BIDDING DOCUMENT
FOR

"Route Survey & Soil Investigation for Construction of 132kV Transmission Line for Power Import to OIL, Madhuban from 132kV Bordubi GSS and preparation of Master Plan for Construction of 1(One) No. of 132/33KV Grid Substation (AIS and GIS) at OIL, Madhuban"

(E Tender)

BID IDENTIFICATION NO: **AEGCL/MD/CGM(UAR)/OIL MADHUBAN/132KV/2026/BID**

Source of Fund: Deposit Scheme

ASSAM ELECTRICITY GRID CORPORATION LIMITED

Price: ₹ 1000/-

Section -1

Instructions to Bidders

This section specifies the procedures to be followed by Bidders in the preparation and submission of their Bids. Information is also provided on the submission, opening, and evaluation of bids and on the award of contract.

Table of Clauses

Section 1 – Instructions to Bidders

1.1.0 General

1.1.1. Scope of Bid

1.1.1.1. In support of the Invitation for Bids indicated in the Bid Data Sheet (BDS), the ***Chief General Manager (O&M), UAR*** on behalf of ***Assam Electricity Grid Corporation Limited (AEGCL)*** (hereinafter referred to as "the Purchaser" or "AEGCL"), issues this Bidding Document for Services incidental thereto as specified in Section 3 (Employer's Requirements). The name and identification nos. of this Competitive Bidding are provided in the Bid Data Sheet (BDS) attached as Appendix to ITB-1 of this Section.

1.1.1.2. Unless otherwise stated, throughout this Bidding Document definitions of terms shall be as prescribed in **Section 5** (Special Conditions of Contract).

1.1.2. Eligible Bidders

1.1.2.1. Subject to meeting the Qualifying Requirements, a Bidder may be a firm or company. When the bidder is a firm, the names and address of the partners should be indicated and a copy of the certificate of registration with the concerned Registrar of firms should be enclosed with the Bid.

1.1.2.2. When the bidder is a Company, the company registration document along with Memorandum of Association should be submitted.

1.1.2.3. When the bidder is an individual carrying on business in a firm's name, the tender should be submitted by the owner of the firm, who may describe himself as carrying on business in the firm's name.

1.1.2.4. JV is not allowed for this tender.

1.2.0 Contents of Bidding Document

1.2.1. Sections of Bidding Document

1.2.1.1. The Bidding Document consists of following six Sections, and should be read in conjunction with any Addenda issued in accordance with ITB ***Clause*** 1.2.3.

Section 1 - Instructions to Bidders (ITB) with Appendix-1 and Appendix-2
Section 2 - Bidding Forms (BDF)
Section 3 - Employer's Requirements
Section 4 - "General Conditions of Supply and Erection of AEGCL"
(This *section is supplied separately)*
Section 5- Special Conditions of Contract (SCC)

1.2.1.2. The Invitation for Bids issued by the Purchaser is not part of the Bidding Document.

1.2.1.3. The Purchaser is not responsible for the completeness of the Bidding Document and its addenda, if they were not obtained directly from the source stated by the Purchaser in the Invitation for Bids.

1.2.1.4. The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Document. Failure to furnish all information or documentation required by the Bidding Document may result in the rejection of the bid.

1.2.2. Clarification of Bidding Document, Site Visit

1.2.2.1. A prospective Bidder requiring any clarification of the Bidding Document shall contact the Purchaser through e-mail or in writing at the Purchaser's address indicated in the ***BDS***. The Purchaser will respond to any request for clarification, provided that such request is received no later than seven (7) days prior to the deadline for submission of bids. The Purchaser's response shall be in writing / e-mail with copies to all Bidders who have acquired the Bidding Document in accordance with ***ITB Clause*** 1.2.1.3, including a description of the inquiry but without identifying its source. Should the Purchaser deem it necessary to amend the Bidding Document as a result of a request for clarification, it shall do so following the procedure under ***ITB Clause*** 1.2.3 and ***ITB Clause*** 1.4.2.2.

1.2.3. Amendment of Bidding Document

1.2.3.1. At any time prior to the deadline for submission of bids, the Purchaser may amend the Bidding Document by issuing addenda.

1.2.3.2. Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the Bidding Document from the Purchaser in accordance with ***ITB Clause*** 1.2.1.3.

1.2.3.3. To give prospective Bidders reasonable time in which to take an addendum into account in preparing their bids, the Purchaser may, at its discretion, extend the deadline for the submission of bids, pursuant to ***ITB Clause*** 1.4.2.2.

1.3.0 Preparation of Bids

1.3.1. Cost of Bidding

1.3.1.1. The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Purchaser shall not be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

1.3.2. Language of Bid

1.3.2.1. The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Purchaser, shall be written in the English language. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages into the English language, in which case, for purposes of interpretation of the Bid, such translation shall govern.

1.3.3. Documents Comprising the Bid

1.3.3.1. The Bid shall comprise two envelopes submitted simultaneously, one called the '**Technical Bid'** containing the documents listed in ***ITB Clause 1.3.3.2*** and the other the **Price Bid** containing the documents listed in ***ITB Clause 1.3.3.3***, both envelopes must be submitted online through e-tendering portal http://assamtenders.gov.in.

1.3.3.2. The Technical Bid submitted by the Bidder shall comprise the following:

(a) Letter of Technical Bid;

(b) Bid Security, in accordance with ***ITB Clause*** 1.3.8;

(c) Documentary evidence in accordance with ***ITB Clause 1.3.5*** establishing the Bidder's eligibility and qualifications to perform the contract if its Bid is accepted;

(d) Documents as called for in ***ITB Clauses***1.1.2.1***,*** 1.1.2.2***,*** and1.1.2.3;

(e) Any other document required in the ***BDS***.

1.3.3.3. The Price Bid submitted by the Bidder shall comprise the following:

(a) Completed schedules as required, including Price Schedules, in accordance with ***ITB Clauses*** 1.3.4 and 1.3.6; and

(b) any other document required in the ***BDS.***

1.3.4. Letter of Bid and Schedules

1.3.4.1. The Letters of Technical Bid and Price Bid, and the Schedules, and all documents listed under ***ITB Clause*** 1.3.3, shall be prepared using the relevant forms furnished in Section 2 (Bidding Forms). The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested.

1.3.5. Documents Establishing the Eligibility and Qualifications of the Bidder

1.3.5.1. To establish its eligibility and qualifications to perform the Contract in accordance with Appendix 2 of ITB (Evaluation and Qualification Criteria), the Bidder shall provide the information requested in the corresponding information sheets included in Section 2 (Bidding Forms).

1.3.6. Bid Prices

1.3.6.1. Unless otherwise specified in the **BDS** and/or Section 3 (Employer's Requirements), bidders shall quote for the entire scope of services on a "single responsibility" basis such that the total bid price covers all the Bidder's obligations mentioned in or to be reasonably inferred from the bidding document in respect of completion of the entire scope.

1.3.6.2. Bidders are required to quote the price for the obligations outlined in the bidding document. No deviation in this regard normally, shall be accepted.

1.3.6.3. Bidders shall give a breakdown of the prices in the manner and detail called for in the Price Schedules included in Section 2 (Bidding Forms), given for reference.
In case of e-tender, the bidder shall fill up the Price schedules as provided in the online tender.

Schedule No. 1: Schedule of Work for Route Survey & Soil Investigation

Schedule No. 2: Preparation of Master Plan for construction of 1(One) No. of 132/33KV Grid Substation (AIS and GIS) at OIL, Madhuban

1.3.6.4. In the Schedules, bidders shall give the required details and a breakdown of their prices as called for in these Schedules.

1.3.6.5. The prices shall be either fixed or adjustable as specified in the **BDS**.

1.3.7. Period of Validity of Bids

1.3.7.1. Bids shall remain valid for the period specified in the ***BDS*** after the bid submission deadline date prescribed by the Purchaser. A bid valid for a shorter period ***shall be rejected*** by the Purchaser as non-responsive.

1.3.7.2. In exceptional circumstances, prior to the expiration of the bid validity period, the Purchaser may request Bidders to extend the period of validity of their bids. The request and the responses shall be made in writing. If a bid security is requested in accordance with ***ITB Clause*** 1.3.8, it shall also be extended for a corresponding period. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request shall not be required or permitted to modify its bid.

1.3.8. Bid Security

1.3.8.1. The Bidder shall furnish as part of its bid, in original form, a Bid Security as specified in the ***BDS***. The amount of Bid Security shall be as specified in the **BDS**.

1.3.8.2. The bid security shall be **submitted online** through the E-tendering portal.

1.3.8.3. The bid security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required performance security.

1.3.8.4. The bid security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder's furnishing of the performance security pursuant to ***ITB Clause***1.5.15.

1.3.8.5. The bid security may be forfeited:

(a) if a Bidder withdraws its bid during the period of bid validity specified by the Bidder on the Letter of Bid Form, except as provided in ***ITB Clause***1.3.7.2 or

(b) if the successful Bidder fails to:

(i) Submit acknowledge for the receipt of Work Order in accordance with ***ITB Clause***1.5.13.1; or

(ii) Furnish a performance security in accordance with ***ITB Clause*** 1.5.14.

1.3.9. Format and Signing of Bid

1.3.9.1. The Bidder shall upload one original of the Technical Bid and one original of the Price Bid comprising the Bid as described in ***ITB Clause*** 1.3.3

1.3.9.2. The uploaded Bid shall be and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified in the ***BDS*** and shall be attached to the bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the bid where entries or amendments have been made shall be signed or initialised by the person signing the bid.

1.4.0 Submission and Opening of Bids

1.4.1. On-line submission of Bids

1.4.1.1. The Technical as well as Price Bid should be submitted **through online portal only.**

1.4.1.2. For Technical bid, all forms and supporting documents as required by ITB Clause 1.3.2 and duly signed and stamped as per ITB Clause 1.3.10 are to be uploaded to the e-tendering portal. The documents are to be uploaded in pdf format (as specified in the e-tender portal **www.assamtenders.gov.in**).

1.4.1.3. The Price Bid must be submitted in the Price Schedule provided on the e-tendering portal as per the online format.

1.4.2. Deadline for Submission of Bids

1.4.2.1. Bids shall be received **ONLINE only** on or before the date and time indicated in the ***BDS***.

1.4.2.2. The Purchaser may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Document in accordance with ***ITB Clause*** 1.2.3, in which case all rights and obligations of the Purchaser and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

1.4.3. Late Bids

1.4.3.1. The e-tendering portal shall allow the bidders to submit bids up to the date and time specified in ITB Clause 1.4.2 as per Server Clock. Bidders are advised to submit their bids well in advance of the deadline for submission of bids to avoid any last-minute difficulties.

1.4.4. Withdrawal, Substitution, and Modification of Bids

1.4.4.1. E-tendering portal shall allow modification of bids any time before the deadline for Bid Submission. A bidder may withdraw its bid, by sending a written notice duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ***ITB Clause*** 1.3.9.1, Notices must be received by the purchaser prior to the deadline prescribed for submission of bids, in accordance with ***ITB Clause*** 1.4.2.

1.4.4.2. No bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Letter of Technical Bid or any extension thereof.

1.4.5. Bid Opening

1.4.5.1. The Purchaser shall conduct the opening of Technical Bids through online process at the address, date and time specified in the BDS. The Bid Opening Committee shall open the bids received online in the presence of Bidders` designated representatives who choose to attend. The Price Bids will remain unopened until the specified time of their opening.

1.4.5.2. Only Technical Bids and alternative Technical Bids read out and recorded at bid opening shall be considered for evaluation. No bid shall be rejected at the opening of Technical Bids except for withdrawn bids.

1.4.5.3. The Purchaser shall prepare a record of the opening of Technical Bids that shall include, as a minimum: the name of the Bidder and whether there is a withdrawal and alternate proposals and the presence or absence of a bid security or a bid securing declaration, if one was required. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record.

1.4.5.4. At the end of the evaluation of the Technical Bids, the Purchaser will invite bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award to attend the opening of the Price Bids. The date, time, and location of the opening of Price Bids will be informed in writing by the Purchaser. Bidders shall be given notice well in advance of the opening of Price Bids.

1.4.5.5. The Purchaser shall conduct the opening of Price Bids of all Bidders who submitted substantially responsive Technical Bids, in the presence of Bidders` representatives who choose to attend at the address, date and time specified by the Purchaser. The Bidder's representatives who are present shall be requested to sign a register evidencing their attendance.

1.4.5.6. Only Bid Prices and discounts read out and recorded during the opening of Price Bids shall be considered for evaluation. No Bid shall be rejected at the opening of Price Bids.

1.5.0 Evaluation and Comparison of Bids

1.5.1. Confidentiality

Information relating to the evaluation of bids and recommendation of contract award shall not be disclosed to Bidders or any other persons not officially concerned with such process.

1.5.1.1. Any attempt by a Bidder to influence the Purchaser in the evaluation of the bids or Contract award decisions may result in the rejection of its bid.

1.5.1.2. Notwithstanding ***ITB Clause***1.5.1.1, from the time of bid opening to the time of Contract award, if any Bidder wishes to contact the Purchaser on any matter related to the bidding process, it should do so in writing duly signed by an authorized representative.

1.5.2. Clarification of Bids

1.5.2.1. To assist in the examination, evaluation, and comparison of the Technical and Price Bids, and qualification of the Bidders, the Purchaser may, at its discretion, ask any Bidder for a clarification of its bid. Any clarification submitted by a Bidder that is not in response to a request by the Purchaser shall not be considered. The Purchaser's request for clarification and the response shall be in writing. No change in the substance of the Technical Bid or prices in the Price Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Purchaser in the evaluation of the bids, in accordance with ***ITB Clause***1.5.9.

1.5.2.2. If a Bidder does not provide clarifications of its bid by the date and time set in the Purchaser's request for clarification, its bid may be rejected.

1.5.3. Deviations, Reservations, and Omissions

1.5.3.1. During the evaluation of bids, the following definitions apply:

a) "Deviation" is a departure from the requirements specified in the Bidding Document;

b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Document; and

c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding Document.

1.5.4. Preliminary Examination of Technical Bids

1.5.4.1 The bidder should submit the hard copies of the following documents in a separate physical envelope at least 2(two) hours prior to bid submission deadline. Techno-commercial bids shall not be opened if these documents aren't submitted in hard copy before the bid submission deadline and the bid may be rejected.

a) Letter of Technical Bid;
b) Written confirmation of authorization to commit the Bidder (i.e., Notarized Power of Attorney)

1.5.5. Responsiveness of Technical Bid

1.5.5.1. The Purchaser's determination of a bid's responsiveness is to be based on the contents of the bid itself, as defined in ***ITB Clause***1.3.3.

1.5.5.2. A substantially responsive Technical Bid is one that meets the requirements of the Bidding Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,

a) if accepted, would:

(i). affect in any substantial way the scope, quality, or performance of the plant and services specified in the Contract; or

(ii). limit in any substantial way, inconsistent with the Bidding Document, the Purchaser's rights or the Bidder's obligations under the proposed Contract; or

b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive bids.

1.5.5.3. The Purchaser shall examine the technical aspects of the Bid submitted in accordance with ***ITB Clause*** 1.3.6, Technical Proposal, in particular to confirm that all requirements of Section 3 (Employer's Requirements) have been met without any material deviation or reservation.

1.5.5.4. If a bid is not substantially responsive to the requirements of the Bidding Document, it shall be rejected by the Purchaser and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

1.5.6. Non-material Nonconformity

1.5.6.1. Provided that a Bid is substantially responsive, the Purchaser may waive any nonconformity in the bid that does not constitute a material deviation, reservation or omission.

1.5.6.2. Provided that a Bid is substantially responsive, the Purchaser may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial non conformity in the Bid related to documentation requirements. Requesting information or documentation on such non conformity shall not be related to any aspect of the Price Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.

1.5.6.3. Provided that a Bid is substantially responsive, the Purchaser shall rectify nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component. The adjustment shall be made using the method indicated in ***Appendix-2 of ITB (Evaluation and Qualification Criteria)***.

1.5.7. Detailed Evaluation of Technical Bids

1.5.7.1. The Purchaser will carry out a detailed technical evaluation of the bids not previously rejected as being substantially non-responsive, in order to determine whether the technical aspects are in compliance with the Bidding Document. In order to reach such a determination, the Purchaser will examine and compare the technical aspects of the bids on the basis of the information supplied by the bidders, taking into account the following:

a) overall completeness and compliance with the Employer's Requirements; deviations from the Employer's Requirements; conformity of the goods and services offered with specified performance criteria; suitability of the goods and services offered in relation to the environmental and climatic conditions prevailing at the site; and quality, function and operation of any process control concept included in the bid. The bid that does not meet minimum acceptable standards of completeness, consistency and detail will be rejected for non-responsiveness;

b) type, quantity and long-term availability of mandatory and recommended spare parts and maintenance services; and

c) other relevant factors, if any, listed in ***Appendix to ITB-2 (Evaluation and Qualification Criteria)***.

1.5.8. Eligibility and Qualification of the Bidder

1.5.8.1. The Purchaser shall determine to its satisfaction during the evaluation of Technical Bids whether a Bidder meets the eligibility and qualifying criteria specified in ***Appendix to ITB-***2 (Evaluation and Qualification Criteria).

1.5.8.2. The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to relevant ***ITB Clause.***

1.5.8.3. ***An affirmative determination shall be a prerequisite for the opening and evaluation of a Bidder's Price Bid. A negative determination shall result into the disqualification of the Bid, in which event the Purchaser shall not open the Price Bid of the Bidder.***

1.5.9. Correction of Arithmetical Errors

1.5.9.1. During the evaluation of Price Bids, the Purchaser shall correct arithmetical errors, if any on the following basis:

a) where there are errors between the total of the amounts given under the column for the price breakdown and the amount given under the Total Price, the former shall prevail and the latter will be corrected accordingly;

b) where there are errors between the total(sum) of the amounts of the different Schedule(s) and the amount given in terms of a Grand Total or Grand Summary, as the case may be the former shall prevail and the latter will be corrected accordingly; and

c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetical error, in which case the amount in figures shall prevail subject to (a) and (b) above.

1.5.9.2. If the Bidder that submitted the lowest evaluated bid does not accept the correction of errors, its bid shall be ***disqualified and its bid security may be forfeited***.

1.5.10. Evaluation of Price Bids

1.5.10.1. The Purchaser shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be used.

1.5.10.2. To evaluate a Price Bid, the Purchaser shall consider the following:

a) the bid price, including taxes, as quoted in the Price Schedules;

b) price adjustment for correction of arithmetical errors in accordance with ***ITB Clause*** 1.5.9.1; and

c) the evaluation factors if any indicated in Appendix 2 (Evaluation and Qualification Criteria).

d) The following methodology will be practiced for identification and treatment of the Abnormally Low Bids (ALB) in this tender process of AEGCL:

i. Absolute Approach is to be considered when there is fewer than five substantially responsive bidders and if the bid price is 20% or more below AEGCL's cost estimate then AEGCL's tender evaluation committee should clarify the Bid price with the bidder to determine whether the Bid is Abnormally low.

ii. Relative approach is to be considered when there are at least 5(five) nos. of substantially responsive bids and the lowest bid price is 20% or more below AEGCL's cost estimate. In this approach, first the Average bid price is determined and then by deducting the standard deviation from the Average bid price, potentially ALB may be determined.

e) In case of an ALB, the tender evaluation committee/appropriate authority of the respective tenders shall undertake the following three stage review process which is as below:

i. To identify ALB as per the steps mentioned in SI no. 1.5.10.2.d.(i) and 1.5.10.2.d.(ii) Whichever is applicable.

ii. To seek and analyze the clarifications from the abnormally low Bidder in terms of resource inputs and pricing, including overheads, contingencies and profit margins. In that respect, the committee may refer to guideline of World Bank, AIIB, ADB etc. prescribed for ALB.

iii. To decide whether to accept or reject the bid.

iv. On acceptance of the bid, whether Additional Performance Security is to imposed on the bidder supplemented by adequate justification.

f) In case of acceptance of ALB with Additional Performance Security:

I. If any abnormally low bid is accepted under point 1.5.10.e.(iii) with additional performance security, it is to be noted that the total performance security should not exceed 20% of the total contract value.

II. The additional performance security shall be treated as part of the original performance security and shall be valid for a period similar to that applicable for defect liability period of the contract.

III. Non submission of the additional performance security shall constitute sufficient ground for rejection of the bid and similar assessment shall then be initiated for next ranked bidder if that bidder is also identified as ALB.

1.5.11. Comparison of Bids

1.5.11.1. The Purchaser shall compare all substantially responsive bids to determine the lowest evaluated bid.

1.5.12. Purchaser's Right to Accept Any Bid, and to Reject Any or All Bids

1.5.12.1. The Purchaser reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to contract award, without thereby incurring any liability to Bidders. In case of annulment, all bids submitted and specifically, bid securities, shall be promptly returned to the Bidders.

1.5.13. Issue of Work Order

1.5.13.1. The Purchaser shall issue Work Order to the Bidder whose offer has been determined to be the lowest evaluated bid and is substantially responsive to the Bidding Document, provided further that the Bidder is determined to be eligible and qualified to perform the Work satisfactorily.

1.5.14. Acknowledgement of Work Order

1.5.14.1. Within **three (3)** days of receipt of the Work Order, the successful Bidder shall be required to submit an acknowledgement for the receipt of Work Order along with an affirmative declaration for submission of Performance Security in accordance with Clause 1.5.15.

1.5.15. Performance Security

1.5.15.1. Within **fifteen (15)** days of the receipt of Work Order (W.O.) from the Purchaser, the successful Bidder shall furnish the performance security in the form of BG/DD in accordance with the conditions of W.O., using for that purpose the Performance Security Form included in ***Section-2, (Bidding Forms).***

1.5.15.2. Failure of the successful Bidder to submit the above-mentioned Performance Security shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security. In that event the Purchaser may award the work to the next lowest evaluated Bidder whose offer is substantially responsive and is determined by the Purchaser to be qualified to perform the work satisfactorily.

APPENDIX TO ITB – 1

Bid Data Sheet (BDS)

A. Introduction

ITB 1.1.1.1	The number of the **IFB** is: **AEGCL/MD/CGM(UAR)/OIL MADHUBAN/132KV/2026/03 Dated: 13/03/2026**
	The Purchaser is: **Assam Electricity Grid Corporation Limited.**
	The name of the Bid is: **"Route Survey & Soil Investigation for Construction of 132kV Transmission Line for Power Import to OIL, Madhuban from 132kV Bordubi GSS and preparation of Master Plan for Construction of 1(One) No. of 132/33KV Grid Substation (AIS and GIS) at OIL, Madhuban"** **Identification Number of the Bid is: AEGCL/MD/CGM(UAR)/OIL MADHUBAN/132KV/2026/BID**

B. Bidding Document

ITB 1.2.2.1	For **clarification purposes** only, the Purchaser's address is: **The Chief General Manager (O&M), UAR, AEGCL** Street Address: **Bijulee Bhawan, Paltanbazar** Floor/Room number: **First Floor** City: **Guwahati** PIN Code: **781001** Country: **India** Telephone: +91 361 2739520 Facsimile number: +91 361 2739513 Electronic mail address: cgmom.uar@aegcl.co.in (**Subject: Route Survey & Soil Investigation for Construction of 132kV Transmission Line for Power Import to OIL, Madhuban from 132kV Bordubi GSS and preparation of Master Plan for Construction of 1(One) No. of 132/33KV Grid Substation (AIS and GIS) at OIL, Madhuban**) Email from prospective bidders should have "**Subject"** of the email in the format as stated above.

C. Preparation of Bids

ITB 1.3.3.2(e)	Bidder shall submit documents as per Section-2 (Bidding forms). The registration certificate / GST/ Income tax certificate etc. of the contractor/ firm etc. participating as the bidder
ITB 1.3.6.5	The prices quoted by the Bidder shall be **FIXED for entire period of the Contract.**
ITB 1.3.7.1	The bid validity period shall be **180 (One Hundred and Eighty)** days.
ITB 1.3.8.1	**The estimated amount for the works comes to Rs. 30,16,670.00. The Bidder shall furnish a bid security online amounting to Rs. 61,000 (Rupees Sixty-One Thousand Only)**
ITB 1.3.9.1	The bidding is through E-tendering portal and received online. However, a bidder has to submit any document(s) in hard copy if asked by the Purchaser.
ITB 1.3.9.2	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***.

ITB 1.4.2.1	For **bid submission purposes** only, **(E-tenders shall be accepted through online portal http://assamtenders.gov.in only)** The purchaser's address is: Attention: **The Chief General Manager (O&M), UAR, AEGCL** Street Address: **Bijulee Bhawan, Paltanbazar** Floor/Room number: **First Floor** City: **Guwahati** PIN Code: **781001** **The deadline for bid submission is** **Date: 06.04.2026** **Time: 12:00 hrs**
ITB 1.4.5.1	The bid opening of Technical Bids shall take place at **Office of The Chief General Manager (O&M), UAR, AEGCL** Street Address: **Bijulee Bhawan, Paltanbazar** Floor/Room number: **First Floor** City: **Guwahati (Assam)** PIN Code: **781001** Country: **India** **Date: 07.04.2026** **Time: 14:00 hrs**

APPENDIX TO ITB - 2

Evaluation and Qualification Criteria (ECQ)

This Appendix contains all the criteria that the Purchaser shall use to evaluate bids and qualify Bidders. In accordance with ITB 1.5.7 and ITB 1.5.8, no other methods, criteria and factors shall be used. The Bidder shall provide all the information requested in the forms included in Section 2 (Bidding Forms).

Table of Criteria

1. Evaluation

1.1 Technical Evaluation

In addition to the criteria listed in ITB 1.5.7.1 (a) – (c), no other factor shall apply.

1.2 Economic Evaluation

Any adjustments in price that result from the procedures outlined below shall be added, for purposes of comparative evaluation only, to arrive at an "Evaluated Bid Price." Bid prices quoted by bidders shall remain unaltered.

1.2.1 Quantifiable Deviations and Omissions

Quantifiable Deviations and Omissions from the contractual obligations: No financial assessment shall be made by the Purchaser for deviations and omissions from the requirements of the Bidding Document. All such deviations, omissions or reservations s[hall be dealt with in accordance with ITB Clauses 1.5.5.2, 1.5.5.3, 1.5.5.4, 1.5.6.1, 1.5.6.2,1.5.6.3,1.5.7.1(a)and1.5.9.

1.3 Time Schedule

Time to complete Works from the Date of issue of Work Order specified is **One-Hundred and Twenty (120) days.**

The above-mentioned time to complete the works comprises of the total duration involved in submission by bidder and approval from AEGCL for the draft as well as final Report.

The conformity to the following timelines is a must for qualifying in the bidding process. The signed and sealed Time schedule (Section-2, Bidding Form (4)) in conformity sought as per this clause must be submitted alongwith the Bid.

1.4 Specific additional criteria

In addition to the above, no additional criteria shall be considered for evaluation of Bids.

2 Qualification

Qualification of bidder will be based on meeting the minimum pass / fail criteria specified below.

2.1 General

2.1.1 EXPERIENCE

2.1.1.1 The Bidder must satisfy the requirement of ITB Sub-Clause 1.1.2 and shall submit necessary document as per the said Clause.

2.1.1.2 Reputed and financially sound civil engineering firms/contractors having experience of successfully executing *similar nature of work during the last 5 years. (Submitted with supporting documents).

**Similar Nature of work- Route Survey & Soil Investigation for atleast one no. of transmission line/lines of length 40kms (and above) and voltage level 132 kV (and above) along with experience in preparation of master plan of sub-station.*

Documentary Evidence of Experience is to be provided in works of a similar nature (as defined in the scope of this bid) in the last five years. The following documents shall be enclosed with the bid as evidence of above:

i. *Completion certificate(s) from the client for the work inter alia indicating final date of completion or any other document, authenticated by the client, containing relevant information to establish that the bidder has completed the requisite work(s) as per the requirement specified above along with experience in preparation of Master Plan of Substation.*

ii. *The copy of corresponding work order(s) shall also be submitted.*

2.2 Additional Qualifying Requirements

2.2.1 The contractor must have registration with the concerned department of Government of Assam/Govt. of India.

2.2.2 The Contractor/Firm should produce work experience/completion certificate from officer not below the rank of Executive Engineer strictly in the name of the Contractor/Firm of at least 1(one) complete work relevant to the tendered work, done within last 3 years. (Submitted with supporting documents).

2.2.3 CAPABILITY

2.2.3.1 Each bid shall be accompanied by a statement by the bidder declaring that he/she/it is a bona-fide engineering contractor and has in possession adequate equipment, access to a proper laboratory (including all testing apparatus), qualified personnel to fill positions required for execution of the work.

2.2.3.2 The Bidder will supply information of the key personnel, design & engineering staff, support staff, field staff etc. proposed for the work along with details of their experience in similar nature of work.

2.2.3.3 The Bidder should also substantiate availability (either owned or leased) of the tools, tackles, spare parts etc. for carrying out the works.

2.3 Litigation

Using the 'Form LIT– 1' (Section 4, Bidding Form), bidder shall list all Pending Litigation. All pending litigation shall be treated as resolved against the Bidder and so shall in total not represent more than **50% percent** of the Bidder's net worth.

2.4 Financial

Minimum **average annual turnover** of **Rs.10,00,000/- (Rupees Ten Lakhs Only)** calculated as total certified payments received for contracts in progress or completed, within the **last 3 years** and audited balance sheets for the same. (Details of works presently under way or contractually committed and their respective clients).

.

Section - 2

BIDDING FORMS

This Section contains the forms that are to be completed by the Bidder and submitted as part of his Bid.

1 Letter of Technical Bid

[Bidder's Letterhead]

Date: .....

Bid Identification No (s): .....

: .....

: .....

: .....

Invitation for Bid No.: .....

To:.....

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) 1.2.3;

(b) We offer to design, manufacture, test and deliver, in conformity with the Bidding Document the following Goods and Related Services: . . . . . .

(c) Our Bid consisting of the Technical Bid and the Price Bid shall be valid for a period of 180 days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period

Name .....

In the capacity of .....

Signed .....

.....

Duly authorized to sign the Bid for and on behalf of .....

Date .....

.....

2 Price Schedule

PREAMBLE

General

1. The Price Schedules is divided into the following schedule:

   Schedule No. 1: Schedule of Works for Route Survey & Soil Investigation

2. The entered rates and prices shall be deemed to cover the full scope as specified in the bidding document, including overheads and profit.
3. If bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with ***ITB*** 1.2.2 prior to submitting their bid.

Pricing

4. Prices shall be filled in indelible ink/ on-line and any alterations necessary due to errors, etc., shall be initialed by the Bidder if asked for hardcopy.
5. Bid prices shall be quoted on-line in the manner indicated in Schedules.

   As specified in the Bid Data Sheet and Special Conditions of Contract, prices shall be fixed and firm for the duration of the Contract, or prices shall be subject to adjustment in accordance with the corresponding Appendix (Price Adjustment) to the Contract Agreement.

   Prices given in the Schedules against each item shall be for the scope covered by that item as detailed in Section 3 (Employer's Requirements) or elsewhere in the Bidding Document.

NOTE: For E-Tendering these forms are indicative only. All prices to be filled in the price schedule provided in the e-tendering portal only.

Schedule No 1 : SCHEDULE OF WORK FOR ROUTE SURVEY & SOIL INVESTIGATION

PRICE SCHEDULE 1 :Schedule of Work for Route Survey & Soil Investigation

(This BOQ template must not be modified/replaced by the bidder and the same should be uploaded after filling the relevent columns, else the bidder is liable to be rejected for this tender. Bidders are allowed to enter the Bidder Name and Values only)

NUMBER #	TEXT #	NUMBER #	TEXT #	NUMBER #	NUMBER #	TEXT #
Sl. No.	Item Description	Quantity	Units	Unit ExWorks (exclusive of taxes) In Figures To be entered by the Bidder in Rs. P	TOTAL AMOUNT (Without Taxes) in Rs. P	TOTAL AMOUNT In Words(INR)
1	2	4	5	13	53	55
1.00	Preliminary survey for Identification of 3 alternative routes using satelite imageries (1:25,000 PAN +LISS merged) for NRSA.Google images and Survey of India maps and finalization of most economical, Optimum route showing the topographical and other features upto 8Kms on either side and indicating final selected route alignment and digital modelling final selected route alignment and digital modelling in undulated hilly terrain along the proposed route using contour data from topographical map and submission of preliminary survey reports for approval as detailed in technical specifications.	5.00	KM		0.00	INR Zero Only

2.00	Detailed survey along the approved route alignment approval after conducting the preliminary survey by using Modern survey equipment like GPS/DGPS, Total stations including profiling tower spotting and optimization of locations by using computer aided technique like ALTM as well as other activities as detailed in the scope of work using PLS-CADD software and submission of draft report for approval. a. Drawing the route profile including Geographical features like Nalas, Rivers, Gardens, P&T Lines, Railways crossing etc. b. KMZ/KML file of approval route. c. Levelling of the profile with reference to Survey of India bench marks(MSL) d. Tower Schedule. e. Line Schedule. f. Burgle details by using Modern Survey techniques and providing GPS, Co-ordinates at each anchor points for identification of anchor locations indluding permanents marks like poles, telephones lines, buildings etc.	5.00	KM		**0.00**	INR Zero Only
3.00	Providing and fixing RCC pillar (M-20) of size 150 X 150 X 1000 mm, with approved marks including painting above the ground level and yellow lettering and marking the direction of incoming and outgoing lines are to be marked clearly on the top with red colour.IF the distance between such anchors points is more than 1KM one more directional stone is to be fixed. So alos, for the road crossings, railway crossing and nala crossings on both the sides.	5.00	Nos (Each Stone)		**0.00**	INR Zero Only
4.00	Conducting Soil resistivity test along the selected route and submitting the test results in the form of draft report as detailed in the technical specifications.	2.00	Nos. (Per Test)		**0.00**	INR Zero Only
5.00	**Preparation of Schedule and Documents**					
5.01	PTCC Proposal containing PTCC questionnaires, topo sheet extracts with marking of the proposed line, SR report, tower sketch, station single line diagram etc. (10 copies/set)	1.00	Per Set		**0.00**	INR Zero Only
5.02	Tree schedule containing the details like name of tree girth size, distance from central line of the alignment, approx height of tree etc., complete and submission of draft report for approval .The details shall bed survey no.wise along the corridor. (As Per Technical Specification)	5.00	KM		**0.00**	INR Zero Only

5.03	Forest proposal inclusives of all works like fixing of stones of size 0.15 X0.15X1.00m buried in the ground at every 20 mts in the centre line and both ends of the corridor , painting of each tree , taking girth size of all the tree coming in the corridor at 1 Mtr height from GL, approximate height of the treetree and forest clearance proposals etc. complete including submission of report /proposal in 6 sets (both Soft &Hard copies). The work shall be carried out as per requirement and as per instruction of Engineer -in- charge & as per latest circular of Forest Department.	1.00	Per KM		**0.00**	INR Zero Only
6.00	Submission of Detailed consolidated report on the surveying work done appending all approved draft reports including all relevant information collected during survey, calibration certificates of the instruments used for the work, photos taken at site and submitting soft copies of all documents and report in 6 sets. The detailed report shall contain following approved draft reports. Preliminary Report Detailed Survey Report Soil Resistivity Report Soil classification report with location wise Tree Schedule Line Schedule Burgie details Digitized contours Digitized village map geo reference and superimposed on the line corridor	1.00	Job		**0.00**	INR Zero Only
7.00	**Detailed Soil Investigation Work as per Specification (The location are selected by field official of AEGCL**					
7.01	Marking 150mm nominal bore holes at various in soil using suitable approved method of boring including clearing the boreholes, collections of samples, observation of ground water level, collection of undisturbed/disturbde sample, testing of soil as per specification and back filling of bore holes on completion of work as per specification and instruction of engineer in charge of work. The scope also includes in charge of work.The scope also includes the submission of final report containing the bore log details with classification of soil, GWT on tested data, HFL collected from local area &all other as specified on technical specification for the purposed	1.00	Location		**0.00**	INR Zero Only

	of providing foundation along with GPS co-ordinates of each boreholes.					
8.00	Preparing of drawings for the remote end bay (at Tinsukia GSS, two nos.) as per technical specification.	1.00	Job		**0.00**	INR Zero Only
9.00	Preparation of BOQ for transmission line as per format given and Preparation of BOQ for XLPE cable route if required.	1.00	Job		**0.00**	INR Zero Only
10.00	Preparation of BOQ for the remote end bays in consultation with site in-charge.	1.00	Job		**0.00**	INR Zero Only
Total in Figures					**0.00**	INR Zero Only
Quoted Rate in Words		**INR Zero Only**				

Schedule No 2: Preparation of Master Plan for Construction of 1(One) No. of 220/132/33KV Grid Substation (AIS and GIS) at OIL, Madhuban

NUMBER #	TEXT #	NUMBER #	TEXT #	NUMBER #	NUMBER #	TEXT #
Sl. No.	Item Description	Quantity	Units	Unit ExWorks (exclusive of taxes) In Figures To be entered by the Bidder in Rs. P	TOTAL AMOUNT (Without Taxes) in Rs. P	TOTAL AMOUNT In Words(INR)
1	2	4	5	13	53	55
1.00	Survey using total station/DGPS of the entire land area up to an offset of 10 m and the approach road outside the substation boundary. In 3 m X 3 m grid, proposed FGL, calculation of earth volume in cutting and filling separately. Submit the contour drawing in AutoCAD 2D as well as 3D.	2.00	Job		**0.00**	INR Zero Only
2.00	Construction of two (2) nos. of permanent RCC benchmark pillars at suitable locations such that all	2.00	Job		**0.00**	INR Zero Only

	future references can be obtained from them. Size of the pillar should be minimum 300mm X 300 mm HFL & FGL markings should be shown in the benchmark pillar. Construction of RCC pillar along the boundary of the plot at every angular point with size 125mm X 125mm and 900 mm height.					
3.00	Preparation of Master Plan by marking of switchyard, control room, incoming and outgoing feeders, residential buildings, approach road, internal roads, drainage system, storm water management , Retaining wall, Boundary wall, security fencing, gate, street lighting etc required to complete a substation in AutoCAD.	2.00	Job		**0.00**	INR Zero Only
4.00	Detailed AutoCAD	2.00	Job		**0.00**	INR Zero Only

	drawings of each building with plan of each floor, elevation and section from all sides, Plumbing and sanitary layout, Electrification details etc.					
5.00	GA Drawing for Water supply arrangement including provision for bore hole, overhead tank, pipeline system, etc in detail.	2.00	Job		**0.00**	INR Zero Only
6.00	Preparing a Proper Substation Layout Drawing to scale along with SLD clearly specifying the schemes on AutoCAD along with switchyard BOQ of every item	2.00	Job		**0.00**	INR Zero Only
Total in Figures					**0.00**	INR Zero Only
Quoted Rate in Words		**INR Zero Only**				

1. **All amounts shall be in Rupees**
2. **Prices shall be exclusive of taxes**

3 Format of Bid Security (EMD to be paid in online mode only)

4 Contract Execution Schedule

The Bidder shall indicate here his proposed Contract Execution Schedule if the contract is awarded to him. The Schedule shall match with the time for completion specified.

The bidder shall submit the execution schedule as per below format.

Sl No.	Description	Month 1				Month 2			
		Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
1	Submission of Route survey report								
2	Submission of detail survey report								
3	Submission of Soil investigation report								
4	Submission of Master Plan for 220/132/33 KV GSS (AIS and GIS)								
5	Submission of final consolidated reports								

5 Bidders Qualification

To establish its qualifications to perform the contract in accordance with Appendix 2 of ITB (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.

5.1 Bidder's Information Sheet

Bidder's name	
Bidder's address	
Bidder's authorized representative (name, address, telephone numbers, fax numbers, e-mail address)	
Attached are copies of the following original documents. ❑ 1. In case of single entity/firm, documents, in accordance with ITB 1.1.2.1. ❑ 2. In case of single Company, documents, in accordance with ITB 1.1.2.2.	

5.2 Pending Litigation

(Fill in this form if applicable, otherwise specify 'NIL')

Each Bidder must fill in this form

- ☐ **No pending litigation in accordance with Criteria 2.1.3 of Appendix 2 of ITB (Evaluation and Qualification Criteria)**
- ☐ **Pending litigation in accordance with Criteria 2.1.3 of Appendix 2 of ITB (Evaluation and Qualification Criteria)**

Year	Matter in Dispute	Value of Pending Claim in Rupees	Value of Pending Claim as a Percentage of Net Worth

5.3 Experience

Each Bidder must fill in this form

Experience				
Starting Month	**Ending Month**	**Months**	**Contract Identification and Name** **Name and Address of Purchaser** **Brief Description of the Works Executed by the Bidder**	**Role of Bidder**

5.4 Manpower and Equipment(s) List

(As per requirements of scope of work of the bid document)

The bidder must submit Manpower and Equipment(s) list separately.

5.5 - Form of Performance Security

Bank Guarantee

(To be stamped in accordance with Stamp Act)

To: _____ *[name of Purchaser]*

_____ *[address of Purchaser]*

*WHEREAS*_____ *[name and address of Supplier/Manufacturer]* has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ *[name of Supplier/Manufacturer and brief description of Scope]* (hereinafter called "the Contract");

AND WHEREAS it has been stipulated by you in the said Contract that the Supplier/Manufacturer shall furnish you with a Bank Guarantee by a recognized/scheduled bank for the sum specified therein as security for compliance with its obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Supplier/Manufacturer such a Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible *to* you, on behalf of the Supplier/Manufacturer, up to a total of _____ *[amount of Guarantee]*[1] _____ *[in words],* such sum being payable in the currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____ *[amount of Guarantee]* as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

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

We further agree that no change or addition to or other modification of the terms of the Contract or of the scope to be performed thereunder or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.
This guarantee shall be valid until the date, 30 days beyond the Warranty Period as per the Contract.

Signature and Seal of the Guarantor _____

Name of Bank _____

Address _____

Date _____

1

An amount is to be inserted by the Guarantor, representing the percentage of the Contract Price specified in the Contract.

Section - 3

Employer's Requirements

Section 3
Employer's Requirements

CONTENTS

3.1.0 Scope of Works

Route Survey & Soil Investigation for Construction of 220kV Transmission Line for Power Import to OIL, Madhuban from 220kV Tinsukia GSS and preparation of Master Plan for Construction of 1(One) No. of 220/132/33KV Grid Substation (AIS and GIS) at OIL, Madhuban as per BoQ (Bill of Quantities) and applicable Technical specifications.

The brief description of the scope covered under this bidding document is furnished below:

a) Preparation of Route Alignment and Detailed survey report to initiate the process of construction of the Transmission Line and preparation of Master Plan of Substation as per BoQ and applicable technical specifications. The route survey is to be carried out from 132V Bordubi GSS, AEGCL to OIL, Madhuban. The coordinate for Bordubi GSS end shall be provided by AGM, Tinsukia. The coordinates may be changed during survey as per site requirement.
b) The different tasks need to be carried out in the scope of work are as laid out in the attached – Sch 1 & 2 - Schedule of Work in Section-2 (Bidding Forms) as well as Section-3, Employer's Requirements.
c) The bidder must arrange a meeting at their own cost with AEGCL consignee and OIL representative regarding recommendation of best route out of selected three routes for detail survey. The MOM of the meeting must be submitted along with the route survey report during approval of route.

Note: Any requirement of manpower, machinery, equipments etc. must be included in the BoQ.
No further price escalation is allowed for the same.

3.2.0 Contractor to Inform Himself Fully

3.2.1 The Contractor should ensure that he has examined the Specifications and Schedules as brought out in this Section as well as other Sections of The Bidding document and has satisfied himself as to all the conditions and circumstances affecting the contract price 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.

3.2.2 The Employer 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 Employer.

3.3.0 Service Conditions

3.3.1 The plant and materials supplied shall be suitable for operation under the following climatic and other conditions:

a) Peak ambient day temperature in still air	: 45°C
b) Minimum night temperatures	: 0°C
c) Reference ambient day temperature	: 45°C
d) Relative Humidity a) Maximum	: 100 %
b) Minimum	: 10 %
e) Altitude	: Below1000 M above MSL
f) Maximum wind pressure	: As per IS: 802 latest code.
g) Seismic Intensity	: ZONE-V as per IS 1893.

3.4.0 Conformity with Indian Electricity Rules & Other Local Regulations

3.4.1. The Contractor shall note that all substation works shall comply with the latest provisions of Indian Electricity Rules and with any other regulations. Local authorities concerned in the administration of the rules and regulation relating to such works shall be consulted, if necessary, about the rules and regulations that may be applicable.

3.4.3. All registration and statutory inspection fees, if any, in respect of his work pursuant to this Contract shall be to the account of the Contractor.

3.5.0 Standards

3.5.1. The scope covered under this bidding document shall, unless otherwise stated be designed in accordance with the latest revisions of relevant Indian Standards and shall conform to the regulations of local statutory authorities.

3.5.2. In case of any conflict between the standards and this specification, this specification shall govern.

3.6.0 Technical Specifications

3.6.1 The technical specifications cover detailed survey including route alignment, profiling, and tower spotting, contouring and soil investigation**.**

The scope of work inter-alia shall include the following:

a) Route alignment using **satellite imageries of NRSA, Google images** and Survey of India maps, inter-alia including:

   i. Identification of three alternative route alignments & selection of optimized route alignment in consultation with the owner. This shall be done **using low resolution satellite imageries of NRSA,**

Google images and Survey of India maps. The output shall be in the form of digitized route alignment drawing with latest topographical and other details/features up to **8 kms** on either side of selected route alignment (**both in hard and soft copies).**

ii. Digital terrain modelling along the selected route using contour data from topographical maps.
iii. Associated field work.

b) Detailed Survey using GPS, DGPS, Total Stations, long range scanners & Digital theodolites of reasonable accuracies or alternatively using ALTM, (Airborne Laser Terrain Modelling) techniques, inter-alia including:
   i. Digitized profiling along the selected route along with plan details using **Power Line Systems Computer Aided Design and Drafting (PLSCADD).**
   ii. Computer aided tower spotting & optimization.
   iii. Soil resistivity measurement along the route.

c) Digitized contouring at undulated/hilly tower locations.
d) Integrating and superimposing the selected route on the digitized land survey maps of Govt. of Assam.
e) Tree enumeration along the corridor of selected route using satellite imageries and also by conducting walk over survey and estimation of the probable cost of tree and crop compensation.
f) **Soil investigation along the selected route**.
g) Preparation of Survey reports including estimation of Bill of Quantities, identification and explanation of route constraints, (like Forest, Animal/ Bird sanctuary, reserve coal belt areas, oil pipe line/ underground inflammable pipe lines etc.) infrastructure details available enroute etc.
h) **Soil resistivity tests along the selected route.**
i) **Preparation of BOQ for Transmission Line and Remote end bay.**

3.6.2 All the bidders shall present their proposed methodology for execution of the work as per specifications and details of the equipment and facilities including soft ware's available with them, based on which the owner may issue suitable work order. A pre bid conference if required shall also be held.

3.6.3 The Provisional quantities for the scope of work are indicated in relevant Price Schedules of Bid Proposal Sheets. The final quantities for route alignment &detailed survey (quantities in "kms" unit) shall be the route length along the approved route alignment. The route alignment, detailed survey, including profiling & tower spotting, contouring, soil investigation etc. shall be carried outby the Contractor as per the technical specifications stipulated herein.

3.6.4 The Contractor must note that the Owner shall not be responsible for loss or damage to properties, trees etc. due to contractor's work during survey. The Contractor shall indemnify the Owner for any loss or damage to properties, trees etc. during the survey work.

3.6.5 The Contractor should note that Owner will not furnish the NRSA satellite imageries or topographical maps prepared by survey of India but will render available assistance that may be required in obtaining these by providing letters of recommendation to the concerned authorities. Further, in case the contractor opts for use of ALTM techniques for detailed survey, he shall be responsible for obtaining necessary clearance/ permission as may be required from concerned authorities. The Owner will provide assistance that may be required in obtaining these clearance/permissions by providing letters or recommendations to the concerned authorities.

3.6.6 The Bidders shall give along with their bid clause by clause commentary indicating their confirmation/comments/observations in respect of all clauses of technical specification.

3.6.7 The work shall be carried out by the contractor using modern surveying techniques. The bidder shall indicate in his offer, the detailed description of the procedure to be deployed. The details of the equipment & facilities including software's for image processing, computer aided tower spotting etc. Available with the bidder or his associates shall also be furnished with the bid.

3.6.8 The contractor shall also engage services of a reputed geo-technical consultant or experts from independent educational /research institutions for examining stability aspects of the selected transmission line route /locations in hilly terrain wherever required.

3.6.9 After carrying out the detailed survey and soil investigations, the contractor shall estimate complete BOQ of the transmission lines and submit the same to the Owner.

3.6.10 No technical deviations what so ever to certain conditions of the bidding documents permitted by the owner and therefore, the bidders are advised that while making bid proposals and quoting prices these conditions may appropriately be taken into consideration. The bidder shall complete all the schedules and annexure in the bid proposal sheets, technical data sheets specified elsewhere.

This specification covers detailed survey of **220 KV Double Circuit** Transmission Line and handing over of final survey report to AEGCL including complete data.

3.7.0 Route Alignment

3.7.1 Route Alignment shall be done using satellite imageries of NRSA (PAN & LISS-III merged product of minimum resolution corresponding to 1:25,000scale) and Survey of India topographical maps (scale 1:50,000). In case the required Survey of India maps are available in digitized form, the same shall be procured and used by the Contractor. The Google Imageries, if required may also be used route alignment. The contractor shall identify & examine three alternative route alignments and suggest to the Owner the optimal route alignment between the terminal points.

3.7.2 **Requirement of Transmission Line Routing**

a) The alignment of the transmission line shall be most economical from the point of view of construction and maintenance. The contractor shall identify & examine alternative route alignments and suggest to the Employer the optimal route alignment.
b) Routing of transmission line through protected /reserved forest area should be avoided. In case it is not possible to avoid the forests or areas having large trees completely, and then keeping in view of the overall economy, the route should be aligned in such a way that cutting of trees is minimum.
c) The route should have minimum crossings of Major Rivers, Railway lines, National / State highways, overhead EHV power lines and communication lines.
d) The number of angle points shall be kept to a minimum.
e) The distance between the terminal points specified shall be kept shortest possible, consistent with the terrain that is encountered.
f) Marshy and low-lying areas, river beds and earth slip zones shall be avoided to minimize risk to the foundations and towers.
g) It would be preferable to utilize level ground for the alignment.
h) Crossing of power lines shall be minimum. Alignment shall be kept at a specified distance from existing lines considering ROW and tower falling distances.
i) Crossing of communication line shall be minimized and it shall be preferably at right angle. Proximity and parallelism with telecom lines shall be eliminated to avoid danger of induction to them.
j) Areas subjected to flooding such as nalla shall be avoided.
k) Restricted areas such as civil and military airfield shall be avoided. Care shall also be taken to avoid aircraft landing approaches.
l) All alignment should be easily accessible both in dry and rainy seasons to enable maintenance throughout the year.
m) Certain areas such as quarry sites, coffee, tea, tobacco and saffron fields and rich plantations, gardens & nurseries which will present the Owner problems in acquisition of right of way and way leave clearance during construction and maintenance should be avoided.
n) Angle points should be selected such that shifting of the points within 100 m radius is possible at the time of construction of the line.
o) The line routing should avoid large habitations, densely populated areas forest, animal/ bird sanctuary etc., to the extent possible.
p) The areas requiring special foundations and those prone to flooding should be avoided.

3.7.3 For examination of the alternatives & identification of the most appropriate route, besides making use of information's /data /details available/extracted through Survey of India Topographical maps, Google Images and computer aided processing of NRSA's satellite imagery, the contractor shall also carry out reconnaissance /walk over survey/ preliminary survey as may be required for verification & collection of additional information/data/details.

3.7.4 The contractor shall submit his preliminary observations & suggestions along with various information's/data/details collected and also processed satellite imagery data, topographical map data marked with the alternative routes etc. The final evaluation of the alternative routes shall be conducted by the contractor in consultation with Owner's representatives and optimal route alignment shall be proposed by the Contractor. Digital terrain modelling using contour data from topographical maps as well as processed satellite data shall be done by the contractor for the selected route. A fly through perspective using suitable software(s) shall be developed for further refinement of the selected route, if required. Site visit and field verification shall be conducted by the Contractor jointly with the Owner's representative for the proposed route alignment.

3.7.5 Final digitized route alignment drawing with latest topographical and other details/features including all rivers, railway lines, canals, roads etc. up to **8 kms** on either side of selected route alignment shall be submitted by the Contractor for Owner's approval along with report containing other information's/details as mentioned above. Changes in the route alignment, if any, during detailed survey, shall be incorporated in the final digitized route alignment drawing.

3.7.6 **Requirement of Route Survey (for XLPE power cable & FO cables)**

The bidder shall fully familiarize itself with the site and route conditions etc. The bidders are advised to visit the site and acquaint themselves with the topography, infrastructure etc. The contractor shall be fully responsible for providing all equipment, materials, system and services specified or otherwise which are required to complete the preparation of cable route including BoQ, of all cables in all respects. All materials required for the Civil and construction/installation work shall be specified in the BoQ by the Contractor. The survey shall be conducted for underground routes to finalize the route and paths for the underground cables including location of straight through joints. The survey shall inter-alia include the following minimum activities:

Map Study: The Contractor shall arrange topographical maps and other maps of the concerned area in proper scale. All links shall then carefully be studied using maps. Various feasible alternative routes shall be identified on the maps and the Contractor shall shortlist most suitable route and submit to owner for its approval.

Collection of details of other utilities during detailed survey: Contractor shall arrange information about existing underground facilities for the proposed routes that may be collected from the local authorities concerned with assistance from field officials of AEGCL. To do so as built drawing or route index diagram for various services viz water works, electric supply utilities, telecom services providers, public health, gas/oil authorities etc. may be collected from the local authorities concerned. In case details are not available, a non-availability undertaking may be given regarding non availability of data or non-receiving of data from concerned authorities duly countersigned by field officials of AEGCL. The undertaking is to be submitted along with the detailed consolidated report within the schedule completion of time.

Identification of cable route of underground power cables & Fiber Optic Cables:

The Contractor shall propose most suitable route for link keeping in view the following broad criteria:

1. The route shall be as straight and as short as possible.
2. Wet or unstable ground shall be avoided to the extent possible.
3. The route for the cables shall be away from the carriage-way of the road to the extent possible.
4. The route shall be suitable for placing manholes wherever required.

5. Future expansion of roads shall be taken into consideration to the extent possible.
6. Road, rail, river, culvert (nallah) crossing, trenchless digging shall be minimum.
7. As far as possible underground cable route shall be on the opposite side of the existing cables laid by DOT/BSNL or other utilities. Wherever both routes fall on the same side of the road, a spacing of about 2.0 m is to be maintained, to the extent possible.
8. Care must be taken to avoid choosing routes, roads, areas that are prone to floods etc.

The Contractor shall submit the survey report and BoQ with the most suitable route for cable links along with details above to owner for its approval.

3.8.0 Detailed Survey

3.8.1 The detailed survey shall be carried out using DGPS, Total Stations, digital theodolites etc. along the approved route alignment. As an alternative, the contractor may also use ALTM (Air borne Laser Terrain Modelling) techniques of equal or better accuracy for the detailed survey.

3.8.2 **Soil resistivity,** along the route alignment shall be measured in dry weather by four electrode method keeping inter-electrode spacing of 50 mtrs. For calculating soil resistivity formula 2 Πar (where a = 50 m and r = megger reading in ohms) shall be adopted. Measurement shall be made at every 2 to 3 KM along the length of route. In case the soil characteristics changes within 2 to 3 KM, values shall have to be measured at intermediate locations also. Megger reading and soil characteristics should also be indicated in the soil resistivity results.

3.8.3 **Route Marking**

a) The route of the transmission line shall be recorded using DGPS of positional accuracy less than 3mtr.
b) The co-ordinates of all the angle points as well as other important crossings, landmarks etc. shall be recorded using DGPS for easy relocating. *In addition, the angle point locations etc. shall be marked using marking stones of size 150 x150 x 1000 mm, with approved marks including painting above the ground level and yellow lettering and marking the direction of incoming and outgoing lines are to be marked clearly on the top with red colour. If the distance between such anchors points is more than 1KM one more directional stone is to be fixed. So also, for the road crossings, railway crossing and nala crossings on both the sides.*
c) At the starting point of the commencement of route survey the coordinates shall be recorded. The co-ordinates of the location of the survey instrument shall also be recorded. Further, the co-ordinates at prominent position at intervals of not more than 750 mtr. Along the transmission line to be surveyed up to the next angle point shall also be recorded. Wherever the line alignment crosses the EHT line, railway line, P &T line or roads, the contractor shall record co-ordinates on the points of crossing. Wherever line route alignment passes over permanent land marks such as rock, boulders, culverts etc. suitable white paint marks with directional and AEGCL markings shall be made and co-ordinates recorded.

3.8.4 **Profiling**

a) The complete profiling along the route shall be carried out using modern surveying equipment viz, total stations, DGPS, digital theodolite, long range scanners etc. Reference levels at every 20 meters along the route are to be recorded. In case of hilly terrain/undulations RL shall also be measured for10mtr on either side of centre line in lateral direction (perpendicular to the line). R/L's at other undulations along the route as well as in the route plan and other enroute details viz. Crossings, building & structure, trees & other infrastructure etc. shall also be recorded. Areas along the route, which in the view of the contractor, are not suitable for tower spotting, shall also be marked.
b) The complete profiling details shall be digitized and the data shall be prepared &stored in the format compatible to computer-aided tower spotting software.

c) A printed/plotted output of the digitized profiling shall be submitted by the contractor to Owner's site-in-charge for review before taking up computer-aided tower spotting.

3.8.5 **Optimization of Tower Location/Tower Spotting.**

a) Optimization of tower locations shall be done by the contractor using computer aided tower spotting software- PLS-CADD. In order to verify the results of computer aided tower spotting, **the contractor shall furnish sample calculations and manual tower spotting drawings for some typical sections.**
b) The sag-tension characteristics of the conductor as well as tower spotting data shall be furnished by the contractor for the owner's approval before execution. Sag template curves, shall be prepared by the contractor **on acrylic sheet indicating cold curve, hot curve, ground clearance curve and support footing curve and the same shall be submitted to the owner.**

3.8.6 **Tower Spotting.**

While, profiling and spotting the towers the following shall be borne in mind.

a) Span:
The number of consecutive spans between the section points shall not exceed 15 spans or 5 km in plain terrain and 10 spans or 3km in hilly terrain. A section point shall comprise of tension point with B/DB/QB type or C/DC/QC type or D/DD/QD type towers as applicable.

b) Extension / Truncation
An individual span shall be as near to the normal design span as possible. In case an individual span becomes too short with normal supports on account of undulations in ground profile, one or both the supports of the span may be extended by inserting standard body/leg extension. In case of locations where the ground clearance is available, truncated towers may be spotted. The provisions kept in the design of towers w.r.t. body /leg extns, truncations shall be considered by the contractor during execution stage.

c) Loading
There shall not be any upward force on suspension towers under normal working conditions and the suspension towers shall support at least the minimum weight span as provided in the designs. In case uplift is unavoidable, it shall be examined if the same can be overcome by adding standard body extensions to the towers failing which tension towers designed for the purpose shall be employed at such positions.

d) Road Crossing
At all important road crossings, the tower shall be fitted with normal suspension and tension insulator strings depending on the type of tower, but the ground clearance at the roads under maximum temperature and in still air shall be such that even with conductor broken in adjacent span, ground clearance of the conductor from the road surfaces will not be less than specified minimum ground clearances. At all national highways, D/DD/QD type towers tension insulator strings shall be used and crossing span will not be more than **250 meters**, unless higher span is permitted by national highways authority in case of highways having more lanes.

e) Railway Crossings

All the railway crossings coming-enroute the transmission line shall be identified by the Contractor. At the time of detailed survey, the railway crossings shall be finalized as per the regulation laid down by the Railway Authorities.

i. The crossings shall be supported on D/DD/QD type tower on either side.
ii. The crossing shall normally be at right angle to the railway track.
iii. The minimum horizontal distance measured at right angles from the centre of nearest track to any part of a structure (all structures shall be rigid and well founded), carrying electrical conductors

crossing a railway shall be equal to the height of the structure in meters above normal ground level plus 6 meters.

iv. No crossing shall be located over a booster transformer, traction switching station, traction sub-station, Overlap Section or a track cabin location in an electrified area.

v. The crossing span will be limited to 300 meters or 80 % of the normal span for which the structure is designed whichever is less.

vi. Minimum ground clearance between crossing conductor under condition of maximum sag and railway line shall maximum of following:

(I) Vertical Clearance for OHE (other than high rise OHE):

Sl. No.	**Transmission Line**	**Minimum clearances from Rail Level**
		New Power Line Crossing or Crossing Planned for Alteration
1	Above 66 kV &upto 132 kV	15.56 m
2	Above 132 kV &upto 220 kV	16.46 m
3	Above 220 kV &upto 400 kV	18.26 m
4	Above 400 kV &upto 500 kV	19.16 m
5	Above 500 kV &upto 800 kV	21.86 m

(II) Vertical Clearance for high rise OHE:

Sl. No.	**Transmission Line**	**Minimum clearances from Rail Level**
		New Power Line Crossing or Crossing Planned for Alteration
1	Above 66 kV &upto 132 kV	17.56 m
2	Above 132 kV &upto 220 kV	18.46 m
3	Above 220 kV &upto 400 kV	20.26 m
4	Above 400 kV &upto 500 kV	21.16 m
5	Above 500 kV &upto 800 kV	23.86 m

Note: Applicable only for electrification of routes where double stack container having maximum height of 6809mm is plying.

(III) Minimum Clearances between Highest Traction Conductor & Lowest Crossing Conductor

1	Above 66 kV &upto 132 kV	3.05 m
2	Above 132 kV &upto 220 kV	4.58 m

3	Above 220 kV &upto 400 kV	5.49 m
4	Above 400 kV &upto 500 kV	7.94 m
5	Above 500 kV &upto 800 kV	7.94 m

f) River Crossings

In case of major river crossing, river crossing towers shall be of suspension type along with anchor towers of D/DD/QD type tower on either side of the main river crossing. Alternately on the basis of economics and / or site/ execution constraints crossing of rivers using normal extended angle towers (+18/+25/+30M Extensions) also shall be considered. For navigable rivers, clearance required by navigation authority shall be provided. For non-navigable river, clearance shall be reckoned with respect to highest flood level (HFL).

g) Power line Crossings

Where the line is to cross over another line, towers with suitable extensions maybe used, depending upon the merit of the prevailing site condition.

For power line crossing of 400 kV or above voltage level, large angle & dead-end towers (i.e. D/DD/QD) shall be used on either side of power line crossing (i.e. D/DD/QD - D/DD/QD arrangement).

For power line crossing of 132 kV and 220 kV voltage level, angle towers (B/C/D/DB/DC/DD/ QB/QC/QD) shall be used on either side of power line crossing depending upon the merit of the prevailing site condition and line deviation requirement.

For power line crossing of 66 kV and below voltage level, suspension/ tension towers shall be provided on either side of power line crossing depending upon the merit of the prevailing site condition and line deviation requirement.

In case of crossing with B/C/DB/DC/QB/QC towers proper guying shall be provided to facilitate stringing of the power line crossing sections separately on obtaining line shutdowns.

Clearance between lines crossing each other shall be kept in accordance with the CEA (Measures Relating to Safety and Electric Supply) Regulations, 2010 as amended up-to-date. In order to reduce the height of the crossing towers, it may be advantageous to remove the ground-wire of the line to be crossed (if this is possible and permitted by the Employer of the line to be crossed).

Minimum clearance in meters between lines when crossing each other:

Sl. No.	**Nominal System Voltage**	**66/132kV (mtr)**	**220kV (mtr)**	**400kV (mtr)**	**765kV**	**800kV**
1	66/132kV	3.05	4.58	5.49	7.94	9.04
2	220kV	4.58	4.58	5.49	7.94	9.04
3	400kV	5.49	5.49	5.49	7.94	9.04

h) Telecommunication Line Crossings

The angle of crossing shall be as near to 90 degrees possible. However, deviation to the extent of 30 degree may be permitted under exceptionally difficult situations.

When the angle of crossing has to be below 60 degrees, the matter will be referred to the authority in charge of the telecommunication System. On a request from the Contractor, the permission of the telecommunication authority may be obtained by the Employer.

Also, in the crossing span, power line support will be as near the telecommunication line as possible, to obtain increased vertical clearance between the wires.

i) Oil Pipe-Line Crossings

Wherever transmission line crosses an oil/ gas pipeline, the angle of crossing shall be as near to 90 degrees possible. Further, a minimum separation of 3 m should be maintained between pipe line and transmission line footings & pipe/ counterpoise earthing.

j) Details Enroute

All topographical details, permanent features, such as trees, building etc. within following distance on either side of the alignment shall be detailed on the profile plan: -

1	1200 kV Single Circuit	44.5 m
2	765 kV Double Circuit	33.5 m
3	765kV Single Circuit Delta	32 m
4	765kV Single Circuit Horizontal	42.5 m
5	+800 kV HVDC	34.5 m
6	400kV Single Circuit	26.0 m
7	400kV Double Circuit	23.0 m
8	+500 kV HVDC	26.0 m
9	220 kV	17.5 m
10	132 kV	13.5m

3.8.7 Clearance from Ground, Building, Trees etc.

Clearance from ground, buildings, trees and telephone lines shall be provided inconformity with the CEA's Regulations 2010 (Measures relating to Safety and Electric Supply)2003as amended up to date.

a) The Contractor shall count, mark and put proper numbers with suitable quality of paint at his own cost on all the trees that are to be cut by the Employer at the time of actual execution of the work as detailed below. Contractor may please note that Employer shall not pay any compensation for any loss or damage to the properties or for tree cutting due to Contractor's work.
b) To evaluate and tabulate the trees and bushes coming within following distance on either side of the central line alignment the trees will be numbered and marked with quality paint serially from angle

point 1 (I) onwards and the corresponding number will be painted on the stem of trees at a height of 1 meter from ground level.

1	1200 kV Single Circuit	44.5 m
2	765 kV Double Circuit	33.5 m
3	765kV Single Circuit Delta	32 m
4	765kV Single Circuit Horizontal	42.5 m
5	+800 kV HVDC	34.5 m
6	400kV Single Circuit	26.0 m
7	400kV Double Circuit	23.0 m
8	+500 kV HVDC	26.0 m
9	220 kV	17.5 m
10	132 kV	13.5 m

The trees list should contain the following:

i. Girth (circumstances) measured at a height of 1 meter from ground level.
ii. Approximate height of the tree with an accuracy of +2 meters.
iii. Name of the type of the species/ tree.
iv. The bushy and under growth encountered within following distance should also be evaluated with its type, height, girth and area in square meters, clearly indicating the growth in the tree/bush statement: -

1	1200 kV Single Circuit	89 m
2	765 kV Double Circuit	67 m
3	765kV Single Circuit Delta	64 m
4	765kV Single Circuit Horizontal	85 m
5	+800 kV HVDC	67 m
6	400kV Single Circuit	52 m
7	400kV Double Circuit	46 m
8	+500 kV HVDC	52 m
9	220 kV	35 m
10	132 kV	27 m

c) The contractor shall also intimate the Employer, his assessment about the likely amount of tree & crop compensation etc. required to be paid by the Employer during execution stage. This assessment shall be done considering prevailing practices/guidelines, local regulations and other enquiries from local authorities.

d) The contractor shall also collect data/details of ownership of land within the line corridor and tower base from the concerned revenue/local authorities during execution stage only (not for route survey stage) and submit the same to owner as per format enclosed with this technical specification at Annexure-E.

e) The Contractor shall also identify the forest/non-forest areas involved duly authenticated by concerned authorities.
   i. A statement of forest areas with survey/ compartment Number (all type of forest RF/ PF / Acquired Forest/ Revenue Forest/ Private Forest/ Forest as per dictionary meaning of forest etc.)
   ii. A statement of non-forest areas with survey/ compartment nos.
   iii. Tree cutting details (Girth wise & specie wise)
   iv. Marking of forest areas with category on topo sheets 1:2,50,000 showing complete line route, boundaries of various forest divisions and their areas involved.
   v. Village forest maps of affected line and affected forest area and marking of the same.
   vi. Forest division map showing line and affected forest area.

f) The Contractor shall finalize the forest clearance proposal on the prescribed format, as per requirements of the state/MOE & F, duly completed in all respects for submission by the Employer to the Forest Department.

3.8.8 Preliminary Schedule

The profile sheets showing the locations of the towers together with preliminary schedules of quantities indicating tower types, wind & weight spans, angle of deviation, crossing & other details etc. shall be submitted by the contractor for review & approval by Employer's site-in-charge.

3.8.9 Checked Survey of Tower Locations.

a) The check survey shall be conducted to locate tower locations on ground conforming to the approved profile and tower schedule.

b) The co-ordinates of all the tower locations shall also be recorded using GPS / DGPS of positional accuracy less than 3m for easy relocating. The position of all tower locations shall be marked in the final digitized route alignment drawing with relative distances from any permanent bench mark area.

c) The contractor shall also collect required data at each tower location in respect of soil strata, ground water level, history of water table in adjacent areas/surface water, distance from permanent bench mark (these details to be furnished in a tabulated form) and classify the suitable type of foundation at each tower location based on the data collected at each location and detailed soil investigations carried out at selected locations etc.

3.8.10 Contouring at hilly / undulated locations

a) The levels up or down of each pit centre with respect to centre of tower location shall be recorded at intervals of 2m using total stations/ GPS/ digital theodolite and digitized contour plans shall be made. Based on the digitized elevation plans, the quantities of benching & protection work vis-à-vis possible unequal leg extensions shall be optimized using suitable computer-aided techniques/ software or manual method. Required tower and foundation details, cost data for comparative valuation for benching & protection work vis-à-vis unequal leg extensions shall be provided by the Employer to the Contractor during execution stage.

b) The changes desired by the Employer in the preliminary tower schedule or as may be required based on detailed survey of tower locations & contouring by the contractor, shall be carried out by the contractor and the final tower schedule shall be submitted for approval of Employer. The tower schedule shall show position of all type of towers, span length, type of foundation for each tower,

benching & revetment requirement, unequal leg extensions, deviation at all angles, crossings & other details etc.

3.8.11 Survey Methodology & Precision

a) All elevations shall be referenced to benchmarks established by the survey of India. Survey operations shall begin and end at benchmarks approved by the Employer.
b) During the levelling of the profile, check surveys will be affected at intervals not exceeding 50 km with benchmarks of known elevations. The difference in elevations as surveyed by the contractor and as declared by Survey of India for these benchmarks shall not exceed the precision required for 3rd order surveys $e \leq 24k$, where k is the distance between benchmarks in km and e is the difference between elevations in mm.
c) In the absence of suitable benchmarks, the levelling shall be done by two independent levelling parties working in opposite directions along the same line. The difference in elevations between the two surveys shall not exceed the precision required for 3rd order surveys as stated above.
d) All-important objects and features along the transmission line centreline (railways, highways, roads, canals, rivers, transmission lines, distribution lines, telephone lines etc.) shall be surveyed and located with a positional accuracy of 1:2000 between points of known horizontal position.

3.8.12 Survey Report

a) Complete BOQ of the transmission lines as per the technical specification at shall be furnished in the survey report.
b) Each angle point locations shall be shown with detailed sketches showing existing close by permanent land marks such as specific tree(s), cattle shed, homes, tube wells, temples, electric pole/ tower, telephone pole, canal, roads, railway lines etc. The relative distance of land marks from the angle points and their bearings shall be indicated in the sketch. These details shall be included in the survey report.
c) Information w.r.t infrastructure details available en-route, identification and explanation of route constraints, etc. shall also be furnished in the Survey report and shall inter-alia include the following:
    i. Information regarding infrastructural facilities available along the final route alignment like access to roads, railway stations, construction material sources (like quarry points for stone, sand and availability of construction water), labour, existing transport facilities, fuel availability etc. shall be furnished in the survey report.
    ii. All observations which the Contractor thinks would be useful to the construction of the transmission lines mentioned under scope of work are to be reported.
    iii. Suggestions regarding the number of convenient zones (line segments/ portions) in which the entire alignment can be divided keeping in view the convenience of construction/project implementation are to be given.
    iv. Suggestions regarding location for setting up stores during line construction in consultation with Employer's representative shall also be provided by the contractor.
    v. Working months available during various seasons along the final route alignment, with period, time of sowing & harvesting of different type of crops and the importance attached to the crops particularly in the context of way leave problems and compensation payable shall be stated by the Contractor. Some portions of the line may require clearance from various authorities. The Contractor shall indicate the portion of the line so affected, the nature of clearance required and the name of concerned organizations such as local bodies, municipalities, P&T (name of circle), Inland navigation, Irrigation Department, Electricity Boards and Zonal railways, Divisional Forest Authorities etc.
d) All the requisite data for processing the case for statutory clearances such as PTCC, Forest and Railway shall be provided along with the report.

e) The contractor shall also collect & report details pertaining to pollution levels envisaged along the transmission line.

f) Six copies of survey reports (Hard & soft) and all documents shall be furnished by the contractor to the Owner.

3.9.0 Geotechnical Investigations

3.9.1 General

a) Employer requires that a detailed Geotechnical investigation be carried out at various tower locations to provide the designer with sufficiently accurate information, both general and specific, about the substrata profile and relevant soil and rock parameters at site on the basis of which the foundation of transmission line towers can be classified and designed rationally.

b) These specifications provide general guidelines for geotechnical investigation of normal soils. Cases of marshy locations and locations affected by salt water or salt peter shall be treated as special locations and the corresponding description in these specifications shall apply. Any other information required for such locations shall be obtained by Contractor and furnished to Employer.

3.9.2 Scope

a) The scope of work includes detail soil investigations and furnishing bore log data at various tower locations. The provisional quantities have been indicated in Bill of Quantities. Detailed soil investigations shall be carried out at least at one location for every five-kilometre line stretch besides critical locations like railway crossing, river crossing etc. However, during actual execution of work, the quantities shall be decided by the Engineer - in - Charge, depending upon the soil strata and terrain. Based on the bore log data/ soil parameter/ soil investigation results, the Contractor shall recommend the type of foundations suitable for each location and the same shall be got approved by the Employer. For other locations, trial pit is to be done in every location for foundation classification up to foundation depth. No separate payment for trail pit shall be done.

b) These specifications cover the technical requirements for a detailed Geotechnical investigation and submission of a detailed Geotechnical Report. The work shall include mobilization of all necessary tools and equipment, provision of necessary engineering supervision and technical personnel, skilled and unskilled labour, etc. as required to carry out the entire field investigation as well as laboratory tests, analysis and interpretation of data collected and preparation of the Geotechnical Report. Contractor shall also collect data regarding variation of subsoil water table along the proposed line route. The aforementioned work shall be supervised by a graduate in Civil Engineering having at least 5 years of site experience in geotechnical investigation work.

c) Contractor shall make his own arrangements to establish the co-ordinate system required to position boreholes, tests pits and other field test locations. Contractor shall determine the reduced levels (R.L.'s) at these locations with respect to benchmarks used in the detailed survey. Two reference lines shall be established based on survey data/details. Contractor shall provide at site all required survey instruments to the satisfactions of the Owner so that the work can be carried out accurately according to specifications and drawings. Contractor shall arrange to collect the data regarding change of course of rivers, major natural streams and nallas etc., encountered along the transmission line route from the best available sources and shall furnish complete hydrological details including maximum velocity discharge, highest flood level (H.F.L.), scour depth etc. of the concerned rivers, major streams and nallas (canals).

d) The field and laboratory data shall be recorded on the proforma recommended in relevant Indian Standards. Contractor shall submit to Employer two copies of field bore logs (one copy each to Employer site and Corporate Office) and all the field records (countersigned by the Employer) soon after the completion of each boreholes/ test.

e) Whenever Contractor is unable to extract undisturbed samples, it shall be immediately informed to the Owner. Payment for boring charges shall be subject to Owner being satisfied that adequate effort has been made to extract undisturbed samples. Special care shall be taken for locations where marshy

soils are encountered and Contractor in such cases shall ensure that specified numbers of vane shear tests are performed and the results correlated with other soil parameters.

f) One copy of all field records and laboratory test results shall be sent to Owner on a weekly basis. Owner may observe all the laboratory testing procedures.

g) The Contractor shall interact with the Owner to get acquainted with the different types of structures envisaged and in assessing the load intensities on the foundation for the various types of towers in order to enable him to make specific recommendation for the depth, founding strata, type of foundation and the allowable bearing pressure.

h) After reviewing Contractor's geotechnical investigation draft report, Employer will call for discussions, to be held normally within one week at Employers site Office, in order to comment on the report in the presence of Contractor's Geotechnical Engineer. Any expenditure associated with the redrafting and finalising the report, traveling etc. shall be deemed included in the rates quoted for the geotechnical investigations.

i) Contractor shall carry out all work expressed and implied in **Clause 4.1(b)** of these specifications in accordance with requirements of the specification.

j) The Contractor shall prepare and submit soil profile along the transmission line route (in digitized form, with digitized route alignment drawing as base) indicating salient soil characteristics/features, water table etc. based on detailed soil investigations and other details/information collected during detailed survey.

3.9.3 General Requirements

a) Wherever possible, Contractor shall research and review existing local knowledge, records of test pits, boreholes, etc., types of foundations adopted and the behaviour of existing structures, particularly those similar to the present project.

b) Contractor shall make use of information gathered from nearby quarries, unlined wells excavation etc. Study of the general topography of the surrounding areas will often help in the delineation of different soil types.

c) Contractor shall gather data regarding the removal of overburden at the tower location area either by performing test excavations, or by observing soil erosion or land slide in order to estimate reconsolidation of the soil strata. Similarly, data regarding recent landfills shall be studied to determine the characteristics of such land fill as well as the original soil strata.

d) The water level in neighbouring streams and water courses shall be noted. Contractor shall make enquiries and shall verify whether there are abandoned underground works e.g. worked out ballast pits, quarries, old brick fields, mines, mineral workings etc.

e) It is essential that equipment and instruments be properly calibrated at the commencement of the work. If the Employer so desires. Contractor shall arrange for having the instruments tested at an approved laboratory at its cost and shall submit the test reports to the Employer. If the Employer desires to witness such tests, Contractor shall arrange for the same.

3.9.4 Codes and Standards for Geotechnical Investigations.

a) All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions. In case of conflict between the present specifications and those referred to herein, the former shall prevail. Internationally accepted standards which ensure equal or higher performance than those specified shall also be accepted.

b) All work shall be carried out in accordance with the following Indian Standards and Codes:

Indian Standards	Title	International Standard
IS 1080	Codes of Practice for Design and Construction of Shallow Foundations on soils (other than Raft, Ring & Shell)	

IS1498	Classification and Identification of Soils for General Engineering purposes.	ASTM D 2487 ASTM D2488
IS 1892	Code of Practice for Subsurface Investigation for Foundation	
IS 1904	Code of Practice for Design and Construction of foundation in Soils: General Requirements.	
IS 2131	Method of Standard Penetration Test for Soils	ASTM D 1586
IS 2132	Code of Practice for Thin-Walled Tube Sampling of Soils	ASTM D 1587
IS 2720 (Part 1-39) (relevant parts)	Method of Test for Soils (Relevant Parts)	
IS 2809	Glossary of Terms and symbols Relating to Soil Engineering	ASTM D 653-14
IS 2911 (Part I-VI)	Code of Practice for Design and construction of Pile Foundations (Relevant Parts)	
IS 3043	Code of Practice for Earthing	
IS 4078	Code of Practice for Indexing and Storage of Drill Cores.	
IS 4091	Code of Practice for Design and Construction of Foundations for Transmission Line Towers and Poles	
IS 4434	Code of Practice for In-situ Vane Shear Test for Soils	ASTM D 2573(M)-15 ASTMD 4648(M)-16
IS 4453	Code of Practice for Sub-Surface Exploration by Pits, Trenches, Drifts and Shafts	
IS 4464	Code of Practice for Presentation of Drilling information and core description in Foundation investigation	
IS 4968(Part-II)	Method for Subsurface sounding for soils, dynamic method using cone and Bentonite slurry	
IS 5313	Guide for Core Drilling observations	
IS 6403	Code of Practice for Determination of Bearing Capacity of Shallow Foundation	
IS 6926	Code of Practice for Diamond Core Drilling for Site Investigation for River Valley Projects	
IS 6935	Method of Determination of Water level in a Bore Hole	

IS 2809	Glossary of Terms and symbols Relating to Soil Engineering	ASTM D 653-14
IS 2911 (Part I-VI)	Code of Practice for Design and construction of Pile Foundations (Relevant Parts)	
IS 3043	Code of Practice for Earthing	
IS 4078	Code of Practice for Indexing and Storage of Drill Cores	
IS 4091	Code of Practice for Design and Construction of Foundations for Transmission Line Towers and Poles	
IS 4434	Code of Practice for In-situ Vane Shear Test for Soils	ASTM D2573 (M)-15 ASTMD 4648(M)-16
IS 4453	Code of Practice for Sub-Surface Exploration by Pits, Trenches, Drifts and Shafts	
IS 4464	Code of Practice for Presentation of Drilling information and core description in Foundation investigation	
IS 4968 (Part-II)	Method for Subsurface sounding for soils, dynamic method using cone and Bentonite slurry	
IS 5313	Guide for Core Drilling observations.	
IS 6403	Code of Practice for Determination of Bearing Capacity of Shallow Foundation	
IS 6926	Code of Practice for Diamond Core Drilling for Site Investigation for River Valley Projects	
IS 6935	Method of Determination of Water level in a Bore Hole	
IS 7422 Part (IV)	Symbols and Abbreviations for use in Geological Maps Sections and subsurface Exploratory Logs (Relevant parts).	
IS 8009(Part-I)	Code of Practice for Calculation of Settlements of Foundations (Shallow Foundations subjected to symmetrical Vertical Loads).	
IS 8764	Method of Determination of Point Load Strength Index of Rocks.	
IS 9143	Method of Determination of Unconfined Compressive Strength of Rock Materials	ASTM D 7012- 14e1
IS 9179	Method of Preparation of Rock Specimen for Laboratory Testing	
IS 9259	Specification for Liquid Limit Apparatus	ASTM D4318-17
IS 9640	Specification for Split Spoon Sampler	ASTM D1586-11
IS 10050	Method of Determination of Slake Durability Index of Rocks.	ASTM D4644-16

IS 11315 (Part 1-12)	Method for the Quantitative Description of discontinuities in Rock Mass	

3.9.5 Field investigation for soils.

Tentative numbers of detailed soil investigation to be done is given in BOQ

a) Boring

Boreholes are required for detailed soil investigations.

(I) General Requirements

- Boreholes shall be made to obtain information about the subsoil profile, its nature and strength and to collect soil samples for strata identification and for conducting laboratory tests. The minimum diameter of the borehole shall be 150mm and boring shall be carried out in accordance with the provisions of IS 1892 and the present specification.
- All boreholes shall be 10m deep for normal soil conditions. The depth of boreholes at river crossings and special locations shall be 40m. If a strata is encountered where the Standard Penetration Test Records N values greater than 100, with characteristics of rock, the borehole shall be advanced by coring at least 3m further in normal locations and at least 7m further for the case of river crossing locations with prior approval of the Employer. When the boreholes are to be terminated in soil strata an additional Standard Penetration Test shall be carried out at the termination depth. No extra payment shall be made for carrying out Standard Penetration Tests.
- Casing pipe shall be used when collapse of a borehole wall is probable. The bottom of the casing pipe shall at all times be above the test of sampling level but not more than 15 cm above the borehole bottom. In case of cohesionless soils, the advancement of the casing pipe shall be such that it does not disturb the soil to be tested or sampled. The casing shall preferably be advanced by slowly rotating the casing pipe and not by driving.
- In-situ tests shall be conducted and undisturbed samples shall be obtained in the boreholes at intervals specified hereafter. Representative disturbed samples shall be preserved for conducting various identification tests in the laboratory. Water table in the bore hole shall be carefully recorded and reported following IS 6935. No water or drilling mud shall be used while boring above ground water table. For cohesion less soil below water table, the water level in the borehole shall at all times be maintained slightly above the water table.
- The borehole shall be cleaned using suitable tools to the depth of testing or sampling, ensuring least or minimum disturbance of the soil at the bottom of the borehole. The process of jetting through an open tube sampler shall not be permitted. In cohesive soils, the borehole may be cleaned by using a bailer with a flap valve. Gentle circulation of drilling fluid shall be done when rotary mud circulation boring is adopted.
- On completion of the drilling, Contractor shall backfill all boreholes as directed by the Employer.

(II) Auger Boring

Auger boring may be employed in soft to stiff cohesive soils above the water table. Augers shall be of helical or post hole type and the cuttings brought up by the auger shall be carefully examined in the field and the description of all strata shall be duly recorded in the field bore log as per IS 1498. No water shall be introduced from the top while conducting auger boring.

(III) Shell and Auger Boring

- Shell and auger boring may be used in all types of soil which are free from boulders. For cohesion less soil below ground water table, the water level in the borehole shall always be maintained at or above ground water level. The use of chisel bits shall be permitted in hard strata having SPT-N value greater than 100 Chisel bits may also be used to extend the bore hole through local obstructions such as old

construction. Boulders rocky formations, etc. The requirements in Clause (II) Auger Boring shall apply for this type of boring also.

- Rotary method may be used in all types of soil below water table. In this method the boring is carried out by rotating the bit fixed at the lower end of the drill rod. Proper care shall be taken to maintain firm contact between the bit and the bottom of the borehole. Bentonite or drilling mud shall be used as drilling fluid to stabilise and protect the inside surface of the borehole. Use of percussion tools shall be permitted in hard clays and in dense sandy deposits.

b) Standard Penetration Test (SPT)

i. This test shall be conducted in all types of soil deposits encountered within a borehole, to find the variation in the soil stratification by correlating with the number of blows required for unit penetration of a standard penetrometer. Structure sensitive engineering properties of cohesive soils and sifts such as strength and compressibility shall not be inferred based on SPT values.

ii. The test shall be conducted at every change of stratum or at interval of not more than 1.5 m whichever is less as per IS 2131, for a depth up to 10 m in case of normal soils and 40 m in case of special locations.

iii. The Equipment, accessories and procedures for conducting the test shall conform to IS 2131 and IS 9640. The test shall be conducted immediately after reaching to the test depth and cleaning of bore hole.

iv. The test shall be carried out by driving a standard split spoon sampler in the bore hole by means of hammer of standard weight as specified in IS 2131, having a free fall of 750 mm. The sample shall be driven using the hammer for 450 mm recording the number of blows for every 150 mm. The number of blows for the last 300 mm drive shall be reported as N value.

v. This test shall be discontinued when the blow count is equal to 100 or the penetration is less than 25 mm for 50 blows. At the level where the test is discontinued, the number of blows and the corresponding penetration shall be reported. Sufficient quantity of disturbed soil samples shall be collected from the split spoon sampler for identification and laboratory testing. The sample shall be visually classified and recorded at the site as well as properly preserved without loss of moisture content and labelled.

c) Sampling

(I) General

- Sufficient number of soil samples shall be collected. Disturbed soil samples shall be collected for soil identification and for conducting tests such as sieve analysis, index properties, specific gravity, chemical analysis etc. Undisturbed samples shall be collected to estimate the physical bearing capacity and settlement properties of the soil.
- All accessories and sampling methods shall conform to IS 2132. all disturbed and undisturbed samples collected in the field shall be classified as per IS 1498.
- All samples shall be identified with date, borehole or test pit number, depth of sampling, etc. The top surface of the sample in-situ shall also be marked. Care shall be taken to keep the core and box samples vertical, with the mark directing upwards. The tube samples shall be properly trimmed at one end and suitably capped and sealed with molten paraffin wax. The Contractor shall be responsible for packing, storing in a cool place and transporting all the samples from site to the laboratory within seven days after sampling with probe, protection against loss and damage.

(II) Disturbed Samples

- Disturbed soil samples shall be collected in boreholes at regular intervals. The weight of sample as per table 2 of IS 1892 shall be collected at 0.5 m intervals starting from a depth of 0.5 m below ground level and at every identifiable change of strata to supplement the boring records. Samples shall be stored immediately in air tight jars which shall be filled to capacity as much as possible.
- In designated borrow areas, bulk samples, from a depth of about 0.5 m below ground level shall be collected to establish the required properties for use as a fill material. Disturbed samples weighing

about 25 kg (250 N) shall be collected at shallow depths and immediately stored in polythene bags as per IS 1892. The bags shall be sealed properly to preserve the natural moisture content of the sample and placed in wooden boxes for transportation.

(III) Undisturbed Samples

In each borehole undisturbed samples shall be collected at every change in stratum or at intervals not more than 1.5 m, whichever is less as per IS 2132, for a depth up to 10 m in case of normal soils and 40 m in case of special locations.

- The spacing between the top levels of undisturbed sampling and standard penetration testing shall not be less than 1.0 m. Undisturbed samples shall be of 100 mm diameter and 450 mm in length. Samples shall be collected in a manner to preserve the structure and moisture content of the soil Accessories and sampling procedures shall conform to IS 1892 and IS 2132.

- **Undisturbed sampling in cohesive soil:**

  Undisturbed samples in soft to stiff cohesive soils shall be obtained using a thin-walled sampler. In order to reduce the wall friction, suitable precautions, such as oiling the surfaces shall be taken. The sampling tube shall have a smooth finish on both surfaces and a minimum effective length of 450 mm. The area ratio of sampling tubes shall be less than 12.5%. However, in case of very stiff soils area ratio up to 20% shall be permitted.

- **Undisturbed sampling in very loose, saturated, sandy and silty soils and very soft clays:**

  Samples shall be obtained using a piston sampler consisting of a cylinder and piston system. In soft clays and silty clays, with water standing in the casing pipe, piston sampler shall be used to collect undisturbed samples in the presence of expert supervision.
  Accurate measurements of the sampling depth, dimensions of sampler, stroke and length of sample recovery shall be recorded. After the sampler is pushed to the required depth, the cylinder and piston system shall be drawn up together, preventing disturbance and changes in moisture content of the sample.

- **Undisturbed sampling in cohesion less soils**

  Undisturbed samples in cohesion less soils shall be obtained in accordance with IS 8763. Sampler operated by compressed air shall be used to sample cohesion less soils below ground water table.

d) Ground Water

(I) One of the following methods shall be adopted for determining the elevation of ground water table in boreholes as per IS 6935 and the instructions of the Employer:

- In permeable soils, the water level in the borehole shall be allowed to stabilize after depressing it adequately by bailing before recording its level. Stability of sides and bottom of the boreholes shall be ensured at all times.
- For both permeable and impermeable soils, the following method shall be suitable. The borehole shall be filled with water and then bailed out to various depths. Observations on the rise or fall of water level shall be made at each depth. The level at which neither fall nor rise is observed shall be considered the water table elevation and confirmed by three successive readings of water level taken at two hours interval.

(II) If any variation of the ground water level is observed in any specific boreholes, the water level in these boreholes shall be recorded during the course of the field investigation. Levels in nearby wells, streams, etc., if any, shall also be noted in parallel.

(III) Subsoil water samples

- Subsoil water samples shall be collected for performing chemical analysis. Representative ground water samples shall be collected when first encountered in boreholes and before the addition of water to aid boring or drilling.
- Chemical analysis of water samples shall include determination of pH value, turbidity, sulphate, carbonate, nitrate and chloride contents, presence of organic matter and suspended solids. Chemical preservatives may be added to the sample for cases as specified in the test methods or in applicable Indian Standards. This shall only be done if analysis cannot be conducted within an hour of collection and shall have the prior written permission and approval of the Employer.

e) Dynamic Cone Penetration Test (only at Special locations)

(I) **With bentonite slurry**

Dynamic cone penetration test shall be conducted to predict stratification, density, bearing capacity of granular soils, etc. The test shall be conducted to the specified depth or refusal, whichever comes first. Refusal shall be considered when the blow count exceeds 100 for 300mm penetration. Equipment, accessories test procedures, field observations and reporting of results shall conform to IS 4968 (Part-II). The driving system shall comprise of hammer of standard weight as specified in IS 4968 (Part-II), having a free fall of 750mm. The cone shall be of 600 and of 62.5mm diameter provided with vents for continuous flow of bentonite slurry through the cone and rods in order to avoid friction between the rods and soil. On completion of the test the results shall be presented as a continuous record of the number of blows required for every 300mm penetration of the cone into the soil in a suitable chart supplemented by a graphical plot of blow count for 300mm penetration vs. depth. On completion of the test, the results shall be presented on the proforma approved by the Employer.

(II) **Without bentonite slurry**

This test shall be conducted with 50mm diameter 600 cones fitted loosely to the driving rod through a cone adopter. The cone shall be driven in to the soil by allowing hammer of standard weight as specified in IS 4968 (Part-II), having a free fall of 750mm. The number of blows for every 100mm penetrations shall be recorded. The process shall be repeated till the cone is driven to the required depth. The penetration depth shall be limited to 5m in cohesion less soil and 10m in mixed soil with some binding material. The cone driving rods, driving head, hoisting equipment shall conform to IS 10589. The test report should be prepared as per guidelines of IS 4968 (Part I).

f) Vane Shear Test. (required for boreholes where UDS is not possible) (Only at Special Locations)

Field vane shear test shall be performed inside the borehole to determine the shear strength and bearing capacity of cohesive soils, especially of soft and sensitive clays, which are highly susceptible to sampling disturbance. Equipment, accessories, test procedures, field observations shall correspond to IS 4434. Tests may also be conducted by direct penetration from ground surface. If the cuttings at the test depth in the borehole show any presence of gravel, sand shells, decomposed wood, etc., which are likely to influence the test results substantially, the test at that particular depth may be omitted with the permission of the Employer. However, the test shall be conducted at a depth where these obstructions cease to occur. On completion of the test, the results shall be reported in an approved proforma as specified in IS 4434.

3.9.6 Field Investigation for Rock

a) Rock Drilling

(I) If, during the investigations, large hard fragments or natural rock beds are encountered, work shall proceed with core drilling methods. The equipment and procedures for this operation shall conform to IS 1892. The starting depth of drilling in rock shall be certified by the Employer. At the end of the investigation, the hole drilled in rock shall be backfilled with grout consisting of 1-part cement and 3-parts sand by weight.

(II) Drilling shall be carried out with NX size tungsten carbide (TC) or diamond tipped drill bits, depending on the type of rock and according to IS 6926. Suitable type of drill bit (TC/Diamond) and core catchers

shall be used to ensure continuous and good core recovery. Core barrels and core catchers shall be used for breaking off the core and retaining it when the rods are withdrawn. Double tube core barrels shall be used to ensure better core recovery and to retrieve cores from layers of bedrock. Water shall be circulated continuously in the hollow rods and the sludge conveying the rock cuttings to the surface shall be collected. A very high core recovery ratio shall be aimed at in order to obtain a satisfactory undisturbed sample. Attempt shall be made to recover cores of 1.5 m in length. Normally TC bit shall be used. Change over to a diamond bit shall require the specific written approval of the Employer, and his decision as to whether a TC or a diamond bit is to be used shall be final and binding on Contractor.

(III) No drilling run shall exceed 1.5 m in depth. if the core recovery is less than 80% in any run, the length of the subsequent run shall be reduced to 0.75 m. During drilling operations observations on return water, rate of penetration etc. shall be made recorded and recorded as per IS 5313.

- The colour of return water at regular intervals, the depth at which any change of colour of return water is observed, the depth of occurrence and amount of flow of hot water, if encountered, shall be recorded.
- The depth through which a uniform rate of penetration was maintained, the depth at which marked change in rate of penetration or sudden fail on drill rod occurs, the depth at which any blockage of drill bit causing core loss, if any, shall be recorded.
- Any heavy vibration or torque noticed during the drilling should be recorded together with the depth of occurrence.
- Special conditions like the depth at which grouting was done during, drilling, presence of artesian conditions, loss of drilling fluid, observations of gas discharge with return water, etc., shall also be observed and recorded.
- All the observations and other details shall be recorded as per daily drill and reported in a proforma as given in IS 5313.

b) Core Sampling

(I) Core samples shall be extracted by the application of a continuous pressure at one end of the core with the barrel held horizontally without vibration. Friable cores shall be extracted from the barrel directly into a suitably sized half round plastic channel section. Care shall be taken to extrude the samples in the direction of coring to avoid stress reversal.

(II) Immediately after withdrawal from the core barrel, the cores shall be placed in a tray and transferred to boxes specially prepared for this purpose. The boxes shall be made from seasoned timber or any other durably material and shall be indexed on top of the lid according to IS 4078. The cores shall be numbered serially and arranged in the boxes in a sequential order. The description of the core samples shall be recorded as instructed in IS 4464. Where no core is recovered, it shall be recorded as specified in the standard. Continuous record of core recovery and rock quality designation (RD/DD/QD) are to be mentioned in the bore log in accordance with IS 11315 (Part-II).

3.9.7 Laboratory Testing

a) Essential Requirements

(I) Depending on the types of substrata encountered, appropriate laboratory tests shall be conducted on soil and rock samples collected in the field. Laboratory tests shall be scheduled and performed by qualified and experienced personnel who are thoroughly conversant with the work. Tests indicated in the schedule of items shall be performed on soil, water and rock samples as per relevant IS codes. One copy of all laboratory test data records shall be submitted to Employer progressively every week. Laboratory tests shall be carried out concurrently with the field investigations as initial laboratory test results could be useful in planning the later stages of field work. A schedule of laboratory tests shall be established by Contractor to the satisfaction of the Employer within one week of completion of the first bore hole.

(II) Laboratory tests shall be conducted using approved apparatus complying with the requirements and specification of Indian Standards or other approved standards for this type of work. It shall be checked that the apparatus is in good working condition before starting the laboratory tests. Calibration of all the instruments and their accessories shall be done carefully and precisely at an approved laboratory.

(III) All samples, whether undisturbed or disturbed shall be extracted, prepared and examined by competent personnel properly trained and experienced in soil sampling. examination, testing and in using the apparatus in conformance with the specified standards

(IV) Undisturbed soil samples retained in liners or seamless tube samplers shall be removed, without causing any disturbance to the samples, using suitably designed extruders just prior to actual testing. If the extruder is horizontal, proper support shall be provided to prevent the sample from breaking. For screw tube extruders, the pushing head shall be free from the screw shaft so that no torque is applied to the soil sample in contact with the pushing head. For soft clay samples, the sample tube shall be cut by means of a high-speed hacksaw to proper test length and placed over the mould before pushing the sample into it with a suitable piston.

(V) While extracting a sample from a liner or tube, care shall be taken to assure that its direction of movement is the same as that during sampling to avoid stress reversal.

b) Test

(I) Tests as indicated in these specifications and as may be requested by the Employer, shall be conducted. These tests shall include but may not be limited to the following: -

- Tests of undisturbed and disturbed samples
  - Visual and engineering classification;
  - Sieve analysis and hydrometric analysis;
  - Liquid, plastic and shrinkage limits;
  - Specific gravity;
  - Chemical analysis;
  - Swell pressure and free swell index determination;
  - Proctor compaction test.
- Tests of undisturbed samples
  - Bulk density and moisture content;
  - Relative density (for sand),
  - Unconfined compression test;
  - Box shear test (for sand);
  - Triaxial shear tests (depending on the type of soil and field conditions on undisturbed or remoulded samples):
    - Unconsolidated undrained;
    - Consolidated drained test;
  - Consolidation
- Tests on rock samples
  - Visual classification;
  - Moisture content, porosity and density;
  - Specific gravity;
  - Hardness
  - Stake durability
  - Unconfined compression test (both saturated and at in-situ water content);
  - Point load strength index;
  - Deformability test (both saturated and dry samples).
- Chemical analysis of sub soil water.

c) Salient Test Requirement

(i) Triaxial shear tests shall be conducted on undisturbed soil samples, saturated by the application of back pressure. Only if the water table is at sufficient depth so that chances of its rising to the base of the footing are small or nil, the triaxial tests shall be performed on specimens at natural moisture content. Each test shall be carried out on a set of three test specimens from one sample at cell pressures equal to 100, 200 and 300 KPa respectively or as required depending on the soil conditions.

(ii) Direct shear test shall be conducted on undisturbed soil samples. The three normal vertical stresses for each test shall be 100, 200 and 300 KPa or as required for the soil conditions.

(iii) Consolidation test shall have loading stages of 10, 25, 50, 75, 100, 200, 400 and 800 KPa. Rebound curve shaft be recorded for all samples by unloading the specimen at its in-situ stress. Additional rebound curves shall also be recorded wherever desired by the Employer.

(iv) Chemical analysis of subsoil shaft includes determination of PH value, carbonate, sulphate (both SO3 and SO4). chloride and nitrate contents, organic matter, salinity and any other chemicals which may be harmful to the foundation material. Their contents in the soil shall be indicated as percentage (%).

(v) Chemical analysis of subsoil water samples shall include the determination of properties such as colour, odour, turbidity, PH value and specific conductivity, the last two chlorides, nitrates, organic matter and any other chemical harmful to the foundation material. The chemical contents shall be indicated as parts per million (PPM) based on weight.

3.9.8 Geotechnical Investigation Report

a) General

Contractor shall submit a formal report containing geological information of the region, procedures adopted for geotechnical investigation, field observations, summarised test data, conclusions and recommendations. The report shall also include detailed bore logs, subsoil sections, field test results, laboratory observations and test results both in tabular as well as graphical form, practical and theoretical considerations for the interpretation of test results, supporting calculations for the conclusions drawn, etc. Initially, Contractor shall submit three copies of the report in draft form for Employer's review.

(I) Contractor's Geotechnical engineer shall visit Employer's Office for a detailed review based on Employer's comments in order to discuss the nature of modifications, if any, to be done in the draft report. Contractor shall incorporate in the report the agreed modifications and resubmit the revised draft report for approval. Ten copies of the detailed final approved report shall be submitted to Employer together with one set of reproducible of the graphs, tables etc.

(II) The detailed final report based on field observations, in-situ and laboratory tests shall encompass theoretical as well as practical considerations for foundations for different types of structures.

b) Data to be furnished

(I) The report shall also include the following

- A plot plant/ location plan showing the locations and reduced levels of all field test e.g. boreholes, trial pits, static cone penetration tests, dynamic cone penetration tests, etc., property drawn to scale and dimensioned with reference to the established grid lines.
- A true cross section of all individual boreholes and test pits with reduced levels and co-ordinates showing the classification and thickness of individual stratum, position of ground water table, various in-situ tests conducted, samples collected at different depths and the rock stratum, if encountered.
- Geological information of the area including geomorphology, geological structure, lithology, stratigraphy and tectonics, core recovery and rock quality designation (RD/DD/QD), etc.
- Observations and data regarding change of course of rivers, velocity, scour depths, slit factor, etc., and history of flood details for mid-stream and river bank locations.
- Past observations and historical data, if available, for the area or for other areas with similar soil profile, or with similar structures in the surrounding areas.

- Plot of Standard Penetration Test (uncorrected and corrected N values) with depth for each test site.
- Results of all laboratory test summarised according to Table 4.0 (i) for each sample as well as (ii) for each layer, along with all the relevant charts, tables, graphs, figures, supporting calculations, conclusions and photographs of representative rock cores.
- For all triaxial shear tests, stress vs. strain diagrams as well as Mohr's circle envelopes shall be furnished. If back pressure is applied for saturation, the magnitude of the same shall be indicated. The value of modulus of elasticity (E) shall be furnished for all tests along with relevant calculations.
- For all consolidation tests, the following curves shall be furnished
  - e vs. log p;
  - e vs. p;
  - Compression vs log t or vs ^t

  depending upon the shape of the plot, for proper determination of coefficient of consolidation. The point showing the initial condition (e0, p0) of the soil shall be marked on the curves.
- The procedure adopted for calculating the compression index from the field curve and settlement of soil strata shall be clearly specified. The time required for 50% and 90% primary consolidation along with secondary settlements, if significant, shall also be calculated.

STANDARD SPECIFICATION OF TRANSMISSON LINE
(SECTION-SURVEY & SOIL INVESTIGATION)

Table 4.0

A) SUMMARY OF RESULTS OF LABORATORY TESTS ON SOIL

Date of Boring:							Name of the Project:															Bore hole no.:			
Ground elevation: (R.L. in m.)							Co-ordinates:							Termination Depth:								Water table:			
Soil details								Grain Size Distribution				Atterberg limits			Soil Density (kg / m³)					Moisture content		Triaxial / Direct shear Test			Remarks
Depth	Sample nos. & type	IS Classification of soil	Description of layers	N – Value (observed)	N – Value (corrected)	Specific Gravity	Gravel	Sand	Silt	Clay	Liquid Limit	Plastic Limit	Plasticity index	Bulk / Natural Density	Dry Density	Submerged Density	Proctor Density	Relative Density	Natural	Optimum	Confining Pressure	Co-hesion	Angle of Repose	

Following additional information should also be provided:

(i) Maximum expected yearly rise / fall of water table

(ii) General topography of the location: whether cultivated or barren, hilly / plain location, river bank location etc.

Note: where ever undisturbed sampling is not possible, reasons must be clearly indicated and all the tests shall be conductedon re-moulded samples.

(Signature)	(Signature)	(Signature)
Prepared by	Checked & Reviewed by	Checked & Approved by
Contractor	Site Incharge, AEGCL	AEGCL, HQ

STANDARD SPECIFICATION OF TRANSMISSON LINE
(SECTION-SURVEY & SOIL INVESTIGATION)

B) SUMMARY OF ULTIMATE BEARING CAPACITIES CONSIDERING MAXIMUM RISE OF WATER TABLE

Location no.	Foundation Classification	Depth of footing considered for bearing capacity calculation	Size of footing considered for bearing capacity calculation	Bearing capacity*	
				Based on settlement criteria (for 40mm total settlement)	Based on shear failure criteria
		3.0m	3.0m x 3.0m		
		3.0m	5.0m x 5.0m		
		3.0m	7.0m x 7.0m		
		3.0m	9.0m x 9.0m		
		3.5m	3.0m x 3.0m		
		3.5m	5.0m x 5.0m		
		3.5m	7.0m x 7.0m		
		3.5m	9.0m x 9.0m		

*** Detailed calculations of all the bearing capacities should be enclosed with soil investigation reports.**

(Signature)	(Signature)	(Signature)
Prepared by	Checked & Reviewed by	Checked & Approved by
Contractor	Site Incharge, AEGCL	AEGCL, HQ

Table C) For Chemical Test

As per Specifications –**Clause-4.8 d) Hydrogeological Conditions**

c) Recommendations

- Recommendations shall be provided for each tower location duly considering soil type and tower spotting data. The recommendations shall provide all design parameters and considerations required for proper selection, dimensioning and future performance of tower foundations and the following: -
  - The subsurface material must provide safe bearing capacity and uplift resistance by incorporating appropriate safety factors thereby avoiding rupture under ultimate loads.
  - Movement of the foundation, including short-term and long-term components under transient and permanent loading, shall be strictly controlled with regard to settlement, uplift, lateral translation and rotation.
  - Co-efficient of permeability of various sub soil and rock strata based on in-situ permeability tests.

Core resistance, frictional resistance total resistance, relation between core resistance, Standard Penetration Test N value, and settlement analysis for different sizes of foundation based on static cone penetration test.

- For shallow foundation the following shall be indicated with comprehensive supporting calculations: -
  - Net Safe allowable bearing pressure for isolated square footing of sizes 4.0, 5.0, 6.0 & 70. m at three different founding depths of 1,2 and 3 & 3.5m below ground level considering both shear failure and settlement criteria giving reasons for type of shear failure adopted in the calculation.
  - Net safe allowable bearing pressure for raft foundations of widths greater than 5m at 2.0, 3.0 and 4.0m below ground level considering both shear failure and settlement criteria.
  - Rate and magnitude of settlement expected of the structure.
  - Net safe bearing capacity for foundation sizes mentioned in above, modulus of sub grade reaction, modules of elasticity from plate load test results along with time settlement curves and load settlement curve in both natural and log graph, variation of Modulus of sub grade reaction with size, shape and depth of foundation.
- The stable slopes for shallow and deep excavations, active and passive earth pressure at rest and angle of repose for sandy soils shall be furnished. The loading of the foundations shall not compromise the stability of the surrounding subsurface materials and the stability of the foundation shall be ensured against sliding or overturning.
- Depending on the subsurface material, water table level and tower type, either reinforced concrete isolated pad and chimney, cast-in-situ bored pile of special foundations shall be installed at a given location.
- Net Safe allowable bearing pressure and uplift resistance shall be provided for the various sizes of isolated square footings founded at various depths below ground level considering both shear failure and movement criteria; rate and magnitude of movement expected of the structure (settlement, uplift, rotation) shall also be given.
- In cases where normal open cast/ pile foundations appear to be impractical, special pile foundations shall be given due consideration along with the following:
  - Type of pile foundation and reasons for recommending the same duly considering the soil characteristics.
  - Suitable founding strata for the pile.
  - Estimated length of pile for 500, 750 and 1000 KN and 4500 KN capacities; end bearing and frictional resistance shall be indicated separately.
  - Magnitude of negative skin friction or uplift forces due to soil swelling.
- Where the subsoil water and soil properties are found to be chemically aggressive. Contractor shall take suitable precautions during construction including any protective coating to be applied on the foundations; susceptibility of soil to termite action and remedial measures for the same shall be dealt with.
- Suitability of locally available soils at site for filling, backfilling and adequate compaction shall be investigated.
- If expansive soil such as black cotton soil is encountered recommendation of removal or retainment of the same shall be given in the latter case, detailed specifications of special requirements shall also be given.
- Susceptibility of subsoil strata to liquefaction in the event of earthquake and remedial measures, if required, shall be considered.
- Any other information of special significance such as dewatering schemes, etc. which may have a bearing on the design and construction shall be provided.
- Recommendations for additional soil investigations, beyond the scope of the present work, shall be given if Contractor considers such investigations necessary.

d) Hydrogeological Conditions

(l) The maximum elevation of ground water table, amplitudes of its fluctuations and data on water aggressivity with regard to foundation structure materials shall be reported. While preparing ground water characteristics the following parameters should be specified for each acquifier:

- bicarbonate alkalinity mg-eq/(deg)
- pH value
- content of aggressive carbon dioxide, mg/l;
- content of magnesia salts. mg/l, recalculated in terms of ions Mg+2;
- content of ammonia salts, mg/l, recalculated in terms of ions NH4+
- content of caustic alkalis, mg/l, recalculated in terms of ions Na+ and K+
- contents of chlorides, mg/l recalculated in terms of ions Clh) contents of sulphates, mg/l, recalculated in terms of ions SO4-2
- aggregate content of chlorides, sulphates, nitrates, carbonates and other salts, mg/l

3.9.9 Rates and Measurements

a) Rates

The contractor's quoted rates shall be inclusive of making observations, establishing the ground level and co-ordinates at the location of each borehole, test pit etc. No extra payments shall be made for conducting Standard Penetration Test, collecting, packing, transporting of all samples and cores, recording and submittal of results on approved formats.

3.9.10 Specific Requirements for Geotechnical Investigation at River Crossings

a) The entire soil investigation work at river crossing locations (if required) shall be carried out in accordance with the relevant parts of the specifications for geotechnical investigation modified to the extent given below.

b) Requirements

- Boreholes shall be executed to specified depth of 40m (refer clause 4.5, a), (I),.). If refusal strata are reached (i.e. SPT-N value is greater than 100 continuously for 5m depth) with characteristics of rock the borehole may be terminated at shallower depth i.e. at 5m in refusal strata, with prior approval of the Employer.
- Laboratory testing shall be conducted on all soil samples to determine grain size distribution, liquid limit and plastic limit of the different soil strata encountered.
- Geotechnical Report must furnish the following:
  - Geotechnical investigation scheme
  - Bore-logs indicating soil stratification, with IS classification, sampling details;
  - SPI 'N' values;
  - Soil cross-sections along various boreholes in two orthogonal directions indicating soil stratification based on field and laboratory tests;
  - Grain size distribution curves;
  - IS classification of soils;
  - Shear tests (UU), to be done on saturated soil samples;
  - Bearing capacity of soil at different levels;
  - Highest flood level (HFL);
  - Maximum discharge, velocity etc. (from authenticated source such as CWC or appropriate State authorities);
  - Recommendations regarding type of foundation to be adopted at the location.

c) A check list for reporting results of river crossing's locations details, detailed soil investigation and river values for river crossing locations shall be furnished to the owner.

3.9.11 Special Terms and conditions for Geotechnical Investigation in the River bed

a) Contractor is required to mobilise a suitable arrangement (floating pontoon, plant, equipment etc.) to carry out geotechnical investigation work in creek/ river locations identified by the Employer.

b) In the event of storm or stoppage of work, etc., Contractor shall not be paid extra for mobilization/ remobilisation of floating pontoon, plant, equipment, etc.
c) Contractor shall fully satisfy himself about the conditions of creek/ river (depth of water, wave currents, wind conditions, etc.) prevailing in the area of proposed investigation and plan the necessary tools and plant to be deployed before quoting. Any claim resulting from lack of data collection in this respect shall not be entertained.
d) Contractor shall make his own arrangements for locating the coordinates and position of boreholes in creek/ river with respect to two grid-lines indicated by Employer.
e) Boring in creek or river shall be payable only below the bed level and no payment shall be made for lowering the casing in water.
f) Contractor shall arrange for necessary transportation on water (e.g. motor boat) to facilitate the supervision of work by officials of Employer at its own cost.
g) Full details of the construction plant, proposed working method for boring and sampling in water shall be submitted along with the Tender.
h) The unit rate quoted for underwater boring shall include complete work required as per specification and no separate payment shall be made on any account.

3.10.0 Statutory Regulations and Standards

3.10.1 Contractor is required to follow statutory regulations stipulated in Electricity Act 2003, Indian Electricity Rules and other local rules & regulations.
3.10.2 The codes and standards referred to in these specifications shall govern. In case of a conflict between such codes/ standards and these specifications, the provisions of the specifications shall prevail. Such codes, standards referred to shall mean latest revisions, amendments, changes adopted and published by relevant agencies.
3.10.3 Other Internationally acceptable standards which ensure equivalent or better performance than those specified shall also be acceptable.

3.11.0 Preparing Drawing for the remote end bay. (Contractor must submitted 6 set of drawings both soft & hard copies)

a) Following drawings are prepared by the contractor for the remote end bay (both soft & hard copies).
   - SLD of remote end bay along with existing Substation SLD
   - A Layout Drawing to scale along with SLD for the remote end bay (at proposed GSS) on AutoCAD. The layout drawing must include proposed cable trench length, proposed switchyard PCC and gravelling area, proposed type of column & beam etc.

3.12.0 GENERAL DESCRIPTION OF TOWERS FOR TRANSMISSION LINE

3.12.1 Type of Towers

a) 400 KV D/C, 220 KV D/C, 110KV/66KV Transmission lines

Type of Tower	Deviation Limit	Typical Use	
DA/A	0 deg – 2 deg	(a)	To be used as tangent tower
DB/B	0 deg – 15 deg	(a)	Angle tower with tension insulator string
	0 deg	(b)	To be used as section tower

DC/C	15 deg – 30 deg	(a)	Medium angle tower with tension insulator string.
	0 deg	(b)	To be used for transposition of transmission line, if required.
DD/D	30 deg – 60 deg	(a)	Large angle tower with tension insulator string.
		(b)	Anchor tower for river crossing with 0 deg. Deviations on crossing side and 0 deg. To 30 deg. Deviation on line side.
DDE/DE	0 deg	(a)	Complete dead end.
		(b)	Dead end with 0 deg to 15 deg deviation both on line and substation side (slack span)

3.12.2 TOWER SPOTTING DATA:

SKIPPER LIMITED Doc No : **SK-2022-AEGCL-GODREJ-220kV-TSD-01** R4

TOWER SPOTTING DATA

• 220 kV Double-Circuit • WZ- 5 • **Single AAAC Zebra Conductor** • 85°C Max. Conductor Temperature •

Sr. No.	Tower ›››	DA (0°-2°)		DB (0°-15°)		DC (15°-30°)		DD (30°-60°)	
	marked as	DA		DB		DC		DD	
1	**Vertical Load limitation on weight span (For both OPGW & conductor)**								
1A	**WITHOUT** Aviation Warning Sphere	Down- ward	Upward	Down- ward	Upward	Down- ward	Upward	Down- ward	Upward
a]	On both spans(m) OPGW/Conductor	525	200	525	0	525	0	525	0
b]	On One Span (m) OPGW/Conductor	315	100	315	-200	315	-200	315	-200
1B	**WITH** Aviation Warning Sphere	Down- ward	Upward	Down- ward	Upward	Down- ward	Upward	Down- ward	Upward
a]	On both spans(m) OPGW/Conductor	495	170	495	0	495	0	495	0
b]	On One Span (m) OPGW/Conductor	297	100	297	-200	297	-200	297	-200
2.a	Tower Checked for							**DEAD END**	
	Line / Slack Side							Line	Slack
	Angle of Deviation							0°-15°	0°-30°
	Wind Span Limits							175 m	60 m
	Total Wind Span							235 m	
2.b	Tower Designation	**SUSPENSION**		**TENSION**		**TENSION**		**TENSION**	
	Angle of Deviation	0° - 2°		0° - 15°		0°-30°		30° - 60°	
3	Permissible sum of adjacent spans in meters for various deviation angles. (subject to availability of minimum specified live metal clearances available) Permissible one span for various deviation angles should not exceed 60% of the value shown for sum of adjacent span.	**Devi. Angle**	**Span**	**Devi. Angle**	**Span**	**Devi. Angle**	**Span**	**Devi. Angle**	**Span**
		3A. FOR SECTIONS **WITHOUT** AVIATION WARNING SPHERE							
		2°	700 m	15°	700 m	30°	700 m	60°	700 m
		1°	725 m	14°	745 m	29°	744 m	59°	740 m
		0°	750 m	13°	791 m	28°	789 m	58°	780 m
				12°	838 m	27°	834 m	57°	821 m
				11°	884 m	26°	879 m	56°	862 m
				10° & below	885 m	25° & below	885 m	55°	903 m
								54° & below	935 m
		3B. FOR SECTIONS **WITH** AVIATION WARNING SPHERE							
		2°	670 m	15°	670 m	30°	670 m	60°	670 m
		1°	695 m	14°	715 m	29°	714 m	59°	710 m
		0°	720 m	13°	761 m	28°	759 m	58°	750 m
				12°	778 m	27°	774 m	57°	761 m
				11°	824 m	26°	819 m	56°	802 m
				10°	825 m	25°	825 m	55°	843 m
		For Sections where Aviation Warning Spheres are installed, All spans (Normal/Basic Span, Wind Span and Maximum Weight Spans) shall be reduced as mentioned in this table. Refer sample supporting calculation in Annexure - A included in this document.						54° & below	875 m
4	Permissible sum of adjacent spans in m. for various deviation angles furnished in 3 above are applicable for conductor & OPGW								
5	Normal Span :	**WITHOUT** Aviation Warning Sphere				**350 M**			
		WITH Aviation Warning Sphere				**332 M**			
	Wind span			**Condition**		DA	DB	DC	DD
		WITHOUT Aviation Warning Sphere		**Normal**		350	350	350	350
				BWC		210	210	210	210
		WITH Aviation Warning Sphere		**Normal**		332	332	332	332
				BWC		199	199	199	199
6	**Tower Type**	**To be used as**							
	DA	0°- 2° Suspension Tower							
	DB	0° - 15° Angle Tower with tension string / 0° Section Tower							
	DC	15° - 30° Angle Tower with tension string / 0° Section Tower							
	DD / DD-DE	30° - 60° Angle tower with tension string / 0° to 15° Complete Dead End / Dead end with 0° to 15° deviation on line side and 0° to 30°deviation on substation side							
7	For Electrical Clearances and Statutory requirements please refer Next Sheet.								

Violaba
Transmission Line Expert
PT Feedback Infra
Indonesia

Approved
General Manager (P&D)
AEGCL

Checked by
Asstt. Manager
O/o the GM (P&D)

Checked
AGM O/o the GM (P&D)

Checked
GM, O/o the G.M.(P&D)

Boyce Mfg

SKIPPER LIMITED Doc No : SK-2022-AEGCL-GODREJ-220kV-TSD-01 R4

TOWER SPOTTING DATA

GENERAL DETAILS:

A) ELECTRICAL CLEARANCE FOR RAILWAY CROSSING

- Prior approval of Railway Authority is to be obtained.
- Minimum Clearance between lowest point of line Conductor and Rail level shall be as per **Column-2 of Table-1** below under maximum sag condition.. However approval of railway crossing from railway authority has to be obtained in each case.
- Minimum Clearance to be maintained between highest traction conductor and lowest transmission line crossing Conductor should be...
  - •• As per **Column-3 of Table-1** At structure as per clause 61 CEA, if nearest OHE structure /fixed structure is within 6000 mm from overhead conductor under maximum sag condition, else it should be as per **column-4 of table-1**.
  - •• As per **Column-4,** At Mid Span as per clause 69 CEA.

Table-1

Voltage Level	Minimum Clearance between lowest point of line Conductor and Rail level	Minimum clearance to be maintained between lowest transmission line crossing conductor and railway structure as per clause 61 CEA (At structure)	Minimum clearance to be maintained between highest traction conductor and lowest transmission line crossing conductor as per clause 69 CEA (At Mid Span)
(1)	**(2)**	**(3)**	**(4)**
66 KV	16960	4000	2440
132 KV	17560	4600	3050
220 KV	**18460**	**5500**	**4580**
400 KV	20260	7300	5490
500 KV HVDC	21160	8200	7940
765 KV	23860	10900	7940
800 KV HVDC	23860	10900	7940

- The crossing span shall be limited to 300 M.
- The crossing shall normally be at right angle to the railway track.
- Crossing should be done with "D" type tower.
- The minimum distance of crossing tower shall be at least equal to the height of tower plus 6.0 m away measured from center of the nearest railway track.

B) MINIMUM CLEARANCE FOR POWER LINE CROSSING EACH OTHER

Table-2

Voltage Level	66 KV (mm)	132 KV (mm)	220 KV (mm)	400 KV (mm)	765 KV (mm)	500 KV HVDC (mm)
66 KV	2440	3050	4580	5490	7940	6790
132 KV	3050	3050	4580	5490	7940	6790
220 KV	**4580**	**4580**	**4580**	**5490**	**7940**	**6790**
400 KV	5490	5490	5490	5490	7940	6790
500 KV HVDC	6790	6790	6790	6790	7940	6790
765 KV	7940	7940	7940	7940	7940	7940
800 KV HVDC	9040	9040	9040	9040	9040	9040
1200 KV	10440	10440	10440	10440	10440	10440

Godrej & Boyce Mfg. Co. Ltd.

SKIPPER LIMITED Doc No : SK-2022-AEGCL-GODREJ-220kV-TSD-01 R4

TOWER SPOTTING DATA

GENERAL DETAILS:

C) TELE-COMMUNICATION LINE CROSSING

- Minimum clearance between Power conductor & telecommunication lines with respect to Voltage Level shall be as per **Table-3** with maximum conductor sag.

Table-3

Voltage Level	66 KV	132 KV	**220 KV**	400 KV	765 KV
Minimum clearance between Power conductor crossing (mm)	2440	2750	**3050**	4480	7900

- The angle of tele-communication line crossing shall be as near to 90° as possible. However, deviation to the extent of 60° may be permitted under exceptionally difficult situations.
- When, the angle of crossing has to be below 60°; the matter will be referred to the authority in charge of the telecommunication system. On a request from the contractor the permission of the telecommunication authority may be obtained by the Owner.
- In the crossing span, power line support will be as near the telecommunication line as possible, to obtain increased vertical clearance between the wires.

D) The number of consecutive spans between the section points shall not exceed 15 or 5 km. In plain terrain and 10 spans or 3 km. in hilly terrain.

E) A section point shall comprise of tension point with "B" type or "C" type or "D" type towers as applicable.

F) Minimum ground clearance required for respective voltage level shall be as per **Table-4.**

Table-4

Voltage Level	66 KV	132 KV	**220 KV**	400 KV	765 KV	500 KV HVDC	800 KV HVDC
Minimum Ground Clearance (mm)	6100	6100	**7015**	8840	18000	12500	18000

G) Sag Error : 150 mm. Add Sag Error to Ground Clearance.

H) At all important road crossings, tension tower to be used.

For all national highway crossing, tension tower is to be used and the crossing span is not to exceed 250 meters.

I) Maximum span of adjacent spans for various angles of deviation are subject to the condition that minimum specified live Metal Clearance & minimum Ground Clearance are available.

J) Maximum deviation of line for dead end tower (D) shall be 15° on line side and 30° sub-station side (slack span side)

Gabriel & Boyce Mfg. Co. Guwahati

SKIPPER LIMITED Doc No : SK-2022-AEGCL-GODREJ-220kV-TSD-01 R4

TOWER SPOTTING DATA

GENERAL DETAILS:

K) The clearances from building, trees, Power line crossings should be made in accordance with latest version of Indian Electricity Rules and IS:5613.

L) Vertical load of individual spans are acting downwards for suspension towers.

M) Corridor requirement and Way leave clearance either side from the C.L. of the Transmission Line shall be as per the **Table-5.**

Table-5

Voltage Level	Corridor requirement (m)	Way leave clearance on either side of C.L. of the TL (m)
66 KV	18	9
132 KV	27	13.5
220 KV	**35**	**17.5**
400 KV Single Circuit (Horizontal Configuration)	52	26
400 KV Double Circuit / Single Circuit (Vertical Configuration)	46	23
765 KV Single Circuit (Horizontal Configuration)	85	42.5
765 KV Single Circuit (Delta Vertical Configuration)	64	32
765 KV Double Circuit	67	33.5
1200 KV	89	44.5
500 KV HVDC	52	26
800 KV HVDC	69	34.5

N) Minimum clearance for power conductor of respective Voltage level over the highest flood level (HFL) in case of non navigable rivers and navigable rivers is as per **Table-6.**

Table-6

Voltage Level	Minimum clearance above HFL (mm)	
	Navigable Rivers (mm)	Non-navigable Rivers (mm)
66 KV	19000	3650
132 KV	19220	4300
220 KV	**20100**	**5100**
400 KV	21900	6400
765 KV	25550	9400
1200 KV	29900	11000
500 KV HVDC	24030	6750
800 KV HVDC	27700	11000

SKIPPER LIMITED Doc No : SK-2022-AEGCL-GODREJ-220kV-TSD-01 R4

TOWER SPOTTING DATA

GENERAL DETAILS:

K) The clearances from building, trees, Power line crossings should be made in accordance with latest version of Indian Electricity Rules and IS:5613.

L) Vertical load of individual spans are acting downwards for suspension towers.

M) Corridor requirement and Way leave clearance either side from the C.L. of the Transmission Line shall be as per the **Table-5.**

Table-5

Voltage Level	Corridor requirement (m)	Way leave clearance on either side of C.L. of the TL (m)
66 KV	18	9
132 KV	27	13.5
220 KV	**35**	**17.5**
400 KV Single Circuit (Horizontal Configuration)	52	26
400 KV Double Circuit / Single Circuit (Vertical Configuration)	46	23
765 KV Single Circuit (Horizontal Configuration)	85	42.5
765 KV Single Circuit (Delta Vertical Configuration)	64	32
765 KV Double Circuit	67	33.5
1200 KV	89	44.5
500 KV HVDC	52	26
800 KV HVDC	69	34.5

N) Minimum clearance for power conductor of respective Voltage level over the highest flood level (HFL) in case of non navigable rivers and navigable rivers is as per **Table-6.**

Table-6

Voltage Level	Minimum clearance above HFL (mm)	
	Navigable Rivers (mm)	Non-navigable Rivers (mm)
66 KV	19000	3650
132 KV	19220	4300
220 KV	**20100**	**5100**
400 KV	21900	6400
765 KV	25550	9400
1200 KV	29900	11000
500 KV HVDC	24030	6750
800 KV HVDC	27700	11000

Vishal Sabu
Transmission Line Expert
PT Feedback Infra
Indonesia

SKIPPER LIMITED

Design: **AEGCL - GODREJ**
Line: **220 kV D/C Line**

SAG TENSION CALCULATION

220 kV D/C Single AAAC Zebra WZ-5 RL-1 TC-1

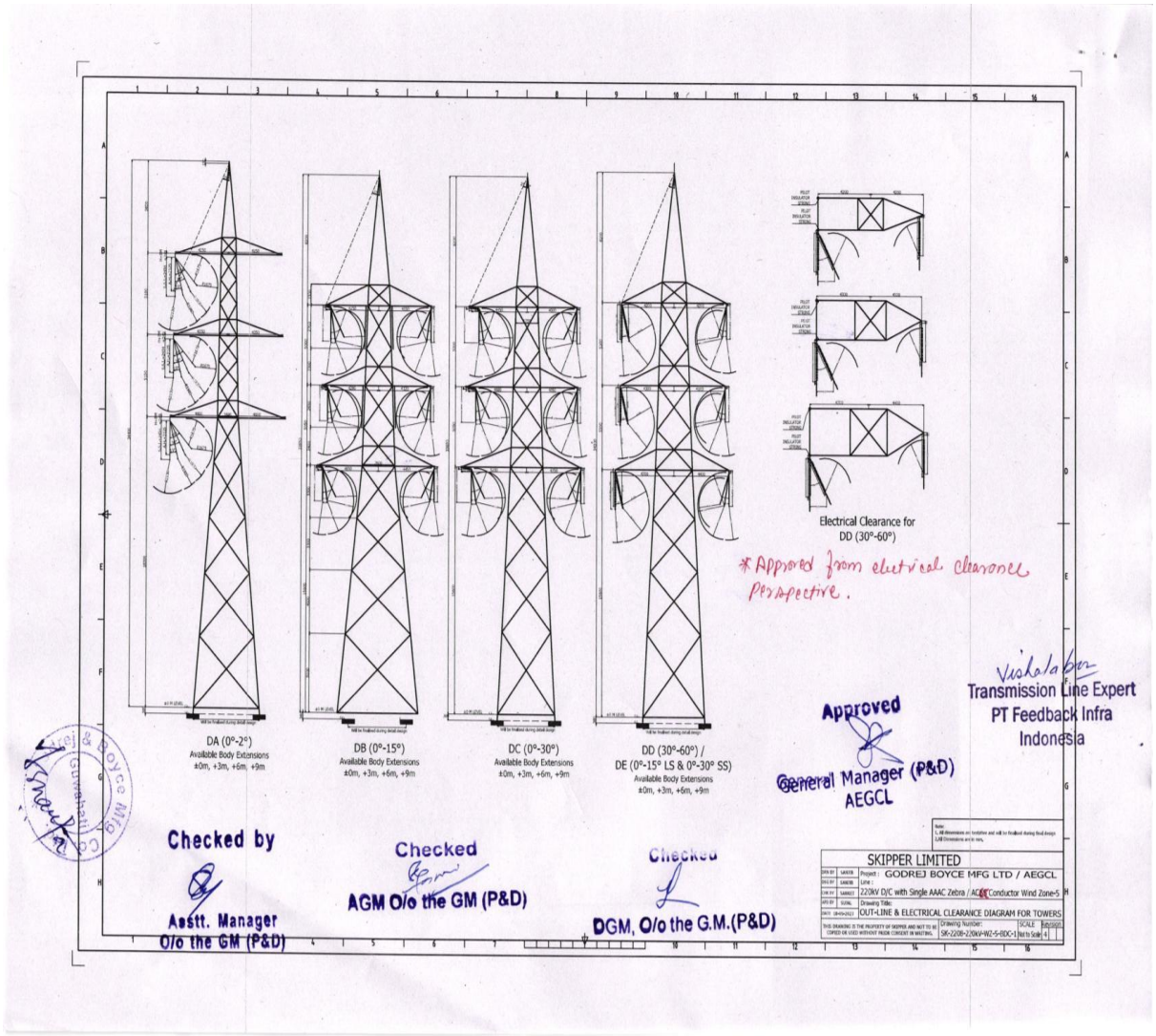
Normal Span		m	**350**					
Wire			**TOP CONDUCTOR**	**MIDDLE CONDUCTOR**	**BOTTOM CONDUCTOR**		**OPGW-1**	
Name			**AAAC ZEBRA**	**AAAC ZEBRA**	**AAAC ZEBRA**		**OPGW**	
Make/Model No./ Stranding/etc.			**37/4.00**	**37/4.00**	**37/4.00**		24F Godrej	
Overall Diameter	D	cm	2.80	2.80	2.80		1.25	
Area	A	cm²	4.65	4.65	4.65		0.6128	
Unit weight	Wt	kg/m	1.281	1.281	1.281		0.48	
Ultimate strength	T	kg	13907	13907	13907		8667.27847	
Young's modulus	E	kg/cm²	581400	581400	581400		1381957.19	
Coefficient of expansio	α	/°C	0.000023	0.000023	0.000023		0.000014	
Starting case								
Temperature		°C	32	32	32		0	
Wind Pressure		kg/m²	0.0	0.0	0.0		0	
K calculation by FOS/Tension/SAG			FOS	FOS	FOS		SAG	
FOS/Tension/SAG Required			4.000	4.000	4.000		3.802	
VALUES FOR TOP CONDUCTOR			**TOP CONDUCTOR - AAAC ZEBRA 37/4.00**					
Case Description			32° • Nil (0) Wind	32° • Full (184.8) Wind	32° • 0.75 wind	0° • Nil wind	95° • Nil wind	0° • 0.36 (66.528) Wind
Wire Tension		kg	**3476.8**	**7894.7**	**6714.8**	**4643.4**	**2231.9**	**5736.5**
		N	34095	77423	65852	45538	21888	56257
% Use			25.00 %	56.77 %	48.28 %	33.39 %	16.05 %	41.25 %
Maximum % Use Allowed			25 %	70 %	70 %	70 %	70 %	70 %
Sag PARABOLA		m	**5.642**			**4.224**	**8.789**	
VALUES FOR MIDDLE CONDUCTOR			**MIDDLE CONDUCTOR - AAAC ZEBRA 37/4.00**					
Case Description			32° • Nil (0) Wind	32° • Full (180.7) Wind	32° • 0.75 wind	0° • Nil wind	95° • Nil wind	0° • 0.36 (65.052) Wind
Wire Tension		kg	**3476.8**	**7793.0**	**6633.6**	**4643.4**	**2231.9**	**5699.6**
		N	34096	76426	65056	45538	21888	55896
% Use			25.00 %	56.04 %	47.70 %	33.39 %	16.05 %	40.98 %
Maximum % Use Allowed			25 %	70 %	70 %	70 %	70 %	70 %
Sag PARABOLA		m	**5.642**			**4.224**	**8.789**	
VALUES FOR BOTTOM CONDUCTOR			**BOTTOM CONDUCTOR - AAAC ZEBRA 37/4.00**					
Case Description			32° • Nil (0) Wind	32° • Full (176.6) Wind	32° • 0.75 wind	0° • Nil wind	95° • Nil wind	0° • 0.36 (63.576) Wind
Wire Tension		kg	**3476.8**	**7690.7**	**6552.0**	**4643.4**	**2231.9**	**5662.9**
		N	34095	75420	64253	45537	21887	55534
% Use			25.00 %	55.30 %	47.11 %	33.39 %	16.05 %	40.72 %
Maximum % Use Allowed			25 %	70 %	70 %	70 %	70 %	70 %
Sag PARABOLA		m	**5.642**			**4.224**	**8.789**	
CALCULATION FOR OPGW-1			**OPGW 24F Godrej**					
Case Description			32° • Nil (0) Wind	32° • Full (229.7) Wind	32° • 0.75 wind	0° • Nil wind	53° • Nil wind	0° • 0.36 (82.692) Wind
Wire Tension		kg	**1652.2**	**3810.4**	**3263.3**	**1933.3**	**1488.1**	**2538.2**
		N	16203	37367	32002	18959	14594	24891
% Use			19.1%	44.0%	37.7%	22.3%	17.2%	29.3%
Maximum % Use Allowed			25 %	50 %	50 %	50 %	50 %	50 %
Sag PARABOLA		m	**4.449**			**3.802**	**4.939**	
% Sag of OPGW to Sag of Cor		%	**79%**			**90%**	**56%**	

Checked by
Asstt. Manager
O/o the GM (P&D)

Checked
AGM O/o the GM (P&D)

Checked
DGM, O/o the G.M.(P&D)

Approved
General Manager (P&D)
AEGCL


DA (0°-2°)
Available Body Extensions
±0m, +3m, +6m, +9m
DB (0°-15°)
Available Body Extensions
±0m, +3m, +6m, +9m
DC (0°-30°)
Available Body Extensions
±0m, +3m, +6m, +9m
DD (30°-60°) /
DE (0°-15° LS & 0°-30° SS)
Available Body Extensions
±0m, +3m, +6m, +9m
Electrical Clearance for
DD (30°-60°)
* Approved from electrical clearance perspective.
Vishal Jain
Transmission Line Expert
PT Feedback Infra
Indonesia
Approved
General Manager (P&D)
AEGCL
Checked by
Asstt. Manager
O/o the GM (P&D)
Checked
AGM O/o the GM (P&D)
Checked
DGM, O/o the G.M.(P&D)
SKIPPER LIMITED
Project : GODREJ BOYCE MFG LTD / AEGCL
Line : 220KV D/C with Single AAAC Zebra / ACSR Conductor Wind Zone-5
Drawing Title: OUT-LINE & ELECTRICAL CLEARANCE DIAGRAM FOR TOWERS
Drawing Number: SK-220B-220kV-W2-5-DDC-1
SCALE: Not to Scale
Revision: 4

3.13.0 Master plan for Construction of 1(One) No. of 132/33KV Grid Substation (AIS and GIS) in conformity with the following

Drawings and Documents in conformity with the following:

3.13.1 Construction of two (2) nos. of permanent RCC benchmark pillars at suitable locations - all future references shall be obtained from them. Size of the pillar should be minimum 300mm X 300 mm. HFL & FGL markings should be shown in the benchmark pillar, for each substation.

3.13.2 For each substation. survey of the entire land area of the GSS in 5 m X 5 m grid marking with RL using total station and submit on AutoCAD, scaled drawing and marking by peg on the field. **

3.13.3 Marking the switchyard including Cable trench, control room, incoming and outgoing feeders, etc. on auto CAD scaled drawing and marking by peg on the field. **

3.14.4 Planning and marking of staff quarters, guest house, internal roads, drainage system, storm water management etc. on AUTOCAD drawing **

3.15.5 Planning and marking on AutoCAD drawings about street lighting, boundary wall with security post, security fencing illumination etc. **

3.15.6 Planning, estimation and marking on AutoCAD drawings about boundary wall and gate with details of entire colony **

3.15.7 Preparing a Proper Substation Layout Drawing to scale along with SLD clearly specifying the schemes on AutoCAD.

3.15.8 GA Drawing for Water supply arrangement, rain water harvesting system and provision for bore hole / overhead tank.

**HFL & FGL: Should be marked in the master plan(s).

Section - 4

General Conditions of Supply and Erection of AEGCL

This Section 'General Conditions of Supply and Erection of AEGCL' can be obtained from AEGCL's website (https://www.aegcl.co.in/wp-content/uploads/2021/04/RulesGeneralConditionsOfSupplyandErection2009.pdf) and supplementary to Section -5 'Special Conditions of Contract' of this document.

Whenever there is a conflict, the provisions in SCC or the other Sections of this document shall prevail over those in the 'General Conditions of Supply and Erection of AEGCL'.

Section - 5

Special Conditions of Contract

This Section 'SCC' is supplementary to Section -4 'General Conditions of Supply and Erection of AEGCL'
Whenever there is a conflict, the provisions in this Section shall prevail over those in the 'General Conditions of Supply and Erection of AEGCL'.

Section - 5
Special Conditions of Contract

5.1.0 All Demand Drafts shall be pledged in favour of the Assam Electricity Grid Corporation Limited, Bijulee Bhawan, Paltanbazar, Guwahati-1, and Payable at Guwahati.

5.2.0 For any litigation arising out of the contract which cannot be resolve through mutual agreement or through Arbitration the honorable Guwahati High Court will have sole jurisdiction of all settlement.

5.3.0 The ruling language of the Work Order shall be English.

5.4.0 The works vide the work order issued to the successful bidder must not be sublet.

5.5.0 No labour below 18 years should be engaged and contractor should have labour license from competent authority.

5.6.0 The contractor will be responsible for safety of his materials.

5.7.0 Cost for construction of temporary building for storage of materials etc. house for contractor and staff should bear by the contractor. No rent will be paid by the AEGCL.

5.8.0 BIDDER SHOULD EXAMINE & UNDERSTAND

All prospective bidders are required to thoroughly study and carefully examine all the terms and conditions, instructions, requirements& specifications pertaining to the work and visit the field of work to fully satisfy and acquaint themselves about the nature and location of work, the configuration of the ground, the surface conditions, quality and quantity of materials required and the type of equipment and facilities needed preliminary to and during the execution of the work and local conditions which may affect the work or cost thereof. Failure to do so will be at the bidder's risk.

5.9.0 Supervising Authority:

The work shall be carried out under supervision of AGM, 220kV Tinsukia GSS, AEGCL and an officer deputed by him at site.

1. After completion of route survey work, the report duly signed by consignee of AEGCL and vetted by OIL is to be submitted to CGM(O&M), UAR, AEGCL for approval.
2. After completion of the detail survey, the report duly signed by consignee of AEGCL is to be submitted to CGM(O&M), UAR, AEGCL for approval.
3. After completion of the soil investigation work, the report duly signed by consignee of AEGCL is to be submitted to CGM(O&M), UAR, AEGCL for approval.
4. After completion of preparation of BoQ, schedule and documents, drawings, consolidated reports etc., duly signed by consignee of AEGCL is to be submitted to CGM(O&M), UAR, AEGCL for approval.

5.10.0 Approving Authority:

Approval shall be issued by CGM(O&M), UAR, AEGCL. After approval, the contractor shall submit the report(s) to the office of CGM(O&M), UAR, AEGCL, First Floor, Bijulee Bhawan as follows:

Hard copies: 6 nos. Soft copies: 6 nos. in USB drives.

All data is to be submitted in AutoCAD format, PDF as well as hard copies (Colored) as referred above.

5.11.0 Execution of Work: The execution of work shall be done in the presence of AEGCL officials/representatives. The successful bidder before beginning of the work shall intimate AEGCL regarding their readiness to initiate the work, upon which the CGM (O&M), UAR, AEGCL shall appoint his representative in whose presence the work shall have to be executed.

5.12.0 COMPLETION SCHEDULE

The completion schedule shall be in accordance with **APPENDIX to ITB-2, Clause 1.3.**

5.13.0 TERMS AND PROCEDURE OF PAYMENT

i. All the invoices/ bills to be submitted to the concerned Supervising Authority/Consignee for onward processing.

ii. All payments shall be released from HQ.

5.13.1. The payment shall be made as follows against completion of deliverables:

Sl No	Deliverable	% of the Contract Value to be Paid
1	Submission of 1st Draft duly signed by consignee (including all drawings/documents in scope) for review by CGM (O&M), UAR, AEGCL	20%
2	Submission of Final Report (including all drawings/documents in scope) for approval to CGM (O&M), UAR, AEGCL	20%
3	Submission of final consolidated reports to AEGCL along with Master Plan after final Approval of all the deliverables by AEGCL	60%

5.13.2. ADVANCE PAYMENT
No advance payment is applicable for this contract.

5.14.3 Fund Availability
Payment shall be made subject to availability of fund against this specific project.

5.14.0 PERFORMANCE SECURITY DEPOSIT

5.14.1. The contractor shall have to deposit to the extent of 10% (ten percent) of the total value of the contract order as performance security (Bank Guarantee / Demand Draft), within **ten (10)** days of receipt of notification of award/LOI and before signing of the Contract Agreement, duly pledged in favor of the Purchaser and such security deposits shall be valid up to **30 days beyond the contract completion period.**

5.14.2. If required, the Surveyor/Contractor on his own has to renew the BG at least 1(one) month before the date of expiry of the BG; failing which the BG shall be revoked by AEGCL within the claim period without any prior intimation to the contractor.

5.14.3. If the supplier fails or neglects to observe, perform any of his obligations under the contract, it will be lawful for the "Purchaser" to forfeit either in full or in part at his absolute discretion, the security deposit furnished by the supplier.

5.14.4. No interest shall be payable on such deposits.

5.15.0 FORCE MAJEURE

5.15.1. "Force Majeure" shall mean any event beyond the reasonable control of the Purchaser or of the Supplier, as the case may be, and which is unavoidable notwithstanding the reasonable care of the party affected, and shall include, without limitation, the following:

(a) war, hostilities or warlike operations whether a state of war be declared or not, invasion, act of foreign enemy and civil war

(b) rebellion, revolution, insurrection, mutiny, usurpation of civil or military government, conspiracy, riot, civil commotion and terrorist acts

(c) confiscation, nationalization, mobilization, commandeering or requisition by or under the order of any government or de jure or de facto authority or ruler or any other act or failure to act of any local state or national government authority

(d) strike, sabotage, lockout, embargo, import restriction, port congestion, lack of usual means of public transportation and communication, industrial dispute, shipwreck, shortage or restriction of power supply, epidemics, quarantine and plague

(e) earthquake, landslide, volcanic activity, fire, flood or inundation, tidal wave, typhoon or cyclone, hurricane, storm, lightning, or other inclement weather condition, nuclear and pressure waves or other natural or physical disaster

(f) shortage of labor, materials or utilities where caused by circumstances that are themselves Force Majeure.

5.15.2. If either party is prevented, hindered or delayed from or in performing any of its obligations under the Contract by an event of Force Majeure, then it shall notify the other in writing of the occurrence of such event and the circumstances thereof within fourteen (14) days after the occurrence of such event.

5.15.3. The party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure continues and to the extent that such party's performance is prevented, hindered or delayed. The Time for Completion shall be extended in accordance with ***SCC Clause* 5.16.0**.

5.16.0 EXTENSION OF TIME FOR COMPLETION

5.16.1. The Time(s) for Completion specified in the Work Order shall be extended if the Work is delayed or impeded in the performance of any of its obligations by reason of any of the following:

(a) any Change in the scope of works by the Purchaser; which justifies extension of completion time as provided in ***SCC Clause*** 5.15.0; and

(b) any occurrence of Force Majeure as provided in ***SCC Clause*** 5.15.0.

5.16.2. Except where otherwise specifically provided in the Contract, the Supplier shall submit to the Purchaser's Representative a notice of a claim for an extension of the Time for Completion, together with particulars of the event or circumstance justifying such extension as soon as reasonably practicable after the commencement of such event or circumstance. As soon as reasonably practicable after receipt of such notice and supporting particulars of the claim, the Purchaser and the Supplier shall agree upon the period of such extension. In the event that the Supplier does not accept the Purchaser's estimate of a fair and reasonable time extension, the Supplier shall be entitled to refer the matter to a Dispute Board, pursuant to ***SCC Sub-Clause 5.18.0***.

5.17.0 LIQUIDATED DAMAGE

5.17.1. The date of completion of work shall be deemed as the essence of the contract and shall not be completed no later than the time specified in the contract. In case of failure, AEGCL shall be entitled to recover an amount at the rate of 0.5% of the contract price per week subject to maximum of 10% of the work order

value as liquidated damage of AEGCL. However, the payment of liquidated damages shall not in any way relieve the Contractor from any of its obligations to complete the work

5.18.0 ARBITRATION

5.18.1. If at any time, any question, disputes or differences whatsoever shall rise between the Purchaser and the Supplier, upon or in relation to or in connection with the contract, either party may forthwith give notice to the other in writing of the existence of such question of dispute or difference and the same shall be referred to the adjudication of three Arbitrators, one to be nominated by the Purchaser the other by the Supplier and the third by the President of the Institution of Engineers, India/ Retired or Sitting Judge not below the status of a retired Judge of High Court of India. If either of the parties fail to appoint its arbitrators within 60(sixty) days after receipt of notice of the appointment of arbitrators then the President of the Institution of Engineers /retired or sitting Judge of India, as the case may be, shall have the power at request of either of the parties, to appoint an Arbitrator. A certified copy of the "President" making such an appointment shall be furnished to both parties.

5.18.2. The arbitration shall be conducted as per provisions of the Indian Arbitration Act, shall be held at Guwahati or any other place as may be decided by the Purchaser. The decision of the majority of Arbitrators shall be final & binding upon the parties and the expenses of the arbitration shall be paid as may be determined by the Arbitrator. However, any dispute arising out of this contract will first be discussed and settled bilaterally between Purchaser and the Supplier.

5.19.0 QUANTITY VARIATION

5.19.1. "Purchaser" shall have the right to increase/decrease the ordered quantity by (±) 20% in terms of contract value and the same shall be carried out at the same rates /prices and terms and conditions stipulated in the order except in regard to completion schedule, which shall be mutually agreed upon in case of enhancement of the ordered quantity.