



**ASSAM ELECTRICITY GRID
CORPORATION LIMITED**

**BID SPECIFICATION
FOR**

**“Construction of 220KV A+6 tower on pile foundation
in place of river eroded tower at loc 207 of 132 KV LTPS-
Mariani S/C feeder under UATTC, AEGCL”**

**Bid identification no
AEGCL/MD/Tech-PILE/2018/32**

₹ 2000/-

SECTION – 1

INSTRUCTION TO BIDDER

1.1.0 Scope of Bid

1.1.1. The ASSAM ELECTRICITY GRID CORPORATION LIMITED, herein after referred to as AEGCL or Employer will receive bids for the following work on turnkey basis under the deposit scheme.

1.1.2.

Sl. No.	Description	Bid Reference No.	EMD Amount (Rs.)
(i)	Construction of 220KV A+6 tower on pile foundation in place of river eroded tower at loc 207 of 132 KV LTPS-Mariani S/C feeder under UATTC, AEGCL	AEGCL/MD/Tech-PILE/2018/32	Rs 2,50,000.00

b) **Scope of Works:** - The scope of works briefly covers the following:

- I. Supply/fabrication of 220 KV Galvanized tower materials.
- II. OPTICAL Ground Wire (OPGW), Insulators, Hardware materials... etc
- III. Construction of foundations for 220 KV D/C towers including setting of stubs.
- IV. Erection of towers on the foundations.
- V. Stringing of conductor and ground wire complete and commissioning.

1.1.3 **Bidders should bid online for supply, erection and dismantle to complete the work.**

1.1.4 The successful bidder will be expected to complete the Works within **6 months** from the date of issue of work order.

1.2.0 Qualification of the Bidder

1.2.1. To be qualified for award of Contract, bidders:

- (A)** shall submit a written power of attorney authorizing the signatory of the bid to commit the bidder;
- (B)** The bidder must possess electrical contractor license from the concerned Govt. authority. A copy of the license should be submitted with the offer, and
- (C)** must compulsorily meet each of the following minimum criteria
 - (i) EXPERIENCE**
 - The bidder should have experience in similar nature of 132 KV & above transmission line work on **turnkey** basis to qualify for the bid.

(ii) PERSONNEL CAPABILITY

The Bidder must be suitably qualified personnel to fill positions required for contract implementations. The Bidder will supply information of the key personnel, design & engineering staff, support staff, field staff giving details of experience in supply and erection of transmission line

(iii) FINANCIAL CAPABILITY

- The Bidder should furnish necessary documents to show that he has access to, or has available, liquid assets, unencumbered real assets, line of credit and other financial means (inter alia including a Guarantee or an undertaking from a Bank or financier).
- **The average annual turnover of the bidder for the three best financial years out of the last five financial years at minimum should be 1 (one) Crore.**
- **Bidder must submit annual turnover report in a separate sheet with the certification from approved Charter Accountant / firm.**
- Bidder shall submit online the scanned copy of complete annual reports together with Audited statement of accounts of the company for last five years.
- The Bidder shall submit online the scanned copy of audited balance sheet and income statement of its own (separate) for the last five years and must demonstrate the soundness of their financial position showing long term profitability. Wherever necessary the Employer may make enquiries with Bidder's bankers

(iv) EQUIPMENT CAPABILITIES

The bidder should assure access to supply of fabricated steel structures and shall furnish necessary proof that he or his supplier has capable of, manufacture & supply of such material. Bidders are further to assume that based on the known commitments the materials will be available for use in the proposed contract.

(v) LITIGATION HISTORY

Bidders shall submit details of all litigation, arbitration or other claims, whether pending, threatened or resolved in the last five years.

The Bidder's offer shall include and substantiate data on qualifying requirements such as in addition to given as above:

- a) ***Copies of original documents defining the constitution or legal status, place of registration, and principal place of business, written power of attorney of the signatory of the Bid to commit the Bidder.***
- b) ***Copies of valid Electrical Contractor License issued by competent authority in the State of Assam or in the State where the bidder's business is registered.***
- c) ***Total monetary value of similar work performed by the bidder in each of the last five years.***
- d) ***Experience in works of a similar nature and volume for each of the last five years, and details of works under way or contractually committed; and clients who may be contacted for further information on those contracts.***
- e) ***Qualifications and experience of key site management and technical personnel proposed for the Contract.***
- f) ***Reports on the financial standing of the Bidder, such as profit and loss statements and auditor's reports for the past five years.***

- g) *The Bidder must demonstrate access to, or availability of, financial resources such as liquid assets, unencumbered real assets, lines of credit, and other financial means, other than any contractual advance payments to meet the cash-flow requirement, of Rs.25,00,000.00. plus its financial obligation for its Current Contract Commitments.*
- h) *Information regarding any litigation, current or during the last five years, in which the Bidder is involved, the parties concerned, and disputed amount.*
- i) *The Bidder should also substantiate availability (either owned or leased) of the tools, tackles, spare parts etc. for carrying out the works.*

1.2.2. Even if the bidders meet the above qualifying criteria, they are subject to be disqualified if they have made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements.

1.2.3. Notwithstanding anything stated herein above, AEGCL reserves the right to assess the capacity and capability of the bidder to execute the work, should the circumstance warrant such assessment in the overall interest of AEGCL

1.3.0 Joint Venture

1.3.1 Bids submitted by a joint venture of two or more firms as partners shall comply with the following requirements:

- (a) The Bid, and, in case of successful Bid, the Form of Agreement shall be signed by all the Partners so as to be legally binding on all partners.
- (b) One of the partners shall be authorized to be as the Lead Partner and submitting a Power of Attorney signed by legally authorized signatories of all the partners shall evidence this authorization.
- (c) The Lead partner shall be authorized to incur liabilities, receive payments and receive instructions for and on behalf of any or all partners of the joint venture and the entire execution of the Contract;
- (d) All the partners of the Joint Venture shall be jointly and severally liable for the execution of the contract in accordance with the contract terms and a relevant statement to this effect shall be included in the authorization mentioned under (b) above as well as in the Bid Form and the Form of Agreement (in case successful bidder).
- (e) A copy of the agreement entered into by the Joint Venture partners shall be submitted with the Bid.
- (f) **Joint Venture agreement must be registered in the Court of Law. Notarized Joint venture agreement shall not be acceptable**

The figures of average annual turnovers and cash flows for each Joint Venture partners shall be added together to determine the bidder's compliance with the minimum financial capability requirements for the package. However, the lead partner must meet at least 40% and each of the other partners must meet at least 20% of the minimum average annual turnover criteria given above

1.4.0 Cost for Bidding

1.4.1. The bidder shall bear all costs associated with the preparation and submission of its bid and AEGCL will in no case be responsible or liable for those costs.

1.5.0 Right of Way

- 1.5.1. Right of way along the surveyed route for diversion shall be arranged by AEGCL and co-ordinated by the contractor. Any type of **compensation that may be necessary shall be paid by the contractor**. The bidder on its own responsibility may visit and examine the Site of Works and its surroundings and obtain information that may be necessary for preparing the bid.
- 1.5.2. A prospective bidder may ask AEGCL in writing for any clarification on the bidding documents at the following address

Managing Director.
Assam Electricity Grid Corporation Limited,
Bijulee Bhawan, Paltanbazar, Guwahati-781001.

1.6.0 Amendment of Bidding Documents

- 1.6.1. At any time prior to the deadline for submission of bids, the Employer may for any reason modify the bidding documents by issuing addenda which shall be communicated in writing to all purchasers of the bidding documents.
- 1.6.2. Any addendum thus issued shall be part of the bidding documents.

1.7.0 Language of Bid

- 1.7.1. The bid, and all correspondence and documents related to the bid, exchanged between the bidder and the Employer shall be in the English language.

1.8.0 Documents Comprising the Bid

- 1.8.1. The bid submitted **online** by the bidder shall comprise **technical proposal** and the **price proposal separately**.
- 1.8.2. The Bid submitted online by bidders shall contain the following:
 - a Bid Submission Sheet (Refer Section 4).
 - b Documentary evidence to establish that the Bidder meet the qualifying requirements in accordance with Clause 1.2.0.
 - c Documents to be furnished as per Clause 1.2.1.
 - d The Bid Guarantee (Bid Security) in accordance with Clause 1.11.0 & its sub clauses of this Section.
 - e All Bidding Schedules (**Section-4**) properly filled up including Price Bid Schedules.

1.9.0 Bid Form and Price Schedules

- 1.9.1. The Bidder shall complete the Bid Form and the appropriate Price Schedules furnished in the bidding documents in the manner and detail indicated therein, following the requirements of Clauses 1.9.0 and 1.9.1.

1.9.2. **Bid Prices**

1.9.3. Bidders shall quote for the entire facilities on a "single responsibility" basis such that the total bid price covers all the Contractor's obligations mentioned in or to be reasonably inferred from the bidding documents in respect of procurement and subcontracting (if any), delivery, construction, installation and completion of the facilities. This includes all requirements under the Contractor's responsibilities for testing and commissioning of the facilities and, where so required by the bidding documents and in accordance with the requirements of the General Conditions of Contract.

1.9.4. Bidders shall use only the items mentioned in the (Price Schedules) while filling up the Price Bidding Schedules. Any other items which are reasonably inferred or necessary for satisfactory completion of the works covered in the Bidding Document, but which are not specifically specified in the above mentioned Schedule of Items shall deemed to be included in other items of those Schedules. No payment shall be made separately for those items.

1.9.5. Bidders shall give a breakup of the prices in the manner and detail called for in the **Schedules of Prices**

1.9.6. In the Schedules, Bidders shall give the required details and a breakup of their prices, including all taxes, duties, levies, and charges payable for both supply and erection.

1.9.7. **Price Adjustment**

Prices quoted by the Bidder shall not be subject to adjustment during performance of the contract to reflect changes in the cost of labour, fuel, material, equipment and transport components. Duties and Taxes shall not also be adjusted, except there is variation due to changes in legislation of the Country.

1.9.8. **Insurance**

The Bidder shall insure the Works in accordance with the requirements of General Conditions of Contract. The bid price shall include all costs in pursuance of fulfilling insurance liabilities under the contract.

1.10.0 **Bid Validity**

1.10.1. Bids shall remain valid for a period of 180 (One hundred and eighty) days after the date of opening of Bids.

1.10.2. In exceptional circumstances, prior to expiry of the original bid validity period, AEGCL may request that the bidders extend the period of validity for a specified additional period. The request and the responses thereto shall be made in writing. A bidder may refuse the request without forfeiting its bid security. A bidder agreeing to the request will not be required or permitted to modify its bid, but will be required to extend the validity of its bid security for the period of the extension, and in compliance with Clause 1.11.0 in all respects.

1.11.0 **Bid Security (Earnest Money)**

1.11.1. The Bidder shall furnish, as part of its bid Proposal, a bid security **as per bid document clause no 1.1.2**. Scanned copy of the bid security must be submitted along the technical bid proposal.

1.11.2. The bid security shall be in the form of an irrevocable Bank Guarantee issued by Nationalized Bank in favour of "**Chief General Manager, Assam Electricity Grid Corporation**

Limited,Guwahati". The bid security shall remain valid for 30 days beyond the original validity period for the bid, and beyond any period of extension subsequently requested.

- 1.11.3. **Original Instrument copy of Earnest Money (BG) and Joint Venture (if any) has to be submitted at the office prior to one hour on the final time and date of the opening of Bid.**
- 1.11.4. Any bid not accompanied by an acceptable Bid Security shall be rejected as non-responsive.
- 1.11.5. The bid securities of unsuccessful bidders will be returned as promptly as possible, after the expiry of the period of bid validity.
- 1.11.6. The bid security may be forfeited
 - (a) if the bidder withdraws its bid, except as provided in Sub-Clause ;
 - (b) if the bidder does not accept the correction of its bid price, pursuant to Sub-Clause 1.17.3; or
 - (c) in the case of a successful bidder, if it fails within the specified time limit to
 - (i) sign the Contract Agreement,
- 1.11.7. No interest shall be payable by the Employer on bid guarantee.

1.12.0 Alternative Proposals by Bidders

- 1.12.1. Bidders shall submit online offers, which comply with the Bidding Documents, including the basic Employer's Requirements as indicated in the bidding documents. Alternatives will not be considered.

1.13.0 Format and Signing of Bid

- 1.13.1. The bidder shall submit the bid proposal **online**, envelope wise separately. In the event of discrepancy between the original and any copy, the original shall prevail. However, AEGCL may ask bidder to submit hard copies of GTP, Drawings, Manufacturers authorization of the major items and **any other document** if deemed necessary.
- 1.13.2. The original and scanned copies of the bid shall be signed by a person or persons duly authorized to sign on behalf of the bidder, pursuant to Sub-Clauses. All pages of the bid where entries or amendments have been made shall be initialed by the person or persons signing the bid.
- 1.13.3. The bid shall contain no alterations, omissions or additions, except those to comply with instructions issued by AEGCL, or as necessary to correct errors made by the bidder, in which case such corrections shall be initialed by the person or persons signing the bid.
- 1.13.4. **The Bid must contain the name, phone number, E-mail ID, address of residence and place of business of the person or persons making the Bid and must be signed and sealed by the Bidder with his usual signature. The names of all persons signing should also be typed or printed below the signature.**
- 1.13.5. Bids by Corporation / Company must be signed with the legal name of the Corporation/Company by the President, Managing Director or by the Secretary or other person or persons authorized to Bid on behalf of such Corporation/Company in the matter.
- 1.13.6. A Bid by a person who affixes to his signature the word 'President', 'Managing Director', 'Secretary', 'Agent', or other designation without disclosing his principal will be rejected.
- 1.13.7. Satisfactory evidence of authority of the person signing on behalf of the Bidder shall be furnished with the Bid.
- 1.13.8. The Bidder's name stated on the proposal shall be exact legal name of the firm
- 1.13.9. Bids not conforming to the above requirements of signing may be disqualified.

1.14.0 Sealing and Marking of Bids

1.14.1 Only the E-bids shall be acceptable

1.14.2 The due process for online bidding should be followed

1.14.3 The uploaded tender document should clearly contain the name of the document.

(a) The hard copies of the Bid securities, Joint venture (if any) etc should be sent to the following address:

**Managing Director,
Assam Electricity Grid Corporation Limited
Bijuli Bhawan, Guwahati- 781 001
ASSAM**

1.14.4 Submission of Bids

1.14.5. Submission, Sealing and Marking of Bids

1.14.5.1 Bidders must submit their bid **online**. Procedures for online submission of bid are in accordance with **IFB & as given in the portal**.

1.14.5.2 Bidders submitting bids online shall upload scanned copy of the original and each copy of the Bid, The rest of the procedure shall be in accordance with **IFB** .

1.14.6 Deadline for Submission of Bids

Bids must be submitted online on stipulated time and no bid can be accepted by the system after expiry of closing time.

1.14.4 Bid withdrawal

A Bidder may withdraw, substitute, or modify its bid after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization. The written confirmation of authorization to sign on behalf of the Bidder shall consist of a written confirmation of Authorization to sign on behalf of the Bidder shall consist of **Notarized Power of Attorney**, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the bid must accompany the respective written notice. All notices must be:

(a) Prepared and submitted in accordance with **Section 1.8.2** and **1.13.0**(except that withdrawals notices do not require copies), and in addition, the respective envelopes shall be clearly marked "Withdrawal," "Substitution," "Modification;" and

(b) Received by the Purchaser prior to the deadline prescribed for submission of bids, in accordance with **Section 1.14.6**

1.15.0 Late Bids

1.15.1 Any bid received by AEGCL after the deadline for submission of bids prescribed in Clause will be rejected and returned unopened to the bidder.

1.15.0 Opening of Bids

1.15.1 AEGCL will open the technical bids online, in the presence of bidders' representatives who choose to attend; at **13:00 hours on 30.03.2018** at the following location:

**O/O the Managing Director.
Assam Electricity Grid Corporation Limited,
Bijulee Bhawan, Paltanbazar, Guwahati-781001.**

The bidders' representatives who are present shall sign a register as evidence of their attendance.

- 1.16.2 The bidders' names, the Bid Prices, the presence or absence of Bid Security, and such other details as AEGCL may consider appropriate, will be announced and recorded by AEGCL at the opening. The bidders' representatives will be required to sign this record.

1.16.0 Process to Be Confidential

- 1.16.1 Information relating to the examination, clarification, evaluation and comparison of bids and recommendations for the award of a contract shall not be disclosed to bidders or any other persons not officially concerned with such process..

1.16.2 Clarification of Bid Proposals and Contacting AEGCL

- 1.16.3 To assist in the examination, evaluation and comparison of Bids, AEGCL may, at its discretion, ask any bidder for clarification of its bid. The request for clarification and the response shall be in writing, but no change in the price or substance of the bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors detected by AEGCL in the evaluation of the bids.

1.17 Correction of Errors

- 1.17.2 Price Proposals determined to be substantially responsive will be checked by AEGCL for any arithmetic errors. Arithmetic errors will be rectified on the following basis. If there is a discrepancy between the unit rate and the total cost that is obtained by multiplying the unit rate and quantity, the unit rate shall prevail and the total cost will be corrected unless in the opinion of AEGCL there is an obvious misplacement of the decimal point in the unit rate, in which case the total cost as quoted will govern and the unit rate corrected. If there is a discrepancy between the total bid amount and the sum of total costs, the sum of the total costs shall prevail and the total bid amount will be corrected.

- 1.17.3 If the bidder does not accept the corrected amount of bid, its bid will be rejected, and the bid security may be forfeited.

1.18.0 Evaluation and Comparison of Bid Proposals

- 1.18.1 AEGCL will evaluate and compare only the bids determined to be substantially responsive.
- 1.18.2 The comparison shall be on all components and raw material incorporated including the cost of transportation, local taxes and duties, civil works, installation and other services required under the contract with due corrections.
- 1.18.3 AEGCL will carry out a detailed evaluation of the bids in order to determine whether the bidders are qualified and whether the technical aspects are substantially responsive to the requirements set forth in the bidding documents. In order to reach such a determination, AEGCL will examine the information supplied by the Bidders and other requirements in the bidding documents

Time Schedule: The works including the facilities covered by this bidding are required to be completed within a period of **6 (six) month** from the date of order.

Bidders submitting bids which deviate from the time schedule specified will be rejected.

- 1.18.4 AEGCL reserves the right to accept or reject any variation or deviation.
- 1.18.5 AEGCL will award the Contract to the bidder whose bid has been determined to be substantially responsive to the bidding documents and who has offered the Lowest Evaluated Bid Price, provided that such bidder has been determined to be qualified in accordance with the provisions.

1.19.0 Employer's Right to Accept any Bid and to Reject any or all Bids

1.19.1 Notwithstanding Clause, AEGCL reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids, at any time prior to award of Contract, without assigning any reason and liability to the affected bidders.

1.20.0 Notification of Award

1.20.1 Prior to expiry of the period of bid validity prescribed by AEGCL, AEGCL will notify the successful bidder by letter, that its bid has been accepted. This letter ("Letter of Acceptance") shall mention the amount which AEGCL will pay the Contractor in consideration of the execution, completion and maintenance of the Works by the Contractor as prescribed by the Contract ("the Contract Price").

1.21.0 Performance Security

As a contract performance security, the successful bidder will be required to furnish a performance security equal to 10% of the contract price in the form of Bank guarantee from a Nationalised Bank within 15 days of issue Letter of Intent (as the case may be) duly pledged in favour of Managing Director, AEGCL. Performance guarantee shall be valid upto 30 days after the end of warrantee period.

1.21.1 The performance guarantee shall cover additionally the following guarantees to the owner:

that the material used in the works shall be free from any defect and workmanship. All defects upon written notice from the Owner shall be rectified.

1.21.2 The Contract performance Guarantee will be returned to the Contractor without any interest at the end of warrantee period.

1.22.0 Retention money

In addition to above performance security deposit, 10% value of each progressive bills will be retained by the purchaser as retention money. The amount will be held by the purchaser till the work under the contract is completed and the completion certificate is issued by the consignee/supervising authority. No interest shall be payable for such deposits..

1.23.0 Warrantee: The material/equipment and services shall be guaranteed for satisfactory performance for a period of 18 months from date of supply or 12 months from the date of commissioning and taking over of the line by AEGCL as per clause.

During the period of guarantee the bidder shall rectify all defects in design, material and workmanship that may develop upon written notice from the consignee. The rectification / replacement must be carried out within a reasonable period free of cost.

1.24.0 Signing of Contract Agreement

1.24.1 A "Contract Agreement" shall be signed between the successful bidder and AEGCL within **15 (fifteen) days** from the date of notification of award.

1.25.0 Forfeiture of Bid Security

1.25.1 Failure of the successful bidder to comply with the requirements shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security.

SECTION-2

SPECIAL CONDITION OF CONTRACT

2.1.0 Introduction

2.1.1. This section "SCC" supplementary to the "General Condition of Supply & Erection of AEGCL". Whenever there is a conflict the provisions in this shall prevail over those in the "General Condition of Supply & Erection of AEGCL".

2.1.2. The General Condition of Supply & Erection of AEGCL is available in the official website of AEGCL. The bidder shall download the same from the AEGCL website [*www.aegcl.co.in*](http://www.aegcl.co.in).

2.2.0 Contractor to Inform Himself Fully

2.2.1. The contractor should admit that he has examined the general condition of contract, specifications and schedule and has satisfied as to all the conditions and circumstances affecting the contract prices and fixed his price according to his own views on these matters and acknowledge that no additional allowances except as otherwise provided therein will be levied. The purchaser shall not be responsible for any misunderstanding or incorrect information obtained by the contractor other than information given to the contractor in writing by the purchaser.

2.3.0 Extension of Time

2.3.1. If the completion of the work is delayed due to reason beyond the control of the contractor, the contractor should without delay give notice to AEGCL in writing of his claim for an extension of time. The AEGCL may extend the completion date as may be reasonable but without prejudice to other terms and conditions of the contract.

2.4.0 Variations, Additions and Omissions

2.4.1. The contractor shall not modify any of the terms and conditions except as directed in writing by AEGCL.

2.4.2. The AEGCL shall have the right during the contract to amend, alter, omit or otherwise vary any of the items by notice in writings. The contractor shall carry out such variations although the said variations shall not exceed (+/-)15% of the contract price. The amount of such variations shall be determined in accordance with rates specified in the contract and where such rates are not available this will be mutually agreed between the purchaser and the contractor.

2.5.0 Taking Over

- 2.5.1. When entire scope of works is completed by the Contractor and successfully commissioned in accordance with the Contract, the same shall be taken over by AEGCL and a Taking-Over Certificate for the Works shall be issued.
- 2.5.2. The date of issue of the 'Taking Over Certificate' by AEGCL or its representative shall be the date of taking over the works.

2.6.0 Terms of Payment

The terms of payment for the works shall be as follows:

- a) No advance payment shall be made in this contract.
- b) No claim for interest shall be entertained by AEGCL
- c) Only one running bill shall be entertained after completion of 50% of the work and upto the extent of 80% for total supply and erection part. 10% retention shall be made in addition to the 10% performance guarantee.
- d) Balance amount including the retention money of 10% shall be paid after satisfactory completion of work.
- (e) Performance guarantee will be retained till the completion of warrantee period
- f) The price is firm and no price variation shall be applicable.

2.7.0 Liability for Accidents and Damage

- 2.7.1. The contractor shall indemnify the AEGCL against any loss , damage, and injury to any person or to any property and against any other liability or obligation and against all actions, suits, claims demands costs, charges and expenses arising in connection with such damage , injury, liability or obligation resulting from:-
- (a). the negligence of the contractor and his workers, agents, subcontractors; and/or
 - (b). the lack of or inadequacy of safety devices on equipment supplied under this contract.

2.8.0 Use of Materials Arranged by the Board

- 2.8.1. If any materials supplied by AEGCL are found to be misused or wasted due to negligence by the contractor comes to the notice of the Corporation then the contractor shall be liable to pay compensation to the Corporation as may be decided by the Corporation.

2.9.0 Penalty for Delayed Execution

- 2.9.1. In the event of delay in completing the work extending beyond the date of completion or beyond any extension, permitted by AEGCL, the contractor shall pay as agreed liquidated damage and not as a penalty a sum equal to 1% of the contract price under this contract for each week of delay or part thereof subject to a maximum of 10% of the contract price.

- 2.9.2. AEGCL is at liberty to cancel the contract wholly or in part and to purchase materials/equipments and execute the erection work at the full risk and cost of the supplier and forfeit the security deposit.

2.10.0 Settlement of the Dispute & Arbitration

- 2.10.1. Any dispute arising out of the contract will first be discussed and settled bilaterally between the AEGCL and firms/ contractors. In case, the dispute cannot be settled bilaterally, it will be referred to arbitration by an arbitrator to be appointed by the Assam Electricity Grid Corporation Limited, The contractor shall not stop the work during settlement of any arbitration case. All disputes arising out of the agreement so made shall be subjected to the jurisdiction of district court of Kamrup District.

2.11.0 Force Majeure

- 2.11.1. Normally, force majeure shall cover only act of God, fire, war, riots and act of Government etc. Any constraints other than those specified above, will not constitute a force majeure condition. In view of other constraints beyond the control of the contractor, primarily due to statutory compulsion, extension of time may be considered on merit of individual case. In case of a force majeure condition, the contractor shall notify the purchaser in writing of such condition within 10 days from the beginning of such delay in writing for consideration and acceptance.

2.12.0 Progress Report

- 2.12.1. **The contractor shall prepare and furnish within 7 (seven) days from the date of issue of the work order a 'Bar Chart' to AEGCL indicating the timeline and the events for execution of works at various phases for successful completion of the project within the stipulated period. The progress of work shall be monitored based on this Bar Chart, and any deviation from the schedule of the Bar Chart shall be thoroughly examined by AEGCL and the cause of the delay shall be made attributable to either of the parties to the contract agreement on the basis of enquiry. The contractor shall submit to AEGCL monthly progress report within the first week of every month giving the status of the contract work for the preceding month.**

2.13.0 Age Limit of Labour

- 2.13.1. The contractor shall not employ persons below the age of 18 years.

2.14.0 Safety & Precautions

- 2.14.1. The contractor shall provide adequate safety devices like head protective gears, belt etc, to his labours while executing the erection work.
- 2.14.2. **Any other point not specifically mentioned will be as per General conditions of supply and erection 2009 of AEGCL for the whole tender**

SECTION – 3

TECHNICAL SPECIFICATIONS

- 3.1.1. This Section is intended to cover the requirements for supply, erection, testing & commissioning of following equipments and materials:
- (i) Towers with all accessories.
 - (ii) Power Conductors and Optical Ground Wires.
 - (iii) Disc Insulators, Insulator String Hardware, Tension & Suspension Clamps and conductor and earth wire accessories.
 - (iv) Boring, providing and installation of bored cast-in-situ RCC vertical piles of specified diameter and of any length below the pile cap with M25 grade of cement concrete, excluding the cost of reinforcement steel but including the cost of boring with temporary guide casing, bentonite solution and the length of pile to be embedded in the pile cap (length of pile for payment shall be measured from bottom of pile cap), all necessary labour materials, plants, tools, & tackles etc. complete as necessary for proper execution of the job. (Boring in weathered rock, shell, fissured rock and soft rock excluded) 800 mm diameter R.C.C vertical bored pile upto 25 m from bottom of pile cap.
 - (v) Providing & laying in position M25 Grade concrete of specified 28 days strength for pile caps, pedestal/chimney and tie beam (if required), excluding reinforcement steel and form work but including cement, all necessary tools and tackles, labour, materials, equipment's for handling, transportation, batching, mixing, placing, vibrating, dewatering etc. all complete.
 - (vi) Erection, testing and commissioning.

Bidders are required to submit the GTP of all the materials and equipment to be supplied and also the name of the firms from where the materials shall be procured including tower materials with proper authorization from the concerned manufacturer .

3.2.0 General

- 3.2.1. The details specifications given below are intended for general description of quality, workmanship etc for the items given above but do not cover minutes details of the work. In the absence of relevance details in the specifications the work shall be execute according to the prevailing practices and to the discretion of the site engineer.
- 3.2.2. This Section shall have precedence in case anything contrary to this is stated anywhere in this contract document. The contractor shall get clarified any doubts about the specifications etc. before tendering in respect pf interpretation of any portion of this document.
- 3.2.3. The code referred to in this specification correspond to the latest revision.

3.3.0 Special Conditions of Contract

- 3.3.1. The Bidder should note that the fabrication of tower materials and construction of tower foundations shall be carried out as per existing design of the line. The drawings related to the line shall be handed over to only the successful Bidder. However, intending Bidder, if so wishes may inspect the drawings at the office of the MD, Assam Electricity Grid Corporation Limited.
- 3.3.2. The Bidder should also note that the towers and foundations of the line was designed with ACSR Panther conductors as per IS: 802, 1977, IS: 5613, 1980 and CBIP Publication No 2, 1977.

3.4.0 Towers with all Accessories

3.4.1. GENERAL

- 3.4.1.1. The AEGCL shall provide drawings for G.I. towers to the successful bidder at the time of award of contract. The Contractor has to regenerate three copies of drawings for approval

3.4.2. DRAWING TO BE PREPARED BY CONTRACTOR

- 3.4.2.1. The contractor shall prepare fresh drawings of the tower structures based on the drawings furnished by AEGCL and shall submit the same along with the detail bill of materials for AEGCL's approval/reference. The fabrication work shall be started only after the approval of detail bill of materials and shall strictly conform to the approved drawings supplied by AEGCL. It is the responsibility of the Contractor to reproduce the drawings and The Site Engineer reserves the right to make changes to drawings supplied to the contractor for revisions to reflect more updated requirements. Revisions to drawings and any new drawings made to include additional works by the contractors shall be considered as a part of this specification and AEGCL shall entertain no extra claim on this account.

- 3.4.2.2. In the case of variations in drawings and specifications the decisions of the site Engineer shall be final. If the contractor found discrepancies in the execution of his work he shall refer such discrepancies to the site Engineer before proceedings with such works.

3.4.3. MATERIALS

- 3.4.3.1. Materials for steel structure including bolts, anchor bolts, washers etc shall be of tested quality and shall conform to IS: 226 and IS: 2062 (for plates over 20mm thick) Dimensions of all bolts and nuts shall conform to IS 6639 and their mechanical properties shall conform to property class 4.6 and class 4 of IS: 1367 for bolts and nuts respectively. Dimensions and mechanical properties of all washers shall conform to IS: 6610 and IS: 3063 respectively. Other materials used in the construction of steel structure shall conform to appropriate IS specification for the materials wherever they exist. All members of the steel structures, bolts, nuts and washers shall be galvanized.

3.4.4. FABRICATION

- 3.4.4.1. The workmanship shall conform to the best practice in modern structural shops and to the provisions of IS: 802 (Part-II) and IS: 800 as applicable.

3.4.4.2. Connections

All connections shall be designed for the full strength and properties of the members. The fabrication, in general shall be bolted type. Bolts shall also be used for field connections unless otherwise specified in the drawings or permitted by the site engineer for any special circumstances. Bolting shall be conforming to IS: 802 (Part-I & II) and IS: 800 as applicable.

Welding where required shall be generally done in accordance with the relevant IS standards. Selection of electrodes shall conform to IS: 815. MS electrodes for welding shall conform to IS 814. Welding procedure shall conform to IS: 816 and IS 823.

3.4.4.3. Tolerances.

Fabrications tolerances shall conform to IS: 802 (Part-II) and IS: 800 as applicable.

3.4.4.4. Marking

The marking procedure shall conform to IS: 802 and IS: 800 as applicable.

3.4.4.5. Shop Assembly

All steelworks (one in each type) shall be temporarily shop assembled complete or as directed by the site engineer before commencing mass fabrication to ensure proper field erections. Reaming of untrue holes will not be allowed. A reasonable amount of drifting will be allowed in assembling. Shop assembled parts shall be dismantled for shipment.

3.4.4.6. Galvanizing

Bolts and other fasteners shall be galvanized in accordance with IS: 5358. Galvanizing members of structures shall conform to IS: 4759 and spring washers shall be galvanized in accordance IS; 1573.

The recommendation given in IS: 2629 and IS: 6159 shall be complied with in respect of surface preparations, safety and applications of coating.

3.4.5. INSPECTION AND PACKING

3.4.5.1. The recommendation given in IS: 802 (Part-II) and IS 800 for inspection and packing shall be complied with.

3.4.6. TESTING

3.4.6.1. The material used for fabrication of towers shall be tested for quality.

3.4.7. FIELD ERECTION

3.4.7.1. Erection work shall be done strictly according to the provisions of IS: 802.

3.5.0 Power Conductor (ACSR Panther)

3.5.1. GENERAL

The Power Conductor shall conform to IS: 398 Part-IV and will be provided by AEGCL.

3.5.2. CONDUCTOR PARTICULARS: The Power Conductor properties shall conform to IS: 398 Part-IV.

3.6.0 Optical Ground wire (OPGW):

OPGW cable construction shall comply with IEEE-P1138 and IEC publication 1396. The cable provided shall meet both the construction and performance requirements such that the ground wire function, the optical fibre integrity and optical transmission characteristics are suitable for the intended purpose. The composite fibre optic overhead ground wire shall be made up of buffered optical fibre units embedded in a water tight stainless steel protective central fibre optic unit surrounded by concentric-lay stranded metallic wires in single or multiple layers. The dual purpose of the composite cable is to provide the electrical and physical characteristics of conventional overhead ground wire while providing the optical transmission properties of optical fibre.

3.7.0 Insulators and Hardware

3.7.1. STANDARDS

3.7.1.1. The tension string assemblies, insulator discs and hardware offered, material and processes adopted in the manufacture of insulator discs and hardware shall conform to the provision of the following standards or equivalent other international standards:

- (1) IS: 731 Specification of porcelain insulators for overhead power lines.
- (2) IS: 2486 Specification of insulator fittings for overhead power lines.
- (3) IS: 2026 Specification for recommended practice for hot dip galvanising of steel
- (4) IS: 2633 Specification for method for testing uniformity of coating on zinc coated articles.
- (5) IS: 2107 Specification for white hearth malleable iron castings.
- (6) IS: 2108 Specification for black hearth malleable iron castings.

3.7.2. Insulator Discs and Strings

3.7.2.1. TYPE OF INSULATORS:

All suspension and tension strings shall consist of standard centre ball and socket type porcelain insulators with all the exposed porcelain parts fully glazed, unless otherwise specified.

3.7.2.2. QUALITY AND STRENGTH OF THE INSULATORS:

The insulators and their hard wares used in the lines shall comply with requirement of relevant IS or other equivalent international standards.

MATERIALS USED

The porcelain used in the manufacture of the insulators shall be of the best quality and shall be manufactured by the wet process. It shall be homogeneous, free from lamination; flaws etc. and well finished making it impervious to moisture. The glaze shall be brown colour and shall cover all the porcelain parts of the insulator except these areas necessarily left unglazed for the purpose of assembly. The cement used in the construction of the insulators shall not cause fracture by expansion or loosening and shall not give rise to any chemical reaction with the metal fittings.

3.7.3. **Hardware fittings for Insulator**

3.7.3.1. *HARDWARE*

Each insulator string assembly shall generally include the following hardware: Anchor shackle for attachment of suspension string assembly to the tower hanger and tension string assembly to the tower strain plate. Suitable top and bottom yoke assemblies with the arrangement of fixing a set of arcing horns.

- Set of arcing horns
- Suspension or tension clamp
- Bolts, nuts, washers, split pins etc.
- Other fittings necessary to make the strings complete such as ball clevis, socket clevis, chain links etc.

The tenderer shall be responsible and satisfy himself that all the hardware included in strings are entirely suitable for the conductor offered.

3.7.3.2. *SUSPENSION CLAMP*

The suspension clamps shall be made of malleable iron or aluminium alloy, hot dip galvanised and shall be suitable to accommodate the conductor together with one set of preformed armour rods. Suitable sheet aluminium liners shall be provided. The suspension clamps shall be designed to avoid any possibility of deforming or damaging the conductor. The lips shall be rounded off and the seating and the bell mouths shall be smooth to avoid corona and radio interference noises. The suspension clamps shall be suitable to carry the bottom part of the arcing horn and to receive the fittings of the insulator string. The suspension clamps shall be such that the conductor should not slip at a load of 25% of the breaking load of the conductor. The ultimate strength of the clamp for vertical load shall not be less than the failing load of the Disc Insulators.

3.7.3.3. *STRAIN CLAMP*

The bolted strain clamps shall also be made of malleable iron or aluminium alloy; hot dip galvanised, lined with sheet aluminium liners and shall be suitable to accommodate the conductor with necessary binding tapes etc. The lips shall be rounded off carefully and conductor seating and the ball mouth shall be smooth to avoid corona and radio interference noises. Suitable attachment for receiving one side of arcing horns and for connecting to the insulator strings shall be provided.

The strain clamps shall be such that the conductor should not slip at a load of 90% of the breaking load of the conductor. The ultimate strength of the clamp for horizontal load shall not be less than the ultimate strength of the conductor. Arcing horns of approved size and dimensions shall be provided for every string of insulators. The performance data for arcing horns to be supplied shall be made available to the Employer.

3.7.3.4. ***OTHER INSULATOR STRING HARDWARE***

The strength of other string hardware namely anchor shackle, yoke plates, socket-clevis etc. shall be co-ordinated with insulator disc strength.

3.7.3.5. **Interchangeability**

The hardware together with ball and socket fittings shall be of standard design, so that this hardware are interchangeable with each other and suitable for use

with disc insulators of any make conforming to relevant Indian/International Standard

3.7.3.6. Ball and Socket Designation

The dimensions of the ball and socket shall be of 20 mm designation for 90 KN discs, in accordance with the standard dimensions stated in IS : 2486-(Part-II) /IEC:120. The dimensions shall be checked by the appropriate gauge after galvanizing only.

3.7.3.7. Security Clips and Split Pins

Security clips for use with ball and socket coupling shall be R-shaped, hump type which provides positive locking of the coupling as per IS: 2486-(Part-III)/IEC: 372. The legs of the security clips shall be spread after assembly in the works to prevent complete withdrawal from the socket. The locking device should be resilient, corrosion resistant and of suitable mechanical strength. There shall be no risk of the locking device being displaced accidentally or being rotated when in position. Under no circumstances shall the locking devices allow separation of fittings.

The hole for the security clip shall be countersunk and the clip should be of such design that the eye of clip may be engaged by a hot line clip puller to provide for disengagement under energised conditions. The force required to pull the security clip into its unlocked position shall neither be than 50 N (5 kg) nor more than 500 N (50 kg).

Split pins shall be used with bolts & nuts.

3.7.3.8. Arcing Horn for EHV Strings

The arcing horn shall be provided on tower side of the hardware fittings. The same shall be either ball ended rod type or tubular type.

The spark gap shall be so adjusted to ensure effective operation under actual field conditions.

3.7.3.9. Dead End Assembly

The dead end assembly shall be suitable for Conductor as detailed in the document.

The dead end assembly shall be compression type with provision for comprising the jumper terminal at one end. The angle of the jumper terminal to be mounted should be 30° with respect to the vertical line. The area of bearing surface on all the connections shall be sufficient to ensure positive electrical and mechanical contact. The resistance of the clamp when compressed on Conductor shall not be more than 75% of the resistance of equivalent length of Conductor.

The assembly shall not permit slipping of, damage to, or failure of the complete conductor or any part thereof at a load less than 95% of the ultimate tensile strength of the conductor.

ERECTION PART :

3.8.0 General

3.8.1. The details specifications given below are intended for general description of quality, workmanship etc for the items given under clause 3.1.0 above but do not cover minutes details of the work. In the absence of relevance details in the specifications the work shall be executed according to the prevailing practices and to the discretion of the site engineer.

3.8.1 Tower Erection

3.4.1 The towers must be truly vertical after erection and no straining will be permitted to bring them to a vertical position. Tolerance limit for vertical shall be one in 360 of the tower height. All nuts shall be tightened properly. Before tightening it is ensured that filler washers and plates are placed in relevant gaps between members, bolts of proper size and length are inspected and one spring washer is inserted under each nut. The tightening shall be progressively carried on from the top downwards, care being taken that all bolts at every level are tightened simultaneously. The threads of bolts projecting outside nuts shall be punched at three positions on the diameter to ensure that the nuts are not loosened in course of time. If during tightening a nut is found to be slipping or running over the bolt threads, the bolt together with the nut shall be replaced.

3.4.2 The tenderer shall arrange for tack welding of all nuts and bolts up to the bottom cross arm level of the towers, if so desired by the Employer. So, the tenderer shall quote separately for such tack welding for each type of tower on per tower basis. The quoted rates for erection of towers shall, therefore, be exclusive of the cost of above tack welding.

3.9.0 Stringing of Conductor and Earth Wire

3.9.1 The stringing of the conductors and earth-wires shall be done in a most standard method used for such lines, which shall be indicated in the tender. The tenderer shall give complete details of the stringing method they propose to follow and indicate its adaptability and advantages. They shall also indicate the tools and equipment required for stringing by the method proposed by them. The contractor shall use his own stringing and erection tools and other equipment.

3.9.2 The contractor shall be entirely responsible for any damage to the towers or the conductors during stringing.

3.10.0 Pulling Operation:

3.10.1 The earth wire shall be strung and securely clamped to the towers before the conductors are drawn up in order of the top conductor first.

3.10.2 The pulling of the conductor into the travellers (comprising of aerial and ground rollers) shall be carried out in such a manner that the conductor is not damaged or contaminated with any foreign substance and that it may not be rubbed with rough ground surface. The traveler surface in contact with aluminium surface of conductor is not damaged. These shall be equipped with high quality ball and roller bearings for minimum friction.

3.10.3 During pulling out operation the tension in each conductor and earth wire shall not exceed the design working tension of the conductor at the actual prevailing

temperature. After being pulled the conductor and the earth wire shall not be allowed to hang in the stringing blocks for more than 96 hours, before being pulled to the specified sag. It shall be ensured that the conductors and earth wire are not damaged due to wind, vibration or other cause.

3.11.0 Sagging in Operation:

3.11.1 The conductors shall be pulled up to desired sag and left in travellers for at least one hour after which the sag shall be rechecked and adjusted. The conductors shall be clamped within 36 hours for sagging in. The sags shall also be checked when the conductors have been drawn up and transferred to the insulator clamps.

3.11.2 At sharp vertical angles the sags and tensions shall be checked on both sides of the angle. Sagging operations shall not be carried out under wind, extremely low temperature or other adverse weather conditions, which prevent satisfactory sagging.

3.12.0 Jointing:

3.12.1 All the joints of the conductor or the earth wire shall be compression type in accordance with the recommendations of the manufacturers, for which the necessary tools and equipment like compressors and dies, grease guns, presses shall have to be arranged by the contractor.

All joints and splices shall be made at least 30 meters away from the structures. No joint or splices shall be made in span crossing over main roads, railways, small rivers or in tension spans. Not more than one joint shall be allowed in one span.

After pressing the joint the aluminum sleeve shall have all corners rounded, burrs and sharp edges removed and smoothed.

3.13.0 Insulator Hoisting:

Suspension insulator strings shall be used up to deviation of 2 degrees on all 'A' type towers in the line and strain insulators on all 'B', C and D' type towers. Except on approaching towers, all suspension strings will consist of the specified number of insulator discs per string with arching horns on line side only and tension string of specified number of insulator discs per string with arching horns on both line and tower sides.

Insulator strings shall be assembled on the ground. These shall be cleaned and examined before hoisting. Insulators with hair cracks or clips or those having glazing defects exceeding half centimeter square will not be used. No separate rates shall be quoted for insulator hoisting. The charges shall be included in the rates of string of conductors.

3.14.0 Accessories:

Accessories like vibration dampers; armour rods etc. for the conductor shall also be fitted on the line. Armour rods shall be provided at all suspension support of the conductors and vibration dampers shall be provided at both ends of each span at suitable distances from the supporting points for each phase conductor. All accessories shall be clean, smooth and in perfect condition before fitting.

3.15.0 Grounding

3.15.1 The Contractor shall measure the tower footing resistance (TFR) of each tower in the diverted section of the line after it has been erected and before the stringing of the earth wire during dry weather. Each tower shall be earthed and the tower footing resistance shall not exceed 10 ohms. Generally pipe type earthing shall be done in accordance with the latest additions and revisions of:

IS: 3043 : Code of practice for Earthing.

IS: 5613 : Code of practice for Design, Installation and maintenance (Part-II/Section-2) of overhead power lines.

3.15.2 The earthing will be effected by burying 3 meters long GI pipe in a 300 mm diameter and 3750 mm deep pit at a distance of not less than 3650 mm diagonally away from the stubs and filling in the pit with finely broken coke having the granule sizes not less than 25 mm and salt in such a way that a minimum cover of 125 mm thick salt mixed coke shall be maintained from the pipe on all sides and that the top edge of the pipe shall be at least 600 mm below the ground level. A 45 X 6 mm-galvanized steel flat shall be used to connect the tower with the pipe. The galvanizing steel strip shall be buried not less than 600 mm deep from the ground level. The tenderer will quote the erection charges for each earthing inclusive of the cost of coke and salt, excavation and back filling etc.

3.16.0 Final Checking, Testing & Commissioning

3.16.1 After completion of the works, final checking of the line shall be done by the contractor to ensure that all the foundation work; tower erection and stringing have been done strictly according to the specifications and as approved by the Employer. All the works shall be thoroughly inspected keeping in view the following main points:

1. Sufficient back filled earth is layed over each foundation pit and it is adequately compacted.
2. All the tower members are correctly used strictly according to final approved drawings are free of any defect or damage whatsoever.
3. All the bolts are fully tightened and they are properly punched.
4. The stringing of the conductors and earth wire done to maintain proper sag.

The contractor shall submit a report to the above effect. After final checking the line shall be tested for insulation and any defect found shall be rectified by the contractor.

3.16.2 After satisfactory tests on the line and on approval by the Employer the line shall be energized at full operating voltage before handing over.

4.0 CONSTRUCTION OF BORED CAST IN-SITU-PILE FOUNDATION

4.1 General Requirement

4.1.1 The specification covers the technical requirements for piling work,general

description of work, quality and workmanship. In every case, work shall be carried out to the satisfaction of the Owner in accordance with the Technical Specifications and conform to location, lines, grades and cross sections shown on the construction drawing or as directed by the Owner. The specifications are not, however, intended to cover all the minute details and the work shall be executed according to the specified IS Codes. In absence of the IS Codes, work shall be executed according to the best prevailing local Public Works Department practice or to the recommendations of the relevant International Standards or to the instructions of the Owner. This specification shall have precedence in case anything contrary to this is stated anywhere in this Bid Document. In case of conflict between the Specification and Codes, the former shall prevail.

- 4.1.2 The work shall include mobilization of all necessary equipments, providing necessary engineering supervision through qualified and technical personnel, skilled and unskilled labour, etc. as required to carry out the complete piling work. The capacity of some equipments are listed below. However, bidder has to furnish information regarding the equipments they intend to deploy for the project.

Sl.No.	Description	Capacity
1.	Tripod height	6m. to 10m. (clear
2.	Rig (winch)	3 T to 5T
3.	Weight of chisel	2T to 3T
4.	Mud pump capacity	15 HP to 25 HP
5.	Dia. of outlet pipe for	2.5 inch
6.	Rotary drilling rig (Hydraulic) alongwith all	Minimum torque 12T

Note: Bidder may have to provide higher capacity equipments than mentioned above, as per the actual requirement for the execution of the job, without any additional financial implication to AEGCL.

3.0 Layout and Levels

- 3.1 Layout and levels of structures etc. shall be made by the Contractor, at his own cost, from the general grid of the plot and the bench marks given by the Owner. The Contractor shall make his own arrangements, at his own cost, for locating the co - ordinates and position of piles as per approved drawings and for determining the Reduced Level (R.L.) of the locations with respect to the single bench mark indicated by the Owner. Two established reference lines in mutually perpendicular direction shall be indicated to the Contractor. The Contractor shall provide at site all the required survey instruments, materials and men to Owner for verification of the detailed layout and correctness of the layout and levels to the satisfaction of the Owner so that the work can be carried out accurately according to specifications and drawings. The contractor shall be solely responsible for the correctness of layout and levels.

4.0 Site Preparation

This section of the specification covers site preparation of the areas as indicated in the drawings.

4.1 Reference Points and Bench Marks

- 4.1.1 Permanent reference pillars have been established and under no circumstances shall the Contractor remove or disturb any permanent mark without the approval of the Owner. The Contractor shall carefully maintain and protect all bench marks and reference points and shall layout all his work by accurate reference thereto. The Contractor shall remove all vegetation, excluding trees, from the site areas as directed by the Owner.
- 4.1.2 The area shall be stripped to remove roots of grass, rubbish and slush, shrubs or other organic materials. Spoiled materials shall be burnt or removed to approved disposal areas on or near the job site as directed by the Owner.

5.0 Properties of Construction Materials

This clause specifies the properties of common building materials unless otherwise mentioned in the drawings or schedule of items.

All materials viz., cement, steel, aggregates, water etc. which are to be used for pile construction are detailed below. However, aggregates more than 20mm shall not be used, except for lean concrete.

5.1 Coarse aggregates/Stone

- 5.1.1 All coarse aggregates shall be as per IS:383 consisting of hard, strong, compact grained and durable pieces of crushed stone having uniform in texture and colour and free from decay, flaws, veins, cracks and sand holes. Coarse aggregates should be of angular shape & rectangular surface and shall be free from organic or clay coatings and other impurities like disintegrated stones, soft flaky particles, adherent coatings, clinkers, slag, mica and any other materials liable to affect the strength, durability or appearance of concrete. The surface of a freshly broken stone shall be bright, clean, and free from any dull, chalky or earthy appearance. Coarse aggregates with round surface shall not be used. A coarse aggregates shall not absorb more than 5% of its weight of water after 24 hours immersion. Samples shall be submitted by the Contractor and approved samples shall be retained by the Owner for comparison of bulk supply.
- 5.1.2 Sieving and washing of aggregates by approved method shall be carried out wherever required.
- 5.1.3 Grading of coarse aggregate shall generally conform to IS:383 and shall be such as to produce a dense concrete of the specified proportions and strength and of consistency that will work readily into position without segregation.
- 5.1.4 The maximum size of aggregate shall be as follows unless specified otherwise:
- i) Reinforced concrete with very narrow space - 10mm.
 - ii) Reinforced concrete & Plain Concrete - 20mm.
 - iii) Lean Concrete M15 -40mm.

5.2 Cement

Cement used shall generally be ordinary Portland Cement conforming to the latest Indian Standard Code IS:8112 or IS:12269. Alternatively, other varieties of cement other than ordinary

Portland Cement such as Portland Pozzolana Cement conforming to IS:1489 or Portland Slag Cement conforming to IS:455 can also be used. The contractor shall submit the manufacturer's certificate, for each consignment of cement procured, to the Owner. However Owner reserves the right to direct the Contractor to conduct tests for each batch/lot of cement used by the Contractor and Contractor will conduct those tests free of cost at the laboratory so directed by the Owner. The Contractor shall also have no claim towards suspension of work due to time taken in conducting tests in the laboratory.

Changing of brand or type of cement within the same structure shall not be permitted without the prior approval of the Owner. Sulphate Resistant Cement shall be used if Sulphate content is more than the limits specified in IS:456, as per Geotechnical investigation report and as mentioned in the construction drawing. No additional payment shall be made for using Sulphate Resistant Cement.

5.3 Sand

Sand shall be hard, durable, clean and free from any adherent coatings or organic matter and shall not contain clay balls or pellets. The sand shall be free from impurities such as iron pyrites, alkalis, salts, coal, mica, shale or other laminated materials, in such forms or quantities as to affect adversely the hardening, strength, durability or appearance of concrete or to cause corruptions to any metal in contact with such concrete. In no case the cumulative percentage of impurities in sand shall be more than 5% by weight. All sand shall be properly graded. Unless otherwise directed by the Owner all sand shall pass through IS Sieve no. 2.36mm. Sand for concrete shall conform to IS:383 .

5.4 Water

Water shall be clean, fresh and free from organic matters, acids or soluble salts and other deleterious substances which may cause corrosion, discoloration, efflorescence etc. Potable water is generally considered fit for use. Water to be used shall comply with the requirements of IS:456 . Average 28 days compressive strength of at least three 15 cm. cubes of concrete prepared with proposed water shall not be less than 90% of average strength of three similar cubes prepared with distilled water. PH of water shall generally be not less than 6.

5.5 Reinforcement

Reinforcement steel shall be clean and free from loose mill scales, dust, loose rust, oil and grease or other coatings which may impair proper bond. Structural steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement shall conform to IS:432 (Part-I). Corrosion resistance steel rebars are used. The CRS shall also satisfy the CRI (Corrosion Resistance Index) value through various tests and their chemical compositions. The procedure for corrosion resistance conform to IS:9077 latest edition. Hard drawn steel wire fabric shall conform to IS:1566. All

steel bars including and above 6mm diameter shall be of tested for quality. Substitution of reinforcement, other than those mentioned above, shall not be permitted without the prior approval of the Owner.

6.0 Storage & Handling of construction Materials

All materials shall be stored by the Contractor in a manner aiding convenient access for identification and inspection at all times. The storage arrangements shall be subject to the approval of the Owner. Storage of materials shall be as described in IS:4082 .

All materials shall be so stored as to prevent deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work. Any material which has deteriorated or has been damaged or is otherwise considered defective by the Owner shall not be used for concrete, and shall be removed from site immediately, failing which, the Owner will get the materials removed and the cost thereof shall be recovered from contract price. The Contractor shall maintain up to date accounts of receipt, issue and balance (stock wise) of all materials.

6.1 Cement

The cement shall be stored in dry enclosed shed, well away from the walls and insulated from the floor to avoid contact with moisture. The cement shall be stacked in easily countable stacks to facilitate removal of first in first out basis. The cement bags shall be gently kept on the floor to avoid leakage of cement from the bags. Sub-standard or partially set cement shall be immediately removed from the site as soon as it is detected. Cement stored for period beyond 90 days shall be tested before use.

6.2 Coarse Aggregates and Sand

All coarse aggregates & sand shall be stored on brick soling or an equivalent platform so that they do not come in contact with dirt, clay, grass or any other injurious substance at any stage. Aggregate of different sizes shall be kept in separate and easily measurable stacks. If so desired by the Owner, aggregates from different sources shall be stacked separately with proper care to prevent intermixing.

6.3 Reinforcement

Reinforcement steel shall be stored consignment wise and size wise, off the ground and under cover. It shall be protected from rusting, oil grease and distortions. If directed by the Owner, the reinforcement steel may have to be coated with cement wash before stacking, to prevent scale and rust at no extra cost to the Owner. The stacks shall be easily measurable. Only steel needed for immediate use shall be removed from storage. Fabricated reinforcement shall be carefully stored to prevent damage, distortion, corrosion & deterioration.

Cement Concrete

7.0 General

- 7.0.1 This section of the specification deals with cement concrete, plain or reinforced, and covers the requirement for concrete mix design, strength and quality, pouring at all levels, forming, protection, curing finishing, admixtures, inserts and other miscellaneous works.
- 7.0.2 The provisions of IS:456 shall be complied with, unless permitted otherwise. Any other Indian Standard Code shall form the part of the specification to the extent it has been referred to or applicable within this specification.
- 7.0.3 The Contractor shall furnish all labour, material and equipment to form, place and finish all structural concrete, concrete works and miscellaneous items complete, as described herein.

7.1 Admixtures

- 7.1.1 The admixtures in concrete for promoting workability, improving strength or for any other purpose, shall be used only after the written permission from the Owner. The Admixtures shall conform to IS:9103.
- 7.1.2 Admixtures should not impair durability of concrete nor combined with the constituent to form harmful compounds nor increase the risk of corrosion of reinforcement.
- 7.1.3 Addition of admixtures should not reduce the specified strength of concrete in any case. The workability, compressive strength and the slump loss of concrete with and without the use of admixtures shall be established during the trial mixes before use of admixtures.
- 7.1.4 The chloride content of admixtures shall be independently tested for each batch before acceptance.
- 7.1.5 If two or more admixtures are used simultaneously in the same concrete mix, data shall be provided to assess their interaction and to ensure their compatibility.
- 7.1.6 In case admixtures are used in the concrete for any structure, fresh mix design be done considering the admixture with the specific approval from Owner. No extra payment shall be made to the Contractor on this account.

7.2 Grades of Concrete

- 7.2.1 The minimum grade of concrete to be used for piling shall be M-25 with minimum cement content 400 kg/m^3 and maximum water cement ratio of 0.5. Concrete shall conform to the controlled design mix as specified in IS:456 . In addition, nominal mixes of 1:3:6 and 1:4:8 (with aggregates of nominal size 40mm maximum, by weight converted to equivalent volume shall also be used as per field quality plan. The concrete in aggressive surroundings due to presence of sulphate, etc., shall conform to IS:456. The slump of concrete shall be maintained between 150 to 200 mm.
- 7.2.2 The Contractor shall carry out concrete mix design in accordance with IS:10262 and submit mix design calculations and get them approved from the Owner well in advance of installation of pile foundations. The Contractor shall carry out adequate number of tests in accordance with IS:456 to ensure concrete of the minimum specified strength at requisite workability(i.e.slump).

7.3 Workmanship

All workmanship shall be according to the current Industry standard and best practices.

Before starting a pour the Contractor shall obtain the approval of the Owner in a "Pour Card" maintained for this purpose. He shall obtain complete instructions about the material and proportions 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 concrete in case of premature stopping of pours.

7.4 Mixing of Concrete

7.4.1 All design mix concrete shall be mixed in mechanically operated mixer of an approved size and type capable of ensuring a uniform distribution on the materials through the mass. However, contractor can also use central batching plant situated within the area allocated for the Contractor's particular use.

7.4.2 The proportions of sand, coarse aggregate, cement and water shall be as determined by the mix design. However, in case of nominal mix concrete (for lean concrete only) the proportions of sand, coarse aggregate, cement and water shall be fixed. The proportions, as determined for design mix concrete and shall always be approved by the Owner. The quantities of the cement, sand and coarse aggregates shall be determined by weight.

However, for a faster progress at site, quantities of the cement, sand and coarse aggregates can be converted to equivalent volume. The water shall be measured accurately after giving proper allowance for surface water present in the aggregate for which regular check shall be made by the Contractor.

7.4.3 The water shall not be added to the mix until all the cement and aggregates consisting 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 uniformity in colour and consistency but in no case shall mixing be done for less than two (2) minutes and at least forty (40) revolutions after all the 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 may be directed by the Owner. Mixers shall not be loaded above their rated capacity as it prevents thorough mixing. If there is segregation after unloading from the mixer the concrete should be remixed.

7.4.4 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 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.

7.5 Conveying Concrete

Concrete shall be handled and conveyed from the place of mixing to the place of final laying as rapidly as practicable, by approved means, before the initial setting of the cement starts. Concrete

should be conveyed in such a way as will prevent segregation of Concrete which may occur during transportation of concrete. In case of any such segregation during transport, the concrete shall be re-mixed. During very hot or cold weather, if directed by the Owner, concrete shall be transported in deep containers, having mortar leak proof, which will reduce the rate of water loss by evaporation and loss of heat. Conveying equipments for concrete shall be well maintained and thoroughly cleaned before commencement of concrete mixing. Such equipment shall be kept free from set concrete.

7.6 Placing of Concrete

- a) Formwork and placement of reinforcement shall be approved in writing by the Owner before concrete is placed. The forms shall be well wetted and oil 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, rehandling or flowing. The interval between adding the water to the dry materials in the mixer and the completion of the final placing inclusive of compaction of the concrete shall be well within the initial setting time for the particular cement in use or as directed by the Owner. As far as possible, concrete shall be placed in the formwork by means approved by the Owner and shall not be dropped from a height or handled in a manner which may cause segregation. Any drop over 1800 mm shall have to be approved by the Owner. 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 formwork.
- b) 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.
- c) After the concrete has been placed it shall be spread and thoroughly compacted by approved mechanical vibration to a maximum subsidence without segregation and thoroughly worked around reinforcement or other embedded fixtures into the 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. Head tamping in some case may be allowed subject to the approval of the Owner. Care must be taken 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 it rains. If there has been any sign of 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. Tie beams, pile caps, footings shall be poured in one operation normally, in special circumstances with the approval of the Owner these can be poured in horizontal layers not exceeding 500 mm in depth. When poured in layers, it must be ensured that the under layer, is not already hardened. Blending of under layer if any, shall be effectively removed.
- d) Wherever 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.

7.7 Inserts

All anchors, anchor bolts, inserts, etc. and any other items those are required to be embedded in the concrete shall be placed in correct position before pouring. Extra care shall be taken during pouring operation to maintain their position as indicated in the drawings. These inserts shall be welded to the nearest reinforcement to keep them in position and all such welding shall be deemed to be included in the unit rate quoted and no extra payment shall be made on this account.

7.8 Blockouts

Blockouts in concrete as indicated in the drawing or as directed by the Owner shall be provided wherever required. No extra payment shall be made to the Contractor on this account.

7.9 Repairs and Finishes of Concrete

All concrete surfaces shall have even and clean finish, free from honeycombs, air bubbles, fins or other blemishes. The formwork joints marks for concrete work exposed to view shall be rubbed with carborandum stone and defects patched up with a paste of 1 part sand and 1 part cement and cured. The finish shall be made to the satisfaction of the Owner.

The unit rate of concrete work shall be inclusive of the cost of cleaning and finishing exposed surface as mentioned above.

7.10 Reinforcement Steel

This section of the specification shall cover providing reinforcement steel and its cleaning, bending, binding, placing with arrangements for chairs, supports and suitable covers for all reinforced concrete works, below and above ground level as per drawings and specifications.

7.10.1 General Requirements

7.10.2 Reinforcement steel of same type & grade shall be used for structural reinforcement work as detailed in the drawing released by the Owner. No work shall be commenced without proper verification with the bar-bending schedule provided in the drawing.

7.10.3 Contractor shall supply, fabricate and place reinforcement to shapes and dimensions as indicated on the drawings and as per specifications. The reinforcement shall be either plain or deformed steel bars or welded wire fabric conforming to relevant IS specifications.

7.10.4 Any adjustment in reinforcement to suit field conditions and construction joints other than shown on drawings shall be subjected to the approval of Owner.

7.11 Bending

7.11.1 Unless otherwise specified, reinforcement steel shall be bent in accordance with procedure specified in IS:2502. Bends and shapes shall

comply strictly with the dimensions in the approved Bar Bending Schedule. Contractor shall be entirely responsible for its correctness. Bars correctly bend shall only be used.

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

7.12 Placing in position

- 7.12.1 All reinforcement shall be accurately fixed and maintained in position as shown on the drawings by approved means as mild steel chairs, and/or concrete spacer blocks. Bars intended to be in contact, at crossing points, shall be securely bond together at all such points by two number No.20G 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 mild steel spacer bars. They should be so spaced that the main bars do not sag perceptibly between adjacent spacers.

- 7.12.2 The placing of reinforcements shall be completed well in advance of concrete pouring. Immediately before pouring, the reinforcement shall be checked by the Owner for accuracy of placement and cleanliness and necessary correction as directed by him shall be carried out. The cover for concrete over the reinforcements shall be as shown on the approved drawings unless otherwise directed by the Owner. 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 Owner.
- 7.12.3 Longitudinal reinforcement in pile shall be high yield strength cold twisted deformed steel bars conforming to IS:1786. Thermo mechanically Treated (TMT) bars (equivalent grade) in place of Cold twisted deformed steel bars are also accepted. Lateral reinforcement in pile shall be of tor steel conforming to IS:432 Part-I.
- 7.12.4 The longitudinal reinforcement shall project 52 times its diameter above cut-off level unless otherwise indicated in the drawing.
- 7.12.5 The minimum diameter of the links or spirals bar shall be 8mm and the spacing of the links or spiral shall not be less than 150mm and in no case more than 250mm. The laterals shall be tied to the longitudinal reinforcement to maintain its shape and spacing.
- 7.12.6 Reinforcement cage shall be sufficiently rigid to withstand handling and installation without any deformation and damage. As far as possible number of joints (laps) in longitudinal reinforcement shall be minimum. In case the reinforcement cage is made up of more than one segment, these shall preferably be assembled before lowering into casing tube/pile bore by providing necessary laps as per IS:456.
- 7.12.7 The minimum clear distance between the two adjacent main

reinforcement bars shall normally be 100mm for the full depth of cage, unless otherwise specified.

7.12.8 The laps in the reinforcement shall be such that the full strength of the bar is effective across the joint and the reinforcement cage is of sound construction. 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.

7.12.9 Laps shall be staggered as far as practicable and as directed by the Owner. Not more than 50% bars shall be lapped at a particular section. Lap joints shall be staggered by at least 1.3 times the lapped length (Center to Center).

7.12.10 Proper cover and central placement of the reinforcement cage in the pile bore shall be ensured by use of suitable concrete spacers or rollers, as required, without any additional cost to the Owner.

7.12.11 Minimum clear cover to the reinforcement shall be 75mm unless otherwise mentioned.

7.12.12 Unless otherwise specified by the Owner reinforcement shall be placed within the following tolerance as specified in IS:456:2000.

a) For effective depth 200mm or less +10mm.

b) For effective depth more than 200mm +15mm.

The cover shall in no case be reduced by more than one-third of specified cover or 5mm whichever is less. Welding of reinforcement bars shall be avoided. However, welding may be done in specific case subject to prior permission from the Owner.

8.0 Construction of Pile Cap, Pedestal, Tie Beam etc.

The Contractor shall deploy all labour, equipment, tools & tackles and materials required for complete execution of the work in accordance with the drawings and as described herein.

8.1 Excavation

8.1.1 The Contractor shall control the grading in the vicinity of all excavation so that the surface of the ground will be properly slopped or diked to prevent surface water from running into the excavated areas during construction.

8.1.2 Excavation shall include the removal of all materials required to execute the work properly and shall be made with sufficient clearance to permit the placing, inspection and setting of forms and completion of all works for which the excavation was done.

8.1.3 Side and bottoms of excavation shall be cut sharp and true, undercutting shall not be permitted. Each side of excavation shall be used in lieu of formwork for placement of concrete unless authorised, in special cases, by the Owner, where limitation of space for larger excavation necessitate such decision.

8.1.4 When machines are used for excavation, the last 300mm before reaching the required level shall be excavated by hand or by such equipment that will leave the soil at the required final level, in its natural conditions.

8.1.5 Suitability for bearing of the bottoms of excavations shall be determined by the Owner.

- 8.1.6 The bottom of excavation shall be trimmed to the required level and when carried below such levels, by error, shall be brought to level by filling with lean concrete 1:4:8 mix, with aggregate of 40mm maximum nominal size at no additional cost to the Owner.
- 8.1.7 The Contractor shall be responsible for assumptions and conclusions regarding the nature of materials to be excavated and the difficulty of making and maintaining the required excavations and performing the work required as shown on the drawing and in accordance with these specifications. The Contractor shall be responsible for any damage to any part of the work and property caused by collapse of sides of excavations. Materials may be salvaged, if it can be done with safety for the work and structure, as approved by the Owner.
- However, no extra claim shall be entertained for materials not salvaged or any other damage to Contractor's property as a result of the collapse. He shall not be entitled to any claim for redoing the excavation as a result of the same. Excavations for foundations specified shall be carried out at least 75mm or as specified in relevant drawings below the bottom of structural concrete and then be brought to the required level by placing lean concrete of 1:4:8 mix or as specified in drawings with aggregate of 40mm maximum nominal size.
- 8.1.8 When excavation requires coffer dams, sheet piling, bracing, sheeting, shoring, draining, dewatering etc. the Contractor shall have to provide the same as required and the cost there of shall be included in the unit rate quoted for the item of excavation and contractor shall submit necessary drawings showing arrangement and details of proposed installation and shall not proceed until he has received approval from the Owner.
- 8.1.9 The Contractor shall have to constantly pump out the water collected in pits due to rain water, springs, seepage etc. and maintain dry working conditions at no extra cost to the Owner.
- 8.1.10 For the purpose of excavation in earthwork, all types of soil including kankar, morum, shingle and boulders up to 150mm size are included and no separate payment shall be made for different type of soils encountered.

8.2 Form work

8.2.1 General

- 8.2.1.1 If it is so desired by the Owner, the Contractor shall prepare, before commencement of the actual work, design and drawings for form work and centering and get them approved by the Owner. The form work shall conform to the shape, alignment and dimensions as shown in the drawings.

Form work shall be composed of steel and/or best quality shuttering wood of non - absorbent type or plywood. Timber shall be free from significant knots and shall be of medium grain as far as possible and hard woods shall be used as caps and wedges under or over posts. Plywood or equivalent shall be used where specified to obtain smooth surfaces for exposed concrete work. Struts shall generally be mild steel tubes, and strong sal

ballis of 150mm in diameter or above. Bamboos, small diameter ballis, etc. shall not be used unless approved by the Owner in specified cases.

- 8.2.1.2 Supports or props should not be supported on an unpropped lower suspended floor or beam unless calculations are submitted to the Owner to confirm the strength of the lower floor or beam and no propping shall be taken out until the Owner approval has been given.
- 8.2.1.3 The form work shall be true and rigid and thoroughly braced both horizontally and diagonally. The forms shall be sufficiently strong to carry without undue deformation, the dead weight of the concrete as well as working load. Where the concrete is vibrated, the formwork shall be strong enough to withstand the effects of vibration, without appreciable deflection, bulging, distortion or loosening off its components. The joints in the formwork shall be sufficiently tight to prevent any leakage of mortar. The formwork shall be such as to ensure a smooth uniform surface free from honeycombs, air bubbles, bulges, fins and other blemishes. Any blemish or defect found on the surface of the concrete must be brought to the notice of Owner immediately and rectified free of charge as directed by him. To achieve the desired rigidity, the bolts, space blocks, the wires and clamps as approved by the Owner shall be used but they must in no way impair the strength of concrete or leave stains or marks on the finished surface, where there are chances of these fixtures being embedded, only mild steel or concrete of adequate strength shall be used. Bolts passing completely through liquid retaining walls/slabs for the purpose of securing and aligning the formwork should not be used.
- 8.2.1.4 Temporary openings for cleaning, inspection and for pouring concrete may be provided at the base of vertical forms and as may be directed by the Owner. The temporary openings shall be so formed that they can be conveniently closed when required and must not leave any mark on the concrete.

8.2.2 Cleaning and Treatment of Forms

- 8.2.2.1 All forms shall be thoroughly cleaned of old concrete wood shavings, saw dust, dirt and dust sticking to them before they are fixed in position. All rubbish loose concrete, chippings, shavings, saw dust etc. shall be scrupulously removed from the interior of the forms before the concrete is poured. Along with wire brushes, brooms, etc. compressed air jet and/or water jet shall be kept handy for cleaning, if directed by the Owner.
- 8.2.2.2 Before shuttering is placed in position the form surface in contact with concrete shall be treated with approved non-standing oil or composition of other material approved by the Owner. Care shall be taken that the oil or composition does not come in contact with reinforcing steel or existing concrete surface. They shall not be allowed to accumulate at the bottom of the shuttering.
- 8.2.2.3 If formwork for pedestal/chimney is erected for the full height of the section, as placing of concrete proceeds, wedges, spacer bolts, clamps or other suitable means shall be provided to allow accurate adjustment of the formwork and to allow it to be removed gradually without jarring the concrete.

8.2.3 Removal of Forms

- 8.2.3.1 The Contractor shall begin the removal of formwork only after approval of Owner. He shall place on record the date on which the concrete is placed in different parts of the work and the date of the removal of formwork there from. This record shall be checked and countersigned by the Owner. The Contractor shall be responsible for the safe removal of formwork but the Owner may delay the time of removal if he considers it necessary. Any work showing signs of damage through premature removal of formwork or loading shall be entirely reconstructed without any extra cost to Owner.
- 8.2.3.2 Forms for various types of structural components shall not be removed before the minimum periods specified below which shall also be subject to the approval of the Owner.
- 8.2.3.3 No supporting forms shall be removed suddenly in such manner as to create shock loading. Forms for sides shall not be removed before 2 days. Bottom forms shall not be removed before 28 days unless this period is reduced with specified concurrence of the Owner. However, in any case, formwork shall not be struck until the concrete has reached a strength at least twice the stress to which the concrete may be subjected to, at the time of removal of forms.

8.2.4 Re-use of Forms

Before re-use, all forms shall be thoroughly scrapped cleaned and joints, etc. shall be examined, when necessary repaired and inside surface treated as specified. Formwork shall not be used/re-used, if declared unfit or unserviceable by the Owner.

8.3 Back Filling

8.3.1 General Requirement

- 8.3.1.1 After completion of foundation footings, pile caps, pedestals, tie beams and other constructions below the elevation of the grades, and prior to back filling, all forms of temporary shoring, timber etc. shall be removed and the excavation cleaned of all trash, debris and perishable materials, back filling shall begin only with the approval of the Owner.
- 8.3.1.2 The soil to be used for back filling purpose shall be inorganic material and shall be free from any foreign substance which can harm or impair the strength of footing in any manner. In any case the soil to be used for back filling purpose shall have the prior approval of the Owner.
- 8.3.1.3 The soil to be used for back filling purpose shall be either from the excavated earth or from the borrow pits, as directed by the Owner. The soil may have to be brought from a distance up to 2 km. By the shortest haulage route as approved by the Owner. If directed by the Owner, the excavated earth from the adjoining areas (which is to be disposed off up to a distance of 500 meters by manual labour) shall be used as for back filling purpose.
- 8.3.1.4 Back filling shall not be dropped directly upon or against any structure where there is danger of displacement or damage.
- 8.3.1.5 Back filling shall be placed in horizontal layers not to exceed 200mm in thickness. Each layer shall be compacted with proper moisture content and with such equipment as may be required to obtain a density equal to or greater than 95% of maximum dry density as determined by the relevant Indian Standard. The method of compaction shall be subject to the approval of the Owner. Pushing of earth for back filling shall not be

adopted under any circumstances.

8.3.1.6 On completion of structures, the earth surrounding them shall be accurately finished to line and grade as shown on the drawings or as per the instruction of the Owner. Finished surface shall be free of irregularities and depressions and shall be within 50mm of the specified level.

8.3.1.7 Any additional quantity of back filling, if required, beyond the excavation payment line shall be done by the contractor at his own expense.

8.4 Construction Joints

- a) When the work is to be interrupted, the concrete shall be rebated at the joint to such shape and size as may be required by the Owner or as shown on the drawings. All vertical construction joints shall be made with stone boards, which are rigidly fixed and slotted to allow for the passage of the reinforcing steel. If desired by the Owner, keys and/or dowel bars shall be provided at the construction joints. Construction joints shall be provided in positions as shown or described on the drawing. Where it is not described, the joints shall be in accordance with the following :
 - i) In a column, the joint shall be formed about 75mm below the lowest soffit of the beams framing into it.
 - ii) Concrete in tie beam shall be placed throughout without a joint, but if the provision or a joint is unavoidable, the joint shall be vertical and at the middle of the span.
 - iii) In forming a joint, concrete shall not be allowed to slope away to thin edge. The locations of construction joints shall be planned by the Contractor well in advance of pouring and have to be approved by the Owner.
- b) Before the fresh concrete is placed, the cement skin of the partially hardened concrete shall be thoroughly removed and surface made rough by hacking, sand blasting, water jetting, air jetting or any other method as directed by the Owner. The rough surface shall be thoroughly wetted for about two hours and shall be dried and coated with 1:1 freshly mixed cement sand slurry immediately before placing the new concrete. The new concrete shall be worked against the prepared surface before the slurry sets. Special care shall be taken to see that the first layer of concrete placed after a construction joint is thoroughly rammed against the existing layer. Old joints during pour shall be treated with 1:1 freshly made cement sand slurry only after removing all loose materials.
- c) The unit rate of concrete work shall include the cost of construction joints.

8.5 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 leaking from such ground during placing of concrete and for a period of three

days or as otherwise instructed by the Owner after placing of concrete. 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 prevent floatation or flooding. Steps, as approved by the Owner, shall also be taken to protect -immature concrete from damage by debris, excessive loading, vibration etc. which may impair the strength or durability of the concrete. All fresh concrete shall be covered with a layer of Hessian or similar absorbent material and kept constantly wet for a period of seven days or more from the date of placing of concrete as per directions of the Owner. Curing can also be made by ponding. Concrete shall be cured by flooding with water of minimum 25mm depth for the period mentioned above. Step shall also be taken to protect immature concrete from damage debris by excessive loading, vibrations, abrasions, deleterious ground water, mixing with earth or foreign materials, floatation etc. that may impair the strength and durability of the concrete. Approved curing compound can be used with the permission of the Owner. Such compound shall be applied to all exposed surfaces of the concrete as soon as possible after the concrete has set.

9.0 Pile Installation

Installation of piles shall be carried out as per pile layout drawings, installation criteria, technical specifications and the directions of the Owner.

9.1 Equipment and Accessories

- 9.1.1 The equipment and accessories for installation of bored cast-in-situ piles shall be selected giving due consideration to the sub soil conditions, ground water conditions and the method of casting, etc. These shall be of standard type and shall have the approval of the Owner.
- 9.1.2 The capacity of the rig shall be adequate so as to reach the specified founding level.
- 9.1.3 Provision shall be kept for chiseling within the pile bore, as specified in this specification. Chiseling shall be carried out only with the approval of Owner. The contractor must have the provision of equipment/accessories which can bore in the hard rock strata if required, without any additional cost implication to the Owner.

9.2 Installation Criteria

- 9.2.1 The Contractor while boring the pile bores, shall constantly collect the bore spoils and these shall be compared with the layer wise soil classifications reported in the bore- log details of the location, reported in the soil investigation report. Should there be any variation between the two soil classification, these shall be immediately reported to the Owner.
- 9.2.2 Whenever the rock strata is encountered in the pile bore, the Contractor shall immediately report the matter to the Owner and shall take up the work of rock chiseling or any other suitable method only after the certification/approval of the Owner. Since the piles are required to be terminated in the firm/hard strata and as stipulated in the construction

drawing the Contractor shall demonstrate such founding strata and seek approval of the Owner before terminating the piles.

9.2.3 The pile should be socketed and founded in good rock only. Whenever rock strata is encountered at any pile bore and the level of good rock (i.e. rock strata is not highly fractured and weathered and core recovery is not less than 80% with RQD 70%) is different than that is given in the Geotechnical Investigation report, in that case to establish the level of good rock, core drilling is necessary to be carried out at least upto 5m depth in rock strata encountered by the contractor without any additional cost implication to GETCO and no time extension will be permitted on this account.

9.2.4 In order to verify the terminating depth, where rock strata is met with, the rock samples obtained from the bore spoils of pile shall also be tested for point load strength index and these shall then be compared/correlated to the values of uniaxial compression strength test shown in the soil investigation report. Accordingly, the termination of piles in the socketing zone shall be done with prior approval of the Owner.

9.3 Control of position and alignment

Piles shall be installed vertically as accurately as possible as per the construction drawing. The permissible limits for deviation with respect to position and inclination/alignment shall conform to IS-2911 (Part I/Sec.2), as reproduced below. Maximum permissible deviation in alignment is 1.5% . Piles should not deviate more than 75mm or D/10 which ever is less from their positions at the working level. In case of piles deviating beyond these limits, the piles should be replaced or supplemented by one or more additional piles including the revised cap size(as the situation may be) at no additional cost to the Owner. Any extra claim whatsoever from the contractor on this account shall not be entertained.

9.4 Boring

9.4.1 Boring operations shall be done by rotary or percussion type drilling rigs using Direct Mud Circulation (DMC), Reverse Mud Circulation (RMC) methods or grab method. In soft clays and loose sands bailer method, if used, shall be used with caution to avoid the effect of suction. In cohesive soils, use of water for boring shall be restricted to a minimum, while boring in cohesion less deposits water level in the bore hole shall be maintained at or slightly above the standing water table.

Boring operations by any of the above methods shall be done using drilling mud. The bidder shall be required to furnish along with their bid, complete details regarding the installation of piles and the method by which they wish to install the piles.

9.4.2 The Contractor shall satisfy himself about the suitability of the method to be adopted for site. If DMC or RMC is used, bentonite slurry shall be pumped through drill rods by means of high pressure pumps. The cutting tools shall have suitable pores for the bentonite slurry to flow out at high pressure. If the Contractor fails to make proper bore for any reason, the Contractor has to modify the boring technique and switchover to other boring methods as approved by the Owner at no extra cost to the Owner.

- 9.4.3 Working level shall be above the pile cut off level. After the initial boring of about 1.0 to 2.0m temporary guide casing shall be lowered in the pile bore. The diameter of guide casing shall be of such diameter to give the necessary finished diameter of the concrete pile. The center line of guide casing shall be checked before continuing further boring. Guide casing shall be minimum 2.0m length. Additional length of guide casing shall be used depending on the conditions of the strata, ground water level etc. as required by the Owner without any additional cost to the Owner.
- 9.4.4 Use of drilling mud (bentonite slurry) for stabilising the sides of the pile bore is necessary wherever subsoil is likely to collapse in the pile bore.
- 9.4.5 The bentonite slurry and the cuttings, which are carried to the surface by the rising flow of the slurry shall pass through settling tanks of adequate size to remove the sand and spoils from the slurry before the slurry is recirculated back to the boring. The bentonite slurry mixing and recirculation plant shall be suitably designed and installed.
- 9.4.6 The bentonite slurry shall be maintained at 1.5m above the ground water level during boring operations and till the pile is concreted. When DMC or RMC method is used the bentonite slurry shall be under constant circulation till start of concreting.
- 9.4.7 The size of cutting tools shall not be less than the diameter of the pile as specified in the drawing and not more than 75mm.

9.5 Chiseling

- 9.5.1 Chiseling, if required, may be resorted to with the permission of the Owner below the socketing horizon. The chiseling tool or bit shall be of adequate size and weight so as to reach the desired depth.

9.6 Cleaning of Pile bore

- 9.6.1 After completion the pile bore up to the required depth, the bottom of the pile bore shall be thoroughly cleaned. Cleaning shall ensure that the pile bore is completely free from sludge/bored material, debris of rock/boulder etc. Necessary checks shall be made as given in this Section to confirm the thorough cleaning of the pile bore.
- 9.6.2 Pile bore shall be cleaned by fresh drilling mud through tremie pipe before start of concreting and after placing reinforcement.
- 9.6.3 Pile bore spoil along with used drilling mud shall be disposed off from site up to 2 Km. or as directed by the Owner.

9.7 Adjacent Structures

- 9.7.1 When working near existing structures care shall be taken to avoid any damage to such structures.

9.8 Concreting

- 9.8.1 Concreting shall not be done until the Owner is satisfied that the bearing strata (soil/rock) met with the termination level of pile, satisfied the installation criteria/approved founding depth.
- 9.8.2 The time between the completion of boring and placing of concrete shall not exceed 6 hrs. In case the time interval exceed 6 hrs the pile bore shall be abandoned. However, the Owner may allow concreting, provided the Contractor extends the pile bore by 0.5 m beyond the proposed depth, and clean the pile bore properly. The entire cost of all operation and materials for this extra length shall be borne by the Contractor.

- 9.8.3 Pile bore bottom shall be thoroughly cleaned to make it free from sludge or any foreign matter before and after placing the reinforcement cage.
- 9.8.4 Proper placement of the reinforcement cage to its full length shall be ensured before concreting.
- 9.8.5 Entire concreting in pile bores shall be done by tremie method. The operation of tremie concreting shall be governed by IS:2911 Part I/Sec.2. Drilling mud shall be maintained sufficiently above the ground water level.
- 9.8.6 Concreting operations shall not proceed if the contaminated drilling mud at the bottom of the pile bore posses density more than 1.25 T/Cu.m. or sand content more than 7%. The drilling mud sample shall be collected from the bottom of pile bore. This shall be checked at regular intervals, as decided by the Owner thereafter.
- 9.8.7 Consistency of the drilling mud suspension shall be controlled throughout concreting operations in order to keep the bore stablised as well as to prevent concrete getting mixed up with the thicker suspension of the mud.
- 9.8.8 It shall be ensured that volume of concrete poured is at least equal to the theoretically computed volume of pile shaft being cast.
- 9.8.9 The temporary guide casing shall be entirely withdrawn cautiously, after concreting is done up to the required level. While withdrawing the casing concrete shall not be disturbed.
- 9.8.10 Tests on concrete cubes shall be carried out as specified in this section of the Specifications.

9.9 Cut-off-level (COL)

- 9.9.1 Cut-off-level of piles shall be as indicated in approved construction drawings or as directed by the Engineer-in-Charge.
- 9.9.2 The top of concrete in pile shall be brought above the COL to remove all laitance and weak concrete and to ensure good concrete at COL for proper embedment into pile cap.
- 9.9.3 When the pile cut off level is less than 1.0 meter below the working level, concrete shall be cast up to the piling platform level to permit overflow of concrete for visual inspection. In case COL of pile is more than 1.0 meter below working level then concrete shall be cast to minimum of one meter above COL.
- 9.9.4 In the circumstances where COL is below ground water level, the need to maintain a pressure on the unset concrete equal to or greater than water pressure shal I be observed and accordingly length of extra concrete above COL shall be determined by the Contractor with prior approval of Owner.

9.10 Sequence of Piling

- 9.10.1 Each pile shall be identified with a reference number and date wise proper record of construction shall be maintained by the Contractor.
- 9.10.2 The convenience of installation may be taken into account while scheduling the sequence of piling in a group. This scheduling shall avoid piles being bored close to other recently constructed piles.

9.11 Building up of Piles

- 9.11.1 If any pile, already cast as per construction drawing, requires any extra

casting due to any change in cut off level or the cast pile top level is less than the specified level or for any other reason, then the pile shall be built up by using M-20 grade of concrete with minimum cement content 400kg/m^3 , ensuring proper continuity with the existing concrete and to the satisfaction of the Owner. Necessary reinforcement as per design requirement and suitable shuttering shall be provided before casting the concrete. Surrounding soil shall also be built up to the required level by proper compaction to ensure lateral capacity of the pile.

9.12 Breaking off of Piles

9.12.1 If any pile already cast requires breaking due to lowering in cut off level or for any other reason, then the same shall be carried out, (not before seven days of casting of concrete in the piles) without affecting the quality of existing pile such as loosening, cracking etc. to the satisfaction of the Owner. No extra payment shall be made on this account.

9.13 Preparation of Pile head

9.13.1 The soil surrounding the piles shall be excavated up to the bottom of the lean concrete below the pile cap with provision for working space sufficient enough to place shuttering, reinforcement, concreting and any other related operations.

9.13.2 The exposed part of concrete above the COL, shall be removed/chipped off and made square at COL not before seven days of casting of pile.

9.13.3 The projected reinforcement above COL shall be properly cleaned and bent to the required shape and level to be anchored into the pile cap as shown in the drawing.

9.13.4 The pile top shall be embedded into the pile cap by minimum 50mm or clear cover to reinforcement, whichever is higher. All loose material on the top of pile head after chipping to the desired level shall be removed and disposed off up to a lead of 2km or as directed by the Owner.

9.14 Rejection and Replacement of Defective Piles

9.14.1 The Owner reserve the right to reject any pile which in his opinion is defective with reference to technical specification & construction drawings on account of load capacity, structural integrity, position, alignment, concrete quality etc. Piles that are judged defective shall be pulled out or left in place as decided by the Owner without affecting the performance of adjacent piles. The Contractor shall install additional piles to substitute the defective piles as per the directions of the Owner at no extra cost to the Owner.

9.14.2 During execution of pile foundation work, if the bore holes need to be abandoned due to any reason and pile position to be shifted or realigned, other than for any design requirement by the Owner, fresh bore holes are to be executed at a suitable new position, which may vary from 2D to 3D (where, D is diameter of pile) as decided by the Owner, which may demand for resizing of pile cap including possible increase in reinforcement quantity due to resizing of pile cap. In all such cases the abandoned bore holes are to be filled up with plain cement concrete M15 so that no cavity remain in the bore hole of the abandoned pile. Any extra claim whatsoever from the contractor on account of abandoned bore hole, filling up of abandoned bore hole with concrete and any extra cost due to resizing of pile cap including increase in reinforcement quantity shall not be entertained by the

Owner & the same have to be born by the contractor.

9.15 CRITERIA FOR TERMINATING THE PILES

- 9.15.1 The piles can be terminated at a depth based on design developed by the Owner, where loads on the piles can be transmitted to the soil in a proper manner or the depth where specified 'N' value is achieved, whichever occurs later. However, in no case piles should be terminated at a higher level than that indicated in the construction drawing.
- 9.15.2 Standard penetration test (SPT) shall be carried out starting from 1.0 M above the specified pile termination depth and there after @ 1m. up to the pile termination depth.
- 9.15.3 The Standard Penetration Test (SPT) shall be carried out based on the following test procedures:

The test shall be conducted by driving a standard split spoon sampler in the borehole by means of a 650 N hammer having a free fall of 0.75 M. The sampler shall be driven for 450 mm using the hammer and the number of blows shall be recorded for every 150mm penetration. The number of blows for the last 300 mm drive shall be reported as N value. The test shall be discontinued when the blow count is equal to 100 or the penetration is less than 25mm for 50 blows, whichever is earlier.

At the location where the test discontinued, the penetration and the number of blows shall be reported. Sufficient quantity of disturbed sample shall be collected from the split spoon sampler for identification/classification of soil. The sample shall be visually classified and recorded at the site.

The specification for the equipments and other accessories, procedure for conducting the test and collection of the disturbed soil sample shall conform to IS:2131. Recording of Piling Data

- 9.15.4 The Contractor shall record all the information during installation of piles. Typical data sheet for recording pile data as shown in Appendix D of IS:2911 Part I/Sec.2 shall be maintained by the contractor. The pile data shall also include all the details as in Annexure-D. On completion of each pile installation, pile record in triplicate shall be submitted to Owner within two days of completion of concreting of the pile.

9.16 Check for Pile bore

- 9.16.1 On completion of boring and cleaning the bottom of each pile bore shall be checked by the methods as approved by the Owner, to ensure that it is free from pile bore spoil/debris and any other loose material, before concreting. Concreting shall be done only after the approval of the Owner.
- 9.16.2 For sampling of drilling mud from the pile bore the following method or any other suitable method shall be adopted. A solid cone shall be lowered by a string to the bottom of pile bore. A sampler tube closed at top with a central hole (hollow cylinder) is lowered over the cone, then a top cover shall be lowered over the cylinder. Care shall be taken for proper fittings of assembly to minimise the leakage while lifting the cone assembly to the ground surface. The slurry collected in the sampler tube shall be tested for density and sand content.

9.17 Properties of drilling mud

- 9.17.1 Properties of drilling mud shall be checked as per requirements indicated in Annexure 'C' prior to the commencement of piling work and thereafter at least once in a week or as found necessary by the Owner, one sample consisting of 3 specimens shall be tested.
- 9.17.2 Density and sand content of the drilling mud shall be checked in each pile.

10.0 Erection of Steel Embedded Parts

- 10.1 This covers the technical requirements for the supply and fabrication and/or erection of all embedded steel parts by the Contractor. The extent and type of embedded steel parts to be erected shall be as per detailed drawings.
- 10.2 The supply of embedded steel parts like ladders, steel pieces set in concrete inserts, dowel bars required for construction joints etc. are in the scope of the Contractor. However, supply of anchor bolts/stubs, as the case may be, will be supplied by tower contractor.
- 10.3 Embedded steel parts shall include items such as foundation anchor bolts, stubs, ladders, steel pieces set in concrete inserts, dowel bars for concrete work, , etc. shown on the drawing or as required by the Owner. Material shall also include setting in forms for connecting in place and grouting as required. The grouting operations, if required, shall be performed as per the direction of Owner.
- 10.4 The Contractor shall erect all embedded steel parts in accordance with the drawings and these specification including setting materials in concrete or grouting pieces in place, furnishing all labour, materials, scaffolding, tools and services necessary for and incidental to the work to its transporting, unloading, storing, handling and erection. Contractor shall furnish welding rods and arrange for field welding as required in accordance with IS : 816.
- 10.5 Exposed surface of embedded material are to be painted with one coat of approved anticorrosive and/or bituminous paint without any extra cost to the Owner. The threads of holding down bolts shall be greased and protected with water proof tape.

11.0 Installation

- 11.1 During erection, the Contractor shall provide necessary temporary bracing or supports to ensure proper installation of the materials. All materials shall be erected in the true locations as shown in the drawings, plumb and level. Extreme care shall be taken to ensure that the threads of holding down bolts and comparable items are protected from damage. Groups of holding down bolts shall be set in such a manner that the tolerance of whole group is not more than 3mm from its true position in plan at the top of the bolt and not more than 3mm from the required level. The top ends of all bolt shanks shall be in one plane to the tolerance stated above. Holding down bolt assemblies shall be set vertically to a tolerance of not more than 1:500.

12.0 Protection Against Damage in Transit

- 12.1 All steel work shall be efficiently and sufficiently protected against damage in transit to site from any cause whatsoever. All protecting plates or bars and all ends of members at joints shall be stiffened, all straight bars and plates shall be bundled, all screwed ends and machined surface shall be suitably packed and all bolts, nuts, washers

and small loose parts shall be packed separately in cases so as to prevent damage or distortion during transit. Should there be any distortion of fabricated members, the Contractor shall immediately report the matter to the Owner. Distorted reinforcement bars or plates received from stores or distorted during transport from stores to the fabrication yard shall not be used in fabrication unless the distortions are minor which in the opinion of the Owner can be removed by acceptable methods. The cost of all such straightening shall be borne by the Contractor within his unit rates.

These distortions shall be rectified by the Contractor by cold bending. If heating is necessary to rectify the defects, the details of the procedure shall be intimated to the Owner whose approval shall be taken before such rectification. The temperature of heat treatment shall not exceed the limits beyond which the original properties of steel are likely to be impaired.

13.0 Foundations Bolts

13.1 The foundation bolts / stubs, as required, for the tower structures shall be supplied by the respective tower contractor. These shall be embedded in concrete while the foundation is cast. The Contractor shall ensure the proper alignment of these bolts to match the holes in the base plate and also co-ordinate with the respective tower contractor for its correctness. The final adjustment of these bolts and their grouting are included in the scope of this contract. Grouting of block outs and the gap between the base plate and top of concrete shall be done by the Contractor after finalisation of alignments. The unit rate of concreting shall include the cost of above adjustments, grouting, and skins etc. required for this purpose.

13.2 The Contractor shall be responsible for the correct alignment and leveling of all steel work on site to ensure that the towers are in plumb.

13.3 Before erection of towers, by tower contractor, on the foundations the top surface of base concrete shall be thoroughly cleaned with wire brushes and by chipping to remove all laitance and loose materials and shall be chipped with a chisel to ensure proper bond between the grout and the foundation concrete. The piling Contractor shall also be responsible for bringing down the top of concrete to the desired level by chipping. In case the foundation as cast is lower than the desired level, the Contractor shall make up the difference by providing additional pack plates without extra cost for any such work or material. No steel structures shall be erected on their foundations unless such foundations have been certified fit for erection by the Owner. Adequate number of air release holes and inspection holes shall be provided in the base plate.

14.0 Stability of Structure

14.1 The Contractor shall be responsible for the stability of the structure at all stages of its erection at site and shall take all necessary measures by the additions of temporary bracings and guying to ensure adequate resistance to wind and also to loads due to erection equipment and their operations. Guying and bracing shall be done for erection equipment and their operations. Guying and bracing shall be done in such a way that it does not interface with the movement or working of other agencies working in the area. For the purpose of guying, the Contractor shall not use other structures in the vicinity which are likely to be

damaged by the guy.

Such temporary bracings shall neither be included in the measurement nor extra rate shall be payable. Such temporary bracings used shall be the property of the Contractor and may be removed by him at the end of the job from the site of work.

Grouting and under Pinning

15.0 General

- 15.0.1 Furnishing of all labour materials and equipment and performance of all operations necessary to complete the work of grouting of block outs and foundation bolt holes and under pinning of base plates is in the scope of the Contractor. The cost of the above shall be included in the unit concreting rate.
- 15.0.2 Grouting shall be adopted for filling the block outs, pockets below foundation bolt holes. The block out and bolt holes which have to be grouted shall be cleaned thoroughly by use of compressed air immediately before taking up the grouting operations.
- 15.0.3 Cement and aluminium powder or anti-shrinkage admixture of approved quality shall be first blended thoroughly in the required proportions as per manufacturer's specification. The mix of grouting shall contain one part of cement and two parts of coarse sand. Admixture should be according to IS:9103.
- 15.0.4 The quantity of aluminum powder shall usually be of the order of 0.005% by weight of cement. Any grout which has been mixed for a period longer than half an hour shall not be used on the work. Immediately after preparation the grout shall be poured into the block outs, pockets and foundation bolt holes either from the sides or through the holes provided for this purpose in the base plate, by using special equipment for pressure grouting. It shall be ensured by rodding and by tapping of bolts that the block out is completely filled without leaving any voids. The pouring shall cease as soon as each hole is filled and any excess grout found on the surface of the concrete foundation shall be completely removed and the surface dried.
- 15.0.5 Under pinning It shall be resorted to for filling the space between the underside of base plate and the top of foundation concrete. After grouting has been completed as specified above, space between the top surface of the foundation concrete and the underside of the base plate shall be filled with mortar or concrete depending upon thickness to be filled as follows :

Less than 40mm	Dry packed cement mortar
Over 40mm	Dry packed fine concrete

Mortar, fine concrete shall be blended with aluminium powder about 0.005% by weight of cement or with anti-shrinkage admixture in a suitable proportion to the cement mortar in accordance with the recommendations of the manufacturer and subject to the approval of the Owner. Mortar shall comprise cement, sand and water in proportion of approx. 1:3:0.4 by weight. Concrete shall comprise cement, sand, 10mm max. sized aggregate and water in proportion of 1:1.25:2:0.4 by weight. In all cases minimum 28 days cube strength should not be less than 25N/mm².

Shims provided for the alignment of bases shall be positioned at the edges of the base to permit subsequent removal which shall take place not less than 7 days after the underpinning has been executed. The resulting cavities shall be made good with the same grade of mortar or concrete as has been used for the underpinning of the rest of the base plate.

- 15.0.6 Cement, sand and aluminium powder or approved anti-shrinkage admixture, shall first be blended thoroughly in the required proportion. The mortar shall then be prepared by mixing with quantity of water which will produce a sufficiently workable mix to enable complete and proper compaction of the mortar.
- 15.0.7 The mortar shall then be placed below the base plate and rammed in a horizontal direction for each edge until the mortar oozes out through the grout holes provided in the base plate.
- 15.0.8 When it is clear that the center of base has been properly filled, the mortar outside the base plate shall be briefly rammed to ensure compaction below the edges. Any mortar which has been mixed for a period longer than half an hour, shall not be used in the work.

15.1 Materials

- 15.1.1 Cement shall conform to the stipulations contained in IS:8112 and shall have a fineness (specific surface of cement) not less than 225 sq.m./kg when tested for fineness by Blaine's air permeability method as per IS:4031.
- 15.1.2 Sand shall conform to the stipulations contained in IS:383.
- 15.1.3 Water shall be clean and fresh and shall be of potable quality.
- 15.1.4 Aluminium powder or anti-shrinkage admixture like 'Groutex' CRS-NS grout (by Cement Research Institute of India) or its equivalent shall be of standard brand from reputed manufacturer and shall be approved by the Owner prior to its use for work.

15.2 CURING

The work shall be cured for a period of 7 days commencing 24 hours after the completion of the grouting and underpinning operations. The curing shall be done by covering the surfaces with wet gunny bags.

16.0 Bar Grips

- 16.1 This covers the technical requirement for furnishing and installation of bar grips complete including all labour materials, equipments, staging, etc.
- 16.2 The Contractor shall furnish and install the bar grips for various dia of deformed bars as indicated in drawings and as required by these specifications. The bar grip splicing system shall be of approved manufacturer and of the best quality available subject to approval of the Owner.

17.0 Splicing

- 17.1
 - a) The reinforcement bars are to be joined without any gap and the sleeve placed in position.
 - b) Pressure is applied by means of a hydraulic press which swages the sleeve down on the bar ends in a series of bites which are

applied at high pressure.

- c) The job can also be done in two stages. The 1st stage is to press the half sleeve on the loose bar at the reinforcement yard. The 2nd stage work is to be done at the actual site after the loose bar is inserted through the unrepresented end of the sleeve and pressed insitu.

- 17.2** The joints shall be staggered as far as possible. Necessary staging arrangements are to be made by the Contractor.
- 17.3** It may be necessary to fix the sleeve to the reinforcement bars at one end in the open yard for the facility of working. All these working details are to be furnished earlier subject to the approval of the Owner.
- 17.4** The length of the sleeve should be adequate, that it is safe under the pull out loading conditions.
- 17.5** One percent representative samples of each dia, bars shall be sent for laboratory testing at the cost of the Contractor to check the efficiency of the joints under ideal condition. These samples of sleeves will be sent in the Laboratory for pull out tests.
- 17.6** All bar grips installation shall be subject to inspection and approval by the Owner before concreting operation are performed. In case of any defect or joint being not up to mark, the same shall be replaced by the Contractor at no extra cost.

NOTE:

At the time of execution the soil strata should match with the parameters considered in the design of pile foundation.

For that req. standard penetration tests will be carried out by contractor at his own cost to ascertain the design parameters. Any change req. in design will have to be carried out with the prior approval of Engineer-in-charge.

Price Schedule Grand Summary

Grand Summary

Schedule	Particulars	Amount in Rupees
Schedule-1	Supply of Plant & Machinery and Mandatory Spares	
Schedule-2	Freight and Insurance	
Schedule-3	(a) Installation and Other Services including civil works	
Schedule-4	(a) Dismantling work including lowering of Conductor, Ground wire etc	
Grand Total	Schedules (1+2+3+4)	

Section – 4

**BID SUBMISSION SHEET, BID FORMS AND
SCHEDULES**

1 Bid Submission Sheet

Name _____ of _____ Contract: _____

To:

The Managing Director,
Assam Electricity Grid Corporation Ltd,
Bijulee Bhawan, Paltanbazar, Guwahati-781001

Sir:

We have examined the General Conditions of Contract, Technical Specification, Schedules, and Addenda Nos _____(if any). We have understood and checked these documents and have not found any errors in them. We accordingly offer to execute and complete the said Works and remedy any defects fit for purpose in conformity with these documents and the enclosed Proposal (Offer), for the fixed sum of Rupees _____ (insert total quoted total price in figures and words).

We accept your suggestions for the appointment of the Dispute Adjudication Board, as set out in the Bidding Document.

We agree to abide by this Bid until _____ and it shall remain binding upon us and may be accepted at any time before that date.

If our bid is accepted, we will provide the specified performance security, commence the Works as soon as reasonably possible after receiving the notice to commence, and complete the Works in accordance with the above-named documents within the time stated in the Bidding Document.

Unless and until a formal Agreement is prepared and executed this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.

We understand that you are not bound to accept the lowest or any bid you may receive.

Commissions or gratuities, if any, paid or to be paid by us to agents relating to this Bid, and to contract execution if we are awarded the contract, are listed below:

Yours faithfully

Signature _____ in the capacity of _____ duly authorized to sign
bids _____ for _____ and _____ on _____ behalf _____ of _____

Address _____

2 Form of Bid Security (Bank Guarantee)

WHEREAS, _____ [*Name of Bidder*] (hereinafter called "the Bidder") has submitted his bid dated _____ [*Date*] for the construction of _____ [*Name of Contract*] (hereinafter called "the Bid").

KNOW ALL MEN by these presents that We _____ [*Name of Bank*] of _____ [*Name of Country*] having our registered office at _____ (hereinafter called "the Bank") are bound unto _____ [*Name of Employer*] (hereinafter called "the Employer") in the sum of _____ for which payment well and truly to be made to the said Employer the Bank binds himself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this ___ day of _____ 20__.

THE CONDITIONS of this obligation are:

- (1) If the bidder withdraws his Bid during the period of bid validity specified in the Form of Bid: Or
- (2) If the Bidder refuses to accept the correction of errors in his Bid; Or
- (3) if the Bidder, having been notified of the acceptance of his Bid by the Employer during the period of Bid validity;
 - (a) fails or refuses to execute the Form of Contract Agreement in accordance with the Instructions to Bidders, if required; or
 - (b) fails or refuses to furnish the Performance Security, in accordance with the Instructions to Bidders;

we undertake to pay to the Employer up to the above amount upon receipt of its first written demand, without the Employer having to substantiate its demand, provided that in its demand the Employer will note that the amount claimed by it is due to it owing to the occurrence of one or all of the three conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date 210 days after the deadline for submission of bids as such deadline is stated in the Instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this Guarantee should reach the Bank not later than the above date.

DATE _____

SIGNATURE OF THE BANK

WITNESS _____

SEAL

(Signature, Name, and Address)

3. Work Completion Schedule

We hereby declare that the following Work Completion Schedule shall be followed by us in executing the works covered under the Scope of this Bid.

Sl. No.	Description of Work	Period in Months (from the date of LOA)
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Date : (Signature)

Place : (Printed Name)

(Designation).....

Seal).....

(Common