TENDER DOCUMENT

TENDER No.: DLI/CON/496/425

FOR

Design, manufacture, testing, inspection, painting prior to dispatch, transportation and supply to site, unloading, erection and final patch up painting at site of 10 nos. Bailey bridges at various locations from BP 2338 to BP 2319 (Demagiri to Mauzam) along IBB in the state of Mizoram including design and execution of associated civil works all complete on turnkey basis.

VOLUME – II

ADDITIONAL CONDITIONS OF CONTRACT
&
TECHNICAL SPECIFICATIONS
ADDITIONAL CONDITIONS OF CONTRACT

1.0 The following Additional Conditions of Contract shall be read in conjunction with General Conditions of Contract. If there are any provisions in these Additional Conditions of Contract (ACC) which are at variance with the provisions of General Conditions of Contract (GCC) and other conditions of the tender documents, the provisions in this Additional Conditions of Contract shall take precedence over General Conditions of Contract.

2.0 INTRODUCTION:-
Construction of Border Fencing and Road for Border Security Force along Indo- Bangladesh Border (IBB) in Mizoram Sector is a Project of Ministry of Home Affairs, Govt. of India, (MHA) and Engineering Projects (India) Limited. (A Govt. of India Enterprise) has been appointed as an “Executing Agency” for this project. The bailey-bridges under the present contract are required for crossing over the rivers or nallahs at different locations.

3.0 HANDING OVER & CLEARING OF SITE
The following shall stand added to clause no.2.0 of GCC:

The contractor, before submitting his tender has duly noted that he shall be required to obtain Inner Line Permit in respect of the staff and labour to be deployed by him. He has also noted the dilapidated conditions of the roads over which he has to carry his materials and machineries including the items required for incorporation in the permanent works as well as for temporary/ preparatory works like welding set, gas cutting set, erection hardwares, rod cutting machine, bending machine, testing & measuring equipments, concrete mixer, form work, winch, hydra, D.G. Set, structures etc. The contractor shall be required to obtain the necessary permits for carrying of all materials, machineries, etc. from one place to another in the state of Mizoram. The contractor may sometimes have to make use of ferry service or marboats to transport the materials. He has considered all such factors at the tendering stage and has duly taken care of expenditure in this respect in his rates. The contractor shall not be entitled to make any claim on EPI on account of any omission or negligence on his part.

4.0 SCOPE OF WORK: The clause no. 3.0 GCC shall stand the amended as below:

The scope of work under the present contract shall include (but not limited to) providing labour and materials such as raw materials, bought out components, consumables, tools and plant, machinery, haulage and erection equipment, erection hardwares, paints, earth moving equipment etc as required and completion in totality of bailey bridge at each location conforming to the type and span as mentioned under bill of quantities, getting the design vetted by a Government Engineering College in Assam or IIT Guwahati undertaking detailed engineering and issuance of construction drawings, shop drawings, bar bending schedule, as built drawings etc all complete, manufacture, testing, inspection at works, painting at works prior to dispatch, packing, forwarding and loading on transport, dispatch to site, unloading and receiving at site, positioning at the designated location, including carrying by ferry/ marboat/ barge, erection, assembly, final fit up, patch up painting etc. all complete of each bailey bridge, earthwork in excavation and back filling, P.C.C, R.C.C., reinforcement, formwork, cast in site bore pile etc. in piers and abutment, all complete at every location as more fully described under Technical Specification (Part-A) and (Part-B) for completeness of the contract for
“Design, manufacture, testing, inspection, painting prior to dispatch, transportation to site, supply, erection and final patch up painting etc. of 10 nos. Bailey bridges at various locations from BP 2338 to BP 2319 (Demagiri to Mauzam) along IBB in the state of Mizoram including design and execution of associated civil works all complete on turnkey basis in all respect”. The contractor shall use the materials of approved make only, wherever specified. In the cases where name of the approved make is not specified the contractor shall obtain prior approval of the Engineer-in-charge in respect of the materials he proposes to use. In no case, however the contractor shall propose materials not conforming to BIS standards. The contractor shall also duly comply with the quality and test procedures as per Quality Assurance Programme as duly approved by the Engineer-in-charge. The bailey bridges must be manufactured in the factory/works already established and of repute in manufacture of bailey bridges. The contractor shall be required to establish bench marks and other reference points at site at site prior to commencement of works at site and shall remain bound to preserve them till completion of works at his cost. The contractor is deemed to have satisfied himself at the tendering stage of the sufficiency and correctness of the tender documents and of the rates and prices quoted which, unless mentioned otherwise, cover all obligations under the contract and all matters and things found necessary for proper completion and maintenance of the works. EPI shall not entertain any claim of the contractor on account of any error or omission by him.

The rates mentioned under Price Schedule - cum – bill of quantities are for the complete item. However, part payment can be released as per agreed billing schedule by EPI.

5.0 RETENTION MONEY

The clause no. 10.0 of GCC shall stand amended as below:

An amount @ 5 % (five per cent) of the gross value of the running bill shall be withheld from each running bill by way of retention money. In case the EMD has been deposited by the contractor in the form of demand draft, the said amount of EMD shall be adjusted first towards the retention money and further recovery of retention money exceeds the amount of EMD deposited in the form of demand draft. The retention money shall become refundable to the contractor at the end of defect liability period of twelve month from the date of handing over of the works or on payment of the final bill whichever is later free of any interest provided always that the contractor has rectified all the defects arising during the defect liability period, EPI did not have to incur any expenditure in setting right the defects if any pertaining to the contractors scope of work, the contractor has demolished and removed all structure including foundations and withdrawn fully from the work site and EPI has received the handing over/ taking over certificate from the Client, MHA.

In case EPI has been requested to make any expenditure on any of these accounts, EPI will keep the retention money till the time all these matters are settled in full including recovery of the expenses, if any made by EPI plus 15% thereon as EPI’s administrative charges from the retention money. Further the contractor while approaching EPI for release of retention money has to furnish a “No Claim” certificate to EPI in confirmation of his having no claim on getting refunded the retention money.

If the amount of retention money deduction in cash is more than Rs.10.00 Lakhs (Rupees Ten Lakhs only), the amount in excess of Rs. 10.00 Lakhs can be released to the contractor against
6.0 MOBILIZATION OF MEN, MATERIALS AND MACHINERY

The following shall stand added to the clause no. 11.0 of GCC:

a) The clause no. 11.6 of GCC shall stand deleted.

b) The clause no. 11.7 of GCC shall stand amended as below:

   The contractor shall prepare all drawings including detail engineering drawings, bar bending schedule, shop and fabrication drawings etc. and submit five copies of these drawings each including for revision before executing the item within his quoted rates. He shall also submit five copies of as built drawings to EPI within his quoted rates. Further details are described under Technical Specification.

c) The contractor at his own cost shall deploy the following minimum plant and machinery at site as and when directed by the Engineer-in-charge.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Hydraulic Excavators</td>
<td>Three</td>
</tr>
<tr>
<td>2.</td>
<td>14/10 Concrete mixer with mechanically operated hopper</td>
<td>Five</td>
</tr>
<tr>
<td>3.</td>
<td>100 KVA DG Set</td>
<td>Three</td>
</tr>
<tr>
<td>4.</td>
<td>Tipper/ Dumper/ Tractor</td>
<td>Five</td>
</tr>
<tr>
<td>5.</td>
<td>Hydraulic crank</td>
<td>Two</td>
</tr>
<tr>
<td>6.</td>
<td>Welding machine</td>
<td>Five</td>
</tr>
<tr>
<td>7.</td>
<td>Vibrators (Petrol/ Kerosene)</td>
<td>Five</td>
</tr>
<tr>
<td>8.</td>
<td>Needles for Vibrators</td>
<td>Ten</td>
</tr>
<tr>
<td>9.</td>
<td>Needles for Vibrators</td>
<td>Ten</td>
</tr>
<tr>
<td>10.</td>
<td>Rollers</td>
<td>Twenty</td>
</tr>
<tr>
<td>11.</td>
<td>20.0 MT Electrical/ Diesel Engine run which</td>
<td>Eight</td>
</tr>
<tr>
<td>12.</td>
<td>C.P. Blocks of different capacity</td>
<td>Eight</td>
</tr>
<tr>
<td>13.</td>
<td>Jack</td>
<td>Eight</td>
</tr>
<tr>
<td>14.</td>
<td>Hydra</td>
<td>Four</td>
</tr>
<tr>
<td>15.</td>
<td>Cranes (type mounted or crawler type)</td>
<td>Four</td>
</tr>
<tr>
<td>16.</td>
<td>Total station</td>
<td>One</td>
</tr>
</tbody>
</table>

The list and number of plant and machinery mentioned above are tentative and shall be augmented as per requirement of work or as per direction of the Engineer-in-charge. In any case, the contractor has to deploy all the required plant and machinery to complete all the works within stipulated specifications and time period as per contract documents.

7.0 LAND FOR LABOUR HUTS/ SITE OFFICE AND STORAGE ACCOMMODATION

a) The following shall stand added to sub-clause no. 28.1 & 28.2 of GCC:

   The contractor shall make efforts to locate his temporary office, labour hutments, storage facilities construction camp etc. as per as possible close to the nearest Border Out Post of Border Security Force at his own cost. The cost of making required approach road, rental
or license fee or lease charges etc. local permits as applicable shall be borne by the contractor within his quoted rates.

b) The sub-clause no.28.3 of GCC shall stand ammended as under:

Within 20 days of issuance of Letter of Intent by EPI the contractor at his own cost shall provide the following facilities to EPI within his quoted rates during currency of the contract including defect liability period.

i) Furnished office accommodation measuring approx100 Sqm covered area with basic amenities like toilets (as least 2 nos.), complete with water flushing system, wash basins, sanitary fittings, mirrors septic tank and soak pit arrangement, all time water and electric supply arrangement, lights, light fittings, fans, room heaters, air conditions, curtains etc. for exclusive use of EPI’s engineers and staff. The specification and design of the office accommodation as well as its locations shall be decided by the Engineer-in-charge.

ii) The following furniture and office equipment in the said office accommodation.

- One no Sr. Executive Officer Table of size 72”x 36” x 30” having three pull out type drawers, on one side and a cabinet on the other side, black close laminated wooden particle board top of reputed manufacture as approved by the Engineer-in-charge.

- Three numbers of Sr. Executive table as above but of size 60” x 36” x 30”.

- One no high back revolving tilting chair with arm and foam rubber cushion of reputed manufacture as approved by the Engineer –in-charge.

- Eight numbers of chairs as above but with low back.

- Two numbers of 78” x 36” x 19” five compartments steel almirah.

- One number of four pull out/ push in compartment steel file cabinet.

- One number UV/RO water purification system (15 liters / hour).

- One number i5 processor 2.8 GHZ, 4 GB RAM, 500 GB, HDD with 6 USB Port, DVD Drive 15.6” antiglare LED Screen, 6 Lithium Cell Battery with original version of Windows 7 Professional, MS Office, MS Project, AutoCAD, Antivirus Laptop of Dell/ HP/ Acer make.

- One number All-In-One e-compatible Laser printer-cum-copier- scanner (upto A3 size) of make CANON/HP/XEROX.

iii) Two brand new four wheel drive Scorpio DX vehicle or equivalent with driver and accessories valuing upto Rs.30,000.00 for each vehicle in duly maintained condition with P.O.L for daily running of the vehicles at the work site or at a place as decided by EPI.

iv) One fixed line telephone with STD facilities and fax transmission and receiving and receiving instrument, call charges restricted to Rs.3000.00 per month.
v) Two mobile handsets costing upto Rs. 5000.00 for each set and with connection having STD facilities but call charges restricted to Rs.1000.00 per month.

vi) One full time office boy-cum cook at a cost restricted upto Rs.15,000.00 per month.

vii) Stationeries such as plain papers, letter heads, staplers, staples, clips,, ink register etc. costing upto Rs.2000.00 per month.

viii) Three project sign boards as per design approved by EPI.

Note:
   a) The cost of maintenance charges of the above facilities shall be borne by the contractor.

   b) In case of break-down of any vehicle, the contractor shall make immediate alternate arrangement failing which EPI shall make the alternate arrangement and recover the expenses incurred in this respect from the amount payable to the contractor including retention money (ies). The decision of EPI in this respect shall be final and binding in the contractor.

   c) All the gadgets and instruments to be provided by the contractor as stated above shall be brand new and shall be duly maintained by the contractor in good condition at his own cost.

   d) The Contractor shall also be responsible for watch and ward and safely of the above facilities at his own cost.

   e) In case, the contractor fails to provide the vehicle(s) EPI shall be entitled to recover an amount of Rs.50,000.00 per month from the amount that would become payable to the contractor including retention money (ies). The decision of EPI in this respect shall be final and binding on the contractor.

   f) In case the contractor fails to provide the facilities other than the vehicles mentioned above, EPI shall be at liberty to get them arranged on account of the contractor and recover the cost from his payable amount. The decision of EPI in this respect shall be final and binding on the contractor.

8.0 HEALTH & SANITARY ARRANGEMENTS

The following shall stand added to the clause no.30.0 of GCC:

The work site is a high risk prone area of falcipureum cerebral malaria (called PF malaria) disease. The contractor his visit to the site at the tendering stage has taken due cognizance of such hazard and has quoted his rates according. The contractor at his own cost shall use fogging machine alongwith the required chemicals and oils. He shall also remain bound to adopt and practice at his own cost any other preventive measure as prescribed by Local health Authorities or as directed by the Engineer-in-charge (EIC).

9.0 WATCH & WARD AND LIGHTING

The following shall stand added to Clause no.29.0 of GCC:

The work site being located near Indo-Bangladesh Border is a high security area. Where movement of personnel and vehicles etc. is regulated by the Security Forces under MHA/
Ministry of Defence (MoD). The contractor is deemed to have undertaken to work as per the provision given by these security agencies from time to time and has also taken note of the restrictions that may be imposed in working hours and areas, access and will deploy his resources accordingly to complete the work within the completion time given in the memorandum. EPI or MHA shall not entertain any claim of the contractor on account of any error or omission by him in this respect.

10.0 No amount shall be paid on account of secured advance and hence clause no.35 of GCC shall stand deleted.

11.0 The following shall stand added to Clause no.43.0 of GCC:

Notwithstanding the schedule and hold points appearing in the agreed Bar Chart/ Network the contractor shall be found to achieve the milestones as below and entitle EPI to withhold the sum(s) from his bills in case of not achieving the respective milestone as mentioned below:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Milestone</th>
<th>Time allowed in days/ months (from date of start)</th>
<th>Amount to be withheld by EPI in case of non-achievement of milestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>A)</td>
<td>Approval of basic design &amp; engineering</td>
<td>One Month</td>
<td>Rs.10.00 Lakhs</td>
</tr>
<tr>
<td>B)</td>
<td>Manufacture of 3 nos. bailey bridges and offering for inspection (pre-dispatch)</td>
<td>Three Months</td>
<td>Rs.50.00 Lakhs</td>
</tr>
<tr>
<td>C)</td>
<td>Manufacture of balance (7 nos.) bailey bridges and offering for inspection (Pre-dispatch)</td>
<td>Four Months</td>
<td>Rs.100.00 Lakhs</td>
</tr>
<tr>
<td>D)</td>
<td>Erection of 3 nos. bailey bridges</td>
<td>Five Months</td>
<td>Rs.100.00 Lakhs</td>
</tr>
</tbody>
</table>

In case entire work is completed within the completion time (i.e. time for completion of work) including any allowed extension thereto without imposition of compensation for delay, the recoveries made if any, for not achieving the aforesaid progress milestones at intermediate stages shall be refunded to the contractor free of any interest.

However, EPI shall be at liberty to determine the contract if the progress milestone mentioned at (C) above is not achieved even after elapse of the time allowed for achieving the progress milestone at (D).

12.0 No additional amount over and above the quoted amount of the contractor shall be paid on any account whatsoever except what is admitted by MHA. Hence clause no.69 of GCC shall stand deleted.

13.0 Specified material viz: cement, steel, structural steel etc shall be used. Material other than specified shall be used only with prior approval of client/EPI and recovery at prevailing market rate shall be done.
14.0  ARBITRATION : Modification of arbitration’s clause no 76.0 of GCC

14.1  Clause no. 76.1 along with note of GCC

Deleted- There shall be no Arbitration Clause for this Contract except between Central Public Sector Undertakings inter se / Government of India Departments / Ministries as mentioned in the Clause No. 76.2 below:-

14.2  Clause no. 76.2 of GCC -

ARBITRATION BETWEEN CENTRAL PUBLIC SECTOR ENTERPRISES INTER SE / GOVERNMENT OF INDIA DEPARTMENTS / MINISTRIES

i) In the event of any dispute or difference relating to the interpretation and application of the provisions of the contracts, such dispute or difference shall be referred by either party for arbitration to the sole arbitrator in the Department of Public Enterprises. The Arbitration and Conciliation Act, 1996 shall not be applicable to arbitration under this clause. The award of the Arbitrator shall be binding upon the parties to the dispute, provided, however, any party aggrieved by such award may take a further reference for setting aside of the award to the Law Secretary, Department of Legal Affairs, Ministry of Law & Justice, Government of India. Upon such reference the dispute shall be decided by the Law Secretary or the Special Secretary/ Additional Secretary, when so authorized by the Law Secretary, whose decision shall bind the Parties finally and conclusively. The parties to the dispute will share equally the cost of arbitration as intimated by the Arbitrator.

ii) Subject to any amendment that may be carried out by the Government of India from time to time, the procedure to be followed in the arbitration shall be as is contained in O.M. No. 4(1)/2011-DPE (PMA) GL dated 12.06.2013. Of Department of Public Enterprises, Ministry of Heavy Industries and Public Enterprises, Govt. of India or any modification issued in this regard.
## 15.0 Deployment of Technical Staff for the work

<table>
<thead>
<tr>
<th>Cost of work (Rs in Crores)</th>
<th>Contract period (Months)</th>
<th>Requirement of Technical Staff</th>
<th>Minimum experience (Years)</th>
<th>Rate of recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>24.0</td>
<td>7</td>
<td>i) Project Manager with degree</td>
<td>10</td>
<td>Rs. 60,000/- p.m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii) Planning /Quality Control Engineer Degree</td>
<td>5</td>
<td>Rs. 50,000/- p.m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii) Junior Engineer Diploma (Civil)</td>
<td>3</td>
<td>Rs 25,000/- p.m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iv) Safety Officer</td>
<td>2</td>
<td>Rs 20,000/- p.m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>v) Supervisors (Diploma Engineering in Electrical/Mechanical/Civil or ITI)</td>
<td>2 Or 8</td>
<td>Rs 30,000/- p.m</td>
</tr>
</tbody>
</table>

Rate of recovery in case of non-compliance of above will be stipulated as above.
TECHNICAL SPECIFICATION

Part-A

1.0 INTENT

This specification is intended to cover the following activities and services in respect of Design, manufacture, testing, inspection, painting prior to dispatch, transportation and supply to site, unloading, erection and final patch up painting at site of 10 nos. Bailey bridges at various locations from BP 2338 to BP 2319 (Demagiri to Mauzam) along IBB in the state of Mizoram including design and execution of associated civil works comprising of design and construction of RCC abutments/piers etc. all complete on turnkey basis.

(a)

(i) Undertaking topographical survey and geo-technical investigation of the proposed sites for generating inputs for design and engineering, basic and detail design and engineering, such as general arrangement drawings indicating the conceptual design, general assembly, structural members, steel sections, jointing procedure, components, sub-assembly, foundation abutment adopted grade of concrete and steel used. Thickness of concrete structural members, steel sections, depth & thickness pier footing/foundation.

(ii) Complete manufacture including shop testing/type testing, inspection, painting, at works (two coats of epoxy primer followed by two coats of final epoxy painting of approved shade).

(iii) Providing engineering data, drawings, erection procedures, O & M manuals etc. for bought out items, recommended preventive measures etc. for review, approval and records of EPI.

(iv) Packing and transportation from the manufacturer’s workshop to site including transit insurance, and the required permits.

(v) Receipt, unloading, storage, preservation, conservation and insurance of equipment at site.
(vi) Fabrication, pre-assembly (if any), erection, testing, final patch up painting, putting into satisfactory operation of the bailey bridges including successful completion of facilities.

(vii) Associated civil and structural works.

(viii) Load test after successful erection / Tests after successful completion of initial operation.

(ix) Providing facilities as mentioned in ACC.

(x) Satisfactory completion of the contract.

(b) The equipment and services to be furnished and installed as required in this Technical Specification shall also meet all the requirements as stated in Notice Inviting tender (NIT) “General Conditions of Contract “(GCC) “Additional Conditions of Contract” (ACC) and “Price Bid cum Bill of Quantities” which shall be considered as a part of this technical specification as bound herewith.

Notes:

1) All drawings shall be prepared in Auto Cad. However design may be carried out manually using computer work sheets or by using suitable software programmes as mutually agreed by EPI.

2) Approval of drawings shall not absolve the contractor of his obligations under the contract.

3) For earthquake the seismic zone as applicable in the state of Mizoram shall be considered.

(c) The Contractor shall be responsible for providing all materials, equipment and services, specified or otherwise (unless specifically excluded) which are required to fulfill the intent of ensuring operability and the reliability of the complete system covered under this contract.
(d) It is not the intent to specify completely herein, all aspects of design and construction of the bailey bridges (the equipment). Nevertheless, the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation.

(e) Bidder is requested to carefully examine and understand the specifications and seek clarifications, if required, to ensure that they have understood the specifications. Such clarifications should reach EPI at least one day before the scheduled date of Pre-bid Conference. The Bidder’s offer should not carry any sections like clarifications, interpretations and/or assumptions.

2.0 The bailey bridges shall conform to the types for each location. The main girder shall be formed from steel panels of welded construction, each panel being pin connected to its neighbour end to end. The girder shall be connected crosswise by transoms resting on the bottom chord of the panels and maintaining the required distance as per drawing between the trusses. The girders shall also be connected by sway braces at each panel bay. Across the transoms there shall be the steel deck plate suitable for all types of vehicles under various load classes mentioned in IRC & AASHTO codes as applicable for the types mentioned under Bill of Quantities. End posts shall be attached to the ends of each truss of bridge girders and supported on bearings resting over base plates placed on the RCC Abutment/piers at each end of the span.

Structural members for bailey bridge panel, raker, chord reinforcement, transom and channel stiffeners of steel deck shall conform to IS: 2062 E410 (Fe 540)-2011 having UTS=540 MPa and minimum yield strength = 410 MPa.

Other structural members and plates having thickness less than 20 mm except chequered plates shall conform to IS:2062 E 250 (Fe 410 W) A-2011 having UTS=410 MPa and minimum yield strength =250 MPa. Plates having thickness more than 20 mm shall conform to IS:2062 E 250 (Fe 410 W) B-200 having UTS 410 MPa and minimum yield strength 240 MPa. Chequered plates shall conform to IS: 3502 Base IS:2062. Panel pins shall be made of alloy steel with yield
stress not less than 78.74 Kg / Sq mm and Izod value not less than 5.5 Kgm. All fasteners shall be of IS:1367 Cl 8.8 & studs of IS: 1367 Cl 8.0.

All structural members including steel decks shall be sand blasted grit blasted acid pickled as per Defence Specification then phosphating and water rinsing wherever applicable prior to painting. Two coats of epoxy primer shall be applied on such members when dry. If the items are found to be satisfactory during pre-dispatch inspection, two coats of epoxy paint of approve shade shall be applied on them prior to dispatch.

All materials to be used shall be new in accordance with the specifications and of approved make. Besides all materials, specially structural materials, to be used shall be free from any rust or will scale or dirt. The welding rods to be used shall conform to the relevant BIS specification and of reputed make like Advani, L & T, IOL, etc as approved by EPIL.

3.0 If during the execution of works it is found that there is interference with the existing facilities/structures, the contractor shall revise his design/ detailed drawings to clear the interference and shall provide all necessary measures for the safety of existing structures. No claim in terms of cost or relaxation in time shall be entertained for any redesign, rework and for safety measures provided. If at any stage of work, any dismantling or modification or relocation of any existing facility is required to be done to complete the work in contractor's scope and which has been agreed by EPI, the same shall be done by the contractor at no extra cost or time implication to EPI/ MHA. All such changes will be as per drawings and work plan approved by EPI/MHA.

4.0 In addition to the specifications indicated in various sections and GCC, ACC and Erection Conditions of Contract as described at later part of this Technical specification shall also form part of the contract.

5.0 The bailey bridges shall mandatory be manufactured in an already established workshop/ factory having past experience of manufacturing bailey bridges.
6.0 The Contractor shall submit a quality assurance programme prior to taking up manufacturing activities field activities and get it duly approved by EPI and shall remain bound to implement the said approved programme prior to taking up the respective activity.

Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor’s/ Sub-contractor’s/ Sub-supplier’s Quality Control Organization, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electric media e.g. E-mail in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM.

Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor’s “Site Quality Control Organization” during various stages of site activities starting from receipt of materials/equipment at site.

The Contractor shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to approval by EPI, without which manufacturer shall not proceed. These approved documents shall form a part of the contract. These approved Quality Plans, shall identify Customer Hold Points (CHP), i.e. test/checks which shall be carried out in presence of EPI or his authorized representative and beyond which the work will not proceed without consent of EPI in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to EPI along with technical justification for approval and dispositioning. EPI however, shall reserve its rights to waive certain tests/checks supposed to be carried out in presence of his representative. However, such waiver shall not absolve the contractor from his obligations under the contract.
The contractor shall submit Field Welding Schedule for field welding activities along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site.

The contractor shall have suitable Field Quality Organization (FQO) with adequate manpower at site, to effectively implement the Field Quality Plan (FQP) and Field Quality Management System for site activities. The contractor shall submit the details of proposed FQO set up (organization structure and manpower) or employer's approval. The FQO setup shall be in place at least one month before the start of site activities.

No material shall be dispatched from the manufacturer's works before the same is accepted, subsequent to predespatch final inspection including verification of records of all previous tests/inspections by EPI or his authorized representative and duly authorized for dispatch by issuance of Material Dispatch Clearance Certificate (MDCC).

All material used for equipment manufacture including casting and forging etc. shall be new unused and of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and / or agreed details.

All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the EPI.

All welding/ brazing procedures shall be submitted to EPI or its authorized representative for approval prior to carrying out the welding/ brazing.

All braziers, welding operators employed on any part of the contract either in Contractor's / Sub-contractor’s works or at site or elsewhere shall be qualified as
per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to EPI.

Welding procedure qualification & Welding qualification test results shall be furnished to EPI for approval. However, where required by EPI, tests shall be conducted in presence of EPI/authorized representative.

For all pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. Similarly any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MP/LPI shall be carried before seal welding.

Unless otherwise proven and specifically agreed welding of dissimilar materials and high alloy materials shall be carried out at shop only.

No welding shall be carried out on cast iron components for repair.

All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.

All non-destructive examination shall be performed in accordance with written procedures as per International Standards. The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination). NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.

All bar stock/ forging of diameter equal to or greater than 50 m shall be ultrasonically tested. In general all plates equal to or greater than 40 mm and for pressure parts, plate of thickness equal to or greater than 25 mm shall be ultrasonically tested unless otherwise as specified in respective specification.
The Contractor shall list out all major items / equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub contractor proposed by the Contractor for procurement of major bought out items including casting, forging, semi-finished and finished components/ equipment etc., list of which shall be drawn up by the Contractor and finalized with EPI.

The contractor’s proposal shall include vendor’s facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-contractors enclosed and shall submitted to EPI for approval well in advance keeping the overall completion schedule in mind. Such vendor approval shall not relieve the contractor form any obligation, duty or responsibility under the contract.

EPI reserves the right to carry out quality audit quality surveillance of the systems and procedure of the Contractor’s or their sub-contractor’s quality management and, control activities through his own employees or through an external agency. The contractor shall provide all necessary assistance to EPI, Agency carry out such audit and surveillance.

The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractor’s and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identify and acceptability of all materials parts and equipment. Contractor shall carry out all tests/ inspection required to establish that the items/ equipment conform to requirements of the specification and the relevant codes/ standards specified in the specification, in addition to carrying out tests as per the approved quality plan.

Quality audit/ surveillance/ approval of the results of the tests and inspection will not, however, prejudice the right of EPI/MHA to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the contractor in ensuring complete conformance of the materials / equipment supplied to relevant specification, standard, data sheets, drawings etc.
Repair/ rectification procedures to be adopted to make the job acceptable shall be subject to the approval of EPI/ authorized representative.

7.0 QA DOCUMENTATION PACKAGE

The Contractor shall be required to submit the QA Documentation in two hard copies and the CD ROM’s as identified in respective quality plan with tick mark.

Each QA Documentation shall have a project specific Cover sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.

The final quality document will be compiled and issued at the final assembly place of equipment before dispatch. However CD Tom may be issued not letter than three weeks.

Typical contents of QA Documentation is as below:-

(a) Quality Plan

(b) Material mil test reports on components as specified by the specification and approved Quality Plans.

(c) Manufacturer/ works test reports/ results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.
(d) Non-destructive examination results/reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

(e) Heat Treatment certificate/Record (Time-temperature chart)

(f) All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details/repair procedure).

(g) CHP/Inspection reports duly signed by the Inspection of the Employer and Contractor for the Agreed Customer Hold Points.

(h) Certificate of Conformance (COC) wherever applicable.

(i) MDCC

Similarly, the contractor shall be required to submit two sets (two hard copies and two CD ROM’s), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/procedures, prior to commissioning of individual system.

Before dispatch/commissioning of any equipment, the Contractor shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

a) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.

b) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract.
documents. When it is done, the quality document (or applicable section) is stamped by the inspector.

c) If a decision is made dispatch, whereas all outstanding actions cannot be readily cleared for the quality document by that time. The supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding action & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the dispatch equipment.

8.0 INSPECTION, TESTING AND INSPECTION CERTIFICATES

EPI or his duly authorized representative and or/ an outside inspection agency acting on behalf of EPI shall have access at all reasonable times to inspect and examine the materials and workmanship of the work during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for EPI and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the Contractor’s own premises or works.

The Contractor shall give EPI written notice 10 (Ten) days in advance of any material being ready for testing. Such tests shall be to the Contractor’s account except for the expenses of the person will in case EPI is not able to attend such tests within 10 (ten) days of the date on which the equipment is noticed as being ready for test/inspection, the contractor may proceed with test which shall be deemed to have been made in presence of EPI and he shall forthwith forward to duly certified copies of test reports in two (2) copies.

EPI shall within 7 (seven) days from the date of inspection as defined herein given notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said
objections or shall inform in writing to EPI giving reasons therein, that no modifications are necessary to comply with the contract.

When the factory tests have been completed at the Contractor’s or sub-contractor’s works, EPI shall issue a certificate to this effect (7 (seven) days after completion of tests but if the tests are not witnessed by EPI, the certificate shall be issued within 7 (seven) days of the receipt of the Contractor’s test certificate. The completion of these tests or the issue of the certificates shall not bind EPI to accept the equipment should it, on further tests after erection be found not to comply with the contract.

In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by EPI or his authorized representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to EPI or to his authorized representative to accomplish testing.

The inspection EPI and issue of Inspection Certificate thereon shall in no way absolve or reduce the contractor’s obligation under the contract.

All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and critically of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by EPI. Wherever asked specifically, the contractor shall recalibrate the measuring/test equipment.

9.0 PACKAGING AND TRANSPORTATION

All the equipments shall be suitably protected, coated, covered or boxed and created to prevent damage or deterioration during transit, handing and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the roads in route should be taken account of the Contractor shall
be responsible for any loss or damage during transportation, handling and storage due to improper packing. Before dispatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site work like grinding, welding, cutting & pre-assembly to bare minimum. EPI shall have right to insist for completion of works in shops before dispatch of materials for transportation.

10.0 ERECTION CONDITION OF CONTRACT

10.1 The following provisions shall supplement the conditions already contained in the other parts of these specifications and documents and shall govern that portion of the work of this contract which is to be performed at site. The erection requirements and procedures not specified in these documents shall be in accordance with the recommendations of the equipment manufacturer, or as mutually agreed to between EPI and the contractor prior to commencement of erection work.

The Contractor upon signing of the contract shall, in addition to a Project Co-ordinator, nominate another responsible officer as his representative at Site suitably designated for the purpose of overall responsibility and co-ordination of the works to be performed at Site. Such a person shall function from the site office of the Contractor during the pendency of Contract.

The welding of all pressure parts and high pressure parts and high pressure piping shall be in accordance with the following requirements:

10.2 Only qualified welding procedures as per ASME section IX shall be used by contractor at site. Welding procedure shall indicate all essential and non-essential parameters as per ASME Section IX. Makes of welding consumables shall be subject to employer's approval.

10.3 Only welders, who are qualified in accordance with the latest applicable requirements of the India Boiler Regulations, shall be permitted to perform any welding work on the pressure parts and its attachment welding. In addition to such statutory qualification requirements, the welders shall also undergo a satisfactory pre-production qualification test to be conducted by the Contractor at site as per ASME Sec IX, if required in presence of EIC or a person duly authorized by him.
All the welders carrying out welding at site shall carry an identification badge, which shall indicate the category and the grade of welding for which they have been tested and authorized to carry out welding.

10.4 Welders performance shall be monitored regularly and record of their performance shall be maintained by contractor in a manner acceptable to the EIC. Contractor shall maintain such records including record of procedure qualification & welder qualification and hand-over to the employer at the end of work.

10.5 On completion of each welded joint, the welder shall mark his regularly assigned identification mark near the joint. The welder’s identification numbers, inspection stamps or code symbol stamps and other information shall not be directly stamped on any alloy steel piping. In alloy steel piping, all such information shall be stamped on separate marking plate which shall be tack welded on pipe near the weld.

10.6 Preparation at site of weld joint shall be in accordance with details acceptable to the EIC. Wherever possible, machining or automatic flame cutting shall be used for edge preparation. Hand flame cutting will be permitted only where edge preparation otherwise is impractical. All slag shall be removed from cuts and all the hand cuts shall be ground smooth to the satisfaction of the EIC. Flame cutting of alloy steel pipe shall be avoided. Wherever such cutting is done, a 200 mm length at the cut face shall be removed by machining. Pneumatic hand tools such as edge preparation, tube cutting machine can be used.

10.7 The Contractor shall submit to the EIC, a certified and complete field welding schedule for all the field welding activities to be carried out in respect of the pressure parts involved in the equipment furnished and erected by him, a least 90 days prior to the scheduled start of erection work at site. Such schedule will be strictly followed by the contractor during the process of erection. The above field-welding schedule to be issued by the Contractor shall contain the following:

(a) Drawing No (s)
(b) Location of the weld
(c) Size of the weld (outside diameter and thickness)
(d) Type of joints
(e) Material specifications
(f) Size of fillet on backing ring, when the type of joint is with backing ring
(g) Number of welds per unit
(h) Number of welds per unit
10.8 No electric cable in use by the Contractor/ Employer will be disturbed without permission. No weigh of any description will be imposed on any such cable and ladder or similar equipment will rest against or be attached to it.

10.9 No repair work shall be carried out any live equipment.

10.10 The Contractor shall employ the necessary number of qualified, full time electricians to maintain his temporary electrical installation.

10.11 No material brought to the Site shall be removed from the Site by the Contractor and/ or his Sub-contractors without the prior writing approval of the Employer.

10.12 EIC shall have the right to re-inspect any equipment though previously inspected and approved by EPI and the contractor’s works, before and after the same are erected at Site. If by the above inspection, the rejects any equipment, the Contractor shall make good for such rejections either by replacement or modification / repairs as may be necessary to the satisfaction of the EIC. Such replacements will also include the replacements or re-execution of such of those works of other Contactors and / or agencies, which might have got damaged or affected by the replacements or re-work done to the Contractor’s work.

10.13 in the execution of the works, no person other than the contractor or his duly appointed representative, Sub-contractor and workmen, shall be allowed to do work on the Site, except by the special permission, in writing by the EIC or his representative.

10.14 CONTRACTOR’S SITE OFFICE ESTABLISHMENT

The Contractor shall establish a office at the Site and keep posted an authorized representative for the purpose of the Contract. Any written order or instruction of the EIC or his duly authorized representative shall be communicated to the said authorized resident representative of the Contractor and the same shall be deemed to have been communicated to the Contractor at his legal address.

10.15 The Contractor shall adhere to the disciplinary procedure set by EIC in respect of his employees and workmen at Site. The EIC shall be at liberty to object to the presence of any representative or employee of the contractor at the site, if in the opinion of the EIC such employee has mis-conducted himself or in incompetent, negligent or otherwise undesirable then the Contractor shall remove such a person objected to and provide in his place a competent replacement.
10.16 The Contractor shall keep the EIC informed in advance regarding his field activity plans and schedules for carrying out each part of the works. Any review of such plan or schedule or method of work by the EIC shall not relieve the Contractor of any of his responsibilities towards the field activities. Such review shall also not be considered as an assumption of any risk or liability by EPI or any of his representatives and no claim of the Contractor will be entertained.

10.17 The Contractor shall provide all the construction equipments, tools, tackles and scaffoldings required for pre-assembly, installation, testing, commissioning and conducting Guarantee tests of the equipments covered under the contract. He shall submit a list of all such materials to the EIC before the commencement of pre-assembly at site. These tools and tackles shall not be removed from the site without the written permission of the Employer. The contractor shall arrange Dozer, Hydra, Cranes, Trailer, etc. for the purpose of fabrication, erection and commissioning.

10.18 **First-aid**

The contractor shall provide necessary first-aid facilities for all his employees, representatives and workmen working at the Site. Enough number of Contractor’s personnel shall be trained in administering first-aid.

The EIC will provide the contractor, in case of any emergency, the services of an ambulance for transportation to the nearest hospital.

10.19 **LINES AND GRADES**

All the works shall be performed to the lines, grades and elevations indicated on the drawings. The contractor shall be responsible to locate and layout the works. The contractor shall inform the EIC well in advance of the times and places at which he wishes to do work in the area allotted to him.

10.20 **FIRE PROTECTION**

The work procedures that are to be used during the erection shall be those which minimize fire hazards to the extent practicable. Combustible materials, combustible waste and rubbish shall be collected and removed from the Site at least once each day. Fuels, oils and volatile of flammable materials shall be stored away from the construction and equipment and materials storage areas in safe containers. Untreated canvas, paper, plastic or other flammable flexible materials shall not at all be used at site for any other purpose unless otherwise specified. If any such materials are received with the equipment at the Site, the same shall be removed and replaced with acceptable materials before moving into the construction or storage area.

Similar corrugated paper fabricated cartons etc. will not be permitted in the construction area either for storage or for handling of materials. All such materials used shall be of water proof and flame resistant type. All the other materials such as working drawings, plants etc. which are combustible but are
essential for the works to be executed shall be protected against combustion resulting from welding sparks, cutting flames and other similar fire sources.

All the Contractor’s supervisory personnel and sufficient number of workers shall be trained for fire-fighting and shall be assigned specific fire protection duties. Enough of such trained personnel must be available at the Site during the entire period of the Contract.

The contractor shall provide enough fire protection equipment of the types and number for the warehouse, office, temporary structures, labour colony area etc. Access to such fire protection equipment, shall be easy and kept open at all time.

10.21 CONTRACTOR’S CO-OPERATION WITH THE EMPLOYER

In case where the performance of the erection work by the Contractor affects the operation of the system facilities of EPI such erection work of the Contractor, shall be scheduled to be performed only in the manner stipulated by the EIC and the same shall be acceptable at all times to the Contractor. It will be the responsibility of the contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and operation of the equipment system which are erected by him. The Contractor shall also be responsible for flushing and initial filling of all the oil and lubricants required for the equipment furnished and installed by him, so as to make such equipment ready for operation. The Contractor shall be responsible for supplying such flushing oil and other lubricants unless other lubricants unless otherwise specified elsewhere in documents and specifications.

10.22 FIELD OFFICE RECORDS

The Contractor shall maintain at his Site Office up-to-date copies of all drawings, specifications and other Contract Documents and any other supplementary data complete with all the latest revision thereto. The Contractor shall also maintain in addition the continuous record of all changes to the above contract Documents, drawings, specifications, supplementary data, etc. effected at the field and on completion of his total assignment under the Contract shall incorporate all such changes on the drawings and other Engineering data to indicate as installed conditions of the equipment furnished and erected under the contract. Such drawings and Engineering data shall be submitted to the EIC in required number of copies.

10.23 CONTRACTOR’S MATERIALS BROUGHT ON TO SITE

The Contractor shall bring to Site all equipment, components, parts, materials, including construction equipment, tools and tackles for the purpose of the Works under intimation to the EIC. All such goods shall goods shall, from the time of their being brought vest in EIC, but may be used for the purpose of the works only and shall not on any account be removed or taken away by the Contractor
without the written permission of EPI. The contractor shall nevertheless be solely liable and responsible for any loss or destruction thereof and damage thereto.

EPI shall have a lien on such goods for any sum or sums which may at any time be due or owing to him by the Contractor, under, in respect of or by reasons of the of the Contract. After giving a fifteen (15 days notice in writing of his intention to do so, EPI shall be at liberty to sell and dispose of any such goods, in such manner as he shall think fit including public auction or private treaty and to apply the proceeds in or towards the satisfaction of such sum or sums due as aforesaid.

After the completion of the works, the contractor shall remove from the site the materials such as construction equipment, erection tools and tackles, scaffolding etc. with the written permission of the EIC. If the contractor fails to remove such materials, within fifteen (15) days of issue of a notice by the EIC to do so then EPI shall have the liberty to dispose of such materials as specified above and credit the proceeds thereto the account of the contractor.

10.24 PROTECTION OF PROPERTY AND CONTRACTOR’S LIABILITY

The contractor shall be responsible for any damage resulting from his operations. He shall also be responsible for protection of all persons including members of public and employees of EPI and the employees of other contractors and Sub-contractors and all public and private property including structures, building, other plants and equipments and utilities either above or below the ground.

10.25 WORK & SAFETY REGULATIONS

The contractor shall ensure proper safety of all the workmen, materials, plant and equipments belonging to him or to EPI or to others, working at the site. The Contractor shall also be responsible for provision of all safety notices and safety equipment required both by the relevant legislation and EPI as he may deem necessary.

The contractor will notify well in advance to the EIC of his intention to bring to the site any container filled with liquid or gaseous fuel or explosive or petroleum substance or such chemicals which may involve hazards. EIC shall have the right to prescribe the conditions, under which such container is to stored, handled and used during the performance of the works and the contractor shall strictly adhere to and comply with such instructions. EIC shall have the right at his sole discretion to inspect any such container or such construction plant/ equipment for which material in the container is required to be used and if in his opinion, its use is not safe, he may forbid its use. No claim due to such prohibition shall be entertained by EPI and EPI shall not entertain any claim of the contractor towards additional safety provisions/ conditions to be provided for/ construction as per the Employer’s instructions.

Further, any such decision of EPI shall not, in any way, absolve the contractor of his responsibilities and in case, use of such a container or entry thereof into the site area is forbidden by the EIC the contractor shall use alternative methods with
the approval of the EIC without any cost implication to EPI extension of work schedule.

Where it is necessary to provide and / or store petroleum products or petroleum mixtures and explosive, the contractor shall be responsible for carrying-out such provision and / or storage in accordance with the rules and regulations laid down in Petroleum Act 1934, Explosive Act, 1948, and Petroleum and Carbide of Calcium Manual published by the Chief Inspector of Explosives of India. All such storage shall have prior approval of EPI incase, any approvals are necessary from the Chief Inspector (Explosives) or any statutory authorities, the contractor shall be responsible for obtaining the same.

All equipment used in construction and erection by Contractor shall meet Indian/ International Standards and where such standards do not exist, the contractor shall ensure these to be absolutely safe. All equipments shall be strictly operated and maintained by the contractor in accordance with manufacture’s operation manual and safety instructions.

Periodical Examinations and all tests for all lifting/ hoisting equipment & tackles shall be carried out in accordance with the relevant provisions of Factories Act 1948, Indian Electricity Act 1910 and associated laws/ Rules in force from time to time. A register of such examinations and tests shall be properly maintained by the Contractor and will be promptly produced as and when desired by EIC.

The contractor shall provide suitable safety equipment of prescribed standard to all employees and workmen according to the need, as may be directed by EIC who will also have right to examine these safety equipments to determine their suitability, reliability, acceptability and adaptability.

The contractor shall provide safe working conditions to all workmen and employees at the site including safe means of access, railings, stairs, ladders, scaffoldings etc. the scaffoldings shall be erected under the control and supervision of an experienced and competent person. For erection, good and standard quality of material only shall be used by the contractor.

The contractor shall not interfere or disturb electric fuses, wiring and other electrical equipment under any circumstances, whatsoever, unless expressly permitted in writing by the EIC to handle such fuses, wiring or electrical equipment.

Before the contractor connects any electrical appliances to any plug or socket belonging to the other contractor or EOI, he shall:

(a) Inform the EIC that the appliance is in good working condition:

(b) Inform the EIC of the maximum current rating, voltage and phases of the appliances;

(c) Obtain permission of the EIC detailing the sockets to which the appliances may be connected.
The EIC will not grant permission to connect until he is satisfied that;

(a) The appliance is in good condition and is fitted with suitable plug;

(b) The appliance is fitted with a suitable cable having two earth conductors, one of which shall be an earthed metal sheath surrounding the cores.

No electric cable in use by the contractor/ EPI will be disturbed without prior permission. No weight of any description will be imposed on any cable and no ladder or similar equipment will rest against or attached to it.

No repair work shall be carried out on any live equipment. While working on electric lines/ equipments whether live or dead, suitable type and sufficient quantity of tools will have to be provided by Contractor to electricians / workmen/ officers.

The Contractors shall employ necessary number of qualified, full time Electricians/ Electrical Supervisors to maintain his temporary electrical installations.

The contractor employing more than 2500 workmen whether temporary, casual, probationer, regular or permanent or on contract, shall employ atleast one full time officer exclusively as Safety Officer to supervise safety aspects of the equipments and workmen.. In case of work being carried out through sub-contractor’s the sub contractor’s workmen/ employees will also be considered as the contractor’s employees/ workmen for the above purpose.

The name and address of Safety officer of Contractor will be promptly informed in writing to EPI before he starts work or immediately after any change of the incumbent is made during currency of the contract.

In case any accident occurs during the construction/ erection or other associated activities undertaken by the contractor thereby causing any minor or major or fatal injury to his employees due to any reason, whatsoever, it shall be the responsibility of the contractor to promptly inform the same to the EIC in prescribed form and also to all the authorities envisaged under the applicable laws.

The EIC shall have the right at his sole discretion to stop the work, it in his opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the persons and / or equipments. In such cases, the contractor shall be informed in writing about the nature of hazards and possible injury/ accident and he shall comply to remove shortcomings promptly. The Contractor after stopping the specific work can, if felt necessary appeal against the order of stoppage of work to the EIC within 3 days of such stoppage of work and decision of the EIC in this respect shall be conclusive and binding on the contractor.
The contractor shall not be entitled for any damages/compensation for stoppage of work due to safety reasons and the period of such stoppage of work will not be taken as an extension of time for completion of the facilities and will not be the ground for waiver of any compensation for delay.

If the contractor does not take all safety precautions and/or fails to comply with the Safety Rules as prescribed by the EIC or under the applicable law for the safety of the equipment and plant and for the safety of personnel and the contractor does not prevent hazardous conditions which cause injury to his own employees or employees of other contractors, or the employer's employees or any other person who are at site or adjacent thereto, the contractor shall be responsible for payment of compensation to EPI as per the following schedule:

1. Fatal injury or accident Rs.1,00,000/- these are applicable for these area causing death applicable
   death/ injury to any person whomsoever

2. Major injuries or accident Rs.20,000/- Causing 25% of more permanent disablement to workmen or employee

Permanent disablement shall have same meaning as indicated in Workmen's Compensation Act. The compensation mentioned above shall be in addition to the compensation payable to the workmen/employees under the relevant provisions of the Workmen's Compensation Act and rules framed there under or any other applicable laws as applicable from time to time. In case EPI is made to pay such compensation then the contractor is liable to reimburse EPI such amount in addition to the compensation indicated above.

10.26 FOUNDATION DRESSING & GROUTING FOR EQUIPMENT / EQUIPMENT BASES

The surfaces of foundations shall be dressed to bring the top surface of the foundations to the required level, prior to placement of equipment / equipment bases on the foundations.

All the equipment/ equipment bases shall be quoted and finished as per these specifications unless otherwise recommended by the equipment manufacture.

The concrete foundation surfaces shall be properly prepared by chipping, grinding as required to bring the top of such foundation to the required level, to provide the necessary roughness for bondage and to assure enough bearing strength.

Grout
The grout shall be high strength grout having a minimum characteristic compressive strength of 60 N/mm² at 28 days. The grout shall be chloride-free, cement based, free flowing, non-metallic grout.

10.27 EQUIPMENT DELIVERY AND ERECTION

10.17.1 General Requirements

(a) This part covers Contractor’s responsibilities for packing, shipping, warehousing and the installation of all equipment and materials furnished and installed under his specification.

(b) The contractor shall submit for EPI’s approval draft manual for Equipment Delivery and Erection (EDE Manual) covering detailed instructions, write up, technical data, drawings, check-lists, documentation formats for all activities after equipment manufacture upto installation of equipment. This manual shall cover general instructions for all equipment and specific Instructions for individual equipment wherever required and shall include at least the following:

1. Instruction for packing, shipping, receiving handing, warehousing and storage.

2. Instructions for location and installation of equipment furnished by this specification.

3. Installation drawings for field mounted equipment, panels, cubicles and other equipment covered under this specification.

4. Instruction relating installation of piping/ tubing, support and routing drawings of impulse pipes/ signal tubes and tube/cable trays.

5. Check list and quality assurance hold points.

6. Format for all related documentation.

(c) The EDE Manual shall conform to the requirements of this specification, all applicable codes and standards, recommendations of equipment manufactures and accepted good engineering practices and shall be subject of Employer approval during detailed engineering.

(d) The contractor shall ensure that all work under this part shall be performed as per the requirements of this specification.

10.17.2 Crating

(a) All equipment and materials shall be suitably coated, wrapped, or covered and boxed or crated for most humid tropical shipment and to prevent damage or deterioration during handling and storage at the site.

(b) The components wherever required shall be packed with suitable desiccants, sealed in water proof vapour-proof wrapping and packed in
lumber of poly wood enclosures, suitably braced, tied and skidded. Lumber enclosures shall be solid, not slatted.

(c) Desiccants shall be either silica gel or calcium sulphate, sufficiently ground to provide the required surface area and activated prior to placing in the packaging. Calcium sulphate desiccants shall be of a chemical nature to absorb moisture. In any case, the desiccant shall not be of a type that will absorb enough moisture to go into solution. Desiccants shall packed in porous containers, strong enough to withstand handling encountered during normal shipment. Enough desiccant shall be used for the volumes enclosed in wrapping.

(d) Review by EPI of the contractor's proposed packing methods shall relieve the contractor of responsibility for damage or deterioration to the equipment and materials specified.

(e) All accessory items shall be shipped with the equipment. Boxes and creates containing accessory items shall be marked so that they are identified with the main equipment. The contents of each box and crates shall be indicated by markings on the exterior.

(f) All boxes, creates, cases bundles, loose pieces, etc. shall be marked consecutively from no.1 upward throughout all shipments from a given port to completion of the other without repeating the same number.

(g) An itemized list of contents shall be enclosed inside each case and one other copy securely fastened to the outside of the case in a tin or light weight sheet metal envelope or pocket. The lists shall be plainly marked and placed in accessible locations to facilitate receipt and inspection. The packing list shall indicate whether shipment is partial or complete and shall incorporate the following information or each container, etc. according to its individual shipping number:

1. Export case markings
2. Case number
3. Gross weight and net weight in Kilograms
4. Dimensions in centimeters
5. Complete description of material

(h) Packaging or shipping units shall be designed with the limitations of unloading facilities and the equipment which will be used for transport. Complications involved with ocean shipment and the limitations of ports, railways and roads shall be considered. It shall be the contractor's responsibility to investigate these limitations and to provide suitable packaging to permit safe handling during transit and at the job site.
(i) Electrical equipment, control and instrumentation shall be protected against moisture and water damage. All external gasket surfaces and flange faces, couplings, motor pump shafts, bearing and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection.

(j) Equipment having antifriction or sleeve bearings shall be protected by weather tight enclosures.

(k) Coated surfaces shall be protected against impact, abrasion, discolouration and other damage. Surfaces which are damaged shall be repaired.

(l) All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors. All female threaded openings shall be closed with forged steel plugs. All pipings, tubing, and conduit equipment and other equipment openings shall be sealed with metallic or other rough usage covers and tapped to seal the interior of the equipment piping, tubing, or conduit.

(m) Provisions shall be made to ensure that water does not enter any equipment during shipment or in storage at the plant site.

(n) Returnable containers and special shipping devices shall be returned by the manufacturer’s field representative at the Contractor’s expense.

(o) While packaging the material, care shall be taken for the limitation from the point of view of availability of railway wagon sizes in India.

10.17.3 Factory Assembly

All separately packaged accessories items and parts shall be shipped with the equipment. Containers for separately packaged items shall be marked so that they are identified with the main equipment. An itemized packing ship, indicating what is in that carton only, shall be attached to the outside and inside of each container used for packing.

A master packing ship covering all accessories items for a given piece of equipment which are shipped in separate containers, shall be attached to one container.

10.17.4 Equipment Installation

(a) General Requirements

The contractor shall furnish all construction materials, tools and equipment and shall perform all work required for complete installation of all control and instrument equipment furnished under this specification.
Contractor shall prepare detailed installation drawings for each equipment furnished under this specification to EPI well in advance equipment/systems furnished by this specification shall be to satisfaction of EPI.

Erection procedures not specified herein shall be in accordance with the recommendations of the equipment manufacturers. The procedures shall be acceptable to EPI.

i) Design calculations and computations and design drawings for approval,

ii) Loading drawings setting out clearly and concisely the various loads taken into consideration for design including equipment loads.

iii) Sequence of pile driving, if piles are required.

iv) Civil and structural drawings showing arrangement, reinforcement details, architectural details, floor details, finishing works, door and windows including their fixing details, rail fixing arrangement, drainage etc.

v) Within 30 days of receipt of approval/comments on design drawings from EPI, the final working drawings including bar bending schedules shall be submitted to Employer for reference. Inserts and anchorage as required shall be shown.

vi) The contractor shall also prepare and submit structural steel fabrication drawings for reference of employer.
1.0 GENERAL

1.01 Unless otherwise specified in the nomenclature of individual item or in the specifications, for all works mentioned in this tender, the specifications and mode of measurements shall be in accordance with C.P.W.D. specifications 2009 Volume I to VI with upto date correction slips upto the date of tender. For the item not covered under CPWD specifications mentioned above, the work shall be executed as per latest relevant standards / codes published by B.I.S (formerly ISI) inclusive of all amendments issued thereto or revision thereof, if any, upto the date of submission of tender.

All mandatory tests specified in CPWD specifications 2009 Volume I to VI with upto date correction slips shall be carried out from the approved laboratories as desired by Engineer in charge of EPI. Testing charges including cartage, conveyance etc what so ever shall be borne by the contractor. If after any such test and in the opinion of the Architect / Engineer In-charge of EPI any work is found defective or unsound, the same shall have to be dismantled and to be redone by the successful bidder at their own cost.

In case of BIS (formerly ISI) codes / specifications are not available for any item of work the decision of the Engineer based on acceptable sound engineering practice and local usage shall be final and binding on the successful bidder.

1.02 The rates for different items of work shall be for all heights, lifts, leads and depths except where otherwise specified in the item of work or in additional conditions appended with the tender.

1.03 The work shall be carried out in accordance with the approved drawings. The drawings shall have to be properly co-related before executing the work. In case of any difference noticed between the drawings, final decision, in writing of the Engineer-in-Charge shall be obtained by the contractor. For items, where so required, samples shall be prepared before starting the particular items of work for prior approval of the Engineer and nothing extra shall be payable on this account.

1.04 Unless otherwise specified in the bill of quantities or drawings, the rates for all the items of work shall be considered as inclusive of pumping out water if required for which no extra payment will be made. This will include water encountered from any source such as rains, floods, sub-soil water table being high or due to any other cause whatsoever.

1.05 Any cement slurry added over base surface (or) for continuation of concreting for bond the cost for the same is deemed to have in built in the item unless otherwise / explicitly stated and nothing extra shall be payable or extra cement considered for consumption on this account.

1.06 The rates for all items in which the use of cement is involved in inclusive of charges for curing.

1.07 The contractor shall clear the site thoroughly of all scaffolding materials and rubbish etc. left out of his work dressed the site to the satisfaction of the Engineer before the work is considered as complete.
1.08 The rates shall be deemed to include making openings and making good these with the same specifications as shown in drawings and/or as directed. No extra payment shall be made to the contractor on this account.

2.0 The rates for civil works are inclusive of earthwork in excavation and backfilling, P.C.C, RCC of required grade cutting, making, bending and placement of view for cement, formwork, deshuttering, curing, bailing out water, strutting, propping, diversion of review/nallah water, cast-in situ, RCC bore piles (if required), clearing of jungle, bush, brick masonry, anchor plate, weep holes etc.

2.1 Piling work

2.2.1 BORED CAST- in-SITU PILES: All piling works until and unless specified shall be of uniform diameter bored cast in-situ piles. The work shall be executed as per IS code 2911 (Part-I Sec.-2)-1979 and its further amendments up to date. The work shall be carried out as per the foundation layout plan and relevant structural drawings.

2.2.1.1 Boring & boring equipments:

The boring operation shall be done by percussion type drilling rigs using direct mud circulation or reverse mud circulation methods. Bailer or chisel method if used should be used with caution to avoid the effect of suction. The size of cutting tool shall not be less than the diameter of pile by more than 75mm in order to install the pile of diameter as per the drawing. Equipments to be sued for piling work shall be got approved from the engineer-in-charge before erecting for piling works. Use of drilling mud for stabilizing boreholes shall be restored as per directions of the engineer-in-charge.

2.2.1.2 Stabilization of boreholes:

A minimum length of temporary casing unless otherwise specifically desired shall be inserted in each borehole in order to seal the borehole against ingress of ground water and against contamination of concrete. Additional length of casing may be used depending on the condition of the strata, ground water level etc. when concreting is carried out under water, a temporary casing shall be installed to the full depth of the borehole or 2m into non-collapsible stratum, so that fragments of ground cannot drop from the sides of the hole into the concrete as it is placed. The temporary casing may not be required except near the top when concreting is done under drilling mud.

Drilling mud of suitable consistency may also be used instead of additional casing for stabilization of boreholes.

The slurry should be maintained at 1.5m above the ground water level if casing is not used

2.2.1.3 Basic properties of drilling mud.

The bentonite suspension used for piling work shall satisfy the following requirements:-

a. The suspension of bentonite used in piling work shall have thixotropic property which permits the material to have the consistency of fluid when introduced into the borehole. It forms a jelly at undisturbed state and becomes fluid again when agitated.
b. The liquid limit or bentonite when tested in accordance with IS-2720 (Part-V) - 1965 shall be more than 300% and less than 450%.

c. The sand content of the bentonite powder shall not be more than 7%.

d. The density of the freshly prepared bentonite suspension shall be between 1.034 and 1.10 gm/ml, depending upon the pile dimension and type of soil in which the piles shall be installed. However, the density of bentonite suspension after mixing with deleterious materials/ excavated materials in the borehole may be upto 1.25 gm/ml.

e. The marsh viscosity when tested by a marsh cone shall be between 30 to 60 seconds; in special case it may be allowed upto 90. It be noted that in the later case, special methods of pumping shall be used.

f. The differential free swell shall be more than 540%

g. The PH value shall be between 9 and 11.5

2.2.1.4 Control of drilling mud:

In case a hole is bored by use of drilling mud, the specific gravity of the mud suspension near about the bottom of the hole shall, whenever practicable, be determined by suitable slurry sampler in a first few piles and at suitable interval of piles and recorded as directed by the Engineer-in-charge. Consistency of the drilling mud suspension shall be controlled throughout the boring as well as in concreting operation in order to keep the hole stabilized as well as to avoid concrete getting mixed up with the thicker suspension of the mud.

2.2.1.5 Cleaning of borehole before concreting:

In case, a bored pile is stabilized by drilling mud or by maintaining water heads within the hole, the bottom of the hold shall be cleaned very carefully before concreting work is taken up. The cleaning of the hole shall be ensured by careful operation of boring toll and / or flushing of the drilling mud through the hole / holes provided at the bottom of the boring tool. Flushing of boreholes before concreting shall be done with fresh drilling fluid/ mud.

2.2.1.6 Concrete:

The mix as stated in the item shall be used for concrete subject to slump of concrete shall range from 110 to 150mm depending as per relevant IS code.

Concreting

Concreting of the piles shall be done by tremie concreting without permitting the concrete to fall freely through the drilling mud and to avoid segregation. In addition to the normal precautions to be taken in termie concreting, the following requirements are particularly applicable to the use of tremie concrete in piles
a) The concrete shall be coherent, rich in cement as specified and of slump not less than 150mm.

b) The hopper and tremie should be a closed system embedded in the placed concrete, through which water cannot pass.

c) The tremie should be large enough with due regard to the size of the aggregate. For 20mm aggregate, the tremie pipe shall be of diameter not less than 200mm. Aggregates more than 20mm shall not be used.

d) The first charge of concrete should be placed with a sliding plug pushed down the tube ahead of it or with a steel plate of adequate charge to prevent mixing of concrete and water. However, the plug should not be left in the concrete as a lump. The tremie pipe should always penetrate well into the concrete with an adequate margin of safety against accidental withdrawal of the pipe is surged to discharge the concrete.

e) The pile should be concreted wholly by tremie and the method of deposition should not be changed part way up the pile, to prevent the laitance from being entrapped with the pile.

f) All tremie tubes shall be cleaned before and after use.

g) Normally concreting of the piles should be uninterrupted. In the exceptional case of interruption of concreting, but which can be resumed within 1 or 2 hours, the tremie shall not be taken out of the concrete. Instead it shall be raised and lowered slowly, from time to time to prevent the concrete around the tremie from setting. Concreting should resumed by introducing a little richer concrete with a slump of about 200mm for easy displacement of the partly set concrete. If the concreting cannot be resumed before final set up concrete already placed, the pile so cast shall be rejected or accepted with modifications.

h) In case of withdrawal of tremie out of the concrete, either accidentally or to remove a choke in the tremie, the tremie may be reintroduced in the following manner to prevent impregnation of laitance or scum lying on the top of the concrete already deposited in the bore.

i) The tremie shall be gently lowered on the old concrete with very little penetration initially. A vermiculite plug should be introduced in the tremie. Fresh concrete of slump between 150mm and 175mm shall be filled in the tremie which will push the plug forward and will emerge out of the tremie displacing the laitance / scum. The tremie will be pushed further in steps making fresh concrete sweep away laitance/scum in its way. When tremie is buried by about 60 to 100cm, concreting may be resumed.

j) The top of concrete in a pile shall be brought at least 60cm above the cut-off level to permit removal of all laitance and weak concrete before capping and to ensure
good concrete at the cut-off level for proper embedment into the pile cap. Prior to pile cap/ tie beam top 60cm must be dismantled at contractor's cost. The rates quoted should cover these scopes of works.

2.2.1.7 Control of piling installation:

Piles shall be installed as accurately as possible as per design, drawing either vertically or to the specified batter.

a) Control of alignment: The maximum allowable tolerance for the piling installation shall be as follows:-

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal displacement</td>
<td>50mm</td>
</tr>
<tr>
<td>Vertical displacement of pile toe with respect to the Top of pile at working level pile</td>
<td>1.5% of the length of the pile</td>
</tr>
</tbody>
</table>

b) Control of cover: The minimum clear cover to all main reinforcement in pile shaft and to the bottom of the pile shall be not be less than as specified in the drawing. Provision shall be made to maintain clear cover in sides as well as at the bottom as specified during insertion of reinforcement cage, during concreting as well as during withdrawal of tremie pipes to the satisfaction of the Engineer-in-Charge.

2.2.1.8 Defective piles:

In case, defective piles are formed, they shall be removed or left in place whichever is convenient without affecting the performance of the adjacent piles or the cap as a whole. Additional piles shall be provided to replace them as directed at the contractor’s cost. Any deviation from the designed location, alignment or load capacity of any pile shall be noted and adequate measures taken well before the concreting of the pile cap and plinth beam if the deviations are beyond the permissible limit. For all the defects attributable to the contractor in this connection shall be rectified at the contractors cost.

2.2.1.9 Pile load tests:

Pile load Tests: The pile load test shall have to be carried out as per the latest edition of IS-2911-Part—IV.

Load Test:

Measurement will be taken for static/ dynamic, lateral load or pull out tests on single piles or groups as per specification and schedule of items on each occasion of test.

3.0 CIVIL FINISHES

Civil finishes shall be as mentioned in the relevant drawings, specifications and schedule of finishes.
3.1 The contractor shall be responsible for structural soundness of the project in all respects and a certificate thereon shall be furnished by the contractor to EPI on the completion of the work.

4.0 MATERIAL

All materials shall be of standard quality and from approved manufacturer, conforming to Indian Standards or equivalent and shall have BIS Mark as far as possible unless otherwise approved by Engineer-in-Charge. The contractor shall get all materials approved by Engineer-in-Charge prior to procurement and use. The contractor shall furnish manufacturers certificates, for the material supplied by him when asked for. Further to that he shall get all the materials tested from an approved test house, if asked for by the Engineer-in-Charge. The cost for all tests and test certificates shall be borne by the contractor. No separate payment shall be made for the testing. The Engineer-in-Charge shall have the right to determine whether all or any material are suitable. If any material procured or brought to site found not conforming to specifications and satisfaction of Engineer-in-Charge, the contractor shall have to remove the same immediately from the site at his own expense and without any claim for compensation due to such rejection.

The contractor shall submit documentary evidence e.g. challans, bills etc. against the construction materials brought to site as a check to ensure that the required quantities as required for execution of works as per specification have been brought to site for incorporation in the work.

The contractor shall ensure that the bought out materials are brought to site in original sealed containers or packing bearing name of manufacturer and brand.

4.1 CEMENT

General: The cement shall be ordinary Portland cement of 43/53 grade conforming to IS: 8112 / IS: 12269 of approved manufacturer, as applicable for design and drawing.

4.2 REINFORCEMENT STEEL

General: Thermo Mechanically Treated bars conforming to IS : 1786 of approved makes shall be used.

4.3 BRICKS

The bricks shall be of approved quality having a minimum compressive strength of 75 Kg / cm², best quality locally available, well burnt, sound and of uniform quality and colour. These shall be free from salt and of standard size and shall conform to IS: 1077.

The water absorption shall not be more 20% of its dry weight when soaked in cold water for 24 hours, as per IS : 3102. The tolerance limit shall be 3% for absorption.

The brick sample taken at random from the lot shall be deposited with, and be approved by the Engineer-in-Charge before being used. All subsequent deliveries shall be upto the standards of the approved sample.
4.4 COARSE AGGREGATE

General: Aggregate of sizes between 4.75 mms to 150 mms will be termed as coarse aggregate. Coarse aggregate from approved quarries and conforming to IS: 383 will only be allowed to be used for the works. Coarse aggregate for reinforced concrete work shall consists of approved broken stone aggregate free from flat laminated or elongated pieces and shall be free from any organic material and shall be within the limits of the relative grading in IS – 383 table – II. Unless otherwise shown on the drawings all coarse aggregate in reinforced concrete shall be graded crushed stone aggregate of 20mm nominal size.

For plain cement concrete 40 mm down / 20 mm down coarse aggregate as per IS : 383 shall be used as per instructions of Engineer-in-Charge.

4.5 FINE AGGREGATE

Aggregate smaller than 4.75mm and within the grading limits and other requirements set in IS: 383 is termed as Fine aggregate or sand. Fine aggregate from approved sources and conforming to the above IS specification shall only be allowed to be used for the works.

For reinforced concrete, plain cement concrete, Brick work, stone work etc. sand of zone I & II shall only be used. Sand shall be clean river or pit sand of approved quality and shall be free from salts, earth dust or others impurities. It shall be washed with clean water and not more than 5% fine materials shall be allowed by settlement in water and passing through 10,000 mesh sieve.

For plasters sand of zone – II / zone – III shall be used as per instructions of Engineer-in-Charge.

4.6 Water: Water shall be clean and reasonably free from injurious deleterious materials, generally potable water shall be used.

5.0 OTHER MATERIALS

All materials not fully specified herein and which may be used in the work shall be approved by the Engineer-in-Charge and he shall have right to determine whether all or any of the materials offered or delivered for use in the work are suitable for the purpose. Contractor shall give the samples of materials to Engineer-in-Charge and shall get it approved before procurement and use.

6.0 PLAIN AND REINFORCED CONCRETE

This section of the specification deals with cement concrete plain or reinforced for general use and covers the requirements for concrete mix design, strength and quality, pouring at all levels, form work, protection, covering, finishing, admixtures, inserts, and other miscellaneous works. The provision of the latest version of IS : 456 shall be compiled with unless permitted otherwise and any other Indian Standard Code (Latest Revision) shall form part of the specification to the extent it has referred to or applicable within this specification.
6.1 **GRADE OF CONCRETE**

All reinforced concrete shall be either nominal mix concrete or design mix concrete and of grade M – 25 unless otherwise specified in drawing.

6.2 **NOMINAL MIX CONCRETE**

In proportioning concrete, the minimum quantity of cement shall be as specified in Table I of this specification and the amount to be actually used shall be determined by weight. The quantities of fine and coarse aggregates may be determined by volume, but preferably should be by weight. If fine aggregates are moist, allowance shall be made for bulking in case of volume batching in accordance with IS: 2386 (Part III). Allowance shall also be made for surface water present in the aggregates when computing the water content. The amount of surface water shall be determined by one of the field methods described in IS: 2386 (Part III). All the above data shall be maintained properly to the satisfaction of the Engineer-in-Charge.

The water cement ratio shall not be more than specified in IS : 456 (Latest edition) for respective grade of concrete. The cement in any nominal mix concrete proportion shall be increased if the quantity of water in a mix has to be increased to overcome the difficulties of placement and compaction so that the water cement ratio specified for a particular grade of concrete is not exceeded. No extra payment shall be made to the contractor for use of the extra cement. If nominal mix concrete made in accordance with the proportion given in IS : 456 for a particular grade dose not yield the specified strength and fails to satisfy the requirements of “Acceptance Criteria” for concrete as specified in IS : 456 the cement content shall be increased as directed by the Engineer-in-Charge to obtain the specified strength at no extra cost.

The use of richer mix shall be continued until the Engineer-in-Charge instructs otherwise.

Nominal mix concrete proportioned for a given specified grade including cases where the Engineer-in-Charge directs use of additional cement over the quantity specified for the particular grade, shall not, however, be placed in a higher grade on the ground that the test strengths are higher than the minimum specified for the desired grade.

6.3 **MIX PROPORTIONS**

The mix proportions for grades of concrete specified in drawings shall be designed to obtain strength corresponding to the values specified in IS : 456 for respective grades of concrete.

Preliminary tests, as specified in the IS code or as required by the Engineer-in-Charge, shall be carried out sufficiently ahead of the actual commencement of the work with different grades of concrete made from representative sample of aggregate and cement expected to be used on the job to ascertain the ratios by weight of cement to total aggregate, of fine to coarse aggregate and water cement ratio required to produce a concrete having specified strength and sufficient workability to enable it to be well consolidated and to be worked into corners of shuttering and around the reinforcement.
**TABLE – I**

MINIMUM CEMENT CONTENT SPECIFIED FOR DIFFERENT GRADES OF CONCRETE

<table>
<thead>
<tr>
<th>Grade of Concrete</th>
<th>Minimum cement content per Cum of finished concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>M – 10</td>
<td>236 Kg.</td>
</tr>
<tr>
<td>M – 15</td>
<td>310 Kg.</td>
</tr>
<tr>
<td>M – 20</td>
<td>360 Kg.</td>
</tr>
<tr>
<td>M – 25</td>
<td>410 Kg.</td>
</tr>
<tr>
<td>M – 30</td>
<td>500 Kg.</td>
</tr>
</tbody>
</table>

**LIMITS OF CONSISTENCY**

<table>
<thead>
<tr>
<th>Degree of Workability</th>
<th>Slump in mm, with standard code as per IS : 1199</th>
<th>Use for which concrete is suitable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min.</td>
<td>Max.</td>
<td></td>
</tr>
<tr>
<td>Very Low</td>
<td>0 25</td>
<td>Vibrated concrete in roads or Large sections.</td>
</tr>
<tr>
<td>Low</td>
<td>25 50</td>
<td>Simple reinforced sections with vibrations.</td>
</tr>
<tr>
<td>Medium</td>
<td>50 100</td>
<td>Normal reinforced wall and Heavily reinforced sections With vibration.</td>
</tr>
</tbody>
</table>

**Note:** Not with standing the above, the slump to be obtained for work in progress shall be as per the instructions of the Engineer-in-Charge.

6.4 **WORKMANSHIP**

All workmanship shall be according to the latest and best possible standard.

Before starting any pour the contractor shall obtain the approval of the Engineer-in-Charge. He shall obtain complete instruction about the materials and proportion to be used, slump, workability, quantity of water per unit weight of cement, number of test cubes to be taken, type of finishing to be done, any admixture to be added, any limitation on size of pour and stopping of in case of premature stopping of pours.

Before pouring any concrete the reinforcement steel, shuttering, staging, inserts etc. are to be got checked by the Engineer-In-Charge of EPI, to be recorded in the stage passing register and to be got signed by Engineer-In-Charge of EPI. Quality of stone chips, sand etc. and availability of the same in adequate quantity shall also to be got checked by Engineer-In-Charge of EPI.
6.5 **MIXING OF CONCRETE**

All concrete shall be mixed in a mechanically operated mixer of minimum capacity of 14 / 10 and including mechanically operated hopper capable of ensuring of uniform distribution of the materials throughout the mass. The proportion of fine and course aggregate, cement and water shall be as determined by the mix design or according to the fixed proportions in case of nominal mix concrete and shall be approved by the Engineer-in-Charge. The quantities of cement, fine aggregate and course aggregates shall be determined by weight. The water shall be measured accordingly after giving proper allowance for surface water present in the aggregate for which regular check shall be made by the contractors.

Water shall not be added to the mix until all the cement and aggregates constituting the batch are already in the drum and dry mixed for at least one minute. Mixing of each batch shall be continued until there is a uniform distribution of the materials but in no case shall mixing be done for less than two (2) minutes and at least forty (40) revolutions after all materials and water are in the drum. When absorbent aggregates are used or when the mix is very dry, the mixing time shall be extended as be directed by the Engineer-in-Charge. Mixer shall not be loaded above their rated capacity as it prevents through mixing. If there is segregation after unloading from the mixer the concrete should be remixed.

The entire contents of the drum shall be discharged before the ingredients for the next batch are fed into the drum. No partly set or remixed or excessively wet concrete shall be used and it shall be immediately removed from the site. Each time the work stops, the mixer shall be thoroughly cleaned and when the next mixing commences, the first batch shall have 10% additional cement at no extra cost to the owner to allow for loss in the drum.

6.6 **PLACEMENT OF CONCRETE**

Form work and reinforcement shall be approved in writing by the Engineer-in-Charge before concrete is placed. The forms shall be well wetted and all shavings, dirt and water that may have collected at the bottom shall be removed before concrete is placed. Concrete shall be deposited in its final position without segregation, re-handling or flowing. The interval between adding the water to the dry materials in the mixer and the completion of the final placing including compaction of the concrete shall be well within the initial setting time for the type of cement in use or as directed by the Engineer-in-Charge.

As far as possible, concrete shall be placed in formwork by means approved by the Engineer-in-Charge and shall not be dropped from a height or handled in a manner which may cause segregation. Any drop over 180 cm shall be approved by the Engineer-in-Charge. Once the concrete is deposited in its final position, it shall not be disturbed. Care should be taken to avoid displacement of reinforcement or movement of form work.

The placing of concrete shall be a continuous operation with no interruption in excess of 30 minutes between the placing of continuous portions of concrete.

After the concrete has been placed it shall be spreaded and thoroughly compacted by approved mechanical vibration to a maximum subsidence without segregation and thoroughly worked around reinforcement or other embedded fixtures to correct form and shape. Vibrators shall not be used for pushing and shoveling concrete into adjoining areas. Vibrators must be operated by experienced men and over-vibration shall not be
permitted. Hand tamping in some cases may be allowed subject to the approval to ensure that the inserts, fixtures, reinforcement and form work are not displaced or disturbed during placing of concrete. No concrete shall be placed in open while washing of cement and sand, the concrete shall be entirely removed immediately. Suitable precautions shall be taken in advance to guard against rains before leaving the fresh concrete unattended. No accumulation of water shall be permitted on or around freshly laid concrete. Slabs, Beams and similar members shall be poured in one operation normally. In special circumstances with the permission of Engineer-in-Charge these can be poured in horizontal layers not exceeding fifty (50) cm in depth. When poured in layers, it must be ensured that the under layer, is not already hardened. Bleeding of under layer if any, shall be effectively removed. Moulding, throating, drip courses, etc., shall be poured as shown in the drawing or as desired by the Engineer-in-Charge. Holes shall be left in concrete as shown on the approved drawings or as directed by the Engineer-in-Charge.

Whenever vibration has to be applied externally the design of formwork and the disposition of vibrators shall receive special consideration to ensure efficient compaction and to avoid surface blemishes.

6.7 CURING AND PROTECTION OF CONCRETE

Newly placed concrete shall be protected by approved means from rain, sun & wind. Concrete placed below ground level shall be protected from falling earth during and after placing. Concrete placed in ground containing deleterious substances shall be kept free from contact with such ground or with water draining from such ground during placing of concrete for a period of at least three days or as otherwise instructed by the Engineer-in-Charge. The ground water around newly poured concrete shall be kept to an approved level by pumping or other approved means of drainage. Adequate steps shall be taken to protect immature concrete from drainage by debris, excessive loading, vibration etc., which may impair the strength and durability of the concrete.

All fresh concrete shall be covered with a layer of Hessian or similar absorbent materials, and kept constantly wet for a period of fourteen days or more from the date of placing of concrete as per directions of the Engineer-in-Charge. Curing can also be done by ponding. Concrete slabs and floors shall be cured by flooding with water of minimum 25 mm depth for the period mentioned above. Steps shall also be taken to protect immature concrete from damage by debris, excessive loading, vibrations, abrasion, deleterious ground water, mixing with earth or foreign materials, floatation etc. that may impair the strength and durability of the concrete. Approved curing compounds may be used in view of moist curing with the permission of the Engineer-in-Charge. Such compounds shall be applied to all the exposed surfaces of the concrete as soon as possible after the concrete has set.

6.8 TESTING AND ACCEPTANCE CRITERIA

The contractor shall carry out all sampling and testing in accordance with the relevant Indian Standards at his own cost, in a laboratory approved by the Engineer-in-Charge.

6.8.1 TESTING OF CONCRETE

a) Normally, only compression tests shall be performed but the Engineer-in-Charge may require other tests to be performed in accordance with IS: 516 (Latest Edition).
b) The minimum frequency of sampling for each grade of concrete shall be as follows:

<table>
<thead>
<tr>
<th>Quantity of concrete in the work cu.m</th>
<th>Number of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 5</td>
<td>1</td>
</tr>
<tr>
<td>6 – 15</td>
<td>2</td>
</tr>
<tr>
<td>16 – 30</td>
<td>3</td>
</tr>
<tr>
<td>31 – 50</td>
<td>4</td>
</tr>
<tr>
<td>51 &amp; above</td>
<td>4 plus one additional sample for each additional 50 cum or part thereof.</td>
</tr>
</tbody>
</table>

However at least one sample shall be taken from each shift.

At least 6 (six) specimens per sample shall be taken and 3 (three) of these shall be tested at 7 (seven) days and the remaining at 28 days. Minimum compressive strength on 15 cm cubes of different grades of concrete at 7 days shall be as per table 5 of IS: 456-1978.

a) To control the consistency of concrete from every mixing plant, slump test and or compaction factor test in accordance with IS: 1199 shall be carried out by the contractor every two hours or as directed for the test specimens and shall be recorded for reference. The Engineer-in-Charge may, at his discretion, may waive the above tests for small and unimportant concreting.

6.8.2 ACCEPTANCE CRITERIA FOR CONCRETE

a) The acceptance criteria for concrete shall be in accordance with IS: 456 (Latest Edition). However, in exceptional circumstances, the Engineer-in-Charge may, at his discretion, accept a concrete of lower strength than specified and which is otherwise unacceptable according to IS: 456 (Latest Edition).

b) Payment for concrete which is normally unacceptable as per the criteria laid down in IS: 456, but has been accepted by the Engineer-in-Charge shall be made at a reduced rate prorate to the strength obtained.

c) Concrete work found unsuitable for acceptance shall have to be dismantled and replacement is to be done as per specification by the contractor. No payment shall be made for the dismantled concrete, the relevant formwork and reinforcement, embedded fixtures, etc. wasted in the dismantled portion. If any damage is done to the embedded portion or adjacent structures, the same shall be made good, free of charge by the contractor, to the satisfaction of the Engineer-in-Charge.

6.8.3 LOAD TEST OF CONCRETE

Load test on concrete, if desired by the Engineer-in-Charge, shall be carried out as soon as possible after expiry of 28 days from the time of placing of concrete as per IS : 456. Entire cost of load testing shall be borne by the contractor and if, any portion of the structure is found unacceptable under the relevant clause of IS: 456, the same shall be dismantled and replaced by a new structure as per specification at no extra cost. If the
adjacent structure gets damaged, the same shall be made good free of charge by the contractor to the satisfaction of the Engineer-in-Charge.

7.0 FABRICATION AND PLACEMENT OF REINFORCEMENT STEEL

The contractor shall prepare and furnish to EPIL bar-bending schedule with working drawings for all R.C.C. works for review and approval by the Engineer-in-Charge. No work shall be commenced without the approval of the bar-bending schedule by the Engineer-in-Charge.

The contractor shall supply, fabricate and place the reinforcement steel to shapes and dimensions as per drawings and specifications.

Any adjustment of reinforcement to suit field conditions, construction joints other than those shown on drawings shall be subject to approval of the Engineer-in-Charge.

7.1 CLEANING

Before placing the concrete all steel for reinforcement shall be made free from loose scale, rust, oil, grease, paint or any other harmful matter which may effect its bond with concrete.

7.2 BENDING

Unless otherwise specified, reinforcing steel shall be bent in accordance with procedure specified in IS: 2520 and or as approved by the Engineer-in-Charge. Bends and shapes shall comply strictly with the dimensions given in the approved Bar Bending schedule. Bending schedule shall be rechecked by the contractor before bending and he shall be entirely responsible for its correctness.

No reinforcement steel shall be bent when in position in the work without approval of Engineer-in-Charge, whether or not it is partially embedded in concrete. Bars shall not be straightened in manner that will injure the material. Re-bending can only be done if approved by the Engineer-in-Charge. Reinforcement bars shall be bent by machine or other approved means producing a gradual and even motion.

7.3 PLACING IN POSITION

All reinforcement shall be accurately fixed and maintained in position as shown on the drawings by such approved means as steel chairs and or concrete spacer blocks. Bars intended to be in contact at crossing points shall be securely bound together at all such points by 20 Gauge annealed soft iron wire.

Binders shall tightly embrace the bars with which they are intended to be in contact and shall be securely held. The vertical distance between successive layers of bars shall be maintained by provision of steel spacer bars. They should be so spaced that the main bars do not sag perceptively between adjacent spacers.

The placing of reinforcement steel shall be completed well in advance of concrete pouring. Immediately before pouring, the reinforcement steel shall be checked by the Engineer-in-
Charge for accuracy of placement and cleanliness and necessary corrections as directed by him shall be carried out. The concrete cover over the reinforcement shall be as shown on the approved drawings unless otherwise directed by the Engineer-in-Charge. Care should be taken to ensure that projecting ends of ties and other embedded metal do not encroach into the concrete cover. Where concrete blocks are used for ensuring the cover and positioning reinforcement, they shall be made of mortar 1:2 (one part cement: two parts sand) by volume and cured for at least 7 days. The sizes and locations of the concrete blocks shall be approved by the Engineer-in-Charge. Laps and anchorage lengths of reinforcing bars shall be in accordance with IS:456, unless otherwise specified. If the bars in a lap are not of the same diameter, the smaller will guide the lap length. The laps shall be staggered as far as practicable and as directed by the Engineer-in-Charge, and not more than 50% of bars shall be lapped at particular section.

8.0 The successful bidder shall establish a field testing laboratory at site, equipped with the minimum following equipments.

1. One no. compression testing machine of 100 tone capacity suitable for testing concrete cube of 150 mm x 150 mm x 150 mm size.

2. One no. electronic weighing machine with maximum weight of 10 kg.

3. 24 nos. MS cube moulds of size 150 mm x 150 mm x 150 mm.

4. One no. slump cone.

5. One set of sieves for fine aggregate. (includes sieves of designation 4.75 mm, 2.36 mm, 1.18 mm, 600 microns, 300 microns, 150 microns).

6. One set of sieves for coarse aggregate. (includes sieves of designation 37.5 mm, 19 mm, 9.5 mm, 4.75 mm).

7. One no. silt testing jar.

8. One no. electric oven.

9. One no. vernier calliper.

10. One no. screw gauge.

Note: The above list is indicative only. the contractor shall remain bound to augment / provide the equipment as required for completeness of the work.