TENDER NO: SRO/CON/ETS/017 DATED 30.01.2019

FOR

E-TENDER FOR CONSTRUCTION OF 1000SFT. APARTMENT BLOCKS-2 NO’S, 800SFT. APARTMENT BLOCKS-1 NO’S, DUPLEX HOUSE AND STORM WATER DRAINS AT IIIT CAMPUS, RGUKT, BASAR, NIRMAL DIST., TELANGANA - 504107

VOLUME - II

Special Conditions of Contract
&
Client Documents
&
Drawings
SPECIAL CONDITIONS OF CONTRACT

The following special conditions shall be read in conjunction with General Conditions of Contract. The provisions in Special Conditions of Contract shall take precedence over General Conditions of Contract.

INTRODUCTION

e-Tender for Construction of 1000Sft. Apartment Blocks-2 No’s, 800Sft. Apartment Blocks-1 No’s, Duplex House and Storm water drains at IIIT Campus, RGUKT, Basar, Nirmal Dist.,Telangana – 504107

The following clauses of Special Conditions of Contract (SCC) shall be applicable for this contract:

These Special Conditions of Contract shall be read in conjunction with General Conditions of Contract, Instructions to Tenderers (ITT), Notice Inviting Tenders (NIT), Bill of Quantities (BOQ), Tender Drawings, and Technical Specifications & Other Tender Documents

1. GENERAL

The work in general shall be carried out as per the latest Andhra Pradesh detailed specifications with up to date correction slips, unless otherwise specified in the nomenclature of the individual item or as per specifications provided with this tender. Any item not covered under these specifications shall be carried out as per approved specifications. In case any item is not covered in any of these documents, the same shall be carried out as per the latest BIS Code in practice or as per approval of Engineer in Charge of EPIL.

Where any portion of special conditions of contract is repugnant to or at variance with any provision of the Instructions to Tenderers and General Conditions of contract and/or the other documents forming part of the contract then unless a different intention appears the provision of the Special Conditions of Contract shall be deemed to over-ride the provisions of the general conditions of contract and/or the other documents forming part of the contract only to the extent such repugnant/variations in the special conditions of contract as are not possible of being reconciled with the provision with Instructions to Tenderers or General Conditions of contract and/or the other documents forming part of the contract.

2. DEFINITIONS

Definitions as per General Conditions of Contract (GCC) shall be amended or the following definitions appended as under

The words “Site” in various clauses of General Conditions of Contract (GCC) and other documents of this Tender shall mean “Construction of 1000Sft. Apartment Blocks-2 No’s, 800Sft. Apartment Blocks-1 No’s, Duplex House and Storm water drains at IIIT Campus, RGUKT, Basar, Nirmal Dist.,Telangana – 504107.”

a) Wherever the sentence “the cost to be incurred by the Contractor shall deemed to be included in the quoted rates of the BOQ items” as mentioned in various General Conditions of contract is appearing, the same shall be read as “the cost to be incurred by the contractor shall deemed to be included in the BOQ rates including the percentage quoted on the BOQ rates / amount.”

b) Wherever in General Conditions of Contract, approval of EPIL / Executing Agency is mentioned, it shall include the approval from the Owner’s representative also.
3. SCOPE OF WORK

The scope of work, in general, includes Construction of 1000Sft. Apartment Blocks-2 No’s, 800Sft. Apartment Blocks-1 No’s, Duplex House and Storm water drains at IIIT Campus, RGUKT, Basar, Nirmal Dist., Telangana – 504107

(hereinafter referred to as “Works”) as per Technical specifications, Designs, Drawings, BOQ, Instructions and Terms and Conditions given in Tender Documents and its amendments/clarifications etc. received from Client/ EPI from time to time.

As the soil condition is poor, the type of foundation adopted for the buildings is with Pile. Accordingly all the building works at this campus were built on pile foundations.

The Piling scope of the proposed buildings were carried out by other agency and the part piling work with super structure work were handed over to EPIL for further construction activities. The statuses of the Piling at different buildings are as follows:

<table>
<thead>
<tr>
<th>Building reference</th>
<th>Percentage of Piling work completed so far</th>
<th>Balance work to be carried out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building no .02 on 1000 Sqft apartment</td>
<td>85%</td>
<td>203 RM</td>
</tr>
<tr>
<td>Building no .04 on 1000 Sqft apartment</td>
<td>90%</td>
<td>127 RM</td>
</tr>
<tr>
<td>Building no .04 on 800 Sqft apartment</td>
<td>25%</td>
<td>1134 RM</td>
</tr>
<tr>
<td>Duplex House Building</td>
<td>100%</td>
<td>Works completed upto pile cab</td>
</tr>
</tbody>
</table>

There is no extra payment will be made over the all the re handling and shifting of rigs. Hence the contractor are request to visited the Site and satisfied itself with Site conditions including sub-soil water conditions, topography of the land, drainage and accessibility etc. or any other condition which in the opinion of Contractor will affect his price / rates before quoting their rates. No claim whatsoever against the foregoing shall be entertained by EPI.

4. Order of Precedence

Clause 42.1 of GCC stands amended as under:

In case of difference, contradiction, discrepancy, dispute with regard to Conditions of Contract, Specifications, Drawings, Bill of Quantities and Rates quoted by the Contractor and other documents forming part of the contract, the following shall prevail in order of precedence:

4.1. Contract Agreement which includes NIT, Special Instructions to Tenderer/Bidder, Memorandum.
4.2. Letter of Intent, detailed letter of Work Order along with statement of agreed variations and its enclosures.
4.3. Description in Bill of Quantity / Schedule of Quantities
4.4. Special Conditions of Contract.
4.5. General Technical Specification as given in the Tender Documents.
4.6. General Conditions of Contract.
4.7. Drawings
4.8. Telangana State Specifications and SoR, AP state technical specifications / building data BIS specifications and CPWD specifications
5. **TIME SCHEDULE & PROGRESS**

The clause No. ‘43.2’ of General Conditions of Contract (GCC) of this Tender document shall be read as under:

“The contractor shall also furnish within 10 days of date of letter/ telegram of Intent a Time and Progress Chart (Bar Chart) for completion of work within stipulated time. This time & progress chart shall be based on the milestones given hereunder. This will be duly got approved from EPIL. This approved Bar Chart shall form a part of the agreement. Achievement of milestones as well as total completion has to be within the time period allowed. The milestones to be applicable for this contract shall be as under:

The contractor shall also ensure achievement of following milestones in terms of financial targets, failing which intermediate liquidity damages shall be liable to be effected as per terms and conditions in GCC;

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Time allowed for Achievement of financial Targets (since inception of project)</th>
<th>Financial Achievement During the Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3 Months</td>
<td>10%</td>
</tr>
<tr>
<td>2</td>
<td>6 Months</td>
<td>25%</td>
</tr>
<tr>
<td>3</td>
<td>9 Months</td>
<td>45%</td>
</tr>
<tr>
<td>4</td>
<td>12 Months</td>
<td>70%</td>
</tr>
<tr>
<td>5</td>
<td>16 Months</td>
<td>100%</td>
</tr>
</tbody>
</table>

6. **Defect Liability Period:**

Defect Liability Period as per GCC Clause No: 74.0 stands modified as Twenty Four Months (24 Months) instead of twelve months (12 months).

7. **Security Deposit Cum Performance Bank Guarantee:** Clause 9.0 of GCC shall be amended as below:

In the event of award of “Works”, Contractor shall submit to EPI, Bank Guarantees OR Demand draft (in the name of Engineering Projects (I) Ltd., payable at Hyderabad ) from a Nationalized Bank / Scheduled Bank towards security deposit @ **2.5% (Two Point Five)** of the contract value of the accepted tender within 10 days from the date of LOI as per the EPI format enclosed and BG shall be valid upto the defect liability period i.e **24 months** from the date of completion and taking over of project by client, with **claim period of 6 months** failing which EPI at his discretion may revoke the LOI & forfeit the EMD furnished along with tender. Security deposit will be returned to the contractor after satisfactory completion of Project and defect liability period.CAR & WC Policy should submit within 15 days after issue of LOI.

8. **RETENTION MONEY:** Clause no. 10.0 of GCC shall be modified as under:

The Retention Money shall be deducted from each running bill of the Contractor at 7.5% (**Seven point five only**) of the gross value of the Running Account bill. 5% of the retention money shall be refunded to the contractor after completion of the Project successfully upto the satisfaction of EPI/ CLIENT along with final Bill and another 2.5% after defect liability period.

9. **MOBILIZATION - NIL**

No mobilization advance shall be paid. Hence **Clause no. 8.0** of General Conditions of Contract (GCC) stands deleted.
10. SECURED ADVANCE: Clause no. 35 of GCC shall be modified as under:

Interest free Secured Advance upto a maximum of 90% (Ninety percent) of the Market value of the materials or the cost of materials as derived from the tendered item rate of the Contractor, whichever is less, required for incorporation in the permanent works and brought to site and duly certified by EPI Site Engineer shall be paid to the contractor for reinforcement steel only. However, for other items, no Secured advance shall be paid.

11. PRICE ADJUSTMENT:

The rates considered for reinforcement steel and cement are as under

<table>
<thead>
<tr>
<th>Material</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinforcement Steel</td>
<td>Rs.47,000/- per MT</td>
</tr>
<tr>
<td>Cement</td>
<td>Rs. 4,750/- per MT</td>
</tr>
</tbody>
</table>

In part modification to clause no 16.0 of GCC, Price Adjustment will be allowed for above said materials only as per G.O.Ms. No.94/TR&B/(R.I)/Dept,dt:16.04.2008 and as amended up to date by the Government in respect of Cement & Steel only. In case of delay to the reasons attributable to the contractor, only minus price adjustment will be given if applicable in addition to levying of liquidated damages.

12. Taxes and Duties: The following shall be also read with clause no 13 of GCC:

1. The bidder/Contractor must be registered with GST and should have valid GSTIN number.

2. The bidder/contractor must submit as an compliances of GST Act, the invoices in GST compliant format failing which the GST amount shall be recovered/adjusted by EPI without any prior notice from the next invoices or available dues with EPI.

3. The bidders/contractors are requested to update/upload the GST/Taxes data periodically so as to avail ITC credit by EPI failing which it shall be recovered/adjusted by EPI without any prior notice from the next invoices or available dues with EPI.

4. Rates to be quoted in this tender are inclusive of all taxes and duties etc. including GST (GST as per applicable shall be released on submission of documentary evidence of payment made towards GST).

5. Bidder while quoting the rates in the tender must also consider the ITC credit applicable for the works, if any.

6. Labour cess shall be reimbursed @ 1% of value of work done or as applicable from to time as per the directions of Government of Telangana.

7. Seigniorage Charges: Seigniorage charges will be recovered as per rules from the work bills of the contract or based on the theoretical requirement of material as per GO Ms. No 198 of Industries and commerce (MI) Dept. dated 13-08-2009 at the rates decided by Govt. time to time. Seigniorage charges not added as per latest APSSR 2017-18, hence no revision in rates even if the Govt. increases.

Seigniorage charges shall be reimbursed as per actual on submission of documentary evidence.

13. PROGRESS REPORTS AND SCHEDULES
Clause no. 43.6 of General Conditions of contract (GCC) shall be read as under:
The contractor shall submit to the Engineer-in-charge by the third day of every Month two
copies of a report duly updated along with BAR/CPM/PERT Chart in an approved Proforma
showing the progress made in construction of the works during the previous month.

14. REVIEW MEETINGS

During the progress of the works the Contractor or his authorized representative is expected to
participate in the monthly review meetings and/or any special meetings as instructed by the
Engineer-in-Charge. Any revision of the schedule of completion as a result of the review, will
be submitted by the Contractor to the Engineer-in-Charge within a week who will approve it
after due scrutiny. The Contractor will adhere to the revised schedule thereafter. No additional
payment shall be made to the Contractor for any multiple shift work or other incentive methods
contemplated by him in his work even though the EPIL/GRUKT approves the time schedule.
The approval of the revised time schedule shall not in any way relieve the contractor from the
terms & conditions of contract contained elsewhere in the contract documents. The Contractor
has to submit weekly, monthly progress reports along with Photographs of different activities at
site without any fail.

15. QUALITY ASSURANCE PROGRAMME

The last paragraph of clause no. ‘81.0’ of General Conditions of contract (GCC) shall be read
as under:

“The quality formats/ checks lists for different components of the work shall be as directed and
approved by the Engineer-in-Charge. The approved formats shall be adopted for
manufacturing, installation, inspection & commissioning of the work. These filled in formats
shall be prepared in two copies and duly signed by representatives of contractor and EPIL. All
the costs associated with printing of formats and testing of materials required as per Technical
Specification or as desired by Engineer-in-charge shall be borne by contractor without any
extra cost to EPIL and shall be deemed to be included in contractor’s quoted rates in the
schedule/ Bill of quantities (BOQ).”

The Quality Control Forms and Checklists provided in the General Conditions of Contract
(GCC) shall be modified by Engineer-in-Charge as per requirements of quality checks on the
basis of Technical Specification & codal requirements, shop drawings etc.

The formats for quality checks/inspection shall be developed and submitted to Engineer-in-
Charge for approval and shall be adopted after approval.

16. ARRANGEMENT OF CONCRETE

The Contractor has to submit the design mix for the work to be executed and other
requirements will be as decided by Engineer in charge. Concrete mix design shall be carried
out by the contractor at his own cost from approved laboratory before starting the work.

17. PROTECTION OF SITE

The contractor is required to make arrangements for protection of site at which the works are
to be executed from inundation due to water, floods or other such situations etc. No extra
payments shall be allowed for any delay in execution of the works on account of water
standing at site of works and no claims for an extra rate shall be entertained on these
accounts unless otherwise expressly specified.

18. DAMAGE AND LOSS
Damage to the existing structures: Any damage to the existing structures during the execution of work shall be made good by the contractor at his own cost and the site of work left clean and tidy on completion. Rectification/reinstatement/making good etc. shall conform to the standard materials originally used in the work and finished work shall match with existing work in all respects to the entire satisfaction of the Engineer-in-charge.

19. SITE DOCUMENTS

The following site documents shall mainly be maintained by the contractor at site:

- a) Copy of contract documents and drawings.
- b) Computerized bill format.
- c) Site Order Book.
- d) Material testing registers/Quality Inspection Reports.
- e) Measurement books on computerized format.
- f) Progress bar chart.
- g) Sample approval register.
- h) Visitors register.
- i) Hindrance Register
- j) Work Diary,
- k) Stage passing Register
- l) Any other detail and specific requirement as deemed necessary

In case the above are not provided at site within 10 days of placement of LOI, EPIL shall provide the same and necessary expenditure shall be deducted from the bills for documents.

20. MINOR DETAILS OF CONSTRUCTION:

The rates quoted by the Contractor shall be deemed to cover for all the minor details/requirement of construction which may not have been specifically shown on the drawings or given in particular specifications, BOQ, but are required as per established engineering practice.

21. DISCREPANCY IN DRAWINGS:

The Contractor shall be responsible to ensure co-relation in Structural drawings Architectural Drawings and Bill of Quantities, before commencement and execution of work. In case of discrepancy, the Contractor shall bring it to the notice of the Engineer-in-Charge for clarifications within 28 days of the issue of Letter of Acceptance. In the event of such discrepancy arising during the course of the work for which drawings are given after the date of issue of Letter of Acceptance, the Contractor shall seek clarifications within 7 days of receipt of such drawings. The Contractor shall take into consideration such contingencies in the completion schedule. The Contractor shall not be eligible for any extension of time for such occurrences. The decision of the Engineer-in-Charge shall be final and binding in this case. The bidder is also advised to visit the site and seek clarifications before submitting his bid.

22. EMPLOYER NOT TO SUPPLY ANY MATERIALS:

The Employer shall not supply or procure any material, for use on works, to the Contractor and he has to make his own arrangements for supplying, procuring, transportation and storage of all such materials required for the construction works at his own cost.

23. WITNESSING OF TESTS BY THE ENGINEER-INCHARGE

The Contractor shall make under the direction and in the presence of Engineer-in-charge, such tests and inspections as have been specified or as the engineer-in-charge shall consider
necessary to determine whether or not the full intent of requirements of the specifications and the other related contract documents have been fulfilled. In case the work does not meet the full intent of the specifications and the other related contract documents it shall be rectified by the Contractor at no extra cost and the Contractor shall bear all the expenses for any further tests considered necessary.

24. PROJECT COMPLETION

The contractor shall inform in writing at least One month in advance about the date of completion of work so that arrangements for taking / handing over are organized by EPIL along with the OWNER well in time. The completion certificate shall be issued by EPIL in consultation with the OWNER after having fully satisfied themselves about the satisfactory completion of the work.

25. During post construction phase the contractor shall be responsible for carrying out the following activities but not limited to the following: Rectification of the defects promptly as pointed out by EPIL or Owner’s representative(s) during the Operation & Maintenance period. Submission of “FINAL REPORT” of the completed project containing all technical & other related details.

26. The Contractor shall hold harmless and indemnify the EPIL and the OWNER against any claims or liability because of personal injury including death of any employees of the contractor arising out of or in consequence of the performance of this contract.

27. EPIL and the OWNER shall not be responsible for any loss or damage to property of any kind belonging to the Contractor or its employees, servants or agents during execution of the contract.

28. In case of any damage or loss of property relating to the WORK (S) that may happen, the Contractor shall at his own cost, repair and make good the same in conformity with the Contract. Adequate insurance coverage shall be obtained by the Contractor for this purpose.

29. PLANTS & MACHINERY:

The Contractor shall deploy sufficient plant & equipment of the required capacity and in good working condition for completion of the works in stipulated time with required quality. The equipment should either be owned by the Contractor or hired/leased. The deployment of equipment by Contractor shall be as decided by EPI and the same shall not be less than the minimum deployment stipulated, if any, for execution of “Works” and as per schedule agreed with EPI. The Contractor shall make arrangement for regular maintenance including preventive and breakdown maintenance and maintain stock of essential spares at site/near to site so as to ensure minimum breakdown time of equipment. The equipment once brought to site shall not be allowed to be removed without the consent of EPI. In case the Contractor fails to deploy sufficient equipment to the satisfaction of EPI or in case of prolonged breakdown of equipment, EPI at its sole discretion shall arrange the required equipment and debit all the related costs including ten percent overheads of EPI and shall recover the same from the due payments of Contractor, including from its bank guarantees available with EPI.

30. EQUIPMENTS FOR TESTING OF MATERIALS & CONCRETE AT SITE LABORATORY

All necessary equipment for conducting all necessary tests shall be provided at the site laboratory by the contractor at his own cost. The following minimum laboratory equipments shall be set up at site office laboratory:

(i) Cube testing machine : 1 No.
(ii) Slump Cone : 3 Nos.
(iii) Tensile Briquette testing machine : 1 No.
(iv) Vicats apparatus : 1 No.
(v) Moisture Meter: 1 No.
(vi) Megger & earth resistance tester: 1 No.
(vii) Pumps and pressure gauges for hydraulic testing: 1 No.
(viii) Drying Oven: 1 No.
(ix) Weighing scale with pan type weight: 2 Nos.
(x) Graduated glass cylinder: 6 Nos.
(xi) Sets of sieves for coarse aggregate [40; 20; 10; 4.75mm]: 2 Nos.
(xii) Sets of sieves for fine aggregate [4.75; 2.36; 1.18; 600; 300 & 150 micron]: 2 Nos.
(xiii) Core cutter for soil compaction with accessories: 1 No.
(xiv) Cube Moulds 15 x 15 x 15cm: 18 Nos.
(xv) Smoke Test Equipements: 1 No.
(xvi) Efflorescence Test Tray: 2 Nos.
(xvii) Multimeter: 1 No.
(xviii) Vernier Callipers: 2 Nos.
(xix) Screw Gauge: 2 Nos.
(x) Any other equipment for site tests as outlined in BIS and as directed by the Engineer-in-charge.
(xxi) Tong Tester

31. DOCUMENTS FOR SUPPLY ITEMS

For supply items in Part III of BOQ the Supplier shall submit the following documents to EPIL.

a) Warranty Cards.
b) Manufacturer’s test certificate.
c) Any other test certificate from an external laboratory to determine the Technical spéifications.
d) Catalogues
e) Pollution Control Certificats.
f) Documents required for registration of vehicle with the local transport Authority and other inter state movement of vehicle.
g) List of recommended spares with specification and costs thereof.
h) Operation & Maintenance manuals.

32. TECHNICAL STAFF FOR WORK : Clause 27.0 of GCC shall be amended as below:

The following minimum key personnel would be deployed on the project by the Contractor for day to day execution and supervision of its works during the entire duration of the project. The minimum number and level of Engineers, Supervisors and other personnel to be deployed by the contractor during Maintenance/defect liability period shall be as directed by EPI. In case contractor fails to deploy adequate number of personnel at site/ office, EPI after giving seven days notice shall engage the required personnel solely at the risk and cost of the contractor and debit the cost of the same to the account of the contractor.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Position</th>
<th>Qualification</th>
<th>Total Experience</th>
<th>Experience in Civil Project</th>
<th>Number required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Project Manager</td>
<td>Engg. Graduate</td>
<td>10 years</td>
<td>5</td>
<td>01</td>
</tr>
<tr>
<td>2.</td>
<td>Engineers</td>
<td>Engg. Graduate Civil/Electrical</td>
<td>8</td>
<td>3</td>
<td>02</td>
</tr>
<tr>
<td>3.</td>
<td>Supervisors</td>
<td>Engg. Diploma Civil/Electrical</td>
<td>8</td>
<td>3</td>
<td>04</td>
</tr>
</tbody>
</table>
33. The contractor shall prepare and submit shop drawings for, Mechanical, Plumbing, Electrical work etc. to Engineer In-charge for approval before execution of the work.

34. The contractor shall get approval of plinth area on completion of work at plinth level and final approval of the area at the completion of building from authority as per approved drawing/norms followed by local authority during approval of construction drawing. No extra claim shall be entertained on this account.

35. The contractor has to get executed the works from specialized agencies for the specialized nature of works such as aluminum works, wood works, false ceiling works, flooring works, finishing items, arboriculture, electrical works any other specialized work as decided by Engineer In charge. The contractor has to obtain the approval from Engineer-In charge of EPIL for execution of specialized nature of work.

36. LAWS, BYE LAWS RELATING TO THE WORK: In addition to Clause 25.0 of GCC, the following responsibility is under contractor scope:

a) It is the responsibility of the contractor for getting the approval from the local statutory authorities such as town planning / municipal authorities / electricity board/fire department etc. and other department for the works executed at site as per the approved plans and designs etc. The statutory fees payable for approval shall be made directly to the local government department / state authorities by EPIL/ RGUKT authorities. Other incidental expenditure if any shall be borne by the contractor and no reimbursement will be made for the same.

b) The contractor is responsible for obtaining the connection for water supply, sewer connection, electric connection and other connections if any from local authorities/state Electricity board.

c) The contractor shall have to obtain all Approvals including Connections/ NOCs/ Completion Certificates/ Occupancy Certificate, etc from the concerned Local/Statutory authorities for Sewerage works, Water Supply works, Fire Fighting work, Fire Alarm system work, DG set etc. at his own cost and nothing extra other than statutory fee/charges shall be payable on this account to the contractor. However, the letters required from the owner for the needful stated purposes will be arranged by EPIL from the owner as per the request of contractor along with the statutory charges/fee demanded by the local/statutory authorities.

d) The contractor shall engage a specialized agency for execution of, fire fighting work, fire alarm system and lift work. The specialized agencies so engaged should have relevant license as required for execution of these works. The contractor will submit the credentials of the specialized agencies along with their consent for approval of EPIL before engaging the specialized agency. It may, however, be noted that the entire responsibility towards quantity and quality of the entire project including services shall remain with the main contractor. Nothing extra will be paid on this account.

4. Computer Operator | Qualified [Proficient in use of MS Project / Primavera]. | 02 | - | 01

5. Lab Engineer/ Technician | Degree/Diploma in Civil Engineering | 05 | 2 | 01

6. Quantity Surveyor | Degree/Diploma in Civil Engineering | 05 | 2 | 01

NOTE: Other supportive staff shall also be adequately deployed by the Contractor as per the requirement of work OR as directed by the Engineer-in-charge.
37. SCHEDULE OF QUANTITIES / BILL OF QUANTITIES: Clause no 46.0 of GCC shall amended as follows,

For items not covered under any of the specifications mentioned in Tender Documents, the works shall be carried out as per APSS Specifications/manufacturer's specifications/General Engineering Practice and/ or as per directions of Engineer-in-Charge. The rate for such extra work shall be derived as as follows:

a) If the item is available in TG SOR 2017-18, contractor has to execute the item with the same rate.

b) If the item is not available in SOR 2017-18 and similar item is available, rate for such extra work shall be derived from the similar item by adding or deleting the differences.

c) If the rate for any item is not possible to derive as mentioned above, the rate for which shall be derived by analyzing as per the prevailing market rates.

38. The contractor should invariably obtain necessary manufacturers test certificates from the suppliers of steel and cement for each and every consignment and furnish them to the Engineer-in-charge before use on works.

39. The original bills of procurement should be submitted to the Engineer-in-charge for making payment of the item. The contractor shall purchase the steel and cement on the name of work, the name of contractor and furnish the same to the Engineer-in-charge. The steel and cement without the above two names will not be accepted on the works.

40. If any difference is observed on carriage inwards, carriage outwards and theoretical requirement of steel and cement for finished works, recovery at double the rate will be effected from the contractors bills for the quantity varied above the allowable limits.

41. For all Schedule BOQ items the nomenclature /rates/ unit of TG SOR items shall be followed. In case any ambiguity is observed in Scheduled BOQ items relevant TG SOR item will hold good.

42. The contractor will arrange to carry out total station survey before start of work and after completion of work, if requires, at his own cost.

43. All the cost of travel, lodging, boarding etc. towards visits by Client, their Consultant etc. to the manufacturing units/works for the inspection of materials, equipment etc. under the scope of work of Contractor shall be borne by the Contractor.

44. Facility by contractor Clause no 28.3 of GCC stands deleted.

45. Payments: Clause no 44.0 of GCC stands amended as follows,

Payments for the work done shall be released to Contractor within seven (07) working days of receipt of RA Bill duly certified by EPI's representative including mobilization advance and secured advance etc. and after deducting recoveries if any. Recovery / Adjustment of the Mobilization advance and secured advance shall be as per the terms of contract / APSS norms.

The final bill payment to the Contractor shall be released 30 days after submitting Sales Tax clearance certificates, EPF clearance certificate, all other clearances, approvals, certificates etc. as per agreement for the “Works” and as per statutory requirement.

The Contractor shall have no claim on EPI in case the payments are delayed by the client due to any reason whatsoever.
46. In case of non-approval of Contractor’s association for the Project by the Client and/or by the corporate office of EPI due to any reasons whatsoever at any stage of the “Works”, the Contractor shall have no claim on EPI.

47. Quantity variation: Clause no. 69.1(v) of GCC shall be modified as under

The quantities indicated in the BOQ are tentative. However contractor has to execute the works as per drawings and site conditions. Payment will be released for the work executed as per the rates quoted by contractor even if the quantities increases or decreases upto any extent.

48. Contractor shall ensure compliance with all Central, State and Local Laws, Rules, Regulations etc. as applicable or may be applicable during the course of execution, maintenance etc. of the “Works” and shall indemnify EPI against any claim or damages whatsoever on such accounts. The Contractor shall keep EPI indemnified at all times against infringement of any Patent or Intellectual Property rights.

49. The “Parties” shall make efforts to settle disputes, if any, amicably. Only if amicable settlement is not possible, the same shall be referred to the sole arbitration of the Chairman & Managing Director (CMD) of EPI or the person appointed by the CMD, EPI and the decision of the arbitrator shall be final and binding on the “Parties”. Arbitration will be according to “Conciliation & Arbitration” clause of GCC. (Enclosed Annexure – II)

50. Project sign board to be supplied and erected at the site office as per the drawing enclosed at Annexure – IV.

51. EPI has agreed to award the work to the Contractor on the basis of details regarding experience profile, financial standing, credentials, fulfillment of statutory obligations, etc. of Contractor submitted by Contractor to EPI. In case, at a later stage if it is found that the Contractor has submitted incorrect, false details and credentials resulting in apprehensions on the capabilities of Contractor with regard to quality & timely completion of works, financial capabilities etc, EPI can terminate this order solely at its option. In this eventuality the Contractor shall be liable for the losses suffered by EPI and further Contractor shall have no claim on EPI, whatsoever.

SIGNATURE OF THE CONTRACTOR WITH SEAL
52. CONCILIATION AND ARBITRATION

General Conditions of Contract (GCC) Sub Clause no.76.1 and 76.3 of Arbitration Clause no.76.0 are amended as given below. Sub Clause no.76.2 will remain the same.

76.0. ARBITRATION

76.1 Before resorting to arbitration as per the clause given below, the parties if they so agree may explore the possibility of conciliation as per the provisions of Part III of the Arbitration and Conciliation Act, 1996 as amended by Arbitration and Conciliation (Amendment) Act, 2015. When such conciliation has failed, the parties shall adopt the following procedure for arbitration:

i) Except where otherwise provided for in the contract, any disputes and differences relating to the meaning of the Specifications, Design, Drawing and Instructions herein before mentioned and as to the quality of workmanship or materials used in the work or as to any other questions, claim, right, matter or things whatsoever in any way arising out of or relating to the Contract, Designs, Drawings, Specifications, Estimates, Instructions, or these conditions or otherwise concerning the works of the execution or failure to execute the same whether arising during the progress of the work or after the completion or abandonment thereof shall be referred to the Sole Arbitrator appointed by the Chairman & Managing Director (CMD) of Engineering Projects (India) Limited (EPI) or any other person discharging the functions of CMD of EPI. The person approached for appointment as Arbitrator shall disclose in writing circumstances, in terms of Sub-Section (1) of Section (12) of the Arbitration and Conciliation Act, 1996 as amended by Arbitration and Conciliation (Amendment) Act, 2015 as follows:

a) Such as the existence either direct or indirect, of any past or present relationship with or interest in any of the parties or in relation to the subject-matter in dispute, whether financial, business, professional or other kind, which is likely to give rise to justifiable doubts as to his independence or impartiality; and

b) which are likely to affect his ability to devote sufficient time to the arbitration and in particular his ability to complete the entire arbitration within a period of twelve months.

The Arbitrator shall be appointed within 30 days of the receipt of letter of invocation of arbitration duly satisfying the requirements of this clause.

ii) If the arbitrator so appointed resigns or is unable or unwilling to act due to any reason whatsoever, or dies, the Chairman & Managing Director aforesaid or in his absence the person discharging the duties of the CMD of EPI may appoint a new arbitrator in accordance with these terms and conditions of the contract, to act in his place and the new arbitrator so appointed may proceed from the stage at which it was left by his predecessor.

iii) It is a term of the contract that the party invoking the arbitration shall specify the dispute/differences or questions to be referred to the Arbitrator under this clause together with the amounts claimed in respect of each dispute.

iv) The Arbitrator may proceed with the arbitration ex-parte, if either party, in spite of a notice from the arbitrator, fails to take part in the proceedings.

v) The work under the contract shall continue as directed by the Engineer-In-Charge, during the arbitration proceedings.
vi) Unless otherwise agreed, the venue of arbitration proceedings shall be at the venue
given in the “Memorandum” to the “Form of Tender”.

vii) The award of the Arbitrator shall be final, conclusive and binding on both the parties.

viii) Subject to the aforesaid, the provisions of the Arbitration and Conciliation Act, 1996 as
amended by Arbitration and Conciliation (Amendment) Act, 2015 or any statutory
modifications or re-enactment thereof and the Rules made there under and for the time
being in force shall apply to the arbitration proceedings and Arbitrator shall publish his
Award accordingly.

53. JURISDICTION:

The courts in Chennai alone will have jurisdiction to deal with matters arising from the contract.
GENERAL TECHNICAL SPECIFICATIONS

[TO BE INCORPORATED AS PER REQUIREMENT OF THE WORK
PUT TO TENDER DULY QUOTING THE RELEVANT
SPECIFICATION NUMBER OF APSS. BSI Code No., MORT&H,
etc. STANDARD SPECIFICATION NO.]
STANDARD SPECIFICATION FOR BUILDING WORK (AS PER A.P.S.S.)

All the items of work shall be executed as per the Standard Specifications laid down in APSS, the relevant I.S Codes of the Special Specification as indicated in Schedule - 'A' of the tender

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the specification</th>
<th>Specification No.of.APSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.01</td>
<td>General</td>
<td>101</td>
</tr>
<tr>
<td>1.02</td>
<td>Common Burnt Clay Brick</td>
<td>102</td>
</tr>
<tr>
<td>1.03</td>
<td>Broken Brick</td>
<td>103</td>
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<tr>
<td>1.04</td>
<td>Surki</td>
<td>104</td>
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<tr>
<td>1.05</td>
<td>Fly Ash</td>
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</tr>
<tr>
<td>1.06</td>
<td>Rough Stones for dry packed Revetments and aprons</td>
<td>106</td>
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<td>1.07</td>
<td>Stone for Masonry</td>
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<td>1.08</td>
<td>Broken Stone/Coarse Aggregate for Concrete</td>
<td>108</td>
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<tr>
<td>1.09</td>
<td>Sand</td>
<td>110</td>
</tr>
<tr>
<td>1.10</td>
<td>Lime</td>
<td>111</td>
</tr>
<tr>
<td>1.11</td>
<td>Portland Cement of not less than '43' glade</td>
<td>112</td>
</tr>
<tr>
<td>1.12</td>
<td>Cement Mortar</td>
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<tr>
<td>1.13</td>
<td>Cement Lime Mortar</td>
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<tr>
<td>1.14</td>
<td>Steel for Reinforcement</td>
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<td>1.15</td>
<td>Steel for Structural Work</td>
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<td>1.16</td>
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<td>1.17</td>
<td>Teak Wood</td>
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<td>1.18</td>
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<td>Ballies</td>
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<td>1.20</td>
<td>Steel Sheets piling Sections</td>
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<td>2.01</td>
<td>Excavation and Forming un compacted banks</td>
<td>301</td>
</tr>
<tr>
<td>2.02</td>
<td>Embankment compacted by other than driven equipment</td>
<td>302</td>
</tr>
<tr>
<td>2.03</td>
<td>Embankment compacted by power driven equipment</td>
<td>303</td>
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<td>2.04</td>
<td>Clay blankets</td>
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<td>2.05</td>
<td>Filters</td>
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<td>2.06</td>
<td>Rock-fill in toe of embankment</td>
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<td>2.07</td>
<td>Turfing</td>
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<td>2.08</td>
<td>Excavation of foundation</td>
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<td>2.09</td>
<td>Filling in foundations</td>
<td>309</td>
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<tr>
<td>2.10</td>
<td>Filling in Basement</td>
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<tr>
<td>2.11</td>
<td>Well sinking for foundations</td>
<td>311</td>
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<tr>
<td>2.12</td>
<td>Well sinking for Water Supply</td>
<td>312</td>
</tr>
<tr>
<td>2.13</td>
<td>RCC Precast and Cast-in-situ pile foundations</td>
<td>313</td>
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<tr>
<td>3.01</td>
<td>lime Concrete and surki concrete</td>
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<tr>
<td>3.02</td>
<td>Cement Concrete for plain and reinforced works.</td>
<td>402</td>
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<tr>
<td>3.03</td>
<td>Reinforced cement concrete work</td>
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<td>3.04</td>
<td>Repair grouting to aprons and revetments with surki Concrete and pointing with surki mortar</td>
<td>404</td>
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<td>4305</td>
<td>Prestressed concrete work.</td>
<td>405</td>
</tr>
<tr>
<td>4.01</td>
<td>Brick Masonry-General</td>
<td>501</td>
</tr>
<tr>
<td>4.02</td>
<td>Brick in Lime Mortar</td>
<td>502</td>
</tr>
<tr>
<td>4.03</td>
<td>Brick in Surki Mortar</td>
<td>503</td>
</tr>
</tbody>
</table>
### Specifications

#### 1.0 Preamble

The technical specifications for various items of work contained here in shall be read in conjunction with the specifications mentioned for each item of work in bill of quantities part-I (Schedule – A) and also plans and drawings in part III.

#### 2.0 General Technical Specifications

2.1 The following are the general technical specifications to be adopted for construction of buildings. Each item of work shall be executed according to the relevant standard specification number as described in the “Andhra Pradesh Standard Specification” (APSS) and Indian Standard (I.S) Specifications, including Water supply, Sanitary and Electrical Installations. In the absence of any definite provisions on any particular item of work in the aforesaid specifications in A.P.S.S., reference may be made to the latest codes and specifications of Indian Standards or Indian Roads congress (IRC in case of Roads). Where even these are silent, the construction and completion of works shall conform to sound engineering practice as approved by Engineer-in-charge and in case of dispute arising out of the interpretation of the above, the decision of Engineer-in-charge shall be final and binding on the contractor.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the specification</th>
<th>Specification No.of.APSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.04</td>
<td>Brick in Cement Mortar</td>
<td>504</td>
</tr>
<tr>
<td>4.05</td>
<td>Brick in Cement Lime Mortar</td>
<td>505</td>
</tr>
<tr>
<td>4.06</td>
<td>Brick in clay</td>
<td>506</td>
</tr>
<tr>
<td>4.07</td>
<td>Brick Arch work</td>
<td>507</td>
</tr>
<tr>
<td>4.08</td>
<td>Brick in Honey Comb work</td>
<td>508</td>
</tr>
<tr>
<td>4.09</td>
<td>Reinforced half-brick partition walls</td>
<td>509</td>
</tr>
<tr>
<td>4.10</td>
<td>Boiler Brick works</td>
<td>510</td>
</tr>
<tr>
<td>4.11</td>
<td>Honey Comb works with white washed pan tiles</td>
<td>511</td>
</tr>
<tr>
<td>4.12</td>
<td>Brick Nogging</td>
<td>512</td>
</tr>
<tr>
<td>2.01</td>
<td>Plastering General</td>
<td>901</td>
</tr>
<tr>
<td>5.02</td>
<td>Plastering with time mortar one coat, 12mm thick, including fine Rendering</td>
<td>902</td>
</tr>
<tr>
<td>5.03</td>
<td>Plastering with cement mortar, one coat 12mm or 20mm thick including fine rendering</td>
<td>903</td>
</tr>
<tr>
<td>5.04</td>
<td>Plastering with cement mortar 2 coats 20mm thick with sponge finish</td>
<td>904</td>
</tr>
<tr>
<td>5.05</td>
<td>Plastering with combination mortar, one coat 12mm thick including fine rendering</td>
<td>905</td>
</tr>
<tr>
<td>5.06</td>
<td>Pointing to masonry with cement mortar</td>
<td>906</td>
</tr>
<tr>
<td>5.07</td>
<td>Pointing to masonry with surki mortar</td>
<td>907</td>
</tr>
<tr>
<td>5.08</td>
<td>White-washing</td>
<td>908</td>
</tr>
<tr>
<td>5.09</td>
<td>Colour-washing</td>
<td>909</td>
</tr>
<tr>
<td>5.10</td>
<td>Dry distempering</td>
<td>910</td>
</tr>
<tr>
<td>5.11</td>
<td>Oil bound distempering</td>
<td>911</td>
</tr>
<tr>
<td>5.12</td>
<td>Water proof cement painting</td>
<td>912</td>
</tr>
<tr>
<td>5.13</td>
<td>Lettering with paint</td>
<td>1221</td>
</tr>
<tr>
<td>5.14</td>
<td>French polishing</td>
<td>1222</td>
</tr>
</tbody>
</table>
3.0 GENERAL INSTRUCTIONS

3.1 Drawings, Instructions, Measurements

All works shall be done according to the detailed drawings and specifications. Figured dimensions shall be followed. Measurement shall be taken of the actual work done but shall not exceed those marked on the drawings for payments.

3.2 Site Clearance and Demolition

The site shall be cleared of all trees, stumps, roots, brush wood, bushes and other objectionable materials. Useful and saleable material shall be the property of the Owner (A.P.S.F.C.) and shall be stacked properly as directed by the Engineer-in-charge. The areas to be covered with embankments shall be stripped of top soil to required depths to expose acceptable founding strata. Top soil unsuitable for use in embankment construction and other fills shall be disposed off as directed. All combustible materials shall be stacked and burnt in locations sufficiently remote to eliminate all danger of fire hazards. All old concrete, brick works and drains which interfere with construction works shall be dismantled with the approval of the Engineer-in-charge duly taking all necessary precautions prescribed in safety specification. Top soil which is suitable for use in construction work shall be stockpiled for later use. Other objectionable materials such as trash, debris, stones, brick, broken concrete, scrap metal etc., shall be disposed off as directed by the Engineer. Payment for cutting and removal of trees, stumps, dismantling existing structures and stripping shall be regulated by the description in the Schedule of Items or Section 2 of A.P.S.S.

3.3 Precision: The works shall be set to the highest precision of dimensions, levels, grades and lines as per designs and drawings using precise scientific equipments and measuring instruments.

3.4 Quality of work:

To be the best quality: All the materials, workmanship, articles, Equipment, tools and plants should be of high and acceptable quality conforming to the standard specifications.

All materials shall be new and of the kinds and qualities described in the contract.

3.5 Testing of works and materials

3.5.1 All materials used and works done shall be subject to approval of the Engineer-in-charge.

3.5.2 The contractor shall arrange sufficiently in advance to test materials and portions of works in order to prove their soundness and efficiency if required, including samples and supporting test results from the approved laboratory and other documentary evidence from the manufacturer, wherever applicable, and indicate the types of materials and their respective sources. The delivery of materials at site shall commence only after the approval of the quality, grading and sources of the materials by the Engineer-in-charge.

3.5.3 The quality of all materials approved shall be maintained throughout the period of construction and periodical tests shall be carried out to ensure that it is maintained. The contractor shall conduct tests at work site/approved laboratories and shall maintain test reports at site for cement, coarse aggregates, fine aggregates, water, steel, bricks and concrete at the following frequency :-
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of material</th>
<th>Frequency of test</th>
<th>Allowable limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CEMENT : (IS : 8112-1989)</td>
<td>One for each source of supply in a month</td>
<td>Shall not be less than 3500 sqcm / gm</td>
</tr>
<tr>
<td>b) Fineness</td>
<td>-do-</td>
<td>Initial setting time shall not be less than 30 minutes and final setting time shall not be more than 60 minutes.</td>
<td></td>
</tr>
<tr>
<td>c) Setting time</td>
<td>-do-</td>
<td>Expansion (unaerated) shall be not more than 10mm by “Le Chatelier” method; if it fails, expansion of aerated sample shall be not more than 5 mm.</td>
<td></td>
</tr>
<tr>
<td>d) Soundness</td>
<td>-do-</td>
<td>Compressive strength for 7 days shall not be less than 330 kg/cm² and compressive strength for 28 days shall not be less than 430 kg/cm²</td>
<td></td>
</tr>
</tbody>
</table>
| 2.      | Coarse aggregate : (IS383-1970) | One test for 15 Cum or at least on the day of concrete if concrete quantity is less than 15 cum. | 40mm Metal :
<p>| a) Gradation | b) Aggregate impact value | -63mm – 100% 40mm-85 to 100% 20mm-0-2-%; 10mm-0.5% |
| b) Flakiness Index : shall be less than 30% by weight 20mm Metal : | | |
| 4.      | FINE AGGREGATE (IS383-m1970) | One test for every 15 cum. | 20 -40(IS 2386-1963) |
| a) Gradation for concrete | | Fineness modules : Fine sand limit 2.2 to 2.6 |
| b) Gradation for masonry | | Medium sand limit 2.6 to 2.9 |
| c) Gradation for finishing | -do- | Coarse sand limit 2.9 to 3.2 |
| d) Bulkage | Three for each day of work i.e. morning noon and evening | b) Silt Content : shall be less than 4% by weight |
| e) Silt content | At least once on the day of work | |
| 4.      | WATER : Chemical test | One test for each source | The water quantity shall be as per clause 5.4 of ISI 456-2000. The PH value of water shall not be less than 6. |</p>
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of material</th>
<th>Frequency of test</th>
<th>Allowable limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>STEEL : (Fe500 (IS1786-1985))&lt;br&gt;a) 0.2% proof stress&lt;br&gt;b) Elongation&lt;br&gt;c) Tensile strength</td>
<td>One for each source of supply and once in six months for fresh supply&lt;br&gt;-do-&lt;br&gt;-do-</td>
<td>5000 kg/cm² (Minimum)&lt;br&gt;Percentage of elongation 14.5% minimum&lt;br&gt;Ultimate tensile strength 5900 kg/cm² (Minimum)</td>
</tr>
<tr>
<td></td>
<td>d) Weight/RM</td>
<td>As per B.I.S.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e) Rebend test</td>
<td>As per B.I.S.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f) Chemical composition of Steel</td>
<td>As per B.I.S.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>BRICKS : (IS:1077-1976)&lt;br&gt;a) Compressive strength&lt;br&gt;b) Water absorption</td>
<td>One for each source of supply and once in two months when change in texture is noticed&lt;br&gt;-do-</td>
<td>Shall not be less than 40 Kg/cm²&lt;br&gt;i) Shall not be greater than 20% by weight for clay bricks.&lt;br&gt;ii) For fly ash bricks – As per standards&lt;br&gt;iii) For Aerocon bricks- As per standards</td>
</tr>
<tr>
<td>7.</td>
<td>CONCRETE : (IS456:2000)&lt;br&gt;a) Cube strength&lt;br&gt;b) Slump</td>
<td>Frequency of testing as per clause 15.2 of IS 456-2000 for example 6 cube specimens, 3 each for 7 days &amp; 28 days strength for every 15 cum. Cube shall be prepared, cured and tested in accordance with the requirement of IS 516.&lt;br&gt;Thrice in a day of concrete in morning, noon and evening</td>
<td>a) Compressive strength (7 days)&lt;br&gt; M15-100 Kg/cm² (Minimum)&lt;br&gt; M20-135 KG.cm² (Minimum)&lt;br&gt;b) Compressive strength (28 days)&lt;br&gt; M15-150 Kg/cm² (Minimum)&lt;br&gt; M20-200 Kg/cm² (Minimum)&lt;br&gt;c) Foundation footing – 10mm to 25mm&lt;br&gt; Column beams and slabs – 25mm to 40mm (with normal reinforcement)&lt;br&gt; Beams, slabs – 4 to 50mm (with congested reinforcement)</td>
</tr>
</tbody>
</table>
A Register of record of material testing and Register of daily events showing materials received, labour engaged, out turn of work etc. shall be maintained at site and shall be signed by the contractor or his authorised representative and the Engineer

3.6 Rejection of Materials/works

3.6.1 Any material brought to site which in the opinion of the Engineer is defective, sub-standard, damaged, contaminated, deteriorated or does not comply with the requirement of the specification shall be rejected. The contractor shall remove from site such materials within 4 hours of notice from site.

3.6.2 If the work or portion of the work which in the opinion of the Engineer is found to be defective or unsound, the contractor shall pull it down and re-execute the same work at his own cost.

3.7 Measurement Materials

For the Controlled Concrete where site mixing is permitted shall be with concrete mixtures fitted with weigh batching scale. Materials shall be weighed and batched in mechanical weigh batchers as per the specified proportions of the approved design mix.

Materials requiring Volumetric mixing, wherever permitted, should be measured separately in boxes of appropriate size before being mixed in the specified proportions.

3.8 Storage of Materials

3.8.1 Adequate safe, dry storage shall be provided for all materials particularly cement.

3.9 Codes

3.9.1 Unless mentioned otherwise, current versions of all codes, specifications and standards issued by the Indian Standards Institution and Indian Roads Congress shall be fully applicable to these specifications. In the absence of appropriate publications by ISI or IRC, adoptable specification of the International Organization for Standardization shall apply.

3.9.2 In case of any conflict in meaning between the specifications mentioned hear in and those of ISI or IRC, the provisions of these specifications shall prevail.

3.9.3 The following codes shall be applicable for the purpose. However the latest revision of these codes shall only be used.
# List of Specifications for the Various Items of Works Supplementing Those Described in Schedule ‘A’ by S.S. Numbers

## General Specifications

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Short Title/ Description</th>
<th>IS. No. and as amended from time to time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A) List of Indian Standards</strong></td>
<td></td>
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<tr>
<td>I. CEMENT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Specifications for 43 Grade Ordinary Portland cement</td>
<td>IS 8112:1989</td>
</tr>
<tr>
<td>2</td>
<td>Methods of physical tests for hydraulic comments</td>
<td>IS 4031 (Part 1 to 15) :1988</td>
</tr>
<tr>
<td>3</td>
<td>53 Grade cement</td>
<td>IS 12269:1989</td>
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<tr>
<td>II. AGGREGATES</td>
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<tr>
<td>1</td>
<td>Specifications for Coarse and Fine aggregates from Natural resources for concrete</td>
<td>IS 383:1970</td>
</tr>
<tr>
<td>2</td>
<td>Specification for Sand for Masonry</td>
<td>IS 2116:1980</td>
</tr>
<tr>
<td>3</td>
<td>Methods of tests for aggregates for concrete.</td>
<td>IS 2386:1963 (Part I to IV)</td>
</tr>
<tr>
<td>4</td>
<td>Specification for test sieves. Part-I Wire cloth test sieves</td>
<td>IS 460:1978 (Part-I)</td>
</tr>
<tr>
<td>III. BRICKS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Specifications for Common Burnt Clay building bricks</td>
<td>IS 1077:1992</td>
</tr>
<tr>
<td>2</td>
<td>Methods of test for burnt clay building bricks</td>
<td>IS 3495:1992 (Part I to IV)</td>
</tr>
<tr>
<td>IV BUILDING STONES:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Method of Tests for determination of strength properties of natural building stones (compressive strength, Transverse strength, Tensile Strength, Shear Strength.</td>
<td>IS 1121 (Part –1 to Part 4): 1974</td>
</tr>
<tr>
<td>2</td>
<td>Schedule of properties and availability of stones for construction purposes</td>
<td>IS 7779:1975 (Part 1 to Part 5)</td>
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<td>3</td>
<td>Quarrying stones for construction purposes</td>
<td>IS 8381:1977</td>
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<tr>
<td>4</td>
<td>Stone Masonry: Specifications for dressing natural building stones</td>
<td>IS 1129:1972 (Part-IV)</td>
</tr>
<tr>
<td>V.</td>
<td>STEEL</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Specification of Mild steel and medium tensile steel bars and hard drawn steel wires for concrete reinforcement. Part-I Mild Steel &amp; Medium tensile steel bars</td>
<td>IS 432:1982 (Part I &amp; II)</td>
</tr>
<tr>
<td>2</td>
<td>Specifications for Cold-worked steel, High strength deformed steel bars and wires for concrete reinforcement.</td>
<td>IS 1786:1985</td>
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<td>3</td>
<td>Specification for steel for General structural purposes</td>
<td>IS 2062:1999</td>
</tr>
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<td>4</td>
<td>Specification for structural steel (Standard quality)</td>
<td>IS 226:1975</td>
</tr>
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<td>5</td>
<td>Specification for steel tubes for structural purposes</td>
<td>IS 1161:1998</td>
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<tr>
<td>6</td>
<td>Hand Drawn Wire</td>
<td>IS 432:1953</td>
</tr>
<tr>
<td>VI</td>
<td>CERAMIC TILES</td>
<td>IS 13712:2006</td>
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<tr>
<td>VII</td>
<td>STACKING AND STORAGE OF MATERIALS</td>
<td>IS 4082:1996</td>
</tr>
<tr>
<td>1</td>
<td>Recommendation of stacking and storage of construction materials and components at site</td>
<td>IS 4082:1996</td>
</tr>
<tr>
<td>VIII</td>
<td>MASONRY</td>
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<tr>
<td>1</td>
<td>Brick Masonry</td>
<td>IS 2212:1962</td>
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<tr>
<td>2</td>
<td>Code of practice for construction of Stone Masonry Part-1 (Rubble stone masonry)</td>
<td>IS 1597:1992</td>
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<td>3</td>
<td>Code of practice for permeability test for masonry (during and after construction)</td>
<td>IS 11216:1985</td>
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<td>4</td>
<td>Code of practice for brick work</td>
<td>IS 2212:1991</td>
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<td>5</td>
<td>Construction of hallow and solid concrete block masonry</td>
<td>IS 2572:2005</td>
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<td>6</td>
<td>Code of practice for construction of autoclaved cellular concrete block masonry</td>
<td>IS 6041:1985</td>
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<td>IX</td>
<td>CONCRETE</td>
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<tr>
<td>2</td>
<td>Method of Sampling and analysis of concrete</td>
<td>IS 1199:1959</td>
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<td>3</td>
<td>Method of test for strength of concrete</td>
<td>IS 516:1959</td>
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<td>4</td>
<td>Recommended guide lines for Concrete Mix Design</td>
<td>IS 10262:1982</td>
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<td>5</td>
<td>Code of practice for Ready-Mixed Concrete</td>
<td>IS 4926:2003</td>
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<td>6</td>
<td>Specification for Admixtures for concrete</td>
<td>IS 9103:1999</td>
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<td>7</td>
<td>Guidelines for false work for concrete structures.</td>
<td>IS:14687:1999</td>
</tr>
<tr>
<td>8</td>
<td>Code of practice for use of immersion vibrators for consolidating concrete</td>
<td>IS 3558:1983</td>
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<td>9</td>
<td>Specifications for Pre-cast concrete coping blocks</td>
<td>IS 5751:1984</td>
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<td>10</td>
<td>Laying in situ cement concrete flooring</td>
<td>IS 2571:1970</td>
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<tr>
<td>11</td>
<td>Code of practice for concrete structures for the storage of liquids</td>
<td>IS 3370:1965 (Part 1 &amp; 2)</td>
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<td>IS 3370-1967 (Part 3 &amp; 4)</td>
</tr>
<tr>
<td>12</td>
<td>Code of practice for concrete roads</td>
<td>IRC: 15-2002</td>
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</tbody>
</table>

**X REINFORCEMENT/ STRUCTURAL STEELWORK**

1. Code of Practice for Bending and fixing of bars for concrete reinforcement
2. Recommendations for detailing of reinforcement in reinforced cement concrete works
3. Mils steel wire for General Engineering purposes
4. Recommendation for welding of cold worked bars for Reinforced concrete construction
5. Code of practice for general construction in steel
6. Code of practice for use of metal arc welding for general construction in mild steel
7. Safety code for erection of structural steel work
8. Tolerance for fabrication of steel structures

**XI. JOINERY:**

1. Specifications for timber paneled and glazed door, window and ventilator shutters (IS 1003-Pat 1-2003 and IS 1003-Part 2-1994)
2. Specifications for cut size timber
3. Code of practice for Glazing in Buildings
4. Specification for aluminium doors, windows and ventilators

**XII EARTH WORK:**

1. Code of Safety for excavation works
2. Safety code for piling and other deep foundations
3. Code of practice for earth work on canals
4. Methods of Test for soils

**XIII OTHER SUBJECTS:**

2. Code of practice for design and construction of foundations in soils: general requirement
   Colours for Ready mixed paints & enamels (IS 5: 2004)
<table>
<thead>
<tr>
<th>Sl.No.</th>
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<tr>
<td>XIV. MACHINERY</td>
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<tr>
<td>1</td>
<td>Batch type concrete mixer</td>
<td>IS 1791:1968</td>
</tr>
<tr>
<td>2</td>
<td>Concrete Vibrators – Immersible type</td>
<td>IS 2505:1980</td>
</tr>
<tr>
<td>3</td>
<td>Specifications for moulds for use in tests of cement and concrete</td>
<td>IS 10086:1982</td>
</tr>
<tr>
<td>4</td>
<td>Compression testing machine used for testing of concrete and mortar</td>
<td>IS 14858:2000</td>
</tr>
<tr>
<td>5</td>
<td>Sheep foot roller</td>
<td>IS 4616:1968</td>
</tr>
<tr>
<td>XV. SAFETY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Criteria for earthquake resistant design of structures.</td>
<td>IS 1893:2002</td>
</tr>
<tr>
<td>3</td>
<td>Code of practice for earthquake resistant design and construction of buildings.</td>
<td>IS 4326:1993</td>
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<tr>
<td></td>
<td>Safety code for scaffolds and ladders</td>
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<td></td>
<td>Part-I – Scaffolds</td>
<td>IS 3696:1987</td>
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</tbody>
</table>

XVI DRAWINGS:

1 Code of practice for general engineering drawings IS 696:1972

2 Code of practice for architectural and building drawings (First revision). IS 962:1989

XVII MEASUREMENT

1 Methods of measurement of building and civil engineering works. IS : 1200

Note:- The above I.S specifications mean latest over and above with amendments if any.

PERFORMANCE OF WORK

Execution of Works

All the works shall be executed in strict conformity with the provisions of the contract documents, explanatory detailed drawings and specifications.

The site should be cleared of all obstructions, vegetation, loose stones and materials before start of work.

The Engineer in charge, Supervisor will inspect the work on a Day-to-Day basis.

Work in Monsoon

The construction may entail working in monsoon also. The contractor must maintain a minimum labour force and execute the construction according to the prescribed schedule.
Contractor is responsible for keeping the construction work site free from water.

**Plinth Levels**

A proper level should be maintained, in terms of horizontal and vertical alignment. A minimum acceptable plinth level above road level shall be maintained. The plinth level shall be agreed with the Engineer’s representative.

**DETAILED SPECIFICATIONS OF MATERIALS**

**Water** (APSS No. 129)

Water should be clean, fresh and free from all chemicals, oils, salts and deleterious materials and vegetable growth. Water has to meet the requirements mentioned in Cl. 5.4 of IS:456-2000. Storage for water should be sufficient and adequate for the regular consumption of works and for the use of labour on site.

**Earth** (APSS No. 309 & 310)

For filling, the soil shall be free from all rubbish, organic or vegetable growth including roots, weeds etc. Black cotton soil should not be used for basement filling.

**Sand/ fine aggregate** (APSS No. 110)

Sand to be used shall be composed of hard silicious material and shall be clean, sharp, hard, strong and angular type. Sand shall be clean river or pit sand of approved quality and free from salts, earth, dust or other impurities. Sand for plain and reinforced concrete shall confirm to IS : 383-1970. Sand for various purposes shall confirm grading as below.

Sand for Masonry  --- table 110-A of APSS No.110

Sand for Plastering  --- table 110-B & 110-C of APSS No. 110

Sand for Plain and Reinforced concrete Zone I to III of table 110-D of APSS No.110

<table>
<thead>
<tr>
<th>L.S. Sieve Designation</th>
<th>Grading Zone – I</th>
<th>Grading Zone - II</th>
<th>Grading Zone - III</th>
<th>Grading Zone – IV</th>
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<tr>
<td>10 mm</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>90-100</td>
<td>90-100</td>
<td>90-100</td>
<td>95-100</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>60-95</td>
<td>75-100</td>
<td>85-100</td>
<td>95-100</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>30-70</td>
<td>55-90</td>
<td>75-100</td>
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<tr>
<td>600.00 microns</td>
<td>15-34</td>
<td>35-59</td>
<td>60-79</td>
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<tr>
<td>300.00 microns</td>
<td>5-20</td>
<td>8-30</td>
<td>12-40</td>
<td>15-50</td>
</tr>
<tr>
<td>150.00 microns</td>
<td>0-10</td>
<td>0-10</td>
<td>0-10</td>
<td>0-15</td>
</tr>
</tbody>
</table>
**Stone for Masonry (APSS No. 107)**

Stones used shall be strong, durable, dense, compact, close grained, homogeneous, fire resistant and shall be obtained from sources approved by Engineer. Stones shall additionally be hard, sound, free from cracks, decay and other flaws or weathering and shall be easily workable. Stones with round surfaces shall not be made use of.

Stones shall have a crushing strength of not less than 1000 Kg/cm\(^2\). Stones with lesser crushing strength may be used in works with prior approval of the Engineer. Stones shall be non-porous and when tested in accordance with IS:1124-“Method of Test for Determination of Water Absorption” etc., shall show water absorption of less than 5% of its dry weight when soaked in water for 24 hours. Tests for durability and weathering shall be done in accordance with IS:1126 and IS:1125 respectively. The working of stones to required sizes and their dressing shall be as per IS:1127 “Recommendations for dimensions and workmanship of natural building stones for Masonry work” and IS:1129 “Dressing of Natural Building Stones”. Stones especially limestones and sand stones, shall be well seasoned by exposure to air before use in construction works.

**Cement (APSS No. 112)**

Cement should comply with the requirements of IS:8112-1989 and should be 43 grade ordinary Portland Cement, for making plain and reinforced concrete, mortar etc. The quality of cement shall be in conformance to the performance characteristics given in IS : 8112 - 1989.

The contractor shall procure bulk cement required for the works only from reputed cement factories (main producers) acceptable to the Engineer and should obtain, furnish from suppliers of cement a test certificate for every consignment of cement. The cement bag shall bear the manufacturer's name or their registered trade mark. Cement shall be tested in accordance with IS : 4031-1988 and IS : 4032-1988.

The cement should be delivered to the site in sound dry bags and shall be stored properly. Cement packed in LDPE Bags may be preferred to ensure protection from moisture and dampness.

The contractor has to make his own arrangements for the procurement of cement of required specification for works subject to the following:

a) The contractor shall procure bulk cement required for the works, only from cement factories (Main producers) of approved make and brand only as approved by the Engineer-in-charge. The contractor shall make own arrangements for adequate storage of cement.

b) The contractor shall procure cement in standard packing (50 Kg per bag) from the authorised manufacturers. The contractor shall make necessary arrangement at his own cost to the satisfaction of Engineer-in-charge for actual weighment of random sample from the available stock and shall confirm with the specification laid down by the Bureau of Indian standards or other standard institutions as the case may be. Cement shall be got tested for all the tests as directed by the Engineer-in-charge at least once in a month in advance before the use of cement bags brought and kept at site godown.

c) Cement bags required for testing shall be supplied by the contractor free of cost.

d) The contractor should store the cement of 60 days requirement at least one month in advance to ensure the quality of cement so brought to site and shall not remove the same without the written permission of the Engineer-in-charge.
e) The contractor shall forthwith remove from the works area any cement that the Engineer-in-charge may disallow for use on account of failure to meet with required quality and standard. Damaged or reclaimed or partly set cement will not be permitted to be used and shall be removed from the site.

f) The contractor will have to construct sheds for storing cement having capacity not less than the cement required for 90 days use at appropriate locations at the work site. The Engineer-in-charge or the representatives shall have free access to such stores at all times.

g) The contractor shall further at all times satisfy the Engineer-in-charge on demand by production of records and books or by submission of returns and other proofs as directed that the cement is being used as tested and approved by Engineer-in-charge for the purpose and the contractor shall at all times keep his records up to date to enable the Engineer-in-charge to apply such checks as he may desire.

h) Cement which has been unduly long in storage with the contractor or alternatively has deteriorated due to inadequate storage and thus become unfit for use on the work shall be rejected by the department and no claims will be entertained. The contractor shall forthwith remove from the work area any cement the Engineer-in-charge may disallow for use on work and replace it by cement complying with the relevant Indian Standards.

STORAGE OF CEMENT

Portland cement readily absorbs moisture not only in the form of free water but also moisture from the atmosphere or from damp material in contact with it and becomes hydrated and loses strength. It is necessary therefore that it should be protected from absorption of moisture before it is used if it is to fulfill its function. An absorption of one or two percent of water has not appreciable effect but further amounts of absorption, results in hardening of the cement and reduced the strength. If the absorption exceeds 5% the cement is for all ordinary purposes ruined.

American, Spanish and German experiments have shown that on average the strength of cement stress in bags is reduced.

- After 3 months by 15 to 20 percent.
- After 6 months by 20 to 30 percent.
- After 12 months by 30 to 50 percent.
- After 2 years by 40 to 50 percent.

These figures prove that special attention should be paid to the storage of cement, even when its strength is equal to or suspense’s the specified normal strength.

As a general principle the cement must be protected as far as possible from any form of moisture prior to mixing concrete mortar.

The cement should be stored in a well constructed dry godown or shed. The cement store should be weather tight construction with a sound wooden or ground to ensure that it is damp proof building. The storage place required for a given quantity of cement can be calculated at the rate of 2.50 sqm for a ton of cement. Cement should not be placed directly on cement plaster flooring and other types of flooring commonly meant with which are not damp proof. A wooden platform or false floor a sheet of water proof paper should be provided.

If none of these is possible, then floor should be covered with straw, hay, cinder or ash or such other material densely and uniformly packed to a thickness of at least one inch and over a laid worth tarpaulin of old cement. Large windows and ventilators if any should be
tightly shut to prevent from circulation of air inside the stores. Drainage should be provided if necessary to prevent accumulation of water in the vicinity of the store.

Cement should be stored in piles arranged parallel to the walls. It is not advisable to pile bags against the walls and an allowance of at least 0.3M all round should be made between the exterior walls and piles. At least 0.6M wide should be left for each access and delivery.

When storing the bags, the floor should be raised 30 cms., above the ground and stacked in rows not exceeding 10 bags high. The cement is to be stored in such a manner that easy access and proper inspection and counting is possible.

Successive consignments covered with some waterproof cover as a both measure of protection and prevent the free circulation of air as each lot of proper fresh air will bring in more moisture. Once the cement has been properly stored should not be disturbed until it is to be used. There is no advantage in moving and stacking the bags to reduce where house set as this practice only exposes fresh cement to the air resulting in loss due to the shifting of cement through the cloth mesh and in damage to the stacks.

Even during the dry weather and when the relative humidity of the atmosphere even in nights is low (that is to say when there is very little moisture in the air) the cement in its stock shall be protected with a tarpaulin through for the stack. When the atmosphere is damp at any time of day or night, greater care has to be taken of the cement and proper strength provided it from the damp.

Cement required for use immediately after delivery to the site may be stored in the open on a raised damp proof floor so long as it is fully protected by tarpaulin or either weather resisting covers. Storage under these conditions should be limited to 48 hours. The tarpaulin should be raised well above the top most tie of bags and must be sloped for rapid drainage in case of showers.

Consignments should be used in the same sequences as they are delivered. To ensure this the date of arrival of each consignment should be clearly indicated. This is best done by tying a piece of country twins or cord to the end bags in the bottom most tier of the days pile, tacking the two places of card up the sides and along the top of pile an tying the main the center. The date of receipt in the store being clearly written on a bin card high from the card. Dead storage where the cement remains in place for a long time which other consignments of cement come in and out should be avoided.

In issuing cement from a store the cement bags should be removed in vertical column of the pile and not horizontal so as to avoid dead stoppage space.

As a rule cement should not be stored longer than three months. Cement held in storage for a period of 90 days or longer shall be re-tested. Especially in the rainy season prolonged storage should be avoided. If stock is likely to be held over for more than three months anticipatory measures should be taken to use it on the works.

Cement that has become supply due to storage in damp positions due to exposure to the weather is generally useless for making concrete and should be removed from the site.

**Bricks (APSS No. 102)**

Bricks for masonry shall be Fly Ash Blocks having minimum crushing strength of 50 Kg/cm² and shall conform the relevant specifications of IS 1077-1992.
They shall be sound, hard with uniform size having rectangular faces with parallel sides and sharp straight right angled edges and be of uniform colour with fine compact uniform texture. They shall be free from flaws, cracks and nodules.

Water absorption after 24 hours immersion in cold water shall be not more than 20% by weight. They shall not absorb more than 10% by weight of water after immersion for six hours.

They shall emit a clear metallic ringing sound when struck by a mallet and shall not break when dropped on their face, from a height of 60 cm.

Fractured surface shall show homogeneous, fine grained uniform texture, free from cracks, air holes, laminations, grits, lumps of lime, efflorescence or any other defect which may impair their strength, durability, appearance and usefulness for the purpose intended.

Samples of bricks brought to the site shall be tested periodically for compression and other tests according to IS:3495, Parts-I, II & III - “Method of Test for Burnt Clay Building Bricks”.

**Coarse Aggregate (APSS No. 108)**

The coarse aggregate shall be from hard granite crushed stone conforming to IS 383:1970. The pieces of aggregate shall be non porous, hard, strong durable clean and free from clay, rounded in shape and shall have granular or crystalline non powdery surfaces. The aggregate shall be well graded. Tests where required shall be carried out in accordance with IS : 2386 - 1963.

**I.S. 383 / 1970 Table – I**

<table>
<thead>
<tr>
<th>I.S. Sieve designation</th>
<th>Percent passing for single-seized aggregate of metal size</th>
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<tr>
<td>12.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mm</td>
<td>40 mm (3) 20 mm (4) mm 10 mm (7) 40 mm (8) 20 mm (9)</td>
<td></td>
</tr>
<tr>
<td>80 mm</td>
<td>--- --- --- --- 100 ---</td>
<td></td>
</tr>
<tr>
<td>63 mm</td>
<td>100 --- --- --- ---</td>
<td></td>
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<tr>
<td>40 mm</td>
<td>85-100 100 --- 95-100 100 ---</td>
<td></td>
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<td></td>
<td>85 –</td>
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</tr>
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<td>20 mm</td>
<td>0-20 100 --- 30-70 95-100 ---</td>
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<tr>
<td>16 mm</td>
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</tr>
<tr>
<td>12.50 mm</td>
<td>--- 85 - 100 100 --- ---</td>
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</tr>
<tr>
<td>10 mm</td>
<td>0-5 0-20 0-45 85 - 100 10-35 25-55</td>
<td></td>
</tr>
<tr>
<td>4.75 mm</td>
<td>--- 0-5 0-10 0-20 0-5 0-10</td>
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</tr>
<tr>
<td>2.36 mm</td>
<td>--- --- 0-5 --- ---</td>
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**TABLE – III**

**ALL-IN AGGREGATE GRADING**

<table>
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<tr>
<th>L.S. Sieve Designation</th>
<th>40mm Nominal</th>
<th>20mm Nominal</th>
</tr>
</thead>
</table>

Signature of the Bidder  Page 30 / 56  EPI
Steel Reinforcement (APSS No. 126)

STEEL

Mild steel bars shall conform to Grade I of IS:432.

High yield steel strength deformed bars shall conform to IS: 1786-2008. Binding wire shall conform to IS:280. The various types of steel shall conform to the relevant IS specification as provided in A.P.S.S. No.126.

The contractor has to make his own arrangements for procurement of tested steel required for the work. He shall also make his own arrangements for transportation and storage.

The contractor shall procure mild steel (MS) reinforcement bars, High yield strength deformed bars (HYSD) bars, rods and structural steel etc., required for the works, only from the reputed main steel (Confirming to Fe-500 Grade as per IS : 1786-2008 and as amended up to date or TMT (Fe -500) bars as approved by the Engineer-in-charge of the work) manufacturing units manufacturing the steel to the prescribed specification of Bureau of Indian Standards or equivalent and licensed to affix ISI or other equivalent certifications, marks and acceptable to the Engineer-in-charge.

The contractor should invariably obtain necessary ISI test certificates from the suppliers of steel for each and every consignment and furnish them to the Engineer-in-Charge, before use on works. Test certificates conforming to IS 1786-2008 are to be furnished. The HYSD steel (IS 1786-2008) bars should have TOR mark.

The original bills of procurement should be submitted to the Engineer-in-Charge for making payment of the item. The contractor shall purchase the steel on the name of the work, number and the name of the contractor and furnish the same to the Engineer-In-Charge. The steel without the above two names will not be accepted on the works. Vendors test certificates and weighment bills are to be furnished to the Engineer-In-Charge and any quantity purchased without test certificates will not be accepted for use on the works.

If any difference is observed on carriage inwards, carriage outwards and theoretical requirement of steel for finished work, the contract will be cancelled and the contractor will be blacklisted.

The diameter and weight of steel should be as per IS 1786-1985 or relevant IS specification with subsequent revisions from time to time:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Diameter of rod</th>
<th>Sectional weight in Kg/ RM both for Plain and HYSD steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6 MM</td>
<td>0.22</td>
</tr>
</tbody>
</table>
Note: If any rods other than those diameters specified above are procured the weights shall be as per standard steel tables.

Quality control: The contractor shall furnish the samples for testing for each batch and consignment along with the test certificates issued by the vendors to the Engineer-In-Charge immediately after receipt of the steel in the stockyard at site of work for verification and testing.

No steel procured by the contractor shall be used in any work until the Engineer-In-Charge has given notice that the test results are satisfactory.

STEEL STORAGE:

a) Reinforcement steel and binding wire shall be stored above ground surface upon platform, skids or other supports protected as far as possible from surface deterioration by direct contact with undesirable elements or by exposure to conditions producing rust and corrosion. Bars shall be so supported as to avoid distortion and sagging of long lengths. All the reinforcement of same designation shall be stacked separately and distinctly marked.

b) Steel shall be stacked and stored in accordance with IS 4082: 1996 as per Recommendations on stacking and storage of construction materials.

c) If the reinforcing rods have to be stored for a long duration, they shall be coated with cement wash before stacking and/or be kept under cover.

Reinforcement shall be free from pitting due to corrosion and free from loose rust, dirt, dust, mill scale, paint, oil, grease, adhering earth etc.

Erected and secured reinforcement after fabrication shall be inspected and approved by the Engineer-in-Charge prior to placement of concrete.

DETAILED SPECIFICATION OF WORKS

Standard

A high standard of workmanship in all trades will be required. The Contractor shall ensure that only skilled and experienced workmen are employed.

Supervision
The Contractor’s supervising staff shall be fully qualified and experienced in the types of work being carried out under the supervision and shall be capable of ensuring that they are done well and efficiently.

**Temporary works**

Where required, the Contractor shall furnish such details of his temporary works as may be called for by the Engineer and the Contractor shall satisfy the Engineer as to their safety and efficiency. The Engineer may direct that temporary works, which he considers unsafe or insufficient, shall be removed and replaced in a satisfactory manner.

**Codes**

Unless mentioned otherwise, current versions of all codes, specifications and standards issued by the Indian Standards Institution and Indian Roads Congress, wherever mentioned, shall be fully applicable to these specifications. Where standards are not yet published by the ISI or IRC, adaptable British Standards or Specifications of the International Organization for standardization shall apply.

In case of any conflict in meaning between the specifications mentioned herein and those of ISI or IRC, the provisions of these specifications shall be prevail.

**Base lines and bench marks**

The Contractor shall establish and maintain, to the satisfaction of Engineer, the base lines and bench marks, based on which the works are set out. Where such base lines and bench marks are provided by the Engineer, the Contractor shall maintain these throughout the period of construction without causing any disturbance to them.

**Setting out**

The Contractor shall set out all the works to be executed by him, in line with the standard base lines, position and bench marks and truly as per drawings within the accepted tolerance limits at no extra cost to Owner. The Contractor shall be solely responsible for the correct setting out of all the works, to be executed by him and the approval of such setting out by the Engineer shall in no way absolve the Contractor of his responsibility for carrying the work to the true lines, levels and positions as per drawings.

**Dewatering**

The Contractor shall carry out all the works, in dry and workable condition and maintain the same in dry condition till the final handing over of works at no extra cost to the Owner. For this the Contractor shall make at his cost all the necessary provisions of dewatering, wherever necessary, to the full satisfaction of the Engineer.

**Safety of existing work**

Before taking up any construction adjoining other property or existing work, the Contractor shall take all steps necessary for the safety and protection of such property or work.

**Protection of existing services**

The Contractor shall take all precautions necessary to prevent damage to or interference with under-ground or over-ground services such as cables, drains, piping or piles, whether
shown on drawings or not. Equipment etc., mounted in position shall be protected against falling debris etc., by means of tarpaulin or such other material.

**Handing over of work site**

On completion of work, the Contractor shall remove all rubbish, debris, surplus materials, temporary work etc., from the site. The site shall be handed over in a tidy and workmanlike manner.

**Brick Work : (APSS 102 APSS 501 & 504)**

The Fly Ash bricks shall be set in cement mortar of 1:8/1:6 proportion by adopting a proper bond (preferably either English bond or a Flemish bond) throughout the wall. The walls shall be taken up truly plumb. All courses shall be truly horizontal (level) and truly vertical. Vertical joints of consecutive courses shall not come directly over one another. Vertical joints, in alternate course shall come directly over one another. Joint’s shall be fully filled with mortar and raked. Every brick shall be laid with full joints of cement mortar on its bed, ends and side in one operation. No feeding of mortar by using excess water shall be allowed.

**Reinforced Half Brick Partition Walls (APSS 102, 501, 504, 509)**

The cement mortar used for reinforced brick work shall be in cm (1:4) and mortar used shall conform APSS No. 113. Reinforcement for half brick walls shall be in the form of MS Bars and shall be of specified qualities. The brick shall be constructed only in stretcher bond. The reinforcement shall be well embedded in cement mortar at every third course and half the joint thickness of mortar shall first be laid and the other half laid after the reinforcement is placed in the position. The free ends of the reinforcement where ever possible shall be pegged into the mortar joints of main brick walls.

**NOTES ON MASONRY**

i) All stones, bricks etc., used in the masonry work shall be thoroughly soaked in water before use to prevent absorption of water from the mortar.

ii) Stones shall be laid on their broadest faces which gives better opportunity to fill the faces between stones.

iii) To give sufficient lateral bond a stone in any course shall overlap the stone in the course below i.e. joints parallel to the pressure in two adjoining course shall not lie too closely in the same vertical line. A minimum overlap of 6” shall be maintained.

iv) To give sufficient transverse bond, prescribed no. of headers shall be used.

v) The practice of building two thin faces, tying width occasionally through stones and filling up the middle with small stones or dry packing shall be strictly guarded against.

vi) Jambs for door and window opening shall be formed with quoins of the full height of the course. The quoins shall be of breadth atleast one and a half times the depth for the course and in length atleast twice the depth.

vii) It is advisable to erect the door and window frames first and build the masonry around.

viii) Thickness of the joint should not be more than 12mm.
ix) Every course of the masonry shall be truly vertical. Use of plumb bob to check verticality by the mason shall be encouraged.

x) Care should be taken to keep all corners and sides including door and window opening truly vertical.

Theoretical requirement of cement should be as follows:

- a. C.R.S. Masonry in C.M. (1:6) 1.58 bags per Cum
- b. C.R.S. Masonry in C.M. (1:8) 1.15 bags per Cum
- c. Brick Masonry in C.M. (1:4) 1.44 bags per Cum
- d. Brick Masonry in C.M.(1:6) 0.96 bags per Cum
- e. Brick Masonry in C.M. (1:8) 0.72 bags per Cum

**Plain and Reinforced cement concrete (A.P.S.S. 402 & 403)**

All R.C.C. work shall be carried out in strict accordance with latest IS specification. No concrete work shall be cast in the absence of the works-in-charge/Engineer. All the materials used should be of good quality as mentioned in **Sec. 4.0** above.

Cast-in-place concrete for the structures shall conform to the requirements of the section. The structures shall be built to the lines, grades and dimensions as per the designs and drawings.

**Controlled concrete:** Controlled concrete shall be used on all concrete works. Reinforced cement concrete shall correspond to **M20/M25** grade as per **IS 456-2000**.

For all major concrete pours like RCC slabs, roofs, beams etc Ready Mix Concrete of specified grade from approved suppliers shall be used.

**Mix Proportions & Strength requirement of concrete:** The proportions of various ingredients to be used in the concrete for different parts of the work shall be established by proper mix through design mix. The contractor shall produce concrete mix design and establish the strength of concrete with this concrete mix design for 3 days, 7 days and 21 days as per IS 456-2000. For controlled concrete, the mix design shall be so designed as to attain in preliminary tests a strength atleast 33 percent higher than that required on work tests. The design mix shall be got approved by the Engineer-in-charge before proceeding with the concreting. The contractor is required to carryout the mix design and the design mix shall be got approved by the Engineer-in-charge, APSFC within the limitations of parameters and other stipulations laid down in IS-456/2000.

The specified characteristic compressive strength of 150 mm size cube at 28 days attained for M20, M25 and M30 grades of concrete shall be 20 N/sqmm, 25N/sqmm and 30 N/sqmm respectively. The mix shall be designed to produce the grade of concrete having the required workability and a characteristic strength at 28 days not less than the appropriate values mentioned in Table-2 of IS-456:2000 The target mean strength of the concrete mix should be equal to the characteristic strength plus 1.65 times the standard deviation.

**TABLE**

**MINIMUM COMpressive STRENGTH OF 15 CM. CUBES**

<table>
<thead>
<tr>
<th>Class</th>
<th>Preliminary test N/mm²</th>
<th>Works test N/mm²</th>
<th>Maximum size of</th>
</tr>
</thead>
</table>

Signature of the Bidder  Page 35 / 56  EPI
Whenever the grade of concrete such as M30 etc., is specified it shall be Contractor’s responsibility to ensure the minimum crushing strength stipulated for the respective grade of concrete is obtained at works.

In the case of M30 grade concrete a minimum cement content of 340Kgs/ Cum shall be used to obtain a minimum cube strength of 30N/ mm² at 28 days age.

The contractor shall maintain the test results on regular basis as indicated in I.S.456/2000 and subsequent amendments thereon.

In all cases, the 28 days compressive strength specified shall be the criterion for acceptance or rejection of the concrete.

The sample of water taken for testing shall be typical of the water proposed to be used for concreting.

The contractor shall be responsible for production of controlled concrete as per design mix to ensure the required works cube strength is attained and maintained. In the designation of concrete mix, letter ‘M’ refers to the Mix and the number to the specified 28 days works cube compressive strength in Newton per sq.mm.

The concrete where site mixing is permitted shall be with concrete mixtures fitted with weigh batching scale. All measuring equipment shall be maintained in a clean serviceable condition and their accuracy periodically checked.

The proportions of cement concrete specified in the above schedule are nominal and are indication of approximate proportion of cement, fine aggregate and coarse aggregate which may have to be altered suitably at site to obtain desired strength and workability. However, the quantity of cement shall not be less than specified below.

<table>
<thead>
<tr>
<th>Nominal Mix</th>
<th>Cement in bags of 50 Kgs per one Cubic metre (net) of cement concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. M25</td>
<td>7.60 bags of 50 Kgs.</td>
</tr>
<tr>
<td>b. M20</td>
<td>7.00 bags of 50 Kgs.</td>
</tr>
<tr>
<td>c. 1:2:4</td>
<td>6.62 bags of 50 Kgs.</td>
</tr>
<tr>
<td>d. 1:2.5:5</td>
<td>5.30 bags of 50 Kgs.</td>
</tr>
<tr>
<td>e. 1:3:6</td>
<td>4.42 bags of 50 Kgs.</td>
</tr>
<tr>
<td>f. 1:4:8</td>
<td>3.31 bags of 50 Kgs.</td>
</tr>
<tr>
<td>g. 1:5:10</td>
<td>2.65 bags of 50 Kgs.</td>
</tr>
<tr>
<td>h. 1:6:12</td>
<td>2.21 bags of 50 Kgs.</td>
</tr>
<tr>
<td>i. 1:8:16</td>
<td>1.66 bags of 50 Kgs.</td>
</tr>
</tbody>
</table>

The quantity of water shall be varied to suit the moisture content of the aggregate and shall be just sufficient in produce a dense concrete with workability. Workability should be checked at frequent intervals as per **IS:1199**. An accurate and strict control shall be kept on the quantity of mixing water.
Concrete quality control measures and concrete quality Assurance Test Programme

a) Concrete quality control measures: The contractor shall be responsible for providing quality concrete to ensure compliance of the bid requirements.

b) Concrete quality Assurance Programme: The concrete samples will be taken by the Department and its quality will be tested in any other recognized laboratory per the relevant Indian Standard Specifications IS 516:1959 and LS. 1199-1959.

Samples shall be drawn on each day for each type of concrete.


Test Facilities: The contractor shall furnish free of cost samples of all ingredients of concrete for testing and obtain approval from the Engineer-in-Charge. He should also supply free of cost, the samples of all the ingredients of concrete for conducting the required tests.

Test results: The Engineer-in-charge will pass the concrete if average strength of the specimens tested is not less than the strength specified. Concrete not meeting requirements of specification in all respects may be rejected by the Engineer-in-charge in which case it shall be removed and reconstructed entirely at the expense of the contractor.

Preparation for placing: No concrete shall be placed until preparation of surface involved, all form work, reinforcement, installation of items to be embedded have been approved by the Engineer-in-charge.

All surfaces, forms, embedded material shall be free from dried mortar, dirt, foreign substances, waste papers etc. Temporary openings shall be provided to facilitate inspection, especially of bottoms of columns and wall forms, to permit removal of sawdust, wood shavings, binding wire, dirt etc. Such openings/holes shall be suitably plugged later.

Foundation surface: Rock surfaces shall be free from oil, objectionable coatings, loose, semi-detached and unsound fragments. Immediately prior to placement of concrete, surfaces of rock shall be washed with an air water jet and shall be brought to a uniform surface dry condition.

Concrete shall not be placed in standing water or on a water-covered surface. Any concrete that has been washed away by heavy rains shall be entirely removed, if there is any sign of cement and sand having been washed away from the concrete mixture.

Starters: Before proceeding with erection of form work for RCC columns, Starters shall be cast with 25 mm thick concrete with string lines placed in position as per the layout.

Slots, openings, holes, pockets etc shall be provided in the concrete work in the positions specified or required or as directed by Engineer-in-charge.

Reinforcement and other items to be cast in concrete shall have clean surfaces that will not impair bond.

Approval by the Engineer-in-charge of any materials and work as required herein shall not relieve the contractor from his obligation to produce finished concrete in accordance with the requirements of the specifications.
**Placing of Concrete:** The contractor shall notify the Engineer-in-charge before batching begins. Batching, mixing and placing of concrete shall be performed only in the presence of an authorized representative of the Engineer-in-charge.

**Weather:** Concrete shall not be placed in rain sufficiently heavy or prolonged to wash mortar from concrete.

The contractor is not entitled for any additional payment over the unit prices bid in the schedule for concrete, by reason of any limitation in placing of concrete under the above paragraphs.

**Mixing:** All cement concrete shall be machine mixed and machine vibrated.

The mixer machines should comply with IS 1971-1968 (IS specifications for batch type concrete mixers).

The mixers with other accessories shall be kept in first class working condition and so maintained throughout the construction.

Any mixer that at any time produces unsatisfactory mix shall not be used until repaired. If repair attempts are not successful, the defective mixer shall be replaced.

The Cement and aggregates shall be mixed thoroughly in the specified proportion in a mechanical mixer until the mixture is of uniform colour. Where machine mixing is done the concrete shall be mixed, until the mixture is of uniform colour and, in no case, for less than two minutes.

**Transportation, placing and compaction of concrete:**

Equipment & methods: 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. The entire placing programme consisting of equipment, layout, proposed procedures and methods shall be submitted to the Engineer-in-charge for approval.

After mixing, the concrete shall be transported from the mixer to the position of placing as rapidly as possible by appropriate mean without causing separation or segregation of concrete, maintaining the required workability.

Concrete shall only be placed after the Engineer has inspected the shuttering and reinforcement. The concrete shall be placed and compacted before initial setting of concrete commences and should not be subsequently disturbed.

The concrete shall be deposited as nearly as practicable directly in its final position and shall not be rehandled in a manner which will cause segregation, loss of materials, displacement of reinforcement, shuttering or embedded inserts, or impair its strength. Concrete shall be placed in the shuttering by approved implements and shall not be dropped into place from a height exceeding 1 meter or handled in a manner which will cause segregation.

Concrete shall be deposited in successive horizontal layers to a compacted depth of not more than 0.45 meters. These shall be placed as rapidly practicable to prevent the formation of cold joints or planes of weakness between each succeeding layer within the pour.

When concrete is conveyed by chutes, the plant shall be of such size and design as to ensure practically continuous flow. Slope of the chute shall be so adjusted that the concrete flows without the use of any excessive quantity of water and without segregation of its ingredients. The delivery end of the chute shall be as close as possible to the point of deposit. The chute
shall be thoroughly flushed with water before and after each working period and the water used for this purpose shall be discharged outside the form work.

**Compaction:** All concrete shall be compacted to produce a dense homogeneous mass. Concrete after depositing should be compacted thoroughly by means of a mechanical vibration. Vibrators shall conform to IS specifications. Vibrators of the surface, form or Immersion type shall be used and the concrete shall be thoroughly worked out around the reinforcement, around embedded fixtures and into corners of form work. The hardened concrete shall be free from voids or cavities. Over vibration and under vibration of concrete are harmful and should be avoided. Use of polythene sheet is recommended above the shuttering to arrest the slurry loss through the shuttering joints while placing and compacting the concrete.

Vibrators shall be operated by experienced men. Immersion vibrators shall be inserted vertically at points not more than 45 cms apart. Immersion vibrators shall be withdrawn slowly. Blending and melding of the concrete between successive layers shall be ensured. Vibrations shall not be applied through reinforcement and where vibrators of the immersion type are used, contact with reinforcement and all inserts shall be avoided.

Prior to beginning concrete placement the contractor shall make ready sufficient number of properly operating vibrators & operators and shall have readily available additional vibrators to replace defective ones during the progress of concrete placement.

**Finishing:** When the structure is in service all the surfaces shall receive no special finish except removal of fine and abrupt irregularities and clean up of loose debris. Unless varied by the Engineer-in-charge, the type of finish for formed concrete shall be as follows. The concrete surfaces shall be consolidated, smooth screeded, and leveled to produce even surfaces. Floating shall be done only after the screeded surface has attained a stiffness to permit finishing operations. The surface shall be uniform in texture and free from screed marks or other imperfections.

Concreting shall be carried out continuously up to construction joints already planned. Joint shall be kept where shear force is minimum. The work shall be resumed at the earliest by scrubbing the wet surface with wire brush and coating the surface with neat cement slurry. The prepared surface shall be approved by the Engineer-in-charge. Special care shall be taken to obtain thorough compaction and to avoid segregation of the concrete along the joint plane.

**Protection of works:** The contractor shall protect all concrete against damage until final acceptance by Engineer-in-Charge. The fresh concrete shall be protected from defacements and damage due to construction operations, rain, sun and winds. The contractor shall provide protection to prevent erosion to fresh concrete whenever precipitation either periodic or sustaining is imminent or occurring. All fresh concrete surfaces shall be protected from contamination and from foot traffic until the concrete has hardened.

**Replacement of unsatisfactory concrete:** Immediately after the shuttering is removed, the surface of the concrete shall be very carefully gone over and all defective areas called to the attention of Engineer-in-charge. If reinforcement is exposed or the honey combing occurs the work may be rejected. Rejected concrete shall be removed and replaced by the contractor. Superficial honey combed surfaces and rough patches if permitted by the Engineer-in-charge shall be made good and finished neatly as per specifications and as directed.

**Curing of concrete:** Rigid supervision shall be maintained for curing the concrete after laying for complete hydration and hardening to take place. The set concrete shall be cured by ponding with clean water. All exposed faces of concrete shall be kept continuously moist
for a minimum period of 28 days by spraying water or by covering with gunny bags which shall be constantly sprinkled with water. The curing operation should be done by using stirrup pump, or by any other methods given code IS 456-1984. For curing floors, flat roofs, concrete pavements and other level surfaces the ponding method of curing shall be adopted.

**CENTERING (FORM WORK) AND SHUTTERING**

**Steel Formwork:** Only steel forms of approved make (Acrow steel centering) shall be used. Forms with surface dents, bulges, undulations or holes shall not be used on the work and shall be removed from the site.

Form work shall be substantially and rigidly constructed of steel and shall be true to the dimensions described. Form work shall be constructed to confine and shape the concrete to the required shape, lines and dimensions described. Liners and cores shall be provided where necessary and shall be due to space and securely fixed.

Shuttering shall be erected true to line and securely braced, cross braced, strutted and supported to prevent deformation under the weight of pressured wet concrete and constructional loads, wind pressure and other forces. The surfaces of the forms shall be clean and free encrustation of mortar, grout or other foreign materials.

The variation in thickness of RCC roof slab due to varying spans or special covering materials should not effect the general roof bed which should be uniform, unless otherwise shown in drawing or as instructed.

All joints shall be sufficiently tight to prevent leakage of cement slurry. All faulty joints shall be adequately caulked.

**Mould Oil:** Before laying the reinforcement, all faces of shuttering and moulds in contact with wet concrete shall be treated with a coat of oil to prevent adherence to concrete. Release agent should be applied so as to provide thin uniform to the forms without coating the reinforcement.

The mould oil (The de-bonding agent) to be applied shall be standard shuttering oil, engine oil or filtered waste oil (Carbon particles and impurities should not be present).

Plumb and string lines in sufficient numbers shall be installed before and maintained during concrete placement. During concrete placement the contractor shall continuously monitor plumb, string line and form positions.

In case of columns, retaining walls and vertical structural components suitable arrangement shall be made for securing the form to the already poured concrete.

**Reinforcement for RCC works:**

Unless shown otherwise in the drawings, the reinforcement to be used shall be of High Yield Strength Deformed (H.Y.S.D.) bars of grade Fe-500 conforming to IS 1786-2008.

Reinforcement shall be steel and shall be free from corrosion, oil, grease, paint or dirt at the time of fixing in position and subsequent concreting.

Reinforcing steel bars shall conform accurately to the sizes, dimensions and shapes given as per designs and drawings. Bars shall be bent cold to the specified shape and dimensions and the bars shall be hooked or bent accurately and placed in exact position as per designs and drawings. Bars having kinks or bends other than those required by design shall not be used.
Bars of full length shall be used. Reinforcement shall be lap jointed or spliced only if unavoidable. The overlaps shall be staggered for different bars and located at points, along the span where neither shear nor bending moment is maximum. Not more than 33% of the bars as specified in drawing shall be lapped at one section.

The reinforcement shall be securely held in position and bound together tight by annealed binding wire, and by using stays, blocks or metal chairs, spacers, metal hangers, supporting wires or other approved devices at sufficiently close intervals.

Bars shall not be allowed to sag between supports. Layers of bars shall be separated by spacer bars, pre-cast blocks or other approved devices. Binders, stirrups, links should be securely wired to the main ring.

**Binding Wire:** Wire for binding reinforcement shall be soft and annealed mild steel of 16 SWG and shall conform to IS:280-2006. Binding wire shall have tensile strength of not less than 5600 Kg/Cm² and a yield point of less than 3850 Kg/Cm².

Proper cover shall be maintained between the reinforcement and the shuttering as per approved drawings and IS codes.

The contractor shall ensure that the bars are not displaced during concreting or any other operation over the work. The contractor shall also ensure that there is no disturbance is caused to the reinforcing bars in concrete that has already been placed.

All bars protruding from concrete and to which other bars are to be spliced and which are likely to be exposed for an indefinite period shall be protected by a thick coat of neat cement grout.

**Measurement and payment**

**a. Measurement:**

Measurement for payment for the reinforcing bars will be made only on the calculated weight of the bars placed in concrete, in accordance with the drawings or as directed by the engineer. The calculated weight for reinforcing bars shall be determined as follows:

i) Reinforcement shall be measured in length separately for different diameters as actually used in the work including the lengths of hooks at ends, but excluding spacer bars, reinforcement chairs, supporting bars and overlaps.

ii) From the length measured, weight of reinforcing bars shall be calculated on the basis of weights specified in the table in this section.

b) Wastage and annealed steel wire for binding shall not be measured as the cost of these items were already included in the unit rate for reinforcement.

**Payment rate**

The unit rate in the bill of quantities for reinforcement is inclusive of the cost of all wastage, overlaps of steel and the cost of binding wire or welding materials at site of work, cover blocks and cost of all incidental and operational charges in cutting, bending, cleaning, placing, binding or welding and fixing in position as shown on the drawings and as necessary to complete the work as per specification.
Cover Blocks

a) Before concreting, cover blocks shall be fixed in all R.C.C works to separate the reinforcement from the shuttering so that when the concrete is set the reinforcement is well within the concrete section at a distance from the outer surface, with specified cover to reinforcement.

b) Use of stone chips as cover for the reinforcement will not be accepted. Only cement mortar cover blocks of required thickness to maintain the specified cover shall be used.

c) Normally a bottom cover of 12mm to 15mm is sufficient for slabs. For columns the cover should be about 40mm, and for beams it is 25mm.

d) Cover blocks shall be reasonably good for using in appropriate grade of R.C.C. work. The mortar for preparing cover blocks shall at least be of proportion 1:2. Cover blocks shall be prepared on a clean and level platform by spreading the mortar in the moulds of required size and depth. When the mortar is still green strands of tying wire shall be inserted into each block. This wire is useful for tying the block to the reinforcement. After 24 hours the blocks shall be removed from the mould and cured for about seven days.

e) A properly made cover block does not get crushed when the reinforcement is tied over it and during the concreting work.

Reinforcement chairs

a) When the reinforcement is tied there is a need to separate bottom steel from the top steel and to maintain correct effective depth.

b) For ensuring separation to top and bottom steel and to ensure that the reinforcement work does not get disturbed due to the load or movement of workers when concrete is being laid, reinforcement spacers or chairs shall be fixed.

c) Use of large sized stones or bricks to separate top and bottom steel will not be allowed.

d) Reinforcement chairs shall be of slightly lesser size so as to accommodate the chair underneath the top steel and after allowing for the required covers to the top and bottom steel.

e) The chair shall be minimum 450mm long and should have legs bent in opposite directions to ensure stability,

f) The chairs shall be placed on a cover block so that the legs do not stick out once the shuttering is removed.

Removal of Form work: Centering and shuttering shall be removed after maturity gradually without jerking. Before removal of the shuttering the concrete shall be examined properly. Form shall not be released until the concrete has achieved a strength of at least twice the stress to which the concrete may be subjected at time of removal of form work. The strength referred to shall be that of concrete using the same cement and aggregates, with the same proportions and cured under conditions of temperature and moisture similar to these existing on the work. Where possible, the form work shall be left longer as it would assist the curing.
**Stripping Time**: In normal circumstances where ordinary portland cement is used and adequate curing is done, form work may generally be removed after expiry of the following period:

<table>
<thead>
<tr>
<th>Type of Formwork</th>
<th>Minimum Period Before Striking Formwork</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Vertical formwork to columns, walls, beams</td>
<td>24-48 hours</td>
</tr>
<tr>
<td>b) Soffit formwork to slabs (Props to be refixed immediately after removal of formwork)</td>
<td>3 days</td>
</tr>
<tr>
<td>c) Soffit formwork to beams/ Flat slabs (Props to be refixed immediately after removal of formwork)</td>
<td>7 days</td>
</tr>
<tr>
<td>d) Props to slabs:</td>
<td></td>
</tr>
<tr>
<td>1) Spanning up to 4.5 m</td>
<td>7 days</td>
</tr>
<tr>
<td>2) Spanning over 4.5 m</td>
<td>14 days</td>
</tr>
<tr>
<td>e) Props to beams and arches:</td>
<td></td>
</tr>
<tr>
<td>1) Spanning upto 6 m</td>
<td>14 days</td>
</tr>
<tr>
<td>2) Spanning over 6 m</td>
<td>21 days</td>
</tr>
</tbody>
</table>

The number of props left under the concrete element, their sizes and dispositions shall be such that they shall be able to safely carry the full dead load and live load likely to occur during further construction.

The contractor shall be liable for damage and injury caused by removing the forms or props before the concrete has gained sufficient strength.

**Conditions on RCC slabs/ Roof Slabs**

The R.C.C. slab laid should be leak proof. After observing for two rainy seasons as defect liability period if the roof or floor is found to be perfectly leak proof and no moisture or dampness is seen underneath at ceiling of the slab, the contractor can ask for refund of E.M.D. or F.S.D. from the department. If there are any defects noticed after laying of roof they must be attended to by the contractor at his own cost. Further the contractor must arrange to get the structure treated as per clause 21 of ISI code No.456/2000 at his own cost on the instructions of the department.

When R.C.C. slab is laid, the contractor shall carry out the following tests at his own cost to prove that the slab is impervious.

a) After the centering is removed and curing period is over the slabs shall be put to test by stagnating water of 15 cms depth for one week and watched carefully to test the leakages if any.

b) If there are any leakages, the contractor shall immediately rectify the same at his own cost and again test the same to see that there are no leakages. No payment will be made to the contractor on this account either for testing or for rectifications thus carried out.

c) The officer observing the leakage test shall issue a certificate to this effect before final bill is made.

The variation thickness of R.C.C. roof slab due to varying spans, or special covering materials should not effect the general roof bed which should be uniform unless otherwise shown in drawings or instructed.
For all slabs to be laid MS hooks to be provided as directed by the department for fixing fans and lights etc., G.I. pipes or PVC pipes has to be provided as directed by the department in the masonry walls or concrete at the specified places for making electrical wiring.

**TABLE – IV**

For Vibrated Reinforced Concrete Items (V.R.C.C.)

**Characteristic Strength of Cube at the age of 28 days of curing**

<table>
<thead>
<tr>
<th>Strength</th>
<th>Mix Proportion</th>
<th>Cube Pressure (N/mm²)</th>
<th>Compressive Strength (Kgs/cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-25</td>
<td>1:1:2</td>
<td>25</td>
<td>250</td>
</tr>
<tr>
<td>M-20</td>
<td>1:1½:3</td>
<td>20</td>
<td>200</td>
</tr>
<tr>
<td>M-15</td>
<td>1:2:4</td>
<td>15</td>
<td>150</td>
</tr>
</tbody>
</table>

**Cement Plastering in two coats CM 1:6 & CM 1:4 (APSS 901, 903 & 904)**

The surface shall be prepared by roughening of the back ground and raking the joints. The surface of the wall shall be kept wet for 2 hours before plastering.

Guides: Patches of 15cm X 15cm of required thickness at not more than 2 meters intervals horizontally and vertically shall be applied over the entire surface truly in the plane and truly plumb to serve as guides.

Plaster shall be started from the top and worked down towards plinth. The work shall be tested frequently with a plumb bob and straight edge. The Mortar in 1:6 proportions shall be dashed and pressed over the surface and then brought to smooth and uniform surface by means of float and trowel. The plaster shall be well pressed into the joints.

After the first coat the surface is left rough to receive the second coat. The final coat shall be applied a day or two after the first coat put on has set, but the first coat shall not be allowed to dry. The final coat shall consist of 1 part of cement to 4 parts of fine sieved sand and shall be applied as in the first coat and brought to a uniform surface and then finished with a sponge to give granular appearance.

All corners, junctions and arises shall be brought truly to a line, level and plumb. The finished surface shall be watered for a period of atleast 10 days.

Theoretical requirement of cement for plastering should be as follows :-

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Bag Requirement per 10 Sqm</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>12 mm plastering in C.M. (1:5)&amp; C.M. (1:3)</td>
<td>1.02 bags</td>
</tr>
<tr>
<td>b.</td>
<td>12 mm plastering in C.M. (1:6)&amp; C.M. (1:4)</td>
<td>0.82 bags</td>
</tr>
<tr>
<td>c.</td>
<td>20 mm plastering in C.M. (1:6)&amp; C.M. (1:4)</td>
<td>1.15 bags</td>
</tr>
<tr>
<td>d.</td>
<td>12 mm plastering in C.M. (1:4)</td>
<td>1.08 bags</td>
</tr>
<tr>
<td>e.</td>
<td>12 mm plastering in C.M. (1:6)</td>
<td>0.72 bags</td>
</tr>
<tr>
<td>Sl No</td>
<td>ITEM/ MATERIAL</td>
<td>MAKES</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Cement 43/53 – OPC</td>
<td>Ramco / CCI / ACC / ULTRA TECH / Ambuja / JK Cement / Penna / Jindal/Zuari or equivalent</td>
</tr>
<tr>
<td>2</td>
<td>Steel</td>
<td>Steel shall be procured from the reputed firms as per Indian Standard Codes/BIS as amended upto date only shall be used duly taking the approval from the Engineer – in – charge of the work (Not below the rank of Executive Engineer) prior to execution.</td>
</tr>
<tr>
<td>3</td>
<td>Ready Mix Concrete (RMC)</td>
<td>The contractor has to arrange/establish concrete batching plant for RMC with all testing equipments etc., at site only. Ready mix concrete shall be used on the work, purchased from the manufacturers or suppliers with prior Approval from Engineer In Charge /Client</td>
</tr>
<tr>
<td>4</td>
<td>Paints (a) Synthetic enamel paint, Oil bound distemper</td>
<td>ASIAN / NEROLAC/ ICI / BERGER</td>
</tr>
<tr>
<td></td>
<td>b) White primer coat external walls</td>
<td>JK / BIRLA/ ICI / BERGER/ ASIAN</td>
</tr>
<tr>
<td></td>
<td>c) Texture Paint</td>
<td>Spectrum, ASIAN / NEROLAC/ ICI / BERGER</td>
</tr>
<tr>
<td>5</td>
<td>Water Proof Compound</td>
<td>FOSROC, SICA</td>
</tr>
</tbody>
</table>
TECHNICAL SPECIFICATIONS

SANITARY AND WATER SUPPLY

STANDARD SPECIFICATION FOR BUILDING WORK (AS PER A.P.S.S.)

All the items of work shall be executed as per the Standard Specifications laid down in APSS, the relevant I.S Codes of the Special Specification as indicated in Schedule - 'A' of the tender

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the specification</th>
<th>Specification No. of APSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.04</td>
<td>Concrete &amp; pre-stressed Concrete Pipes &amp; Collars</td>
<td>1304</td>
</tr>
<tr>
<td>13.16</td>
<td>Handling, transport and custody of pipes, fittings valves etc.</td>
<td>1316</td>
</tr>
<tr>
<td>13.17</td>
<td>Trench work excavation and back filling</td>
<td>1317</td>
</tr>
<tr>
<td>13.21</td>
<td>Laying &amp; jointing of cement pipes</td>
<td>1321</td>
</tr>
</tbody>
</table>
1.01 General

1.01.1 All water supply, drainage and sanitary work shall be executed by a licensed or authorized plumbing supervisor or licensed or authorized plumber and shall be in accordance with the requirements of relevant bye-laws of municipal or other authorities in whose jurisdiction the work is being carried out.

1.01.2 All items such as earthwork excavation, concrete, brick work, stone work, painting, etc., relevant specifications for those shall apply unless otherwise specified.

1.01.3 Unless otherwise specified, all exposed work shall be painted with synthetic enamel paint of approved colour in two coats over a priming coat.

1.01.4 The diameter of pipes and fittings wherever mentioned shall mean the internal diameter of nominal bore unless otherwise specified.

1.01.5 The job shall include the cost of making necessary chases, grooves, holes etc., in walls, floors and in other places and also making good or completion of the works. ANY DAMAGE caused to walls etc., during the execution of the sanitary and plumbing works shall be made good by the Contractor at his own cost to the satisfaction of the Engineer-in-charge.

1.01.6 All the water supply and sanitary connections are to be tested against leakage and satisfactory performance based on standard tests before they are fixed.

**Codes and Standards**

**SCHEDULE -C**

**LIST OF SPECIFICATIONS FOR THE VARIOUS ITEMS OF WORKS SUPPLEMENTING THOSE DESCRIBED IN SCHEDULE ‘A’ BY S.S. NUMBERS**

**GENERAL SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Description</th>
<th>IS.No. and as amended from time to time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>A) LIST OF INDIAN STANDARDS</strong></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Method of test for concrete pipes.</td>
<td>IS 3597:1998</td>
</tr>
<tr>
<td>IV</td>
<td><strong>LAYING OF PIPES</strong></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Code of practice for laying concrete pipes.</td>
<td>IS  783 :1985</td>
</tr>
<tr>
<td>V</td>
<td><strong>ROOF DRAINAGE SYSTEM</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** The above I.S specifications mean latest over and above with amendments if any.

**Materials:** Materials, fittings and appliances for sanitary and plumbing work, used in the work shall be as specified in the Bill of quantities. The contractor shall submit to the Engineer-in-charge, samples of all materials, fittings and appliances for approval well in
advance before starting the work. All materials, fittings and appliances used in the work shall confirm to the approved samples.

**Concrete Pipes:** The type of jointing for concrete pipes shall be with loose concrete collars and the joints shall be packed from other side with spun yarn dipped in cement slurry as specified for jointing stoneware pipes; stiff cement mortar (1: 1) shall be filled from both sides and splayed at an angle of 45 degree on both side, the joints shall be adequately cured as specified for joints in stoneware pipes.

**Laying of pipes:**

**Concrete pipes:** The laying of concrete pipelines shall conform to clause 9 of IS:783. Pipes shall be laid true to line and grade. Laying of pipes shall always proceed upgrade of a slope.

**Inspection pits and trap pits:**

Construction of pits shall commence only after the pipes have been laid in position to true line and levels as shown on the drawings to the satisfaction of the Engineer.

**Inspection Pits:** Inspection pits shall be constructed as indicated in the drawings/bill of quantities. Unless otherwise specified, all inspection pits shall be constructed with rubble masonry in cement mortar (1:4). Half round channels of size suitable for the inlet and outlet pipe diameter shall be formed on the floor of the pit with M-10. The floor on the pit shall be haunched towards the channel as shown in the drawings. Inside pits shall be finished with cement sand plaster as specified in the specification and finished smooth with cement punning. Care shall be taken to avoid invert level after finishing and shall be as shown in drawings and/or as directed by the Engineer.

**Inspection/master trap pits:** The pits for the glazed stoneware master trap shall be constructed as indicated in the drawings/bill of quantities. The construction and finishing of the pit shall be haunched towards the interception/master trap pits. Gully trap pits shall be constructed as indicated in the drawings/bills of quantities. The construction and finishing of the pit shall be as described in specification for inspection pit. The cast iron grating shall be set flush with the finished ground/apron level.
EXTERNAL ELECTRIFICATION
(AS PER NUMBERS OF APSS, BIS CODE, MOST, ETC)

1.0 GENERAL SPECIFICATIONS AND INSTRUCTIONS Electrical

I.E. RULE 1956: the installation shall generally be carried out in conformity with Indian electricity rule 1956 as amended from time to time and national electrical code which contains specific regulations to be adhered to in the supply and use of electrical energy in the interest of safety.

MATERIALS: All materials, fittings, equipment and their accessories, appliances, etc, used in an electrical insulation shall confirm the bureau of India standard specification wherever they exist. Incase the Indian standard does not exist, the materials and other items shall be those approved by the competent authority. A list of approved materials for use in the electrical works is enclosed.

2.0 EXCAVATION AND BACKFILL: All excavation and backfill including tempering, shorting and strutting required from the installation of the cable shall be carried out by the contractor in the accordance with the drawing and requirements laid down else where. Trenches will be filled in layer not exceeding 150mm. Each layer shall be properly rammed and consolidated before laying the next layer. The contractor shall restore all surface, road ways, side walks, curbs, wall or other worked out by excavation to their original condition, satisfactory to the departmental officers.

Prior to burying of cables, following tests shall carried out

Insulation test between phases, phase and earth for each length of cable before and after jointing.
On completion of cable laying work, the following test shall be conducted in the presence of the departmental engineer.
Insulation resistance test
Continuity test
Earth test

3.0 MEDIUM VOLTAGE AND LOW VOLTAGE SWITCH GEAR PANEL BOARD:

The main panel board shall be floor mounted and totally enclosed. The design shall include all provisions for safety of operating and maintenance personal. The general construction shall confirm to appropriate Indian standard specifications. Cubical type switch board shall be fabricated out of sheet steel not less than 2.00mm thick. Such sheet steel member shall be stiffened by angle iron frame work. Unless otherwise approved, incomer bus section panel or sections shall be separate and independent. The general arrangement for multiplier construction shall be such that the horizontal bar framed present aplesant and authentic look. The general arrangement shall be got approved before fabrication. All cable entries shall be through gland plates. Cable entry plates shall be sectionalized. The construction shall include necessary cable supports for crimping the cable alloy or rear cable chamber. incomer termination shall be suitable for receiving busbar trunking. Busbar shall be firmly fixed on support constructed from a suitable inscutting material which confirms to relevant Indian standards. The support shall be sufficiently robust to effectively with stand electromechanical stresses produced in the event of short circuit. The minimum clearance to be maintained for open and closed indoor air insulated busbars/electrically iron exposed and working at system voltage up to 600volts shall be as follows:

<table>
<thead>
<tr>
<th>BETWEEN</th>
<th>MAINCLERANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase to earth</td>
<td>26mm</td>
</tr>
<tr>
<td>Phase to phase</td>
<td>32mm</td>
</tr>
</tbody>
</table>

4.0 DISTRIBUTION: Distribution boards shall be assembled, aligned and installed as per installation manual of the switch board supplier and relevant Indian standard specifications. Phase sequence
for each incomer shall be tested and connections adjusted accordingly. A mechanical endurance test shall be carried out by closing and opening of the circuit breaker.

5.0 COMPLETION DRAWINGS: At the completion of the work and before issuance of virtual completion contractor shall submit to the departmental officer five sets of layout drawings drawn at approved scale indicating the complete wiring system “as installed”. The drawings shall in particular give the following information.

Run and size of conduits, inspection and junction boxes.
Number and size of conductors in each circuit
Location and rating of sockets and switches controlling the light and power out lets.
Location and details of distribution boards, main switches and others particulars.
A complete wiring diagram as installed and schematic diagram showing all connections in the complete electrical system.
Instructions, maintenance and operation manuals if any for the equipments.
Contractor should obtain necessary approval, from electrical inspectorate submitting necessary drawings test certificates etc.

10.0 SPECIAL CONDITIONS FOR THE ELECTRICAL WORKS (GENERAL)

The work shall be carried out strictly in conformity with (1) code of practice for electrical wiring and fittings in Govt. buildings (2) the Indian standard specification (3) the departmental specification, if the work carried out does not comply with the code of practice and departmental specifications and if the workmanship is unsatisfactory it will be binding the contractor to redo the job without any extra cost and pay penalty as decided by the department.

- The work should be carried out under the direct supervision of persons holding a certificate of competency for the type of work involved.

- After completion of work a plan of building should be prepared indicating the location of various main and sub-boards and all the fitting together with a circuit diagram duly numbered (in the diagram). The final bill will not be paid till the above and the diagram submitted and approved after verification.

- The contractor will be responsible for any defects noticed for either improper work man ship or defective materials supplied by him for one calendar year from the date of final completion of work.

- Lugs should be provided for all earth connections.

- The contractor himself should arrange for the transportation of men and material to their work spot.

- All civil works and patch works indicated for providing electrical installations should be well finished to the satisfaction of the civil authorities. A certificate from them should be obtained to the effect that the civil and patch work done is to the satisfaction civil authorities. It will be the responsibility of the electrical contractor to obtain such certificate from the civil engineer. Unless such certificate is produced this office will have right to with held the bill.

- Concerting to the pole and providing independent earthing should be done in presence of EPIL staff.

- The distribution board with switch controls shall be separate in each floor for normal supply and essential supply.
• The lighting circuits shall be provided with separate conductor to enable to connect the normal lighting and essential lighting with linking to any of the above system to ensure to switch over to essential supply in the order to have minimum to avoid inconvenience to the staff working.

• The control for the luminary to be provided in the hall for both to be connected to the normal supply and essential supply shall be separate and away from each system.

• For the points to be connected to essential supply a separate conduit system is to be laid as enumerated in the above conditions includes circuit a main of any system.

• The location for the D.B’s and switch controls for essential supply will be decided during the course of execution where the circuit conduit way have to be terminated.

**GENERAL SPECIFICATIONS**

**LIST OF INDIAN STANDARDS FOR ELECTRICAL WORKS**

Relevant Indian standards for the various materials to be used in electrical works as per specification condition No

<table>
<thead>
<tr>
<th>S//l.No.</th>
<th>Description</th>
<th>IS.No. and as amended from time to time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PVC insulated cables for working Voltage upto and including 1100 V</td>
<td>IS 694:1990</td>
</tr>
<tr>
<td>2</td>
<td>PVC Insulated (heavy duty) electrical cables</td>
<td>IS 1554:1988</td>
</tr>
<tr>
<td>3</td>
<td>11 KV XLPE cables</td>
<td>IS 7089-part-II</td>
</tr>
<tr>
<td>4</td>
<td>Recommended current ratings for cables</td>
<td>IS 3961-1967</td>
</tr>
<tr>
<td>5</td>
<td>PVC insulations and sheath of electric cables</td>
<td>IS 5831:1984</td>
</tr>
<tr>
<td>6</td>
<td>Conductors for insulated electric cables &amp; flexible cords (superceding IS 1753: 1967)</td>
<td>IS 8130:1984</td>
</tr>
</tbody>
</table>

**Standards for Electrical Equipment**

11.1 Unless otherwise stipulated in this specification, all equipment or material covered under this specifications shall be designed, manufactured and tested in accordance with the latest standards of Indian Standard’s specifications.

11.2 All equipment shall conform to latest Indian electricity Rules, Indian electricity act and Indian Insurance rules as regard safety, earthing and other essential provisions specified in for installation and operation of electrical equipments.

11.3 Extreme care shall be taken to make enclosures for switch gears proof against rodents, lizards and other creeping vermin.

11.4 Continuity of power supply is to be given maximum consideration and the design of the equipment shall be such as to simplify inspection maintenance and testing at site. The design
shall include all reasonable precautions and provisions for safety of operating personnel and maintenance personnel.

3. **CABLES**

3.1 **Scope:** The scope under this section covers Power cables

3.2 **Standards**

<table>
<thead>
<tr>
<th></th>
<th>Specification for conductors for insulated electric cables</th>
<th>IS:8130 -</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Specification for Armoured/ unarmoured power cables</td>
<td>IS:1554-Part I -</td>
</tr>
<tr>
<td>C</td>
<td>Recommended current ratings for cables</td>
<td>IS:3961 -</td>
</tr>
<tr>
<td>D</td>
<td>Specifications for PVC insulation and sheathing of electric cables</td>
<td>IS:5831-1984</td>
</tr>
</tbody>
</table>

3.3 **General requirements for cables**

a) Cables should be stranded aluminium conductors for 6mm and above.

b) L.V. cables shall be 1100 Volts grade.

c) Cables shall have colour coded insulation.

d) PVC inner and outer sheathing shall be applied by extrusion.

e) Steel armouring between inner and outer sheathing.

f) The PVC insulation and sheathing shall confirm to IS:5831-1984.

g) The armouring for cables up to 16mm² shall be of round steel wire and that above 16mm² shall be of galvanized steel strings.

3.4 **Laying of Cables**

a) Cables if laid underground shall be at a depth of not less than 60 Cms., in a trench. Sand filling shall be provided at the bottom of trench before laying the cable. Bricks shall be provided on either side of the laid cable. Sand filling shall be done to cover the cable laid. Bricks shall be provided on the top. Earth filling shall be done. M.S. cable identification tags, route indicators embedded in C.C. are to be provided at every 8 meters length of cable laid.

b) Hume pipe, trenches/tunnels with proper pre-cast slabs to withstand wear and tear of vehicular traffic shall be provided at road crossings.

c) Cables if laid in the air shall be laid on cable trays and shall be properly clamped to the trays by plated MS. saddles at proper intervals. Cables shall be properly dressed before fixing on the cable trays.

d) Extra cable loops of minimum 500 mm shall be provided at each end of cables laid.

e) Cables shall be bent to a radius of 20 times the diameter of the cable with a minimum of 10 times diameter at restricted space.

f) Control/Telephone cables shall be laid away from power cables on separate cable trays.
3.5 Testing:

Manufacturers test report shall be submitted for tests on cables in accordance with Indian standards specifications.

Cables shall be tested after installation before commissioning by using 1000 Volts Megger and the following readings shall be obtained and tabulated.

- Continuity on all conductors
- Insulation Resistance  
  a) between conductors
  b) all conductors and ground

The tests shall be conducted in the presence of Site Engineer and results submitted.

5.0 CABLE TERMINATION:

Cable gland body shall be made of brass castings and machined to final size. The general construction of the glands should be as per standard manufacturer’s drawings. It mainly consists

a) Compression Nut - Brass - 1 No.
b) Gland body with Hexagonal head - Brass - 1 No.
c) Rubber Ring - Rubber - 1 No.
d) Brass washers - Brass - 3 Nos.
e) Check nuts - Brass - 1 No.

Metal parts of the gland shall be free from blow holes and surface shall be machined smoothly.

All edges shall be debarred and then nickel plated wherever necessary. The cable glands shall be of single compression type.

6.0 L.T. PANEL BOARDS

6.1 Scope

The Scope covers the requirement of designs, construction, assembly, testing, Supply and installation of Panel Boards.

6.2 Standards:

IS: 13947 - Specification for low-voltage switch gear and control gear
  Part-1 General rules (Supercedes IS 4237 & IS 2147)
  Part-2 Circuit breaker (Supercedes IS 2516)
  Part-3 Switches, disconnectors (Supercedes IS 4064)
  Part-4 Contractors, motor-starters (Supercedes IS 2959)
  Part-5 Control circuit devises & switching elements (Supercedes IS 6875)
IS:13703 - Low Voltage fuses (Supercedes IS:9224 & IS 2208)
IS:2705 - Current Transformers
IS:1248 – Indicating Instruments
IS 5578 - Guide for Marking insulated conductors ( Superceding IS 375)
IS 11353 - Guide for uniform system of marking & identification of conductors and apparatus terminals
IS:3156 - Voltage Transformers
IS:3231 - Relays
6.3 CONSTRUCTION:

The panel board shall be:

i) of the metal enclosed, indoor, floor mounted, free standing type.

ii) be made up of the requisite vertical sections, which, when coupled together shall form continuous dead front switchboards.

iii) provide dust and damp protection, the degree of protection being no less than IP, 51 to IS. 2147.

iv) be readily extensible on both sides by the addition of vertical sections after removal of the end covers.

6.3.1 The panel boards shall be constructed only of materials capable of withstanding the mechanical, electrical and thermal stresses, as well as the effects of humidity, which are likely to be encountered in normal service.

6.3.2 Each vertical section shall comprise:

i) A front framed structure of rolled/folded sheet steel channel section, of minimum 2 mm thickness, rigidly bolted together. This structure shall house the components contributing on the major weight of the equipment, such as circuit breaker fuse switch units, main horizontal busbars, vertical risers and other front mounted accessories. The structure shall be mounted on a rigid base frame of folded sheet steel of minimum 2 mm thickness and 100 mm height. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation.

ii) A cable chamber housing the cable and connections, and power/control cable terminations. The design shall ensure generous availability of space for ease of installation and maintenance of cabling, and adequate safety for working in one vertical section without coming into accidental contact with live parts in an adjacent section.

iii) Front and rear doors fitted with dust excluding neoprene gaskets with fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors, generous overlap shall be assured between sheet steel surface with closely spaced fasteners to prelude the entry of dust.

6.3.3 The height of the panel should not be more than 2400 mm. The total depth of the panel should be adequate to cater for proper cabling space.

6.3.4 Doors and covers shall be minimum 2.0/1.5 mm thick sheet steel. Sheet steel shrouds and partitions shall be of minimum 1.5 mm thickness. All sheet steel work forming the exterior of switch boards shall be smoothly finished, levelled and free from flaws. The corners should be rounded.

6.3.5 The apparatus and circuits in the panel boards shall be so arranged as to facilitate their operation and maintenance and at the same time to ensure the necessary degree of safety.
6.3.6  Apparatus forming part of the panel boards shall have the following minimum clearances:

i) Between phases - **25 mm**
ii) Between phases and earth - **25 mm**
iii) Between phases and earth - **25 mm**
iv) Between neutral and earth - **19 mm**

When, for any reason, the above clearances are not available, suitable insulation shall be provided. Clearances shall be maintained during normal service conditions.

Creepage distances shall comply to those specified in relevant standards.

6.3.7  All insulating material used in the construction of the equipment shall be of non-hygroscopic material, duly treated to withstand the effects of high humidity, high temperature tropical ambient service conditions.

6.3.8  Functional units such as circuit breakers and fuse switches shall be arranged in multi-tier formation, except that not more than two air circuit breakers shall be housed in a single vertical section.

6.3.9  Metallic/insulated barriers shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact with:

i) Main busbars and vertical risers during operation, inspection or maintenance of functional units and front mounted accessories.

ii) Cable terminations of one functional unit, when working on those of adjacent unit/units.

6.3.10 All doors/covers providing access to live power equipment/circuits shall be provided with tool operated fasteners to prevent unauthorized access.

6.3.11 Provision shall be made for permanently earthing the frames and other metal parts of the switch gears by two independent connections.

6.4  METAL TREATMENT AND FINISH:

6.4.1 All steelwork used in the construction of the switchboards, should have undergone a rigorous metal treatment process as follows: (Seven tank process.)

i) Effective cleaning by hot alkaline degreasing solution followed by cold water rinsing to remove traces of alkaline solution.

ii) Pickling in dilute sulphuric acid to remove oxide scales and rust formation, if any, followed by cold water rinsing to remove traces of acidic solution.

iii) A recognized phosphating process to facilitate durable coating of the paint on the metal surface and also to prevent the spread of rusting in the event of the paint film being mechanically damaged. This again, shall be followed by hot water rinsing to remove traces of phosphate solution.

iv) Passivating in de-oxalite solution to retain and augment the effects of phosphating.

v) Drying with compressed air in a dust free atmosphere.

vi) Primer coating with two coats of a highly corrosion resistant primer, applied wet on wet & stove dried under strictly controlled conditions of temperature and time.

vii) A finishing coat of stoving synthetic enamel paint to the specified shade of IS.5. The total thickness of paint should not be less than 15 to 20 microns.
### LIST OF APPROVED MAKES / MATERIALS TO BE USED FOR ELECTRICAL WORKS

<table>
<thead>
<tr>
<th>Sl No</th>
<th>ITEM/ MATERIAL</th>
<th>MAKES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Annealed copper conductor, PVC insulated, 1100 volts grade flexible copper cables manufactured to IS-694 (with FR &amp; ISI marking)</td>
<td>Havells/ Finolex / Polycab / Q-Flex/ Nicco / Anchor/ RPG/ Suncab</td>
</tr>
<tr>
<td>2</td>
<td>PVC insulated aluminium conductor, PVC sheathed, Armored Underground cables to IS 1554-Part-I-1976 or latest revision</td>
<td>Universal / ICC/ CCI / Nicco/ Poly cab Havells / Finolex/ Suncab / Fine cab / Radiant / Asian/ Unistar / Paragon/ Premier/ Polycab</td>
</tr>
<tr>
<td>3</td>
<td>Cable Glands</td>
<td>Siemens / Dowells / Crompton Greaves</td>
</tr>
<tr>
<td>4</td>
<td>Cable Lugs</td>
<td>Dowells / Jaison</td>
</tr>
<tr>
<td>5</td>
<td>Cable Terminating Kits</td>
<td>M-Seal / Raychems / CCI</td>
</tr>
<tr>
<td>6</td>
<td>PVC Pipes &amp; Fittings</td>
<td>Sudhakar, Supreme, Prince</td>
</tr>
</tbody>
</table>
Proposed Drain Layout

1. R.C.C Drain - 4172 RMT
2. Brickwork drain - 1000 RMT
Drain Section
Drain Size 600x600mm
(With R.C.C)

Drain Section
Drain Size 600x600mm
(With Brick Work)

100 mm Thk. Plaster with CM 1:3
PCC 1:4:8 using 40mm HBG metal
300mm Thick Sand Well Compacted

M 25 Concrete
300mm Thick Sand Well Compacted

8 tor @250 c/c (Vertical)
8 tor @250 c/c (Horizontal)

8 tor @250 c/c Both ways

1200
200
200
150

450
603
450

150

100

400

600