</td>
<td>Code of Practice for steel tubular scaffolding</td>
</tr>
<tr>
<td>7</td>
<td>IS : 4990</td>
<td>Specification for plywood for concrete shuttering work</td>
</tr>
</tbody>
</table>

** 3.0 Design of Formworks :  
3.1 The design and engineering of the formwork as well as its construction shall be the responsibility of the contractor. If so instructed, the drawings and calculations for the design of the formwork shall be submitted well in advance to the Engineer-in-charge for approval before proceeding with the work at no extra cost to the department. Engineer-in-charge’s approval shall not relieve the contractor of the full responsibility for the design and construction of the formwork.  
3.2 The design shall take into account all the loads vertical as well as lateral that the forms will be carrying including live load and vibration loads.  
3.3 Depending upon the height of the staging suitable vertical and horizontal cross bracings shall be provided.  
3.4 The contractor shall note that no concrete work of floor, beam, slab including roof slab will be permitted unless the staging work is inspected and the approval in writing for its soundness is given to the Engineer-in-charge prior to commencement of concrete work.**

** 4.0 Type of Formwork :  
4.1 Formwork may be of timber, plywood, metal, plastic or concrete. For special finishes the formwork may be lined with plywood, steel sheets, oil tempered hard board, etc. sliding forms and slip forms may be used with the approval of engineer-in-charge.**

** 5.0 Formwork Requirement :  
5.1 Forms shall conform to the shapes, lines, grades and dimensions including camber of the concrete as called for on the drawings. Ample studs, waler braces, ties, straps, shores, etc. shall be used to hold the forms in proper position without any distortion whatsoever until the concrete has set sufficiently to permit removal of forms. Form shall be strong enough to permit the use of immersion vibrators; in special case form vibrators may also be used. The shuttering shall be close boarded. Timber shall be well seasoned, free from sap, shakes, loose knots, worm holes, warps or other surface defects in contact with concrete shall be free from adhering grout, plaster, paint, projecting nails, splits or other defects. Joints shall be sufficiently tight to prevent loss of water and fine material from concrete.  
5.2 Plywood shall be used for exposed concrete surface where called for. Sawn and wrought timber may be used for unexposed surfaces. Inside faces of forms for concrete surface, which are to be rubbed finished shall be planed to remove irregularities or unevenness in the face. Formwork with lining will be permitted.
5.3 All new and used form timber shall be maintained in a good condition with respect to shape, strength, rigidity, water tightness, smoothness and cleanliness of surfaces. Form timber unsatisfactory in any respect shall not be used and if rejected by the Engineer-in-charge shall be removed from the site.

5.4 Shores supporting successive stories shall be placed directly over those below or be so designed and placed that the load will be transmitted directly on them. Trussed supports shall be provided for shores that can be secured on adequate foundation.

5.5 Form work during any stage of construction showing signs of distortion or disturbed to such a degree that the intended concrete work will not conform to the exact contours indicated on the drawings shall be re-positioned and strengthened. Poured concrete affected by faulty formwork shall be removed entirely and the formwork shall be corrected prior to placing new concrete.

5.6 Excessive construction camber to compensate for shrinkage settlement etc. that may impair the structural strength of the members will not be permitted.

5.6.1 Forms for substructure concrete may be omitted in the opinion of the Engineer-in-charge the open excavation is firm enough to act as the form. Such excavation shall be slightly larger than that required by drawings to compensate for irregularities in excavation and to ensure the design requirement.

5.7 Forms shall be designed and constructed that they can be stripped in order required and their removal do not damage the concrete. Face form work shall provide true vertical and horizontal joints conforming to the architectural features of the structure as to location of joints and be as directed by the Engineer-in-charge.

5.8 Where exposed smooth or rubbed concrete finishes are required, the forms shall be constructed with special care so that the desired concrete surfaces could be obtained which require a minimum finish.

6.0 Bracing, Struts and Props:

6.1 Shuttering shall be braced, strutted, propped and so supported that it shall not deform under weight and pressure of the concrete and also due to the movement of men and other materials. Bamboos shall not be used as props or cross bracings.

6.2 The shuttering for beams and slabs shall be so erected that the shuttering on the sides of the beams and under the soffit of slab can be removed without disturbing the beam bottoms.

6.3 Re-propping of the beams shall not be done except when the props have to be reinstalled to take care of construction loads anticipated being excess of the design load. Vertical props shall be supported on wedges or other measures shall be taken whereby the props can be gently lowered vertically while striking the shuttering.

6.4 If the shuttering for a column is erected for the full height of the column, one side shall be left open and built upon sections as placing of concrete proceeds or windows may be left for pouring concrete from sides to limit the drop of concrete to one meter or as directed by the engineer-in-charge.

7.0 Form Oil:

7.1 Use of the form oil shall not be permitted on the surface that requires painting. If the contractor desires to use form oil on the inside of form work of the other concrete surfaces, a non staining mineral oil or other approved oil 'CEMOL-35' of M/s Hindustan Petroleum Co. Ltd. or equivalent may be used provided it is applied before placing of reinforcing steel and embedded parts.

7.2 All excess oil on the form surfaces and any oil on metal or other parts to be embedded in the concrete shall be carefully removed. Before treatment with oil forms shall be thoroughly cleared of dried splatter of concrete from placement of previous lift.

8.0 Chamfers and Fillets:

8.1 All corners and angles in the finished structure shall be formed with mouldings to form chamfers or fillets on the finished concrete. The standard dimensions of chamfers and fillets unless otherwise specified shall be 20 mm x 20 mm. Care shall be exercised to ensure accurate mouldings. The diagonal face of the moulding shall be planed or surface to the same texture as the forms to which it is attached.

8.2 Vertical construction joints on faces which will be exposed at the completion of the work shall be chamfered as above except where not permitted by Engineer-in-charge for structural or hydraulic reasons.

9.0 Reuse of Forms:

9.1 Before reuse all forms shall be thoroughly scraped, cleaned, nails removed, holes that may leak suitably plugged and joints examined and when necessary repaired and the inside retreated to prevent adhesion to
the satisfaction of Engineer-in-charge. Warped timber shall be resized. Contractor shall equip himself with enough shuttering to complete the job in the stipulated time.

10.0 Removal of Forms:

10.1 Contractor shall record in the drawings or a special register the date upon which the concrete is placed in each part of the work and the date on which the shuttering is removed there from.

10.2 In no circumstances shall form struck until the concrete reaches a strength of at least twice the stress due to self weight and any construction/erection loading to which the concrete may be subjected at the time of striking of formwork. The strength referred to shall be that of concrete using the same cement and aggregates and admixture, if any, with the same proportions and cured under conditions of temperature and moisture similar to those existing on the work.

10.3 In normal circumstances where the ambient temperature does not fall below 15oC and where Ordinary Portland Cement is used and adequate curing is done the stripping time is to be followed as specified in IS: 456-2000 (clause 11.3).

10.4 Striking shall be done slowly with utmost care to avoid damage to arise and projections and without shock or vibration by gentling easing the wedges. If after removing the formwork it is founds that timber has been embedded in the concrete, it shall be removed and made good as specified earlier.

10.5 Reinforced temporary openings shall be provided as directed by the Engineer-in-charge to facilitate removal of formwork which otherwise may be inaccessible.

10.6 Tie rods, clamps, form bolts, etc. which must be entirely removed from walls or similar structure shall be loosened not sooner than 16 hours not later than 24 hours (in case the conditions in 10.3 are satisfied) after the concrete has been deposited. Ties except those required to hold the forms in place may be removed at the same time. Ties withdrawn from walls and grade beams shall be pulled towards the inside face. Cutting ties back from the faces of forms and grade beams will not be permitted. Work damaged due to premature or careless removal of forms, any undulation in exposed concrete surface due to sag / settlement or movement of supports found after removal of shuttering shall be reconstructed or rectified to the satisfaction of the Engineer-in-charge by the contractor at his own risk and cost. Abrupt changes in surface of concrete, mortar fins at formwork joints shall be made even by chipping, grinding and finishing with cement mortar, curing, etc. as directed by Engineer-in-charge at his own cost.

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Description [As per IS :456]</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>For vertical members such as columns, beams, shear walls etc</td>
<td>16-24 Hours</td>
</tr>
<tr>
<td>3</td>
<td>Soffit form work to Slabs</td>
<td>3 days (care to be taken so that props to be fixed immediately after removing form work)</td>
</tr>
<tr>
<td>4</td>
<td>Soffit form work to Beam –</td>
<td>7 days (care to be taken so that props to be fixed immediately after removing form work)</td>
</tr>
<tr>
<td>5</td>
<td>Props left under slab can be removed after 7 days if spanning is less than 4.5 m and 14 days for spanning over 4.5 m</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Props left under slab can be removed after 14 days if spanning is less than 6 m and 21 days for spanning over than 6 m</td>
<td></td>
</tr>
</tbody>
</table>

11.0 Mode of Measurement:

11.1 The net area of exposed surfaces of concrete members as shown in the drawings coming in contact with form work shall be measured under item of form work in square meter.

11.2 The dimensions of the formwork shall be measured correct to a centimeter.

11.3 No deductions shall be made from the shuttering for openings/obstructions up to an area of 0.10 m² and nothing extra shall be paid of forming such opening.

11.4 For the purpose of measurements for formwork IS: 1200 (Part V) shall be referred.
1.01 SPECIFICATION OF BRICK MASONARY WORKS

1.0 General:

1.1 brick shall be table moulded of uniform size, shape and colour must be well burnt so as to give a clear ringing sound when struck. They shall be clean, whole and free from flaws, cracks, stones or lumps of any kind, especially lime. They shall have sharp edges, shapes and even surface and shall be sound & hard to resist compression. They shall be from a source to be approved by the Engineer-in-charge and the quality of the brick should be such that they shall not absorb more than 20% of water by weight after immersion in water for 24 hours and shall have a compressive strength of 3.5 N/mm² as per IS: 1077-1992.

1.2 All bricks shall be thoroughly saturated with water before use. They should be soaked for about 12 hours for this purpose. No broken bricks shall be used except as closers. The course shall be laid flush in mortar and every course shall be thoroughly grouted, joints shall be broken vertically and they shall not exceed 10 mm in thickness. The horizontal joints shall not be more than 10 mm in thickness. The work shall not be raised more than 12 courses per day. It shall be kept constantly wet for at least 10 days and twice a day for a month. Date of laying the brickwork shall have to be marked, as directed by the Engineer-in-charge, on the wall so as to ensure easy monitoring of the curing period.

1.3 Before starting the brick masonry, the concrete surfaces e.g., plinth beams, columns, slabs, chajjas, etc. shall be thoroughly hacked and washed to remove all mud, dirt, loose particles, etc. No holes for supporting scaffolding arrangement shall be allowed especially at the junction of concrete surfaces and the brickwork. However, these holes may be allowed elsewhere and are to be made good after the scaffolding is removed in such a manner so as to ensure complete watertightness. When the fresh brickwork to be started on the old brick masonry the surface should be thoroughly cleaned and washed to remove all moss deposit, loose mortar, mud and dirt, etc.

1.4 String courses and mouldings shall be set straight and true by projecting brickwork with properly cut and shaped bricks wherever necessary with as fine joints as possible.

1.5 The walls shall be carried up regularly in all cases when the nature of the work will admit of it, not leaving any part 1.0 M lower than another, when circumstances render it necessary to carry out on the same section of a building in uneven course. The brick shall be raked back so as to maintain uniform and effectual bond.

1.6 In brick arched and other circular work, the brick shall be shaped to have joints indicating correctly to the center from the front to back of walls with thickness not meter than 10 mm. The face brick shall be of uniform colour and with sharp surfaces.

1.7 Where pointing or plastering is specified the joints in all brickwork shall be raked out on both the faces of the wall as the work proceeds.

1.8 The size of the brick shall be 230 (9") x 115 (4-1/2") x 75 mm (3") (or 190 x 90 x 90 mm). 230 mm (9") and 115 mm (4-1/2") thick walls will be built fair on one side only. All walls of greater thickness shall be built without exception with fair face to both sides.

1.9 Half brick or 115 mm thick brickwork shall be carried out in panels and with horizontal stiffeners of 115 x 75 mm with two bars of 10 mm diameter and spacers of 6 mm diameter at 900 mm center to center and vertical stiffeners of 115 x 75 mm with two bars of 10 mm diameter and spacers of 6 mm diameter at 2M center to center laid in 1:2:4 concrete properly filled including formwork, consolidation, curing, etc. The RCC work shall not be measured separately but will be included in the brickwork. The MS reinforcement however will be measured separately.

1.10 The contractor shall provide all necessary openings doors, windows or such other services and shall embed electrical fittings and fixtures; sleeves supplied by the other agency if required at no extra cost. Also shaping of the bricks for the exhaust fan, circular openings shall also be carried at no extra cost. All these openings shall be closed and gaps to be filled and finished neatly after the installation of all these services at no extra cost.

1.11 The rate for brickwork for both 230 mm and 115 mm thick walls shall include all single or double scaffolding, tools and plants, quoins and jambs, hacking, cutting and wastage of bricks for splayed joints, watering, etc. deductions shall be made for all the openings, lintels, sills, columns, etc. The unit for measurement of 230 mm brick masonry and above will be in cubic meter and for 115 mm thick masonry in square meter. The rates for brickwork shall also include the cost of the following –

1.11.1 Making good all holes (also ensuring the water tightness of the holes left out in external walls for supporting the scaffolding), chases to any depth due to conduit pipes, holdfast, switches, plug box, exhaust fan openings and other openings, etc.
2.0 Mortar:

2.1 Mortar for brick masonry shall be prepared as per IS: 2250. Mix for cement mortar shall be as specified in the respective items of work. Gauge boxes for sand shall be of such dimensions that one complete bag of cement containing of 50 kg of cement forms one unit. The sand shall be free from clay, shale, loam, alkali and organic matter and shall be of sound, hard, clean and durable particles. Sand shall be approved by Engineer-in-charge. If so directed by the Engineer-in-charge sand shall be thoroughly washed till it is free from any contamination.

2.2 For preparing cement mortar, the ingredients shall be first mixed thoroughly in dry condition. Water shall then be added and mixing continued to give a uniform mix of required consistency. Cement mortar shall preferably be machine mixed, though hand mixing in a thorough manner may be allowed. The mortar so mixed shall be used within 25 minutes of mixing. Mortar left unused beyond specified period shall be rejected.

2.3 The contractor shall arrange for test of mortar sample if so directed by the Engineer-in-charge. Re-tempering of mortar shall not be permitted.

2.4 All the brickwork shall be built tightly against column, floor slabs or other structural members.

3.0 Workmanship:

3.1 Soaking of bricks:

3.1.1 The bricks required for masonry shall be thoroughly wetted with clean water for about 4 hours before use or as directed. The cessation of bubbles, when the bricks are wetted with water is an indication of thorough wetting of bricks.

3.2 Laying:

3.2.1 Bricks shall be laid in English bond unless directed otherwise. Half or cut bricks shall not be used except when necessary to complete the bond; closer and in such case it shall be cut to required size and used near the ends of walls.

3.2.2 A layer of mortar shall be spread on full width for suitable length of the lower course. Each brick shall first be properly bedded and set home by gently tapping with the handle of the trowel or wooden mallet. Its inside face shall be flushed with mortar before the next brick is laid and pressed against it. On completion of the course, the vertical joints shall be fully filled from the top, with mortar.

3.2.3 The walls shall be taken up truly in plumb. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Vertical joints in alternate courses shall generally be in one vertical plane. The thickness of brick course shall be kept uniform.

3.2.4 The bricks shall be laid with the frog facing upwards. A set of tools comprising of wooden straight edges, manson's spirit level, square half meter rub, pins, string and plumb shall be kept on the site of work for frequent checking during the progress of work.

3.2.5 Both the faces of walls, having thickness greater than 23 cm. shall be kept in proper plumb. All the connected brick work shall be kept not more than 1 m. over the rest of the work. Where this is not possible, the work shall be raked back according to bond (and not left toothed) at an angle not steeper than 45.

3.2.6 All the fixtures, pipe outlets of water, holdfasts of doors and windows, etc. which are required to be built in the wall shall be embedded in CM, as per the drawings or as directed.

3.3 Joints:

3.3.1 Bricks shall be so laid that all joints are quite flush with mortar. Thickness of joints shall not exceed 12 mm. The face joints shall be raked out as directed by taking tools daily, during the progress of work, when the mortar is still green so as to provide key for plaster or pointing to be done, subsequently.

3.3.2 The face of bricks shall be cleaned everyday on which the brick work is laid and all mortar dropping shall be removed.

3.3.3 At the end of day's work or on holidays the top of unfinished masonry shall be kept wet. If the mortar becomes dry, white or powdery, for want of curing, work shall be pulled down and re-built at Contractor's expense.

3.4 Curing:

3.4.1 Fresh work shall be protected from rain suitably. Masonry work shall be kept moist on all the faces for minimum period of 7 days. The top of masonry work shall be kept well wetted at the end of the day's work.
1.01 SPECIFICATION OF PLASTERING AND POINTING WORKS

1.0 Scope:
1.1 The work covered under this specification consist of supplying all materials and rendering all types of plaster / pointing finishes strictly in accordance with these specifications and applicable drawings etc..

2.0 Applicable Codes and Specification
2.1 The relevant I.S. specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

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3.0 Cement Plaster With Neeru Plaster
3.1 The specifications for cement, sand and water shall generally conform to their relevant specifications described under ‘Reinforced Concrete and Allied Works’.
3.2 Neeru shall be prepared from best available hydraulic lime slaked with fresh water and sifted. The lime shall be ground fine in a mortar mill and kept moist until used. A sample of lime to be used for neeru shall be produced by the contractor for the approval of Engineer-In-charge. Samples of lime may be subjected to tests as per relevant I.S. before final approval. All time/ neeru to be used on the work shall conform to the approved sample.
3.3 Double scaffolding shall be adopted for all plaster work unless permitted to otherwise by the Engineer-In-charge. No holes shall be made in the masonry for supporting the scaffolding.
3.4 The scaffolding members shall not be tied to windows or door frames and other members provided in the walls.
3.5 The rate for all plaster work shall also include for making good and completing the plaster after the flooring, skirting or dado tiles are laid either by the same or any other agency.
3.6 No extra will be paid for making groovers in the internal plaster work.

4.0 Cement Plaster With Cement Finish:
4.1 The specifications for cement, sand and water shall generally conform to their relevant specifications described under ‘Reinforced Concrete And Allied Works’.
4.2 Cement and fine screened sand shall be thoroughly mixed dry in the proportion specified.
4.3 Only minimum water shall then be added and the mortar mixed thoroughly until homogenous and required consistency is obtained.
4.4 No more mortar shall be mixed than can be used up in half an hour.
4.5 The surface to be plastered shall first be thoroughly cleaned and all joints raked out at least 12 mm deep to serve as keys. The raking shall be done carefully and no chipping of the masonry shall be allowed.
4.6 All concrete surfaces shall be hacked to provide necessary bonding for the plaster.
4.7 The rate for plaster should include the hacking of surfaces also. All dirt, soot, oil, paint or any other material that might interfere with satisfactory bond shall be removed.
4.8 Soft and crumbling brick and stone work, oil soaked material and timber are not suitable for receiving plaster directly and therefore, the surface shall be brushed and washed with fresh water and maintained in a thoroughly wet condition for 24 hours before commencing plastering.
4.9 The plastering shall not be commenced until the preparatory work is approved by the Engineer-In-charge.

4.10 The cement mortar for the plaster work shall be as specified in the item of schedule.

4.11 The plaster shall be applied with somewhat more than the required thickness and leveled with a wooden trowel so that the final plaster after trawelling will have the specified thickness for concrete and bricks masonry surfaces.

4.12 Before the scratch coat hardens, the surface shall be cross scratched to provide mechanical key for the final coat. The cross scratching shall be horizontal as far as possible to aid curing.

4.13 The surface shall be kept continuously damp for at least two days immediately following its applications. It shall then be allowed to dry.

4.14 Fine sand of approval quality shall be used for finish coat. The finish coat shall be about 5 mm thick.

4.15 There shall be at least a 3 days interval between application of the first coat an finish coat. Before applying the finishing coat, dampen the first coat evenly by frog spray wherever possible and the coat shall be applied from top to bottom in one operation eliminating joining marks.

4.16 The plaster shall be well pressed into the joints and the surface rubbed smooth after floating it with a coat of pure cement.

4.17 The use of dry cement shall not be permitted.

4.18 All plaster work shall be kept damp continuously for a minimum period of 10 days after the application of finishing coat.

4.19 To prevent excessive evaporation of the sunny or windward sides of buildings in hot dry weather, matting or gunny bags should be hung over the outside of the plaster to keep it moist.

4.20 Should the plaster crack through neglect of watering or for any other fault of the contractor the work shall be remove and redone at the contractors expenses.

4.21 Should the contractor fail to water the work to the satisfaction of the Engineer-In-charge the latter may engage requisite men to water the work properly at the cost of the contractor.

5.0 Water Proof Plaster :

5.1 The same specification as detailed for ‘Cement Plaster With Cement Finish’ shall apply to this plaster also.

5.2 However, plaster shall be finished smooth with neat cement and water proofing compound of approved manufacture shall be added in cement mortar @ 2% by weight of cement.

5.3 The water proofing compound shall have to be supplied by the contractor. No extra shall be paid or mixing the water proofing compound in the mortars as directed.

6.0 Sand Faced Cement Plaster :

6.1 Surface preparation shall be done in the same manner as for ‘Cement Plaster With Cement Finish’.

6.2 Sand faced plaster shall be done in two coats. Backing coat shall be in cement mortar 1:4 and finishing coat shall be in cement mortar 1:3.

6.3 The sand to be used for the finishing coat shall be screened to pass through 2.36 mm mesh sieve and all material passing through 1.18 mm mesh sieve shall be eliminated.

6.4 The sand shall be thoroughly washed to remove all dust and silt.

6.5 The cement and sand shall be mixed dry until the mixture is homogenous and water shall then be added gradually to the required extent, the mixture being turned over as often as required to produce a homogenous mass of uniform colour.

6.6 Backing coat of 12 mm thick with cement mortar 1:4 shall be applied first. Approved water proofing compound @ 2% by weight of cement shall be added in the backing coat.

6.7 No extra shall be paid for mixing the water proofing compound in the cement mortar as directed.

6.8 The surface shall be made even and uniform by means of wooden floats and roughened with wire brushes to give a good bond to the finishing coat.

6.9 The backing coat should then the thoroughly cured for at least 7 days before the finishing coat is taken in hand.
6.10 The finishing coat of 8 mm thick in cement mortar 1:3 should then be applied uniformly with wooden float.

6.11 The entire surface should then be rubbed with approved sponges to expose the sand grains uniformly and predominantly.

6.12 The surface shall be cured again for at least 10 days.

7.0 Groove in Sand Faced Cement Plaster:

7.1 The horizontal and vertical grooves shall be exactly to the required depth and width as shown in the drawings.

7.2 The grooves shall be neatly finished with extreme care.

7.3 All horizontal and vertical grooves shall be imperfect straight lines without any break in the continuity.

7.4 No Payment shall be given for making grooves as specified in the detailed item specifications.

8.0 Mode of Measurement:

8.1 The unit of measurement for all the plaster items shall be square metre.

8.2 The measurement shall be taken on unplastered surfaces.

8.3 The areas of doors, windows, and all other openings shall be deducted and areas of jambs, reveals, soffits of openings and sills shall be measured and paid for.

8.4 The unit of measurement for grooves in sand faced cement plaster shall be running metre.

9.0 Providing and laying 10 mm. thick cement plaster in CM 1:3, at all floors, at all heights with necessary scaffolding, curing, making grooves, forming pattas and drip moulds etc. complete, with smooth finishing as directed by the Architect and Engineer-in-charge.

9.1 Workmanship:

9.1.1 Scaffolding: Wooden ballies, bamboo, planks, trestles and other Steel scaffolding shall be sound. These shall be properly examined before erection and use. Stage scaffolding shall be provided for ceiling plaster, which shall be independent of the walls.

9.2 Preparation of background:

9.2.1 The surface shall be cleaned of all dust, loose mortar droppings, traces of algae, efflorescence and other foreign matter by water or by brushing. Smooth surface shall be roughened by wire brushing if it is not hard and by dense hacking if it is concrete. In case of concrete surface, if a chemical retarder or shuttering oil has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles shall be cleaned off and care shall be taken that none of the retarder is left on the surface. Trimming of projections on brick/concrete surface wherever necessary shall be carried out to get an even surface.

9.2.2 Raking of joints in case of masonry wherever necessary shall be allowed to dry out for sufficient period before carrying out the plaster work.

9.2.3 Scaffolding for carrying out plastering work shall be double scaffolding having two sets of vertical supports so that the scaffolding is independent of the walls.

9.3 Preparation of Surface:

9.3.1 All putlog holes in brickwork and junction between concrete and brickwork shall be properly filled in advance. Joints in brick work shall be raked about 10 mm. and concrete surface shall be hacked to provide grip to the plaster. Projecting burrs of mortars formed due to gaps at joints in shuttering shall be removed. The surface shall be scrubbed clean with wire brush/coir brush to remove dirt, dust etc., and the surface thoroughly washed with clean water to remove efflorescence, grease and oil etc., and shall be kept wet for a minimum of two hours before application of plaster.
9.3.2 For external plaster, the plastering operation shall be started from the top floor and carried downwards. For internal plaster, the plastering operations may be started wherever the building frame and cladding work are ready and the temporary supporting ceiling resting on the wall of the floor have been removed. Ceiling plaster shall be completed before starting plaster to walls.

9.4 Applications of Plaster:

9.4.1 The plaster about 15 cm. x 15 cm., shall be first applied horizontally and vertically at not more than 2 m. intervals over the entire surface to serve as gauge. The surfaces of these gauges shall be truly in plane of the finished plastered surface. The mortar shall then be applied in uniform surface slightly more than the specified thickness, then brought to a true surface by working a wooden straight edge reaching across the gauges with small upwards and sideways movements at a time. Finally, the surface shall be finished off true with a trowel or wooden float according to the texture, smooth or sandy granular, as may be required. Excessive Trowelling or over working the float shall be avoided. All corners, arises, angles and junctions etc. shall be carried out with proper templates to the size required.

9.4.2 Cement mortar shall be used within half an hour after addition of water. Any mortar or plaster which is partially set shall be rejected and removed from the site.

9.4.3 In suspending the work at the end of the day, the plaster shall be left out, clean to line both horizontally and vertically. While recommencing the plaster, the edges of the old work shall be scrapped clean and wetted with cement putty before plaster is applied to the adjacent areas to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of the wall and shall not be nearer than 15 cm. to any corners or arises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakage. No portion of the surface shall be left out initially to be patched up later on.

9.4.4 Each coat shall be kept damp continuously till the next coat is applied or for a minimum period of 7 days. Moistening shall commence as soon as plaster is hardened sufficiently. Soaking of walls shall be avoided and only as much water as can be readily absorbed shall be used, excessive evaporation on the sunny or windward side of building in hot air or dry weather shall be prevented by hanging mats or gunny bags on the outside of the plaster and by keeping them wet.

10.0 Providing & laying average 20 mm. thick cement plaster in two coats at all heights and any levels. First base coat in CM 1:4 with rough finishing with wired and second coat in CM 1:3 in cement mala finish (finished with steel trowel) including scaffolding, curing, making grooves, forming pattas and drip mould, etc. complete, as directed.

10.1 Materials & Workmanship:

10.1.1 The relevant specifications of item No. 9.0 shall be followed except that the thickness of the plaster shall be average 20 mm. and shall be carried out as specified in the item. The base coat shall be carried in CM 1:4 having average 12 mm. thickness. Before the plastered surface hardens roughing shall be done to receive the second coat. Second coat shall be applied only after minimum curing of 72 hours. The second coat shall be carried out in CM 1:3 having average 8 mm thickness. The surface shall be finished smooth with steel trowel (Mala finish).

11.0 Providing cement vata, 10 cm. x 10 cm. size, quarter round in cement mortar 1:1 including neat cement finishing, watering, etc. complete.

11.1 Workmanship:

11.1.1 The work of cement vata of 10 cm. x 10 cm. size shall be carried out at junctions of parapets and terraces as directed. The vata shall be finished in quarter round shape. The work shall be carried out in the best workman-like manner. The internal portion of rain water pipe shall be rounded off properly during constructing the vata. The work shall be cured for 7 days.

11.2 Mode of Measurement and Payment:

11.2.1 The work shall be measured for finished item in rmt.

11.2.2 The rate shall be for an unit of one rmt.
12.0 Providing throating or plaster drip and moulding to R.C.C Chhajjas.

12.1 Workmanship:

12.1.1 The work shall be carried out as directed. The proportion of the mix for finishing and touching shall be in CM 1:2, by volume. Curing shall be done for not less than 7 days. The work shall be carried out in best workman-like manner. The throating or plaster drip and moulding shall be 10 mm in thickness.
# SPECIFICATION OF PAINTING AND POLISHING WORKS

## 1.0 Scope:

1.1 The work covered under these specifications consist of furnishing the various types of paints and also the workmanship for these items, in strict compliance with these specifications, which are given in detail here-in-after with the item of schedule of quantities.

## 2.0 Materials:

2.1 Paints, oils, varnishes etc. of approved brand and manufacture shall be used. Ready mixed paints as received from the manufacturer without any admixture shall be used.

2.2 If for any reason, thinning is necessary in case of ready mixed paint, the brand of thinner recommended by the manufacturer or as instructed by the Engineer-in-Charge shall be used. Approved paints, oils or varnishes shall be brought to the site of work by the contractor in their original containers in sealed condition. The materials shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnights work. The materials shall be kept in the joint custody of the contractor and the Engineer-in-Charge. The empties shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the Engineer-in-Charge.

2.3 The contractor shall associate the chemist of paint manufacturers before commencement of work, during and after the completion of work who shall certify the suitability of the surface to receive painting and the paint before use etc.

## 3.0 Commencing Works:

3.1 Scaffolding: Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No ballies, bamboos or planks shall rest on or touch the surface which is being painted.

3.2 Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls.

3.3 For painting of the ceiling, proper stage scaffolding shall be erected.

3.4 Painting shall not be started until and unless the Engineer-in-Charge has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work.

3.5 Painting, except the priming coat, shall generally be taken in hand after all other builders work, practically finished.

3.6 The rooms should be thoroughly swept out and the entire building cleaned up at least one day in advance of the paint work being started.

## 4.0 Preparation Surfaces:

4.1 The surface shall be thoroughly cleaned. All dirt, rust, scales, smoke and grease shall be thoroughly removed before painting is started. Minor patches if any in plastered/form finished surfaces shall be repaired and finished in line and level in C.M. 1:1 and cracks & crevices shall be filled with approved filler, by the contractor at no extra cost to the Department. The prepared surface shall have received the approval of the Engineer-in-Charge after inspection, before painting is commenced.

## 5.0 Applications:

5.1 Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its containers. When applying also, the paint shall be continuously stirred in the smaller containers so that consistency is kept uniform.

5.2 The external surfaces of the buildings under reference including the R.C.C. Jalli, fins and the panels above and below the window etc. shall be finished in different colours of approved shade. The contractor will make suitable samples at site for Departments approval before taking up the work in hand and they will be allowed to proceed with the work only after getting Departments approval for the same.

5.3 The painting shall be laid on evenly and smoothly by means of crossing and laying off, the later in the direction of the grain in case of wood. The crossing & laying off consists of covering the area with paint,
brushing the surface hard for the first time and then brushing alternately in opposite directions two or three
time and then finally brushing lightly in direction at right angles to the same. In this process, no brush marks
shall be left after the laying off is finished. The full process of crossing and laying will constitute one coat.

5.4 Where so stipulated, the painting shall be done with spraying. Spray machine used may be (a) a high
pressure (small air aperture) type or (b) a low pressure (large air gap) type, depending on the nature and
location of work to be carried out. Skilled and experienced workmen shall be employed for this class of work.
Paints used shall be brought to the requisite consistency by adding a suitable thinner. Spraying should be
done only when dry condition prevails.

5.5 Each coat shall be allowed to dry out thoroughly and rubbed smooth before the next coat is applied. This
should be facilitated by thorough ventilation.

5.6 Each coat except the last coat, shall be lightly rubbed down with sand paper or fine pumice stone and cleaned
of dust before the next coat is laid.

5.7 No left over paint shall be put back into the stock tins. When not in use, containers shall be kept properly
closed.

5.8 The final painted surface shall present a uniform appearance and no streaks, blisters, hair marks from the
brush or clogging of paint puddles in the corners of panels, angles of moldings etc. shall be left on the work.

5.9 In case of cement based paints/primers, the absorbent surfaces shall be evenly damped so as to give even
suction. In any weather, freshly painted surfaces shall be kept damp for at least two days.

5.10 In painting doors and windows, the putty around the glass panes must also be painted, but care must be
taken to see that no paint stains etc. are left on the glass. Tops of shutters and surfaces in similar hidden
locations shall not be left out while painting. Perspect covers of electrical switch boxes have to be painted
from inside by removing them. Care shall be taken while removing them in position after painting with
respective approved paints. In painting steel work, special care shall be taken while painting over bolts, nuts,
rivets, overlaps etc.

5.11 The additional specifications for primer and other coats of paints shall be as in accordance to the detailed
specifications under the respective headings.

5.12 Any damage caused during painting work to the existing works/surfaces shall be made good by the contractor
at his own cost

6.0 Brushes and Containers:

6.1 After work, the brushes shall be completely cleaned off paint and linseed oil by rinsing with turpentine. A brush
in which paint has dried up is ruined and shall on no account be used for painting work. The containers, when
not in use, shall be closed, kept air tight and shall be kept at a place free from dust. When the paint has been
used, the containers shall be washed with turpentine and wiped dry with soft clean cloth, so that they are
clean & can be used again.

7.0 White wash with lime on any surfaces (3 coats with brush) to give an even shade, including thoroughly
brooming the surface to remove all dirt, dust, mortar drops and other foreign matter etc. complete.

7.1 Materials :

7.1.1 The clearcolle shall be made from glue and boiling water by mixing 1 Kg. of glue to every 15 litres of water
Mixture shall be suitably tinted where required for use under coloured distemper, if directed. Glue shall
conform to IS : 852-1969 (Specifications for animal glue).

7.1.2 Lime used shall be freshly burnt class `C' Lime (fat lime) and white in colour conforming to IS : 712:1973.
Water shall conform to M-1. Best quality of gum (D.D.L) of Pidilite Industries Ltd. shall be used in the
preparation of white wash. Ultramarine blue or Indigo : They shall conform to IS : 55-1970 for paints and
shall be used for preparation of white wash. Pigments : Mineral colours, not affected by lime shall be used
in preparing colour wash.

7.2 Workmanship :

7.2.1 Preparation of white wash solution : Surface already white washed or coloured : The fat lime shall be
slaked at site and shall be mixed and stirred with about five litres of water for 1 Kg. of unslaked lime to
make the mixture creamy. This shall be allowed to stand for a period of 24 hours and then shall be screened through a clean coarse cloth. 4 Kg. of gum or glue of Pidilite Co. (D.D.L.) dissolved in hot water shall be added to each cubic meter of lime cream. Small quantity of ultramarine blue (upto 3 gms. per kg. of lime) shall also be added to the last two coats of white wash solution, if directed and the whole solution shall be stirred thoroughly before use.

### 7.3 Preparation of surface:

#### 7.3.1 The surface shall be thoroughly cleaned of all dust, dirt, mortar dropping and other foreign matter before white wash is to be applied.

#### 7.3.2 The surface spoiled by smoke soot shall be scrapped with steel wire brushes or steel scrapers or shall be rubbed with over burnt surkhi or brick bats. The surface shall be then broomed to remove all dust and dirt and shall be washed with clean water.

#### 7.3.3 Oil or grease spots shall be removed by suitable chemical. Smooth surfaces shall be rubbed with wire brushes.

#### 7.3.4 All unsound portion of the surface plaster shall be removed to full depth of plaster in rectangular patches and plastered again after raking the masonry joints properly. Such portions shall be wetted and allowed to dry. Any crevices, at any level shall be cleaned and filled with the plaster mortar and cured as above. They shall then be given one coat of white wash.

#### 7.3.5 All unnecessary nails shall be removed, the holes, cracks, patches etc. shall be made good with material similar in composition to the surface to be prepared.

### 7.4 Scaffolding:

#### 7.4.1 Wherever scaffolding is necessary, it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be white or colour washed. A properly secured, strong and well tied suspended platform (Zoola) may be used for white washing. Where ladders are used, pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the floors and walls. For white washing of ceilings, proper stage scaffolding shall be erected where necessary. Also, while painting the ceiling, the floor area shall be covered properly with plastic so that the flooring is not spoiled.

### 7.5 Application of white wash:

#### 7.5.1 On the surface so prepared, white wash shall be applied with moon brush. The first stroke of the brush shall be from top to downwards, another from bottom to upwards over the first stroke and similarly one stroke from the right and another from the left over the first stroke of the brush before it dries. This will form one coat. Each coat shall be allowed to dry before next coat is applied. Number of coats as specified in the item shall be applied. It shall present smooth and uniform finish, free from brush marks and it should not come off easily when rubbed with a finger.

#### 7.5.2 Splashing and droppings, if any on the doors and windows, ventilators, floors etc. shall be removed and the surface shall be cleaned.

#### 7.5.3 Each coat shall be allowed to dry before next coat is applied. If additional coats are required then what have been specified and applied, the same shall be applied to obtain uniform and smooth finish. It shall be done at no extra cost. The finished dry surface shall not show any signs of cracking and pealing nor shall come off easily on the hand when rubbed.

#### 7.5.4 Sample shall be approved by the Architect and Engineer-in-charge before execution of the work.
8.0 Distempering (3 coats) with oil bound washable distemper of approved manufacturer like Asian, Berger, Nerolac or equivalent

8.1 Materials :

8.1.1 Oil bound washable distemper and cement primer if on plastered surfaces and wood orite, if on wood surfaces, shall be of approved brand and manufacture. The distemper shall be of required colour and shade and the same shall conform to IS : 428-1969.

8.2 Workmanship :

8.2.1 Scaffolding :

Where scaffolding is required, it shall be erected in such a way that as far as possible, no part of scaffolding shall rest against the surface to be distempered. A properly secured strong and well tied suspended platform (Zoola) may be used for distempering. Where ladders are used, pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the walls and floors. For distempering to ceiling, proper stage scaffolding shall be erected where necessary and the floor area shall be covered with plastic so that the flooring is not spoilt.

8.2.2 Preparation of surface :

8.2.2.1 The undecorated surface to be distempered shall be thoroughly brushed from dust, dirt, grease, mortar dropping and other foreign matter and sand papered smooth. New plaster surface shall be allowed to dry for at least 2 months before applications of distemper or one coat of white wash with white cement shall be done prior to painting with distemper.

8.2.2.2 All unnecessary nails, hooks etc. shall be removed. Pitting in plaster shall be made good with plaster again and papered with a fine grade sand paper and made smooth. A coat of distemper shall be applied over the patches. The surface shall be allowed to dry thoroughly before the regular coat of distemper is applied. The surface affected by moulds, moss, fungi, algae lichens, efflorescence etc. shall be treated in accordance with IS : 2395 (Part-1)-1966. Before applying distemper, any unevenness shall be made good by applying putty made out of plaster of paris mixed with water, on entire surface, including filling up the undulation and then sand papering the same after it has dried.

8.2.3 Priming coat :

8.2.3.1 A priming coat of cement primer of approved manufacture shall be applied over the papered surface in case of new work or undecorated surface. If the distemper priming is done after the plastered wall surface dries completely, the distemper primer shall be avoided.

8.2.4 Application of primer and putty :

8.2.4.1 The primer shall be applied with a brush on the clean, dry and smooth surface. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. A coat of putty (lapi) shall be applied to the entire surface. Putty shall be used of ready made or brought of the company like Asian as directed by the Engineer-in-charge and Architect. The second coat of primer and putty shall then be applied and it shall thereafter be allowed to dry for at least 48 hours before oil bound distemper or paint is applied.

8.2.4.2 Oil bound distemper is not recommended to be applied within six months of the completion of wall plaster.

8.2.5 Preparation of oil bound distemper :

8.2.5.1 The distemper shall be diluted with mineral turpentine oil or any other prescribed thinner in a manner recommended by the manufacturer only. Sufficient quantity of distemper required for a day's work shall be prepared.

8.2.6 Application of Distemper coat :

8.2.6.1 On any surfaces, after the primer coat has dried for at least 48 hours, the surface shall be lightly sand papered to make it smooth for receiving the distemper, taking care not to rub out the priming coat. All loose particles
shall be dusted off after rubbing. Minimum two coats of distemper shall be applied with brushes in horizontal strokes followed immediately by vertical strokes which together shall constitute one coat. The subsequent coats shall be applied after a time interval of at least 24 hours between 2 consecutive coats to allow proper drying of the preceding coat. The finished surface shall be even and uniform without patches, brush marks, distemper drops etc.

8.2.6.2 Sufficient quantity of distemper shall be mixed to finish one room at a time. The application of a coat in each room shall be finished in one operation and no work shall be started in any room which cannot be completed on the same day.

8.2.6.3 15 cm. double bristled distemper brush shall be used. After a day’s work, brushes shall be thoroughly washed in hot water with soap solution and hung down to dry. Old brushes which are dirty and caked with distemper shall not be used on the work.

8.2.7 Protective measure:

8.2.7.1 The surface of doors, windows, ventilators, floors, articles of furniture etc. and such other part of the buildings which are not to be distempered shall be protected from being splashed upon. Such surfaces shall be cleaned of distemper splashes, if any.

8.3 Providing & applying three coats (first two coats are with brush and final coat is with roller) of plastic emulsion paint of desired shade, of approved make

8.4 Materials:

8.4.1 The plastic emulsion shall conform to IS : 5411-1969(Part-1).

8.5 Workmanship:

8.5.1 The relevant specification of item no. 8.0 shall be followed except that plastic emulsion paint shall be applied on any surfaces. For flat and pearl luster (semi gloss) paint of same specification shall be followed except that the type of paint shall be changed as per the direction of Architect and Engineer-in-charge, to give the desired finish.

8.5.2 Preparation of Mix:

8.5.2.1 This shall be done as per the manufacturer’s instructions. The thinning of emulsion is to be done with water and not with turpentine. The quantity of thinner to be added to shall be as per manufacturer’s instructions.

8.5.3 Application:

8.5.3.1 Before pouring into small containers for use of applying, the paint shall be stirred thoroughly in its container. Also, the paint shall be continuously stirred in the smaller container, so that its consistency is kept uniform.

8.5.3.2 The paint shall be laid on evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area over 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 direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat. No hair marks from the brush or clogging of paint puddles in the corners of panels, angles of moldings etc. shall be left on the work.

8.5.3.3 The paint shall be applied with brush for first two coats and final coat shall be done with roller only. The surface shall be treated with minimum one coat of alkali resistant primer and putty as specified in relevant specification of workmanship of item no.11.02.a. The second or subsequent coat shall not be started until the preceding coat has become sufficiently hard to resist marking of the brush being used.

8.5.3.4 The surface on finishing shall present a flat velvety smooth/pearl luster (semi gloss) finish, as specified in the item. It shall be even and uniform in shade without patches, brush marks, paint drops etc.

8.5.4 Precautions:

8.5.4.1 Old brushes if they are to be used with emulsions paints, shall be completely dried of turpentine or oil paint by washing in warm soap water. Brushes shall be quickly washed in water immediately after use and shall be kept immersed in water during break periods to prevent the paint from hardening on the brush.

8.5.4.2 In the preparation of walls for plastic emulsion painting, no oil base putties shall be used in filling cracks, holes
etc.

8.5.4.3 Splashes on floors etc. shall be cleaned out without delay as they will be difficult to remove after hardening.

8.5.4.4 Washing of surfaces treated with emulsion paint shall not be done within 3 to 4 weeks of application.

9.0 Applying priming coat of yellow zinc chromate, over new steel and other metal surfaces after and including preparing the surface by thoroughly cleaning oil, grease, dirt and other foreign matter and secured with brushes, fine steel wood scrapes and sand paper, with ready mixed priming paint, brushing with red lead.

9.1 Materials:

9.1.1 The ready mixed primer, brushing red lead shall conform to IS : 102-1962.

9.1.2 The thinner (linseed oil) shall conform to IS : 75-1973, if, for any reason, thinning is necessary. In case of ready mix paint, the brand of thinner recommended by manufacturer shall be used.

9.2 Workmanship:

9.2.1 Preparation of surfaces:

9.2.1.1 The surfaces to be painted shall be cleaned of all rust, scale, dirt and other foreign matter sticking to it with wire brushes, steel wool, scrapers, sand paper etc. This surface shall then be wiped finally with mineral turpentine which shall also removed grease and perspiration of hand marks. The surface shall then be allowed to dry.

9.2.2 Application of primer:

9.2.2.1 After the preparation of the surface, the priming coat shall be applied immediately. The brushing operations are to be adjusted to the spreading capacity advised by the manufacturer of the particular primer. The paint shall be applied evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area over with paint, brushing alternately in opposite directions, two or three times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat.

9.2.2.2 During painting, every time after the priming coat has been worked out of the brush bristles or after the brush has been unloaded of the primer, the bristles of the brush shall be opened up by striking the brush against portion of the unpainted surface with the end of the bristles, held at right angles to the surface, so that bristles thereafter will collect the correct amount of paint when dipped again into a paint container. The primary coat shall be allowed to dry completely before painting is started.

9.2.2.3 No hair marks from the brush or clogging of paint puddles in the corner or panels angles of mouldings etc. shall be left on the work.

9.2.2.4 Special care shall be taken while painting over bolts, nuts, rivets overlaps etc.

9.2.2.5 The container when not in use shall be kept close and free from air so that paint does not get thickened and also shall be kept guarded from dust.

10.0 Providing and applying Silicone paint solvent base/water based over exposed concrete and brick surfaces and plastered surfaces, as directed with a minimum 5 years guarantee on stamp paper to the employer directly. (The Contractor should specify the % concentration of silicone while quoting the rate.)

10.1 Materials:

10.1.1 Silicone paint shall be of approved quality like Repelin or equivalent (water repellent paint) as approved by the Architect and Engineer-in-charge.

10.2 Workmanship:

10.2.1 The silicone paint shall be diluted with water in proportion, 1 part of silicone to 8 parts of water. The paint shall be sprayed with spray gun as directed.

10.2.2 A guarantee bond on appropriately stamped paper shall be given by the Contractor to the Client in the manner
form prescribed below:

FORM OF GUARANTEE BOND

"I/We ......................(Contractor) hereby guarantee that work will remain unaffected and will not be in any way damaged by water or any other humid conditions, for a period of 5 years after completion of the work of Silicone painting as per the terms and conditions of the contract and Contractor hereby indemnifies and agrees to save the Client from any loss and or damage that might be caused on account of exposure to water and hereby Guarantees to make good any loss or damages suffered by the Client and further guarantee to redo the affected work without claiming any extra cost."

2.3 This guarantee shall remain force for the period of 5 years from the completion of the work under the contract and it shall remain binding to the Contractor for period of 5 years.
6.01.a Steel work, riveted, in built-up sections, framed work, including cutting, hoisting fixing in position and applying a 3 coat of zinc chromate yellow oxide/red oxide primer and 2 coats of synthetic enamel paint, in Door/Window/Ventilator steel frames, shutters and the like.


2.0 Workmanship:

2.1 The steel sections, as specified or required, shall be straightened and cut square, to the correct lengths, as per drawings and design, measured with a steel tape. The sections shall be cold straightened and the finished goods shall be free from bending, twisting and other such defects. The cut ends, exposed to view shall be finished smooth. No two pieces shall be welded or otherwise jointed, to make up the required length or member, except as indicated in the drawing or as directed. All straightening and shaping, to form the specified shape and size shall be done by application of pressure and not by hammering. Any bending or cutting shall be carried out in such a manner, as not to impair the strength of the metal. All operations shall be done in cold state, unless otherwise directed/permited.

2.2 Steel riveted or bolted, in built-up sections, frame work:

2.2.1 The steel structure as shown in the drawings or as per direction of the Architect and Engineer-in-charge, shall be laid out on a level platform to full scale or in parts. A steel tape shall be used for measurements to ensure maximum accuracy.

2.2.2 The rate shall include all means of hoisting to places with scaffolding and equipments, etc., cutting chases, etc. in walls and floors of R.C.C, neat finishing, concreting, etc.

2.2.3 Wooden templates 12 mm. to 19 mm. thick, or metal sheet template shall be made to correspond to each connecting gusset plate/member and rivet holes shall be accurately marked on them and drilled. The templates shall be laid on the steel members, and holes of the steel members shall also be marked for drilling. The base of steel columns and the position of the anchor bolts shall be carefully set out.

2.2.4 All stiffeners shall be formed by pressure and where practicable, the metal shall not be cut and welded in making these. In major works or where so specified, shop drawings giving complete details and information for the fabrication of the component parts of the structure, including location, type, size, length and details of rivets, bolts, or weld shall be prepared in advance of the actual fabrication. The drawings shall indicate the shop and field rivets and bolts. The steel members shall be distinctly marked or stenciled with paint with the identification mark, as given in the shop drawings.

2.2.5 Great accuracy shall be observed in fabrication of various members, so that these can be assembled without being unduly packed, strained or forced into position and when built-up, shall be true and free from twists, links, buckles or open joints. Before making holes in individual members for fabrication, the steel work intended to be riveted or bolted together, shall be assembled or clamped properly and tightly, so as to ensure close abutting or lapping of surfaces of the different members, with proper jigs and fixtures. All contact surfaces shall be cleaned and given a coat of primer. All stiffeners shall bear tightly, both at top and bottom, without being drawn or caulked. The abutting joints shall be cut or dressed true and straight, in the required manner, as per the details and fitted close together, properly and tightly.

2.2.6 Web splice plates and fillers under stiffeners, shall be cut within 3 mm. to fit properly, or flange angles, web plates of girders shall have their ends flush with the top of angles forming the flanges, unless otherwise required. The web plates when spliced shall have clearance of, not more than 6 mm.

2.2.7 The erection clearance for cleared ends of members connecting steel to steel shall preferably be not greater than 1.5 mm. The erection clearance at the ends of beams without web cleats shall not be more than 3 mm. at each end but where for a practical reason greater clearance is necessary, suitably designed seating shall be provided.

2.2.8 Pins and rollers shall be accurately turned to gauge. These shall be straight and smooth and free from flaws. The roller bearing shall be provided with adequate arrangement for holding the girders or trusses resting on it. In columns caps and bases, the ends of shafts together with the attached gusset angles, channels etc., after riveting together shall accurately be mechanised so that the parts butt connected against each other over the entire surface of contact, connecting angles or channels shall be fabricated and placed in position with greater accuracy so that they are not unduly reduced in thickness by machining.

2.2.9 The ends of bearing stiffeners shall be mechanised or ground to fit tightly, both at the top and bottom. All holes shall generally be drilled to the required size and at required position. Sub punching shall be permitted, provided it is done 3 mm. or less in diameter and reamed thereafter to the required size. The holes for rivets and bolts shall be larger than the nominal diameter of rivets or black bolts, as allowable by IS:800.

2.2.10 Holes shall have their axis perpendicular to the surface bored through. The drilling or reaming shall be free from burrs.
2.2.13 Rivets shall be used where the connection is such that slip under load has to be avoided.

2.2.13.1 Rivets shall be used where the connection is such that slip under load has to be avoided.

2.2.13.2 Members to be riveted shall have all their parts firmly drawn and held together before and during riveting and special care shall be taken in this respect for all single riveted connections. For multiple riveted connections, a service bolt shall be provided in every third or fourth hole.

2.2.13.3 The shanks of rivets shall project beyond the plate surface sufficiently so as to fill the hole thoroughly and form the required head after riveting.

2.2.13.4 The riveting shall be done by hydraulic or pneumatic process. However, where such facilities are not available, hand riveting may be done, if permitted by Architect and Engineer-in-charge. The rivet shall be heated red hot, care being taken to control the temperature of heating so as not to burn the steel. Rivets of diameter less than 10 mm. may be fitted cold. Rivets shall be heat finish with heads full and of equal size. All loose, burnt or badly formed rivets with concentric or different heads shall be cut out and replaced. The heads of rivets shall be central to shanks and shall grip the assembled members firmly. In cutting out rivets, care shall be taken so as not to injure the rivets and the assembled members. Caulking or reoccupying shall not be permitted.

2.2.13.5 For testing rivets, hammer weighing approximately 0.25 Kg. shall be used. Both heads of the rivets shall be tapped, slack rivets will give a hollow sound and a jar.

2.2.13.6 All rivet heads shall be painted with red lead paint, within a week of their fixing.

2.2.13.7 While bolting, all bolt heads and nuts shall be hexagonal and of equal size, unless specified otherwise. The screwed threads shall conform to IS : 1363-1960 and the threaded surface shall not be tapered.

2.2.13.8 The nominal length of the bolt shall be the distance from the underside of the head to the farthest end of the shank. The nominal diameter shall be the diameter at the shank above the screwed threads. Bolts, nuts, washers shall be thoroughly cleaned and dipped in double boiled linseed oil, before use. The bolts shall be of such length so as to project at least 2 clear threads beyond the nuts when fixed in positions and these shall fit in the holes without any shakes. The nut shall be fit in the threaded ends of bolts properly, i.e. by tightening them so as to transfer the required tension. Where turned and fitted bolts are required to be used in place of rivets, they shall be provided with washers not less than 6 mm. thick so that the nut when tightened shall not bear on the unthreaded body of the bolt. Tapered washers shall be provided for all heads and nuts bearing on levelled surfaces. The threaded portion of the bolts shall not be within the thickness of the parts bolted together, it shall project through the nut atleast by 2 thread. The faces of the bolt heads and nuts abutting against steel members shall be machine finished. Where there is a risk of the nut being removed or becoming loose due to vibrations or reversal of stresses, these shall be secured from slackening by the use of lock nuts and spring washers of cross-cutting, as directed.

2.2.13.9 Bolts, nuts and washers shall be thoroughly cleaned and dipped in double boiled linseed oil before use. The whole steel work shall be painted with a coat of priming coat of red lead oxide and 3 coats of synthetic enamel paint as per relevant specifications of painting item no. 11.08a and 11.09. However, the application shall be such that the first coat of paint shall be much lighter than the final coat, the second coat shall be slightly lighter than the final coat and the final coat shall be exactly of the shade specified. This differentiation is done to demarcate the no. of application of painting
coats.

3.0 Mode of Measurements and Payment:

3.1 The rate includes cost of all material, labour, erection, hoisting, scaffolding, safety measures and sundry required for proper completion of the item of work, at all heights. This shall also include conveyance and delivery, handling, loading, unloading and storing etc. required for completion the item described above including necessary wastage involved.

3.2 The rate shall be for an unit of one kg.

6.01.b Steel work, welded, in built-up sections, framed work, including cutting, hoisting fixing in position and applying a priming coat of red lead paint and 3 coats of synthetic enamel paint, in Door/Window/Ventilator steel frames, shutters and the like.


2.0 Workmanship:

2.1 The relevant specifications of item No. 6.01 shall be followed except that the steel work shall be done by welding. Straightening, shaping to form, cutting and assembling shall be as per item no. 6.01.a as far as applicable except that the words ‘riveted or bolted’ shall be read as ‘welded’ and holes shall be made for the bolts used for temporary fastening as shown in drawings. The definition of various terminology in welding process shall be as follows:

2.1.1 Run: The metal deposited during one passage of the electrode or blow pipe, in making of a joint.

2.1.2 Bead: A single run of weld metal deposited on a surface.

2.1.3 Weld: An union between two pieces of metal at faces rendered plastic or liquid by heat or by pressure or both. Filler metal may be used to effect the union.

2.1.4 Weld metal: All metal melted and/or made plastic in making a weld.

2.1.5 Butt weld: A weld in which the weld metal lies substantially within the extension of the planes of the surfaces of the parts joined or within the extension of the planes of the smaller of the 2 parts, of different size. The edges of the metal pieces shall be bevelled or chiselled to the required shape at the throat, for which no extra payment shall be made.

2.1.6 Crater: A depression left in the weld metal where the arc was broken or the flame was removed.

2.1.7 End crater: A crater at the end of a weld or at the end of a joint.

2.1.8 Fillet weld: A weld of approximately triangular cross-section joining two surfaces, approximately at right angles to each other in a lap joint, tee joint or corner joint. It shall be of two types 1) Continuous 2) Intermittent.

2.1.9 Fusion welding: Any welding process in which the weld is made between metals in a state of fusion without hammering or pressure.

2.1.10 Fusion Penetration:

2.1.10.1 In fusion welding, the depth to which the parent metal has been fused.

2.1.10.2 In spot, seam or projecting welding, the distance from the interface to the edge of the weld nugget, measured in each case on a cross-section through the center of the weld and normal to the surface.

2.1.11 Non-fusion welding: A term applied to the deposition by Oxy-Acetylene process, of filler metal on parent metal, without fusion of the latter.

2.1.12 Oxy-Acetylene pressure welding: Pressure welding in which an Oxy-Acetylene flame is used to make plastic the surface, to be united. No filler metal is used.

2.1.13 Throat: In a resistance welding machine, the distance from the center line of the electrodes or platens to the nearest point of interference for flat work or sheets. In case of seam-welding machine with an universal head, the throat depth is measured with the machine arranged for transverse welding.

2.1.14 Throat thickness: The minimum thickness of weld metal in a fusion weld measured as under:
   a) For a fillet weld or A, V, U, J or a bevel butt weld: Along a line passing through the roof.
   b) For a close square-butt-weld: In the plane of the abutting faces.
   c) For an open square-butt-weld: At the center of the original gap in a plane parallel to the fusion faces.
2.2 Welding shall generally be done by electric process. The electric arc welding is usually adopted and is economical. In absence of electricity, generators shall be used. Gas welding shall be restored to using oxyacetylene flame with specific prior approval. Gas welding shall not be permitted for structural steel work as it requires heating of the members along with the welding rod and temperature stresses are likely to be developed in the welded members. Precautions shall be taken to avoid distortion of the members due to temperature stresses.

2.3 The work shall be done as shown in the shop drawings which should clearly indicate various details of the joints to be welded, shop and site welded as well as type of electrodes to be used. Symbol for welding on plans and shop drawing shall be according to IS : 813-1961. As far as possible, every effort shall be made to limit the welding that must be done after erection so that, improper welding that is likely to be done due to heights and difficult position on scaffolding etc., after erection, is avoided. The maximum diameters of electrodes for welding any work shall be as under, unless otherwise specified.

<table>
<thead>
<tr>
<th>Average thickness of plate or section.</th>
<th>Maximum dia. of electrode to be used.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 mm.</td>
<td>3 mm.</td>
</tr>
<tr>
<td>5 mm. upto but not including 8 mm.</td>
<td>4 mm.</td>
</tr>
<tr>
<td>8 mm. upto but not including 10 mm.</td>
<td>5 mm.</td>
</tr>
<tr>
<td>10 mm. upto but not including 16 mm.</td>
<td>6 mm.</td>
</tr>
<tr>
<td>16 mm. upto but not including 25 mm.</td>
<td>9 mm.</td>
</tr>
<tr>
<td>25 mm. and over</td>
<td>9 mm.</td>
</tr>
</tbody>
</table>

The welding work shall conform to IS : 816-1969.

2.4 Preparation of surface : Surfaces which are to be welded together shall be free from loose mill scale, rust, paint, grease or other foreign matter. A coating of boiled linseed oil shall be permitted.

2.5 Assembly for welding : Before welding is commenced, the plates shall be first brought together and firmly clamped or spot welded, at specified distance. The temporary connection has to be strong enough to hold the plates accurately in place without displacement.

2.6 Precautions : The operations connected with welding and cutting equipment shall conform to safety requirement given in IS : 818-1968.

2.7 Welding process : The following points shall be borne in mind during the process of welding :
(a) Welds shall be made in flat position wherever practicable.
(b) Arc length, voltage and amperage shall be suited to the thickness of material, type of groove and other circumstances of the work.
(c) The sequence of welding shall be such that where possible, the members which offer the greatest resistance to compression are welded first.
(d) Freedom of movement of one member of the joint shall be allowed wherever possible. Wherever joints shall be welded allowance shall be made for the movement of one component to the order of 1.5 mm.
(e) The electrode manipulation during welding shall be such as to ensure that (1) The base metal is in fused stage when the filler metal makes contact with it. (2) The filler metal does not overflow upon any unfused base metal. (3) The base metal is not under-cut along the weld edges. (4) and that the metal floats, the slag, the oxides and the gas that bubbles to the surface behind the advancing pool.

2.8 Each time the arc is started, the electrode shall be moved in such a way that the fusion of the base metal at the starting point is assured. At the completion of a run the movement of electrode shall be adjusted or the electrode size changed.

2.9 After every interruption of the arc except at the completion of a run, the arc shall be restarted ahead of previous deposit and then moved back to fill the crater or such alternative technique shall be used as will ensure complete filling of the crater or complete fusion between the new and old deposits and the base metal at the point of junction and result in continuous weld. Before the welding operation is completed, all traces of slag shall be removed from the deposit, by chipping if necessary and the deposit and the adjoining base metal shall be wire brushed and cleaned at all points. The requirements shall apply not to successive layers, but also to successive beads and to the overlapping area wherever a junction is made on starting a new electrode.

2.10 The weld shall be free from cracks, discontinuity and other defects like under size, over size, under-cutting etc. All the defective welds which shall be considered harmful to the strength shall cut out and re-welded.
2.11 Finished welds and adjacent part shall be protected with clean boiled linseed oil and after all slag has been removed from the welds and adjacent parts, painting shall be done after the same is approved.

2.12 All the members shall be thoroughly cleaned of rust, cakes, dust etc. and given a priming coat of red lead paint before fixing them in position.

2.13 Grinding to the finished level is to be done, if directed by the Architect and Engineer-in-charge. All expose weld shall be ground smooth. Welds which have not been ground shall be scrubbed with a 10% solution of Hydrochloric acid which shall be washed off with water before painting unless alkali resistant paint is used.

2.14 For erection the relevant specifications of item no. 6.01.a shall be adopted except that while erecting a welding structure, adequate means shall be employed for temporary fastening the members together and bracing the framework until the joints are welded. Such means shall consist of bolts, tack welding or other positive devices imparting sufficient strength and stiffness to resist all temporary loads and lateral forces including wind.

3.0 Mode of Measurements and Payment:

3.1 The relevant specifications of item No. 6.01.a shall be followed. The weight of welding material shall not be added in the weight of members for payment and nothing extra shall be paid for making and filling the temporary fastening of members during erection before welding.

3.2 The rate shall be for an unit of one kg.

3.3 Only standard sectional weight will be considered and welding will not be considered in weight.

6.3 Providing, erecting and fixing in position tubular steel sections having nominal bore 32mm, 50 mm, 80mm, 100 mm medium class conforming to IS:806 and IS:1161 for the work of monkey ladder, spiral staircase, sheds, canopy, space frame, cattle trap, railing, etc. including necessary rolled joists, channels, angles, tees, flats, angle cleats, gusset plates, position hip and jack lifters, purlins, etc. including cutting, and welding the members as per detailed drawing and design. The rate shall include for applying Two coats of approved make synthetic enamel paint over a coat of zinc chromate yellow oxide, as per instructions. (Only standard measurements will be paid for).

1.0 Materials & Workmanship:

1.1 The relevant specifications of item No. 6.01.b shall be followed. Prior to fabrication, all rolled sections shall be cold straightened and freed from twists, wraps etc. Hot working shall be done only after prior permission of the Engineer-in-charge. The surface of the members to be welded shall even so that temporary fastening alignment should not allow passage of a 0.2mm. thick filler gauge more than 20mm. deep from the member’s edge. All members shall be cut mechanically by saw or shear or by oxyacetylene flame.

1.2 Welding shall generally be done by electric process. Gas welding shall be restored to using oxyacetylene flame with specific approval. Gas welding shall not be permitted for structural steel work.

1.3 The work shall be done as shown in the shop drawings which should clearly indicate various details of the joints to be welded, shop and site welded as well as type of electrodes to be used. Symbol for welding on plans and shop drawing shall be according to I.S. 813-1961. As far as possible every effort shall be made to limit the welding that must be done after improper welding that is likely to be done due to heights and difficult position on scaffolding etc.

The welding work shall conform to I.S. 816-1969.

1.4 Preparation of surface: Surfaces which are to be welded together shall be free from loose mill scale, rust, paint, grease or other foreign matter. A coating of boiled linseed oil shall be permitted.

1.5 Assembly for welding: Before welding is commenced, the plates shall be first be brought together and firmly clamped or spot welded at specified distance. The temporary connection in form of tack welding, has to be strong enough to hold the plates accurately in place without displacement and shall be done keeping in view the finished dimensions of the structure.

1.6 Precautions: The operations connected with welding and cutting equipment shall conform to safety requirement given in I.S. 818-1968.

The following points shall be borne in mind during the process of welding:

(a) Welds shall be made in flat position wherever practicable.
(b) Arc length, voltage and amperage shall be suited to the thickness of material, type of groove and other circumstances of the work.
The segments of welding shall be such that where possible, the members which offer the greatest resistance to compression are welded first.

Proper care shall be taken while welding, for shrinkage and distortions, as the drawing dimensions are the finished dimensions of the structure.

The defective welds which shall be considered harmful to the strength shall cut out and rewelded.

Finished welds and adjacent part shall be protected with clean boiled linseed oil and after all stag has been removed welds and adjacent parts shall be painted after the same are approved.

All the members shall be thoroughly cleaned of rust, cakes, dust etc. and given a priming coat of red lead paint before fixing them in position. All fabricated members shall be suitably packed to be protected from any damage while transportation, if any.

Grinding to the finished level is to be done, if directed by the Architects and Engineer in charge. All exposed weld shall be ground smooth. Welds which have not been ground shall be scrubbed with a 10% solution of Hydrochloric acid which shall be washed off with water before painting unless alkali resistant paint is used.

Erection in general, of the entire/part structure shall be carried out as per the requirement and approval of the Engineer-in-charge. Positioning and levelling of the structure, alignment and plumbing and fixing every member of the structure shall be in accordance with the relevant drawings and to the complete satisfaction of the Engineer-in-charge. The following checking and inspection shall be carried out before, during and after erection:
- Damages during transportation
- Accuracy of alignment of structures
- Erection according to drawings and relevant specifications

Mode of measurement & payment:

The relevant specifications of item No. 6.01 shall be followed.

The rate shall be for unit of one kg.

Only standard sectional weight will be considered & welding will not be considered in weight.

Providing, erecting and fixing in position tubular steel sections having nominal bore 32mm, 50 mm, 80mm, 100 mm medium class confirming to IS:806:1968 and IS:1161:1979 for the work of for sheds, canopy, space frame etc. including necessary rolled joists, channels, angles, tees, flats, angle cleats, gusset plates, position hip and jack lifters, purlins, etc. including cutting, and riveting the members as per detailed drawing and design. The rate shall include for applying three coats of approved make synthetic enamel paint over a coat of zinc chromate yellow oxide as primer, as per instructions. (Only standard measurements will be paid for).

Materials & Workmanship:

The relevant specifications of item No. 6.01.a shall be followed and in addition, the following clauses shall be followed.

For assembling the Web plates for girders, which have no cover plates, shall have their end flush with the top od angles unless otherwise required. The web plates when spliced shall have a clearance of not more than 5mm. The erection clearance for cleated ends of members connecting steel to steel shall preferably be not greater than 1.5mm. The erection clearance at the ends of beams without web cleats shall not be more than 3 mm. at each end but where for practical purposes, greater clearance is necessary, suitable designed seating shall be provided.

Column splices and butt joints of struts and compression members shall be accurately machined and close-butted over the whole section. In column caps and bases, the ends of shafts together with the attached gussets, angles, channels etc. shall be accurately assembled so that the parts abutting against each other over the entire surface of contact.

Erection: Steel work shall be hoisted and erected in position carefully, without any damage to itself. The method of erection proposed by the Contractor shall be got approved from the Engineer-in-charge. The contractor shall be responsible for safe and proper erection without unduly stressing the various members. Proper equipment such as derricks, lifting tackles, winches, ropes etc. shall be used.

The work may be erected in suitable parts as may be directed by the Engineer-in-charge. Fabricated members shall be lifted at such points so as to avoid the deformation or excessive stress in members. The structure or the part placed in position shall be secured against overturning or collapse by suitable means. The steel work shall be placed in proper position as per the approved drawings. Final reveting or permanent bolting shall be done only after...
proper alignment has been achieved.

Trusses shall be lifted only at the nodes. The trusses above 10m in span shall not be slinged at the apex, as it shall develop compression stresses in the bottom member. They shall be lifted by slinging at the two midpoints of the rafters, which shall be temporarily braced by wooden member of suitable section. After the trusses are placed in position, purlins and wind bracing shall be fixed as soon as possible.

The end of the truss which faces the prevailing winds shall be fixed with holding down bolts and the other end shall be kept free to move. For spans up to 10m, the free end of the truss shall be laid on lead sheet or steel plate as per design and the holes for holding down bolts shall be made in the form of oblong slots so as to permit the free movement. For larger spans, the bearing shall be as per design.

Columns and stanchions shall be erected truly vertical with the necessary cross bracing etc. as per drawing. The base shall be properly fixed with the foundation concrete by means of anchor bolts etc. as per design. Anchor bolts shall be placed in concrete foundation. they shall be held in position with a wooden template. The anchor bolts shall be provided with suitable timber mould or pipe sleeve to allow adjustment, which shall be removed after the initial set of concrete. The spaces left around the anchor bolts shall have a slopping channel leading to the side of the pedestal and on the underside of the base plate to allow spaces being grouted up after the base plate is fixed in position. Grouting shall be in CM 1:3 or as specified.

Bedding of column, stanchions etc. shall not be carried out till the steel work has been finally levelled, plumbed and connected together. The stanchion shall be supported on steel wedges and adjusted to make the column plumb. For multi-storied buildings, the bedding shall not be done till sufficient numbers of bottom lengths of stanchions have been properly lined, levelled and plumbed and sufficient floor beams are fixed in position. The base plates shall be wedged clear of the base by MS wedges and adjusted where necessary to plumb the columns. The gaps under the base plates up to 25 mm shall then be pressure grouted with cement grouts.

Painting: Relevant specification of item no. 6.01.a shall be followed.

2.0 Mode of measurement & payment:

2.1 The relevant specifications of item No. 6.01.a shall be followed.

2.2 The rate shall be for unit of one kg.

2.3 Only standard sectional weight will be considered.
9.01 Supplying and spreading of large size hand broken graded (rubble) stone aggregates 90 mm. to 63 mm. size for soling and Water Bound Macadam Surface including spreading the same in required grade and camber in two layers of 90 mm. thick each to obtain compacted thickness of 115 mm. filling the hollows with smaller size stone aggregates, spauls, spreading good quality murrum to fill up the interstices and voids to make plain surface, spreading of blindage, profusely watering including consolidating by power driven roller of 8 to 10 ton capacity in required camber, dry and wet rolling etc. complete as directed.

1.0 Materials:

1.1 Hand broken metal 90 mm. to 63 mm. size shall be collected by the Contractor to the site of work. Stacking shall be done in systematic way so as to allow easy inspection and in such a place as will not cause any loss. The metal shall be collected from approved quarry situated around Himmatnagar or place near to the site as approved by the Architects and Engineer-in-charge.

1.2 Murrum or selected earth brought from outside shall be clean, of good binding quality, and of approved quality obtained from approved pots/quarries of disintegrated rocks which contain silicones materials and natural mixture of clay of calcareous origin. The size of murrum shall not be more than 20 mm. and shall be approved by the Engineer-in-charge before use.

1.3 The control on quality of material shall be exercised by the Engineer by carrying out the required tests at the frequencies as per IS norms from time to time as directed by the Engineer-in-charge.

1.4 The sample of the metal collected shall be got tested at Govt. recognised laboratory or as approved by the Architect and Engineer-in-charge. The cost of the same shall be born by the Contractor.

1.5 Materials for the purpose shall be of approved quality. Any material which is found of inferior quality shall be rejected and the Contractor shall remove such rejected material from the site at his own cost immediately. The material shall be collected from quarries approved by the Engineer-in-charge.

1.6 The material shall be got approved by Engineer-in-charge prior to collection on site. It shall be free from all rubbish, dust and any organic materials as well as clods of black cotton soil. Material shall not be allowed to be collected within the road boundary. Material to be used as crust and for side shoulders shall have a C.R.B.I’s report and that to be used as blindage in W.B.M. road construction shall have P.I. Value of less than 6, as determined in accordance with IS:2720 (Part-V).

2.0 Workmanship:

2.1 Regular stacks shall be done by the Contractor on a fairly level ground. Stacking of the metal shall be done in a manner as directed by the Architect and Engineer-in-charge.

2.2 Stacking of material as per requirement shall be carried out. The metal stack shall be checked by the Engineer-in-charge before spreading. The collection shall always commence at one end of the road and carried out continuously towards the other end unless the Architect and Engineer-in-charge shall direct otherwise.

2.3 It shall be spread evenly on the prepared surface in required grade and camber by using camber broads etc. so as to ensure that the surface is in true camber and grade. At least two camber boards shall be in use on site. The surface shall be checked at every 50 ft. by means of templates, while the correctness of the camber in between shall be tested by strings and corrected as required. Between the straight lengths and the curves and the meeting points of the convex and concave portions of reverse curves the change in camber of the road and super elevation shall be made very gradually as directed by the Architect and Engineer-in-charge.

2.4 Metal shall not be spread without permission of the Architect and Engineer-in-charge. Metal should be spread under careful supervision and by trained collies only. Contractor shall see that uniform spreading as per collection of metal is done. The Contractor shall spread the metal fully from the stacks without keeping any balance unless directed by the Architect and Engineer-in-charge to keep some stacks in balance for making unevenness or depressions good during rolling work.

2.3 To ensure that the materials are spread to the required thickness, the road surface shall be marked out on to the length over which the contents of heaps are to be spread. The bounds of earth or murrum (one on either side) shall be made along the outer edge of metalling simultaneously with spreading of metal.
These bounds shall be laid with a distance equal to the width of the road to be metalled and shall be enough to prevent the loose metal from spreading out during consolidation and to retain water used for consolidation as well.

2.4 The spreading of metal shall proceed only 200 m. (maximum) advance of the rolling operations. At the time of rolling, all surface irregularities hollows, depressions, humps, shall be set right. The spreading of metal in required layer shall be done by the Contractor.

2.5 Immediately after the spreading of the stone rolling shall be started with three wheeled power roller 8 to 12 ton capacity or tandem roller or equivalent vibrator roller. The weight of the roller shall depend upon the type of the aggregate and as indicated by the Architect and Engineer-in-charge.

2.6 Except on super elevated portions where the rolling shall proceed from inner edge to outer, rolling shall begin from the edges gradually progressing towards the center. First the edge/s shall be compacted with roller running forward and backward. The roller shall then move inward parallel to the center line of the road, in successive passes uniformly lapping preceding tracks by at least one half way width.

2.7 Rolling shall continue until the aggregate is thoroughly keyed and the creeping of the aggregate ahead of the roller is no longer visible. During rolling slight sprinkling of water may be done. If necessary, rolling shall not be done. When the sub-grade is soft or yielding or when it causes a wave like motion in the sub-grade or sub-base course.

2.8 The roller surface shall be checked transversely and longitudinally with templates and any irregularities corrected by loosening the surface, adding or removing necessary amounts of aggregate and rerolling until the entire surface conforms to desired camber and grade. In no case shall be use of screening be permitted to make up depressions.

2.9 The blindage material where it is required to be used shall be applied, successfully in two or more thin layers at a slow and uniform rate. After each application, the surface shall be continuously sprinkled with water, the resulting slurry shall be swept in with hand brooms or mechanical brooms to fill the voids properly and rolled, during which water shall be applied to the wheels of the rollers if necessary to wash down the binding materials sticking to them. These operations shall continue until the resulting slurry after filling of voids, forms a wave ahead of the wheels of the moving roller.

2.10 After the final compaction of water bound macadam course, the road shall be allowed to dry overnight. Next morning hungry spots shall be filled with screening of binding materials as directed, lightly sprinkled with water if necessary, and rolled. No traffic shall be allowed on the road until the macadam has set. The Architect and Engineer-in-charge shall have the discretion to stop hauling traffic from using the completed water bound macadam course if in his opinion it would cause excessive damage to the surface.

3.0 Mode of Measurement and Payment:
3.1 Payment shall be made on m³ basis without deduction for voids.

3.2 The rate includes digging the murrum, supplying, conveying with all lead and lift on the road side and stacking the same in regular stacks and making side shoulders. Material shall be collected in required quantity only at any stage of work.

3.2 The contract unit rate for collecting, carting and spreading shall include:
1. Obtaining metal and murrum from approved quarry.
2. Transporting at site.
3. Storing, stacking, protecting and spreading.
4. Keeping record of supply and use.
5. Rolling the metalled surface with 8 to 10 ton capacity power driven roller.
6. Testing the samples in the approved laboratory.

9.02 Providing and laying rubble soling, 23 cm. Thick (compacted), in plinth and for plinth protection, using 150 to 230 mm. cut size stones, covering and leveling the surface with a layer of murrum after filling the voids with smaller sized stones 20-40mm, 40-63mm, 63-90mm, 90-150 mm (i.e. Graded stone) size of stone/metals or stone chips, including watering, ramming well and consolidating each layer by roller.
### CW 9.00 Miscellaneous Works

**1.0 Materials:**

1.1 Stone and stone chips shall conform to M-16 and Murrum brought from outside shall be clean, of good binding quality, and of approved quality obtained from approved pots/quarries of disintegrated rocks which contain silicones materials and natural mixture of clay of calcareous origin. The size of murrum shall not be more than 20 mm. and shall be approved by the Engineer-in-charge.

1.2 Rubble stones 150 mm. to 230 mm. size shall be collected by the Contractor to the site of work. Stacking shall be done in systematic way so as to allow easy inspection and in such a place as will not cause any loss. The rubble shall be collected from approved quarry situated around Himmatnagar or from quarry approved by the Architects and Engineer-in-charge.

1.3 The control on quality of material shall be exercised by the Engineer by carrying out the required tests at the frequencies as per IS norms from time to time as directed by the Engineer-in-charge.

1.4 The sample of the rubble collected shall be got tested at Govt. recognised laboratory. The cost of the same shall be born by the Contractor.

1.5 Materials for the purpose shall be of approved quality. Any material which is found of inferior quality shall be rejected and the Contractor shall remove such rejected material from the site at his own cost immediately.

1.6 The materials shall be got approved by Engineer-in-charge prior to collection on site. It shall be free from all rubbish, dust and any organic materials as well as clods of black cotton soil. Material shall not be allowed to be collected within the road boundary. Material to be used as crust and for side shoulders shall have a C.R.B.I's report and that to be used as blindage in W.B.M. road construction shall have P.I. Value of less than 6, as determined in accordance with IS:2720 (Part-V). The material to be used should be got tested prior to use in road construction. Testing charges shall be borne by the Contractor.

**2.0 Workmanship:**

2.1 The first layer of stone, of average size 150 to 230 mm. shall be laid in roads, pavings etc. Thereafter, the voids between the stones laid in the first layer shall be filled by hand packing the stones of smaller size or stone chips of the same stones, as directed. The voids shall be filled with largest possible stones. The layers then shall be rammed well and consolidated.

2.2 The surface of the stone layer then shall be covered and levelled with a layer of murrum. This then shall be watered and well consolidated using power driven rammers or rollers as directed. The consolidated thickness of the above layers totally should be average 23 cm. thick.

2.3 Collection of the materials shall be completed in whole, campus wise, as per the final requirement and measurement shall be recorded. Until the quantity of materials as per the final requirement is not collected work shall not be started and payment shall not be done.

2.4 Stacking of material as per requirement shall be carried out. The collection shall always commence at one end of the road and carried out continuously towards the other end unless the Architect and Engineer-in-charge shall direct otherwise.

2.5 It shall be spread evenly on the prepared surface in required grade and camber by using camber broads etc. so as to ensure that the surface is in true camber and grade. At least two camber boards shall be in use on site. The surface shall be checked at every 50 ft. by means of templates, while the correctness of the camber in between shall be tested by strings and corrected as required. Between the straight lengths and the curves and the meeting points of the convex and concave portions of reverse curves the change in camber of the road and super elevation shall be made very gradually as directed by the Architect and Engineer-in-charge.

2.6 Rubble shall not be spread without permission of the Architect and Engineer-in-charge. Rubble should be spread under careful supervision and by trained collies only. Contractor shall see that uniform spreading as per collection of rubble is done. The Contractor shall spread the rubble fully from the stacks without keeping any balance unless directed by the Architect and Engineer-in-charge to keep some stacks in balance for making unevenness or depressions good during rolling work.

2.7 To ensure that the materials are spread to the required thickness, the road surface shall be marked out.
on to the length over which the contents of stacks are to be spread. The bounds of earth or murrum (one on either side) shall be made along the outer edge of soiling simultaneously with spreading of rubble. These bounds shall be laid with a distance equal to the width of the road to be metalled and shall be enough to prevent the loose rubble from spreading out during consolidation and to retain water used for consolidation as well.

2.8 At the time of rolling, all surface irregularities hollows, depressions, humps, shall be set right.

3.0 Mode of Measurement and Payment:

3.1 Payment shall be made on m³ basis after deduction for voids at 75% of the recorded measurements, at 75% of the rate quoted by the Contractor and remaining 25% shall only be released after the spreading of rubble and murrum in layer wise is completed as directed by the Architect and Engineer-in-charge or as per the actual work done.

3.2 The rate includes the cost of collecting, carting stones and murrum, with all leads, lifts and labour for laying, hand packing and consolidating the same for roads, pavings, etc.

3.3 The contract unit rate for collecting, carting and stacking shall include:
   1. Obtaining rubble from approved quarry at Himmatnagar or nearby place as approved by the Architect and Engineer-in-charge.
   2. Transporting at site.
   3. Storing, stacking and protecting.
   4. Keeping record of supply and use.
   5. Testing the samples in the approved laboratory.

3.4 The rate includes digging the murrum, supplying, conveying with all lead and lift on the road side and stacking the same in regular stacks of the required dimensions, spreading, etc. complete. Material shall be collected in required quantity at any stage of work.

3.5 The rate shall be for a unit of one m³ and includes all the above operations with all lead and lift except consolidation.

9.03 Supplying and spreading of murrum/binding material for any work like make up of ground, filling, etc. including spreading the same in required grade and camber, in 15 cm. thick layers to obtain required compacted thickness to make plain surface, profusely watering including consolidating by power driven roller of 8 to 10 ton capacity or suitable means as directed in required camber, dry and wet rolling etc. complete as directed.

1.0 Materials and Workmanship:

1.1 Materials for the purpose shall be of approved quality. Any material which is found of inferior quality shall be rejected and the Contractor shall remove such rejected material from the site at his own cost immediately. The material shall be collected from quarries approved by the Engineer-in-charge. The material shall be granular and gritty.

1.2 The material shall be got approved by Engineer-in-charge prior to collection on site. It shall be free from all rubbish, dust and any organic materials as well as clods of black cotton soil. Material shall not be allowed to be collected within the road boundary. Material to be used as crust and for side shoulders shall have a C.R.B.I’s report and that to be used as blindage in W.B.M. road construction shall have P.I. Value of less than 6, as determined in accordance with IS:2720 (Part-V). The material to be used should be got tested prior to use in road construction. Testing charges shall be borne by the Contractor.

1.3 River or nala or sea sand required for the work shall be clear, sound, properly graded, free from organic material, silt clay etc. and shall be got approved from the Architect and Engineer-in-charge. The sand shall be obtained and brought from the source approved by the Architect and Engineer-in-charge. The sand shall be well graded.

1.4 It shall be stacked on road land beyond the top of the bank and on a level ground.

2.0 Mode of Measurement and Payment:

2.1 The payment shall be made on m³ basis.
2.2 The rate includes digging the murrum, supplying, conveying with all lead and lift on the road side and stacking the same in regular stacks of the required dimensions. Material shall be collected in required quantity only at any stage of work.

9.04 Supplying and spreading good quality river sand for any work like make up of ground, filling, preparing sub-base for soling, mettaling etc. including spreading the same in required grade and camber, in 15 cm. thick layers to obtain required compacted thickness to make plain surface, profusely watering including consolidating by suitable means as directed in required camber etc; complete as directed.

1.0 Materials : Sand shall conform to M-6 and shall be from the source approved by the Architect and Engineer-in-charge. It shall be screened and free from rubbish, dust, grass etc.

2.0 Workmanship :
2.1 Spreading of sand shall be started after the full quantum is collected, measured and recorded in the measurement books. Permission of the Architect and Engineer-in-charge shall be obtained before spreading of sand is allowed. Before spreading, it shall be seen that the formation is dressed to the required camber and grade. The spreading of sand shall be uniform and as it has to act as a binding surface. It shall be forming a smooth running surface, as far as possible. The rate is for gross measurements and no deduction of voids shall be made.

2.2 If the sand is to be spread on lower earthen embankment as a sub-base or for side shoulders, it shall be spread in a manner as directed by the Architect and Engineer-in-charge and as per required width and thickness. The Contractor shall make good all unevenness, depressions, projections, etc. during consolidation work and rate of this item includes all these operation except consolidation.

3.0 Mode of Measurements and Payment :
3.1 The relevant specification of item no. 15.06.a shall be followed.

3.2 The rate includes cost of collecting, carting good quality sand, with all lead, lift and labour for spreading the same. The rate shall be for an unit of one m³.

9.05 Specification for Fencing works With Barbed Wire Fencing and Chain Link Fencing

1.0 General:
1.1 The work shall generally be carried out as per these specifications, relevant drawings and as directed by the Engineer-in-Charge

2.0 M.S Posts and Struts:
2.1 All the M.S. posts/struts shall be free from rust, scale, cracks, twists and other defects and shall be fabricated to the required shape and size out of the specified sections. The posts and struts shall be conforming to relevant specifications stipulated here-in-before under relevant sections. All the posts and struts shall be of sizes and lengths as specified in the tender schedule and drawing. The posts and struts shall have split ends for proper fixing and shall be embedded in the cement concrete of mix. 1:3:6 or as specified in the schedule. The exposed surfaces of the posts and struts shall be painted with two coats of synthetic enamel paint of approved make and shade over a coat of approved primer.

3.0 R.C.C Posts and Struts:
3.1 All the posts and struts shall be of standard size as specified in schedule. These shall be casted on suitable places/platforms in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12.5 mm. nominal size) as per relevant specifications stipulated here-in-before under relevant sections. The reinforcement shall be provided as shown in the drawings, as directed by Engineer-in-Charge and specified here-in-before under relevant sections. The posts and struts shall be free from honeycombing, cracks and other defects.

3.2 After casting, the posts/struts shall be left at the same place and cured for a minimum period of 7 days. After 7 days curing the same shall be shifted to a levelled ground and stacked for further curing for 14 days. After 21 days of curing only, the posts/struts shall be transported to work site without any damage, for fixing in position.

4.0 Spacing of Struts:
4.1 The spacing of posts shall be 3 m. centre to centre unless otherwise specified or as directed by the Engineer-in-Charge, to suit the dimensions of the area to be fenced. Every 10th posts, last but one end posts, corner posts, and posts where the level of fencing changes in steps and end post when the fencing changes its direction shall be strutted on both sides, or as directed by the Engineer-in-Charge. End posts where barbed wire fencing is discontinued shall be strutted on one side only.

5.0 Fixing of M.S Struts and Post:

5.1 Pits of size 45 x 45 x 45 cm. deep or of sizes mentioned in the drawings, shall first be excavated centrally in the direction of proposed fencing work, true to line and level to receive the posts. In case of struts, the pits shall be so excavated, as to receive minimum 15 cm. concrete cover at any point of the struts to suit its inclination or as shown in the drawing.

5.2 The pits shall be filled with a layer of 15 cm. thick cement concrete of specified mix. The posts and struts shall then be placed in the pits, the posts projecting to the specified height above ground level, true to line, plumb and position, by providing adequate supports temporarily, and cement concrete of specified mix shall then be filled-in so that the posts are embedded in cement concrete blocks of specified sizes. The concrete in foundation shall be watered for at least 7 days to ensure proper curing.

6.0 Bared Wire:

6.1 The barbed wire shall be of M.S. or G.I. as specified and it shall generally conform to I.S. 278-1978.

6.2 The base metal of the line and point wire shall be of good commercial quality mild steel. The line and point wire shall be circular in section, free from scales and other defects and shall be uniformly galvanized if specified.

6.3 The line wire shall be in continuous lengths and shall generally be free from signs of welds. It shall be able to withstand wrapping and unwrapping 8 turns round its diameter.

6.4 The barbed wire shall consist of two splices per reel. The barbed wire shall be formed by twisting two lines wires one containing the barbs.

6.5 The barbed wire and its weight shall be as given in the table below:

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Nominal Diameter of Wire</th>
<th>Nominal Distance between two barbs [in mm]</th>
<th>Mass of complete barbed wire [in grm /m.]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Line Wire [in mm.]</td>
<td>Point Wire [in mm]</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2.50 (12 Guage)</td>
<td>2.50 (12 Guage)</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>2.50</td>
<td>2.50</td>
<td>150</td>
</tr>
<tr>
<td>3</td>
<td>2.50</td>
<td>2.00 (14 Guage)</td>
<td>75</td>
</tr>
<tr>
<td>4</td>
<td>2.50</td>
<td>2.00</td>
<td>150</td>
</tr>
<tr>
<td>5</td>
<td>2.24 (13 Guage)</td>
<td>2.00</td>
<td>75</td>
</tr>
<tr>
<td>6</td>
<td>2.24</td>
<td>2.00</td>
<td>150</td>
</tr>
</tbody>
</table>

6.6 The barbs shall carry four points and shall be formed by twisting two point wires, each two turns, tightly round one line wire, making altogether 4 (four) complete turns. The barbs shall be so finished that the four points are set and locked at right angles to each other.

6.7 The barbs shall have a length of not less than 13 mm. and not more than 18 mm. The points shall be sharp and well pointed. Barbed spacing shall be as given in the above table. Wherever required for every 50 reels or part thereof, samples of the barbed wire and the individual line wires shall be put to tensile test and in case of failure to conform to tensile properties given below, two additional tests of each kind shall be made on the samples cut from other reels.

7.0 Fixing of Barbed Wire:

7.1 The barbed wire shall be stretched and fixed in number of rows and two diagonals as specified. The bottom row shall be 140 mm. above ground and the rest at 125 mm or at given spacing as per drawing. The diagonals shall be stretched between adjacent posts from top wire of one post to the bottom wire of the 2nd post. The diagonal wires will be interwoven with horizontal wires by fixing the odd rows of wires, then the diagonal cross wires and lastly the even rows of wires. The jointing of the barbed wire in between the posts shall not be permitted.
7.2 Necessary holes should be tapped in the post and the barbed wire shall be fixed in position by means of 'U' clamps or bolts and nuts as specified in drawings. In case of fixing with 'U' clamps, the legs of the 'U' clamps passing through the 10 mm. dia. hole in the R.C.C. post to hold barbed wire shall be turned up and down to get an over-lap of 25 mm. on the face of RCC post. Turn buckles and straining bolts shall be used at the end posts if specified.

8.0 Chain Link Fencing:

8.1 The chain link shall be of approved manufacture and of correct size, gauge etc. It shall be of M.S. or G.I. as specified of approved manufacture and of required size, gauge etc. The base materials of the wire shall be of good commercial quality mild steel. The wire shall be circular in section, free from rust, scale, cuts, welds and other defects and shall be uniformly galvanized if specified.

8.2 Fixing of Chain Link Fencing to M.S or R.C.C Post:

8.2.1 The chain link of specified height of fencing shall be fixed first to the end post with necessary G.I. approved type U clamps threaded at both the ends and G.I. nut, bolts, washers etc. and with 6 mm. dia. full height M.S./G.I. anchor bar. After fixing the chain link at the end post, it shall be stretched tightly and fixed to next post one after the other by the above mentioned clamps and bars etc. leaving 50 mm. clearance from the ground and 20 mm. clearance in the case of concrete coping at bottom to avoid rusting. The point at the change in level of the fencing top/bottom, necessary links shall be adjusted suitably as per the manufacturers specification or as directed by the Engineer-in-Charge. The entire chain link fence shall be painted with two coats of synthetic enamel paint of approved make and shade over a coat of approved primer or as specified in the item/drawing.

9.05 Providing and fixing concertina coil fencing with punched tape concertina coil 450 mm, having 60 nos rounds per 6 metre length, upto 3 m height of wall with angle iron "Y" shaped placed 1.8m apart and with 6 horizontal R.B.T. reinforced barbed wire, stud tied with G.I. staples and G.I. clips to retain horizontal, including necessary bolts or G.I. barbed wire tied to angle iron, all complete as per direction of Engineer-in-charge, with reinforced barbed tape(R.B.T.) / Spring core (2.5mm thick) wire of high tensile strength of 165 kg/ sq.mm with tape (0.52 mm thick) and weight 43.478 gm/ metre (cost of M.S. angle shall be paid separately)

Item shall be followed as per 9.04 but for concertina coil.

9.06 Expansion joint Capcell HD 100 Supreme or equivalent make of 50mm thickness of best quality, including cutting to required size and shape at all levels complete as directed by Engineer in charge. The works shall also including cost of primer in expansion joint and providing and laying polysulphide sealant at 1.5 kg per meter for expansion joints of BASF / Sika / Fosroc or equivalent make and make the joint water tightness as per direction of Engineer in charge Scope of Works:

1.1 The work contemplated under these specifications consist of supplying the expansion joint fiber boards, sealing compound, aluminum plates etc. strictly as per these specifications and relevant drawings.

2.0 Materials:

2.1 Materials for expansion joint filler boards shall be of best quality bitumen impregnated performed non-extruding, resilient type of specified thickness in the standard sizes available.

2.2 The sealing compound to close the gaps at the edges shall be of best quality rubberized bituminous hot pour, made from special grades of bitumen and shall not show flowing tendency in hot weather and is resilient in the cold weather. The liquid primer shall be made from blown grade bitumen of approved quality.

2.3 The aluminum plates for fixing at floor level shall be of specified size and out of extruded sections, free from any rolling defects.

2.4 The aluminum sheet for fixing at bottom of beams or sides of columns shall be of specified size without any defects

3.0 Preparation of Surfaces:

3.1 All the concrete surfaces already cast and where the expansion joint is to be formed, shall be properly cleaned off all dirt, mortar/concrete sticking, dust etc. One coat of primer shall be applied
by brush to the entire concrete surface, just prior to the next concreting

4.0 Workmanship:

4.1 Soon after the primer is applied, the filler board shall be placed at the side and held tight with the concrete surface, by suitable means. Care shall be taken that the boards do not get damaged or warped during all the operations. Utmost care shall also be taken to ensure that the board is held tightly to the concrete surface and no stone chip, concrete etc. is allowed to splash between the board and the existing concrete surface against which the board is placed.

4.2 After the deshuttering, the surface shall be cleaned off all grit, mortar, cement plaster etc. and edges filled with the sealing compound, and properly pressed to render smooth and uniform surface.

4.3 If desired by the Engineer-in-charge, the aluminium plates/sheets of specified thickness and sizes shall be fixed to under side/above beams. The plates shall have round holes at 300 mm. c/c. of required diameter on one side of joint through which screws shall be fixed into the concrete. On the other side, slotted holes at 300 mm. c/c shall be provided so that when screwed, these shall render smooth movement of plates during expansion/contraction. The plates shall be fixed correctly to required level, line, plumb etc. and as directed by the Engineer-in-charge.

4.4 In case of plates fixed on floors, they shall be fixed when floor mortar screed is laid to required level over the expansion joint duly filled up with sealing compound.

4.5 In case of roof, the expansion joint in beams placed vertically, shall be extended upwards, when RC/Brick masonry curbing is laid to the desired height (approximate 450 mm.) over which horizontal flat board is laid to the extent of 150 mm. or so as shown in drawing as per procedure laid down here-in- before.
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<td>189 Urinals</td>
<td>IS:2556 (PART VI)</td>
</tr>
<tr>
<td>190 Half round channels</td>
<td>IS:2556 (PART VII)</td>
</tr>
<tr>
<td>191 Specific requirements of siphonic wash down W.C.</td>
<td>IS:2556 (PART VIII)</td>
</tr>
<tr>
<td>192 Ss sink/C.I./flushing tank brackets</td>
<td>IS:775</td>
</tr>
<tr>
<td>193 C.I. siphonic flushing cistern</td>
<td>IS:774</td>
</tr>
<tr>
<td>194 Lead pipes</td>
<td>IS:404 (PART I)</td>
</tr>
<tr>
<td>195 Sand cast pipes &amp; fittings</td>
<td>IS:1729</td>
</tr>
<tr>
<td>196 C.I. spun soil pipes &amp; fittings</td>
<td>IS:3939</td>
</tr>
<tr>
<td>197 Gully trap</td>
<td>IS:651</td>
</tr>
<tr>
<td>198 Glazed stone ware pipes &amp; fittings</td>
<td>IS:651</td>
</tr>
<tr>
<td>199 Ac pipe</td>
<td>IS:1626, IS:1626 (PART I)</td>
</tr>
<tr>
<td>200 High pressure/crydon ball valve</td>
<td>IS:1703</td>
</tr>
<tr>
<td>201 C.I. sluice valve</td>
<td>IS:780</td>
</tr>
<tr>
<td>202 Capstan head</td>
<td>IS:1795</td>
</tr>
<tr>
<td>203 Malleable iron fittings</td>
<td>IS:1879 (PART I TO X)</td>
</tr>
<tr>
<td>204 C.I. pipes</td>
<td>IS:1536, IS:1537</td>
</tr>
<tr>
<td>205 Molten (pig) lead</td>
<td>IS:782</td>
</tr>
<tr>
<td>206 C.I. manhole frames &amp; covers</td>
<td>IS:1726</td>
</tr>
<tr>
<td>207 Concrete pipes</td>
<td>IS:458</td>
</tr>
<tr>
<td>208 Threads for screwed pipes</td>
<td>IS:554</td>
</tr>
<tr>
<td>209 Lead jointing</td>
<td>IS:718</td>
</tr>
<tr>
<td>210 Carbon steel for pipes</td>
<td>IS:9161</td>
</tr>
<tr>
<td>211 Low level ceramic cistern</td>
<td>IS:774</td>
</tr>
<tr>
<td>212 Bowl pattern flat back urinals</td>
<td>IS:2556 (PART IV)</td>
</tr>
<tr>
<td>213 Showers</td>
<td>IS:2064</td>
</tr>
<tr>
<td>214 Heavy C.I. pipes</td>
<td>IS:1729</td>
</tr>
<tr>
<td>215 Concrete mix design</td>
<td>IS:10262</td>
</tr>
<tr>
<td>216 Code of practice for construction of floor and roof with joists and filler blocks</td>
<td>IS:6061 (PART I)</td>
</tr>
<tr>
<td>217 Code of practice for construction of light weight concrete block masonry</td>
<td>IS:6042</td>
</tr>
<tr>
<td>218 Specification for load bearing light weight concrete blocks</td>
<td>IS:3590</td>
</tr>
<tr>
<td>219 Code of practice for construction of hollow concrete block masonry</td>
<td>IS:2572</td>
</tr>
<tr>
<td>220 Specification for concrete masonry units (hollow and solid concrete blocks)</td>
<td>IS:2185 (PART I)</td>
</tr>
<tr>
<td>221 Chemical composition of ordinary Portland cement</td>
<td>IS:4032</td>
</tr>
<tr>
<td>222 Sulphate resistant cement</td>
<td>BS:4027 &amp; ASTM C-150 TYPE II</td>
</tr>
<tr>
<td>223 Specifications for circular hollow sections</td>
<td>IS:1161</td>
</tr>
<tr>
<td>224 Properties of rectangular &amp; square hollow sections</td>
<td>IS:4923</td>
</tr>
<tr>
<td>225 Cold formed welded &amp; seamless carbon steel structural tubing</td>
<td>ASTM A 500</td>
</tr>
<tr>
<td>226 Cold but not formed welded &amp; seamless carbon steel structural tubing</td>
<td>ASTM A 501</td>
</tr>
<tr>
<td>227 Hot formed welded &amp; seamless high strength low alloy tubing</td>
<td>ASTM A 618</td>
</tr>
<tr>
<td>228 Hot rolled structural steel hollow section</td>
<td>BS:4848</td>
</tr>
<tr>
<td>Sr No</td>
<td>Material Detail</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Cement – OPC</td>
</tr>
<tr>
<td>2</td>
<td>Reinforcement</td>
</tr>
<tr>
<td>3</td>
<td>Structural Steel</td>
</tr>
<tr>
<td>4</td>
<td>Aggregates</td>
</tr>
<tr>
<td>5</td>
<td>Chemical Admixtures &amp; Additives</td>
</tr>
<tr>
<td>6</td>
<td>Anchor Fastener, Rebar, Chemical/Mechanical, Fastener, Core - Cutting, Dry Stone Cladding Clamp, Expandable Fasteners</td>
</tr>
<tr>
<td>7</td>
<td>Bricks</td>
</tr>
<tr>
<td>8</td>
<td>Cement Fiber Board</td>
</tr>
<tr>
<td>9</td>
<td>External Paver (Cement Base)</td>
</tr>
<tr>
<td>10</td>
<td>Kerb Stone</td>
</tr>
<tr>
<td>11</td>
<td>Expansion Joint System</td>
</tr>
<tr>
<td>12</td>
<td>Expansion Filler Board – Premoulded compressible</td>
</tr>
<tr>
<td>13</td>
<td>Non Shrink Cementious precision (anchoring) Grout</td>
</tr>
<tr>
<td>14</td>
<td>Paint – Acrylic, Synthetic Enamel</td>
</tr>
<tr>
<td>15</td>
<td>Paint – High Albedo paint/ Solar Reflective paint</td>
</tr>
<tr>
<td>16</td>
<td>Polysulphide Sealant</td>
</tr>
<tr>
<td>17</td>
<td>Precast Concrete landscape elements, Grating, kerb, Drain cover</td>
</tr>
<tr>
<td>18</td>
<td>Sand</td>
</tr>
<tr>
<td>19</td>
<td>Safety and Road Marking Equipment</td>
</tr>
<tr>
<td>20</td>
<td>Signage vinyl sticker</td>
</tr>
<tr>
<td>21</td>
<td>SS Bolts, Washers and Nuts, Pressure plates &amp; Screws</td>
</tr>
<tr>
<td>22</td>
<td>Kota Stone</td>
</tr>
</tbody>
</table>

**Note:**

All the Materials/Makes listed above and other than as specified above shall be used after obtaining prior approval from the Consultants/Engineer-in-charge. Refer Civil Works BOQ for the detailed specifications.
**W3**

Ground lvl. +00 mm

Plinth lvl. +450 mm

Lintel lvl. +2550 mm

Parapet lvl. +7800 mm

Slab lvl. +6800 mm

Beam bottom lvl. +6200 mm

Sill lvl. +1350 mm

**W2a**

Slab lvl. +3625 mm

Lintel lvl. +5725 mm

**W2**

1000

**D2**

Lintel lvl. +2100

**V1**

SCHEDULE FOR OPENINGS (MM)

<table>
<thead>
<tr>
<th>Location</th>
<th>Size</th>
<th>Sill</th>
<th>Lintel/Beam bottom</th>
<th>No.</th>
<th>Ground floor</th>
<th>First floor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>1800 x 2100</td>
<td>0</td>
<td>2100</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>D2</td>
<td>1200 x 2100</td>
<td>0</td>
<td>2100</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>D3</td>
<td>900 x 2100</td>
<td>0</td>
<td>2100</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>D4</td>
<td>750 x 2100</td>
<td>0</td>
<td>2100</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Windows/Vents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W1</td>
<td>3318 x 2575</td>
<td>0</td>
<td>2575</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>W2</td>
<td>1200 x 1975</td>
<td>600</td>
<td>1975</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>W2a</td>
<td>1200 x 2575</td>
<td>0</td>
<td>2575</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>W3</td>
<td>925 x 1200</td>
<td>900</td>
<td>2100</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>V1</td>
<td>600 x 600</td>
<td>1975</td>
<td>2575</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**SIDE ELEVATION**

**FRONT ELEVATION**

**BACKSIDE ELEVATION**
TERRACE FLOOR PLAN

1. All Dimensions are in milimeter.
2. Windows & doors sizes are of inside clear.
3. Drawing to be read only not to be measured.
4. Please read all dimensions carefully & if any discrepancy/ambiguity please contact architect's office immediately.
5. Providing work and finishing quality is contractor's responsibility.

TERMINAL NOTES:

TERRACE - 67.47 sq.m / 726.33 sq.ft
China Mosaic

DRAWING DETAILS:

MULTIPURPOSE AREA, EDI BHQ
FLOORING LAYOUT, TERRACE FLOOR

ISSUED FOR:
TENDER

DESIGN CONSULTANT:
COLLABORATIVE DESIGN
613, Pushti heights, Nr. Subhash Chowk, Mominpura,
Ahmedabad-380006.

ph: 079 26651217
email: info@collaborativedesign.in

REVISION DETAILS:

NO DATE DETAILS PROJECT
R0 03-05-2023 ISSUED FOR TENDER MULTIPURPOSE AREA, EDI BHQ

DRAWN BY
CHECKED BY
DATE

2301_EDI-MULTIP_GFC_A-004-R0
**CLIENT:** ENTREPRENEURSHIP DEVELOPMENT INSTITUTE OF INDIA  
**PROJECT:** MULTIPURPOSE AREA @ EDI, BHAT  
**CONSULTANTS:** AXEES CONSULTANTS / COLLABORATIVE DESIGN

### (I) MAIN BUILDING CIVIL WORK

#### EXCAVATION SECTION

- **Item No. 101:** Excavation for Foundation pits, trenches, etc.
  - Description: Excavation in any kind of soil except rock for foundations of walls, columns, raft, ducts, lift pit, basement, and plinth beams, pipe trenches, etc. The rate to include shoring, strutting, refilling with the approved earth in the trenches, foundation pits, etc. by ramming, watering, consolidating with mechanical roller in 25-30cm layers, removing and stacking simultaneously the excavated stuff as directed and/or for filling up pits/trenches, spreading soils in layers on site (including plinth filling) with the approved surplus earth as directed and compacting the same to achieve 95% Proctor density.
  - Payment will be on the basis of net dimensions shown on drawing. Rates shall include extra space for shoring or working and bailing of storm water, etc. The Contractor should stack the same at the available space in the premises (Maximum lead of 1 km). No extra payment shall be paid for the re-handling of the earth. No working space shall be considered for measurement & payment beyond the net dimensions shown in the drawings. The contractor shall consider working space if required while quoting the rate.

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Rate</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>101A</td>
<td>FOR DEPTH (0-3.0M)</td>
<td>M3</td>
<td>108.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>102A</td>
<td>FILL AND COMPACT SELECTED EARTH BROUGHT FROM WITHIN THE SITE USING MECH. VIBRO ROLLER</td>
<td>M3</td>
<td>72.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### ANTITERmite TREATMENT

- **Item No. 103:** Pre-construction anti-termite treatment to buildings shall be with emulsified insecticides as per IS: 6313 (part II) (latest revision). The Contractor shall carry out the work through an approved agency and provide a guarantee for seven years on a stamp paper from an approved agency. Only plinth area shall be considered.

- **Rate:** M2 91.00

#### CONCRETE SECTION (ALL EXPOSED RCC WORK)

- **Item No. 200:** Generally, all concrete work shall be as per IS 456 (latest revision) and measured in M3. No allowance is made for thickness of members. The rate shall also include mix design for various strengths and cubes taken from fresh concrete and tested as per the relevant IS code. No extra amount will be paid for admixtures to improve workability or to influence setting time or gain early strength in recommended portions as per IS:9103 (latest revisions), except for water proofing admixtures for which item is separately mentioned. The rates shall include for providing of all materials, mixing, placing, forming pockets for holding down bolts, placing inserts as shown in drawing at correct location, level, necessary changes in formwork, reinforcement, etc. complete with curing, all equipments like pumps, concrete carrying trucks, etc., materials, labour, etc. complete. Measurement shall be on the basis of net quantity of concrete worked out from the dimensions/ details given in the drawing. All concrete shall be machine mixed and machine vibrated. Volumetric system of concrete manufacturing is not allowed. Formwork and Reinforcement measured separately. Please refer to other general notes for concrete in preamble and is applicable to all the items under this section unless otherwise specified separately.

#### PLAIN CEMENT CONCRETE

- **Item No. 201:** Providing and laying in position plain cement concrete with 20mm and down size graded stone aggregate including site machine mixed, shuttering if required, consolidation, finishing, curing, etc. complete, as base or sub base for masonry walls, piers, R.C.C. foundations, base for concrete floor, etc. The proportion of the mix for concrete shall be by volume.

  - **Rate:** M3 19.00

#### M-25 CONC. IN FOUNDATIONS, PEDESTALS, COLUMNS, BEAMS, COPINGS, WALLS, SLABS, SHELVES, STAIRS ETC.

- **Item No. 202:** Providing and laying in position site machine batched, machine mixed and machine vibrated design mix cement concrete of M25 grade for reinforced cement concrete structural elements like Raft, pedestals foundation, columns, beams, brackets, walls, fins, pards, gutters, pile, pile caps, floor slabs, weather sheds, lintels, trenches, shelves, stair/steps etc. for all leads and lifts/height.

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPTO PLINTH LEVEL</td>
<td>M3</td>
<td>60.00</td>
</tr>
<tr>
<td>ABOVE PLINTH LEVEL</td>
<td>M3</td>
<td>74.00</td>
</tr>
</tbody>
</table>

#### FORMWORK SECTION

- **Item No. 300:** Rate to include for formwork, centering, boxing, shuttering, propping, including special nuts, bolts etc. in perfect line, level, plumb and, if required, to provide camber, slope and removal thereof. Forms shall be watertight and thoroughly cleaned before placing concrete. Colourless oil or grease of approved quality shall be applied to forms before placing steel. Rate to include for any shape including chamfers, residues, grooves, drip moulds etc. as directed. Mode of measurement shall be in (m2) sq. m regardless of shape, size and thickness of members for all items under this section.

#### FORMWORK FOR CONCRETE (PLYWOOD SHUTTERING)

- **Item No. 301:** Providing, fabricating, erecting and fixing in position plywood, fair face formwork, centering and shuttering true to line and level, including mild steel propping, staging, applying shuttering removal emulsion / oil as approved, required bracing, chamfering corners including making leak proof joints etc. complete. Also including removing and dismantling the aforesaid assembly after specified or as approved period from the day of casting of concrete, by the Engineer complete at all heights, levels, floors.

  - **Rate:** M2 698.00
### 400 REINFORCEMENT SECTION

The rate for reinforcement shall include the cost of materials - reinforcement steel, binding wire, cover blocks etc., plant equipment, labour involved in the operations, transportation, safe storage of steel bars etc. required for all operations described above such as cleaning of reinforcement bars, straightening, cutting, hooking, bending, binding placing in position etc. as required or directed including tack welding on crossing of bars in lieu of binding in wires etc.

Measurement relating to nominal mass, dimensions and tolerances of various types of steel shall conform to relevant IS codes. Reinforcement shall be measured in lengths of bar as actually placed in position on standard weight basis, no allowance being made in the weight for rolling margin. Wastages, laps other than specified, chairs and binding wire shall not be measured but shall be considered for reconciliation of material.

Laps for Beams & Columns as shown on Structural drawings shall only be measured. If Structural Drawings doesn’t show laps, chairs and splices (specially required) – the same shall not be measured & paid. The exact values for nominal masses of individual bars/ wires shall be as conforming to IS: 1786. In case of coupled joints, measurement for payment shall be limited to equivalent length of overlap as per design. The Contractor shall prepare the Bar Bending Schedules and incorporate the same on the reinforcement drawings all as directed and submit it to Engineer-in-charge for approval. The reinforcement should not be stored at site on bare ground and it should be free from rust, ground moisture, mud, dusting, etc. as directed by Engineer-In-Charge. (STEEL MAKE : VINAYAK, NILKANTH TMT, MONO OR EQUIVALENT)

According to IS:13920 – Clause no 5 – For TMT Reinforcement grade should confirm followings:
- The actual 0.2 percent proof strength of steel bars based on tensile test must not exceed their characteristic 0.2 percent proof strength by more than 20 percent.
- The ratio of the actual ultimate strength to the actual 0.2 percent proof strength shall be at least 1.15.

### 401 HIGH STRENGTH DEFORMED BARS MINIMUM Fe-500 N/MM² (Fe-500)

Supplying, cutting, straightening, bending, lapping, placing TMT High yield strength deformation bars of grade Fe 500 conforming to IS:1786 & IS:13920 with a minimum 0.2% proof stress of 500 N/mm² and fixing in proper position with 16 gauge annealed binding wire etc complete, at all heights and levels with all leads and lifts as directed. Necessary chairs and cement mortar blocks to be placed at proper locations for keeping reinforcement in position. Rate to include lapping of reinforcement as specified by the engineer. Reinforcement shall be bent in accordance with the procedure stipulated in IS: 2902.

Standard weight shall be measured and paid for the net length of the bar.

### 500 BRICK MASONRY SECTION (ALL EXPOSED BRICK WORK)

The rate shall include for supply of all materials, labour, necessary scaffolding and plant etc. and for embedding electrical conduits, boxes, holdfasts of doors, windows, sanitary and water supply pipes, toolings, forming opening, racking out joints, curing etc. complete.

The rate shall include for masonry work of any shape e.g. wall, pilaster, projection, columns, steps, curved or tapered walls, drip courses, parapet, load walls, etc. as per drawing. All materials, joints, bond, mortar, sampling, testing, placing, scaffolding and curing etc shall conform to IS: 1905 IS: 5454, IS: 3495 & IS: 13757. Minimum crushing strength for burnt clay brick shall be 50 kg/cm² and for fly ash bricks shall be 75kg/cm² for fly ash bricks unless otherwise specified. Bricks shall confirm to IS code and be procured from an approved supplier only.

### 501 BRICK MASONRY (Burnt clay bricks) IN 1:6 CEMENT MORTAR

Providing & laying Brick masonry in 1:6 cement mortars with well burnt locally available good approved quality bricks having strength of 50 kg/cm² as per drawing in true line, level and plumb. Brick masonry under this item shall be measured in M3.

<table>
<thead>
<tr>
<th>Description</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A ABOVE PLINTH LEVEL (350 mm thick)</td>
<td>M3 80.00</td>
</tr>
<tr>
<td>B ABOVE PLINTH LEVEL (230 mm thick)</td>
<td>M3 12.00</td>
</tr>
</tbody>
</table>

### 600 DOORS & WINDOWS

#### 601 FLUSH DOOR

Rate to include for 40 mm thick solid cored approved quality flush door faced with 4 mm thick water proof plywood of approved make to receive paint with 16 mm teakwood lipping tongued into door edges all round, single or double leaves. Also include for three 100 mm butt hinges and necessary fixtures like rubber door stop, stopper, and mortise lock with two keys, etc. complete. Include for one under coat and two coats of enamel paint of approved make.

<table>
<thead>
<tr>
<th>Description</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAME AS 601 FLUSH DOOR WITH BOTH SIDE 1MM TK LAMINATED SHEET OF APPROVED BRAND &amp; SHADE</td>
<td>M2 17.00</td>
</tr>
</tbody>
</table>

### 602 ALUMINIUM WINDOW AND VENTILATION

Supplying and fixing openable, sliding anodized aluminium windows with aluminium frame of Indal/ Jindal / Hindalco make, having weight of aluminium sections as approximately weight mentioned of opening area (excluding the weight of binding for glass/ panel fixing). size, shape and design as per details including all fittings and fixtures with 6 MM thick glass fixed with special EPDM gasket and wool felt (Include for rough ground on top and sides of the window and approved quality silicone sealant at joints) on all sides. Aluminium beading of approved make with all materials and labour etc. complete.

<table>
<thead>
<tr>
<th>Description</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAME AS 602 BUT EXCEEDING 2KG/M2 BUT NOT EXCEEDING 4KG/M2 OF OPENING AREA</td>
<td>M2 32.00</td>
</tr>
</tbody>
</table>
### PLASTERING SECTION

- OUTSIDE DOUBLE COAT SAND FACED CEMENT PLASTER
  - 20 mm thick EPDM Flooring
  - OUTSIDE TWO COATS OF ACRYLIC BASED PAINT “APEX” OR EQUIVALENT

### PAINTING

- INSIDE TWO COATS OF PLASTIC EMULSION PAINT INCLUDING TWO COAT PUTTY
  - PROVIDING TWO FINISHING COATS OF PREMIUM PLASTIC EMULSION PAINT OF (ASIAN PAINT OR APPROVED EQUIVALENT) APPROVED MAKE AND SHADE TO WALLS AND CEILINGS APPLIED EVENLY TO GIVE IMPROVED UNIFORM FINISH. ALLOW FOR PREPARATION OF SURFACE AND A COAT OF PRIMER AS SPECIFIED BY THE MANUFACTURER. RATE TO INCLUDE FOR MIN. 1.5 MM THICK WHITE CEMENT PUTTY OF BIRLA OR OTHER APPROVED MAKE TO ACHIEVE A SMOOTH SURFACE TO SERVE AS BASE FOR THE PAINT ON PLASTERED SURFACE, INCLUDING CLEANING, STAGING, AND NECESSARY TOOLS AND MAKE THE SURFACE AS PER MANUFACTURES SPECIFICATIONS.

### GRADE SLAB WORKS

- RUBBLE SOLING FOR FOOTING AND GRADE SLAB
  - SUPPLY, LAY AND COMPACT CLEAN, CRUSHED, GRADED AGGREGATES & GRANULAR MATERIAL, PREMIXED WITH WATER TO A DENSE MASS OVER PREPARED SUB-BASE AND CONSOLIDATING IT TO SPECIFIED THICKNESS IN ACCORDANCE WITH ITEM WET MIX MACADAM OF MORT&H SPECIFICATIONS, INCLUDE FOR SPREADING, FILLING THE VOIDS WITH QUARRY DUST/STONE DUST, COMPACTION EQUIPMENT AND FREE FROM RIDGES, CRACKS OR LOOSE MATERIALS. ALLOW FOR ROUNDING ANGLES, CHAMFERED ANGLES, GROOVES AND FOR MAKING GOOD AFTER ALL TRADES. THE MEASUREMENT SHALL BE ON CUBIC METER BASIS OF THE NET AREA EXECUTED.

### MAIN BUILDING FINISHING WORK

#### ITEM NO. DESCRIPTION UNIT QUANTITY RATE AMOUNT

| 1 | Flooring work with bedding |
| A | Polish Kotah stone GF | M2 | 95.00 |
| B | Polish Kotah stone skirting GF | | |
| C | Polish Kotah stone FF | RMT | 50.00 |
| D | Polish Kotah stone skirting FF | M2 | 95.00 |
| E | 20 mm thick EPDM Flooring | M2 | 95.00 |
| F | Toilet/Store wall dado (As per selection) | M2 | 75.00 |
| G | Toilet/Store flooring (As per selection) | M2 | 18.00 |
| H | China Mosaic flooring for terrace | M2 | 95.00 |
| I | Water Proofing work for terrace | M2 | 95.00 |

#### TOTAL AMOUNT (EXCLUDING GST) = 0.00
GROUND FLOOR PLAN

FIRST FLOOR PLAN

GENERAL NOTES:
1. All Dimensions are in Millimeter.
2. Window & Door sizes are of inside clear.
3. Drawing to be read only not to be measured.
4. If any discrepancy/ambiguity please contact architect's office immediately.
5. This drawing is for tender.
6. This drawing should not be used anywhere without prior consent.

REVISED DETAILS:

NO DATE DETAILS
R0 03-05-2023 ISSUED FOR TENDER

DRAWING DETAILS:

DESIGN CONSULTANT:

COLLABORATIVE DESIGN
613, Pushti heights, Nr. Subhash chowk, Memnagar, Ahmedabad-380006
Phone: 079 26651217
Email: info@collaborativedesign.in

GENERAL NOTES:
1. All Dimensions are in millimeter.
2. Windows & doors sizes are of inside clear.
3. Drawing to be read only not to be measured.
4. If any discrepancy/ambiguity please contact architect's office immediately.
5. This drawing is for tender.
6. This drawing should not be used anywhere without prior consent.
### III. MAIN BUILDING ELECTRICAL WORK

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>DESCRIPTION</th>
<th>UNIT</th>
<th>QUANTITY</th>
<th>RATE</th>
<th>AMOUNT</th>
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<tbody>
<tr>
<td>A</td>
<td>CABLE LAYING / TERMINATION / CABLET TRAY &amp; STEEL STRUCTURE</td>
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<tr>
<td>1.00</td>
<td>Laying horizontally and vertically of XLPE insulated cables of following sizes on cable trays, supported on steel structures, in ready made trenches and / or to pull-through pipes. The rates shall include Installation, testing and commissioning of a G.I. saddles / clamps, saddle bars, etc, including transportation from owner's site store to the place of installation, unpacking and return the cable drums to site stores with all labour and materials as per the standard specifications, drawings and directions of Engineer-in-charge.</td>
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<tr>
<td>1.01</td>
<td>4C X 6sqmm CU Flexible</td>
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<td>4c x 25 sqmm XLPA AL</td>
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<td>3.5c x 35 sqmm XLPA AL</td>
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<tr>
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<tr>
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<tr>
<td>1.07</td>
<td>3.5c x 95 sqmm XLPA AL</td>
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<td>R.O</td>
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<td>2.00</td>
<td>Supply &amp; Termination of XLPE insulated cables of different sizes and connection of the Leads including supply of weatherproof single compression type cable glands and tinned copper lugs, including cutting / stripping of cable insulation, Installation, testing and commissioning of cable glands, crimping of the cable cores, marking with wire number ferrules, etc., including all labour and materials, as per standard specifications and directions of Engineer-in-charge.</td>
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<td>4c x 35 sqmm A2XWY</td>
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<td>1.00</td>
<td>Supply, installation, testing &amp; commissioning of Maintenance Free earthing as per specification, drawing and as per the instruction of Engineer-in-charge. The unit rate shall include Excavation &amp; backfilling, copper bonded rod, filled with high conductive and corrosion resistant crystalline mixture and Backfill Compound around electrode.</td>
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<td>1.01</td>
<td>50mm DIA x 3mtr GI Type maintance free Earthing With Pre Cast RCC Earthing Chamber</td>
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<td>SITC of G.I/Copper earthing loop / grid conductors/Cu. Cables of following sizes along the cable trenches / cable trays / on the wall or structures / buried in ground (500mm depth) including excavation and back filling. Installation shall include the welding at joints and providing anti corrosive point (black butimine) at the welded portion and clamping using G.I. clamps and necessary hardware and materials as per standard drawings, specifications and directions of Engineer-in-charge.</td>
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<td>2.01</td>
<td>6sqmm CU Flexible Wire with PVC Conduit</td>
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<td>C</td>
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<td>Supply installation testing and Commissioning of 8Way TPN DD Type DB I/C-63A FP MCB 10KA, o/C:- 32A DP MCB-3nos, 10/16/20/25A SP MCB -18nos</td>
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<td>Supply installation testing and Commissioning of 6Way TPN DD Type DB I/C-40A FP ELCB 30ma, o/C:- 32A DP MCB-3nos, 10/16/20/25A SP MCB -12nos</td>
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<td>3.00</td>
<td>Supply installation testing and Commissioning of 6Way SPN DD Type DB I/C-25 DP ELCB 30ma, o/C:- 10/16/20/25A SP MCB -4nos</td>
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<td>D</td>
<td>PLANT LIGHTING</td>
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<td>Wiring of points to be done in open/concealed manner in 25 mm dia medium guage Rigid PVC FRLS pipe. Wiring shall be done with FRLS type copper flexible wire of 650V/1100V. Separate pipe should be taken for circuit mains. Nos of circuit of the same phases may be taken in same conduit (maximum 2 ctk).The circuit shall be laid in 25/40 mm dia medium guage rigid PVC FRLS pipe. The point rate shall include all the necessary piping and wiring from DB to Switch board, switch board to Light Point / DB to MCB L.P. The wiring should be done as per relevant prevailing standards. The looping or the wiring should be done in the switch boxes or light and fan point outlet boxes to avoid the junction boxes. The junction boxes and switch boxes for the ceiling light point, fan point etc shall be minimum 60/75 deep. All the necessary jarry in brick plastered walls should be done with machine cutter only , also jarry should be filled with cement, sand and wire mesh as required, the material cost for rough finish shall be included in point rate. Whenever pipes are required to be laid in flooring shall be of heavy guage. Wiring should be done as per distrobution details. Each circuit should have dedicated phase, neutral &amp; earth wire. Wire sizes to be used as under.</td>
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<td>Description</td>
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<td>Supply installation testing and Commissioning of Primary Light point con...</td>
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<td>Supply installation testing and Commissioning of Secondary Light point co...</td>
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<td>Supply installation testing and Commissioning of Fan point with 1.5sqmm of...</td>
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<td>Supply installation testing and Commissioning of 20W LED TUBELIGHT</td>
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<td>Supply installation testing and Commissioning of 18WT LED Surface Light ...</td>
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<td>Supply installation testing and Commissioning of Fixing of 1200 Ceiling F...</td>
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<td>Supply &amp; laying of cat 6 wire in pvc conduit</td>
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<td>SITC of 8 port POE Switch</td>
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<td>SITC -Laying of 1.5 sqmm x 2 c cu cable shielded cable in pvc conduit</td>
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<td>SITC of GBL control speaker</td>
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<td>SITC of 200w Amplifier</td>
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<td>SITC of 2 tr High wall unit with necessary Equipments i.e. Cable, Support</td>
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<td>TOTAL AMOUNT (EXCLUDING GST)</td>
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</table>
GENERAL NOTES:
1. All Dimensions are in millimeters.
2. Windows & doors sizes are of inside clear.
3. Drawing is for information only and not to be measured.
4. Please refer to the actual construction and its dimensions as shown in the drawing.
5. The drawing is for information only.
6.必ず工事現場にて施工品質を確認してください。
7. The drawing is for the contractor's responsibility.
8. This drawing is for the contractor's responsibility.
9. This drawing is for the contractor's responsibility.
10. The drawing should not be used anywhere without prior consent.

GROUND FLOOR PLAN

FIRST FLOOR PLAN

REVISION DETAILS:

DRAWING DETAILS:

DESIGN CONSULTANT:
COLLABORATIVE DESIGN
813, Pushali Heights, Nr. Subhash Chowk, Memnagar,
Ahmedabad-380006.
Ph: 079 26651217
Email: info@collaborativdesign.in

2301_EDI-MULTIP_GFC_A-005-R0
## (IV) MAIN BUILDING PLUMBING WORK

### ITEM NO. DESCRIPTION

<table>
<thead>
<tr>
<th>A</th>
<th>SUB-HEAD: I : SANITARY :-</th>
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</table>
| 1.0 | Supply, checking, storing and fixing **S. S. sink, single bowl** with tap point on wall / counter comprising of Concealed type brackets fixed to wall with adjustable clamp to push against counter rim, 40 mm heavy plated C.P. waste coupling JAQUAR-ALD-729 fitting without pop-up, with flexible PVC pipe with connector, CP swan neck sink faucet model JAQUAR-LYR-38347S Painting brackets with two coats of white enamel paint over one coat of primer, table mounted / wall mounted. Kitchen sink with drain board)(model : Nirali-olympia or equivalent) (Final Model of fixture to be selected by architect)  
  Each | 1.00  
| 2.0 | Supply, checking, storing and fixing in position European water closet comprising of Wall hung European W.C. Pan Model ARIA-ARS-WHT-3995 or Equivalent in white paint, on approved type of chairs, Metropole Model No. FLV-1093NSQ or Equivalent as directed, C.P. health faucet Model No. JAQUAR-ALD-857 or Equivalent with required length of flexible tube, clamp and bracket for fixing to wall, CP Basin faucet JAQUAR-KUP-30021PM or Equivalent, CP Toilet paper holder Model JAQUAR-ACN-1151N or Equivalent Solid bakelite water closet cover and seat with CP hinges and rubber buffers, Fixing W.C. unit with brackets and accessories in position, Necessary pipe connection to PVC / PP / CI soil pipe, Painting bracket with two coats of white enamel paint over a coat of primer. (Final Model of fixture to be selected by architect)  
  Each | 2.00  
| 3.0 | Supply, checking, storing and fixing Under Counter wash hand basin MODEL: JAQUAR-JDS-WHT-25907H ith .32 mm heavy plated C.P. waste coupling JAQUAR-ALD-729 fitting with pop-up, 32 mm heavy plated C.P. bottle trap JAQUAR-ALD-768L250x190 with cleaning eye with extension piece and wall flange, Painting brackets with two coats of white enamel paint over one coat of primer, CP Basin Faucet JAQUAR-KUP-35021PM with 15 mm C.P. brass heavy grade flexible inlet connection with C.P. nut (minimum length 450 mm) made to measure. (Final Model of fixture to be selected by architect)  
  Each | 2.00  
| 4.0 | Supply, checking, storing & fixing C.P. brass towel ring MODEL: JAQUAR-ACN-1121BN Round to PVC cleats with C.P. brass screws including cutting and making good the walls wherever required. (Final Model of fixture to be selected by architect) | 2.00  
| 5.0 | Supply, checking, storing & fixing C.P. brass angle valve for basin & Sink MODEL: JAQUAR-ALI-85053, of approved quality conforming to IS: 8931 for a) 15mm Nominal Bore (Final Model of fixture to be selected by architect)  
  Each | 2.00  
| 6.0 | Supply, checking, storing & fixing C.P. brass bib cock MODEL: JAQUAR-ALI-85037 of approved quality conforming to IS: 8931 (Final Model of fixture to be selected by architect) a) 15mm Nominal Bore  
  Each | 2.00  
| 7.0 | Supply, checking, storing & fixing of Heavy class S.S. Grating Model No. Chilly-CCT-SFC-127 or Equivalent with Mosquito / Cockroach proof S.S. strainer of approved design by Interior including setting in floor with cement motor to match with floor finish as per architect requirement suitable for FD (Floor drain) and FT (Floor trap). Note : Size of trap is vary as per final Product Selection.  
  Each | 4.00  
| 8.0 | Installation testing and commissioning self contained pressure type water coolers suitable for operation on 230 voltage - 10% single phase AC supply and generally confirming to the requirements of IS : 1476/78 having following nominal cooling capacity at an ambient temperature of 30 deg. c and drinking water inlet temperature of 35 deg. c and drinking water outlet temperature of 13.5 deg. complete with compressor over head protector, thermostat and steel tank. 40 Ltr. Cooling and 40 Ltr. Heating  
  Each | 2.00  

### TOTAL SUB-HEAD: I : SANITARY :-

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<th>B</th>
<th>SUB-HEAD: II: SOIL WASTE AND VENT PIPE :-</th>
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| 9.0 | Supply, Installation, testing and commissioning of Silent soil & waste pipes of PP (Polypropylene) material As per EN 12056 with Min. density 1.2 g/cm3 with mineral wool (for noise reduction) with push fit lock seal joints, with necessary fittings such as making proper connections to equipments including all necessary fittings and specials such as bends, tees, reducers., Wye, Door tee, Vent cock, Access pipe for cleaning in required interval(on service floor & basement), nuts, bolts, gaskets, supports and plugs etc. Fixing at wall/ ceiling level supported by clamps, fire collars, expansion joints, Y branches, hangers etc. as per the specification, drawings and schematics. All hangers, clamps, brackets, anchor/ fixed support, guides, rollers etc. shall be of galvanized iron unless specified otherwise and then supply and installation of the same shall also be excluded for rates under this head. Welding of any kind on the galvanized support / hanger shall not be permitted. (The pipe length inserted in the fitting shall not be measured for payment) (Pipes for soil , waste for internal toilet & Shaft).  
  Each | 10.00  
| 9.1 | 75 mm metre | 10.00  
| 9.2 | 110 mm metre | 30.00  
| 10.0 | Providing, laying and jointing in true line and level 160 diametre U.P.V.C (Type B) conforming to IS 13592-1992 with one end plain and other end socketed with rubber ring, & fittings conforming to ISI 14735-1999 of approved make for drainage system pipe line, pipe shall be jointed with each other with rubber lubricant, pipe shall be fixed on wall using of PVC clamp of the size 160 mm diametre x 210 mm length x 196 mm heigh at every 2000 mm center to center or shall be concealed in walls as directed including necessary fittings such as bends, shoes etc. including testing of pipes and joints and jointed with adhesive solvent cement including cost of all materials.  
  metre | 20.00  
| 11.0 | Supply, installation, testing and commissioning Polyproplene (PP) 110mm x 110mm size P trap (Floor trap) of self cleaning design with Min. 50mm water seal with and without vent arm jointing with push fit rubber ring socket fittings complete, cutting chases / hole in floors / slabs and bringing the same in proper condition and shape after placing the trap in right position in case of suspended / open plumbing or setting the trap in 1:2.4 CC in case of concealed plumbing , etc. complete, as required. The trap shall be of following sizes: Temporary airtight PVC cover to be provided to prevent dirt entry.  
  Each | 3.00  

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6 OF 7
12.0 Supply, installation, testing and commissioning Polypropylene (PP) 110mm x 75mm size Multi floor trap/Height riser of self cleaning design with Min. 50mm water seal with and without vent arm jointing with push fit rubber ring socket fittings complete, cutting chases / hole in floors / slabs and bringing the same in proper condition and shape after placing the trap in right position in case of concealed / open plumbing or setting the trap in 1:2:4 CC in case of concealed plumbing, etc. complete, as required. The trap shall be of following sizes: Temporary airtight PVC cover to be provided to prevent dirt entry. (In

TOTAL SUB-HEAD: II: SOIL WASTE AND VENT PIPE

C SUB-HEAD: III: INTERNAL WATER SUPPLY :

13.0 Providing, fixing, jointing and testing in position the following U-PVC pressure threaded Pipes as per ASTM D 1785 Schedule 40 and threaded conforming to IS:554. Cut to required lengths including all necessary fittings and specials such as bends, tees, unions, reducers, flanges and plugs etc. The pipes & fittings shall be tested to a pressure of 15 Kg/Sq.cm. Fixing at wall/ ceiling level supported by clamps, fastener, hangers etc. as per specification. Cutting hole in wall / floor slab and making good the same with cement concrete 1:2:4 complete as required. GI heavy class pipe sleeve of larger diameter shall be provided wherever the pipes crossing the walls/floor slab and sealing the sleeves as per consultants requirement. Threading, jointing & making proper connections & as per provided drawings by architect, technical specification and as directed by the authority EIC. (Make: Astral, Ashirvad & supreme)

13.1 25mm dia metre 10.00
13.2 32mm dia metre 10.00
13.3 40mm dia metre 10.00

14.0 Providing and fixing forged brass lever operated ball valve of full flow with forged brass ball (Machined to mirror smooth finish with hard chrome plated) and spindle with setting and gland of superior quality having minimum working pressure of 16 kg/cm2 etc. complete in all respect. (Make: Sant, Zoloto, Leader)

14.1 32mm dia Each 3.00
14.2 40mm dia Each 1.00

TOTAL SUB-HEAD: III: INTERNAL WATER SUPPLY :-

D SUB-HEAD: IV: EXTERNAL WATER SUPPLY, DRAINAGE, STORM WATER: -

15.0 Providing and Laying Underground drainage System Foam Core SN8 pipe complete with all fittings excavation of trench 0.7m wide and depth varying from 0.75m to 2.4m , and refilling the same after laying of drain and concrete encasement in M10 grade concrete with minimum thickness of encasement 100m thk & as per provided drawings by architect, technical specification and as directed by the authority EIC. (Make: Supreme, Astral or equivalent)

15.1 150 mm dia metre 16.00

16.0 Providing and fixing S.W. gully trap with C.I. grating brick masonry chamber and water tight C.I. cover with frame of 300mmx300mm size (inside) with standard weight.(I) Square mouth traps.(B)150mm x 100mm size P or R type

17.0 Constructing brick masonry chamber for underground C.I. Inspection chamber and bends with bricks having crushing strength not less than 35Kg. Cm2 in C.M. 1:5 C.I. cover with frame (Light duty) 455mm x 610mm internal dimensions total weight of cover with frame to be not less than 38Kg. (Wt. of cover 23 Kg.) and Wt. of frame 15Kg.) (R.C.C. top slab with 1:2:4 mix (1-cement :2- coarse sand :4-graded stone aggregate 20mm size) foundation concrete 1:5:10 inside plaster 15mm thick with cement mortar 1.3 finished smooth with a floating coat of neat cement on walls and bed concrete etc. complete.(I) Inside dimensions 455mmx610mm and 450mm deep for single pipe line. (more than 10 ton)

TOTAL SUB-HEAD: IV: EXTERNAL WATER SUPPLY, DRAINAGE AND STORM WATER

E SUB-HEAD: V: HIGH SIDE EQUIPMENTS:

18.0 Supply, installation, testing & commissioning of Submersible single stage single entry pumps connected to submersible motor (The motor shall be IIE3 watertight according to IEC class IP 68, and incorporate class F, insulation materials to withstand a continuous operating temperature of 155 deg C) for 415 + 10% volts, 3 phase, 50 cycles A.C. power supply with mechanical seal, pump connector unit Or Auto Coupling with rubber diaphragm and bend, vertical discharge pipe, Outdoor type Control panel, pumps at high level with cut off at dry level as determined. The pump shall be provided with a lifting devise of pull chain/guide rail & G.I. heavy class rising main of 5m length including interconnecting piping, valves (Ball Valve / Butterfly), Non return valves (GM/CI) 15 m cable etc.High level and low level sensor with motorized butterfly valve as per requirement complete in all respects. (Pumps shall be installed in a set of two pumps One working and One standby, with cascade operation).

For supplying Domestic Water up to terrace

Capacity per pump - 100 LPM

Head - 15 mtr

1 Set = 2 Nos. Pump (1 Working + 1 Standby - cascade operation)

Suction head - flooded positive suction

Supply, Installation, testing & commissioning (Make: Kriloskar, Lubi)

TOTAL SUB-HEAD: V: HIGH SIDE EQUIPMENTS

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<tr>
<td>(I)</td>
<td>MAIN BUILDING CIVIL WORK TOTAL AMOUNT (EXCLUDING GST)</td>
<td>0.00</td>
</tr>
<tr>
<td>(II)</td>
<td>MAIN BUILDING FINISHING WORK TOTAL AMOUNT (EXCLUDING GST)</td>
<td>0.00</td>
</tr>
<tr>
<td>(III)</td>
<td>MAIN BUILDING ELECTRICAL WORK TOTAL AMOUNT (EXCLUDING GST)</td>
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<tr>
<td>(IV)</td>
<td>MAIN BUILDING PLUMBING WORK TOTAL AMOUNT (EXCLUDING GST)</td>
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</tr>
<tr>
<td></td>
<td>GRAND TOTAL AMOUNT (EXCLUDING GST)</td>
<td>0.00</td>
</tr>
</tbody>
</table>

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