BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP
SUBCONTRACTS MANAGEMENT
6TH FLOOR, BHEL SADAN,
PLOT NO. 25, SECTOR 16A, NOIDA,
DISTT. – GAUTAM BUDDH NAGAR (U.P.) - 201301

TENDER DOCUMENTS

FOR

TENDER FOR PROVIDING DESIGN CONSULTANCY SERVICES FOR TYPE TESTED 400KV TRANSMISSION LINE TOWER DESIGN SUITABLE FOR DOUBLE CIRCUIT QUAD MOOSE CONDUCTOR FOR WIND ZONE -III AT 2 X 800 MW NTPC LARA STAGE -II, CHHATTISGARH.

CUSTOMER

NTPC Ltd.

TENDER SPEC. NO.: TBSM/LARA/DESIGN CONSULTANCY SERVICES/TENDER/24-25

DATE: 30.01.2025

TRANSMISSION BUSINESS GROUP

SUBCONTRACTS MANAGEMENT

INDEX

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS GROUP
SECTOR-16A, NOIDA -201301

e-mail: akmeena@bhel.in

NOTICE INVITING TENDER

REF.: TBSM/LARA/DESIGN CONSULTANCY SERVICES/TENDER/24-25 **Date: 30.01.2025**

SUB: TENDER FOR "PROVIDING DESIGN CONSULTANCY SERVICES FOR TYPE TESTED 400KV TRANSMISSION LINE TOWER DESIGN SUITABLE FOR DOUBLE CIRCUIT QUAD MOOSE CONDUCTOR FOR WIND ZONE -III AT 2 X 800 MW NTPC LARA STAGE -II, CHHATTISGARH".

Dear Sirs,

1. **Sealed tenders are invited for the following:**

NAME OF WORK	TIME OF COMPLETION	EARNEST MONEY DEPOSIT	TENDER SUBMISSION DATE AND TIME	TENDER OPENING DATE & TIME
TENDER FOR PROVIDING DESIGN CONSULTANCY SERVICES FOR TYPE TESTED 400KV TRANSMISSION LINE TOWER DESIGN SUITABLE FOR DOUBLE CIRCUIT QUAD MOOSE CONDUCTOR FOR WIND ZONE -III AT 2 X 800 MW NTPC LARA STAGE -II, CHHATTISGARH	02 Months from the date of LOI	NIL	12.02.2025 11.00 hrs.	12.02.2025 16.00 hrs. (Technical bid only)

2. Bidder **has** to submit offer directly through E-PROCURMENT MODE. Bidder may visit **https://eprocurebhel.co.in**

Procedure for Submission of Tenders through e-tendering: The tender is also floated online through our E-Procurement Site https://eprocurebhel.co.in . The bidder may respond by submitting their offer online in our e-Procurement platform at https://eprocurebhel.co.in

Offers are invited in two-parts only.

Documents Comprising the e-Tender

The tender shall be submitted online above as mentioned below:

a) Technical Bid (Un priced Tender)

All Technical details (e.g. Eligibility Criteria requested (as mentioned below)) should be attached in e-tendering module, failing which the tender stands invalid & may be REJECTED. Bidders shall furnish the following information along with technical tender (preferably in pdf format):

i) Technical Bid (without indicating any prices).

b) Price Bid:

i) Prices are to be quoted in the attached Price Bid format online on e-tender portal.
ii) The price should be quoted for the accounting unit indicated in the e-tender document.
iii) Note: It is the responsibility of tenderer to go through the Tender document to ensure furnishing all required documents in addition to above, if any. Any deviation would result in REJECTION of tender and would not be considered at a later stage at any cost by BHEL.
iv) A person signing (manually or digitally) the tender form or any documents forming part of the contract on behalf of another shall be deemed to warrantee that he has authority to bind such other persons and if, on enquiry, it appears that the persons

so signing had no authority to do so, the purchaser may, without prejudice to other civil and criminal remedies, cancel the contract and hold the signatory liable for all cost and damages.

v) A tender, which does not fulfil any of the above requirements and/or gives evasive information/reply against any such requirement, shall be liable to be ignored and rejected.

c) Uploading of the price bid in prequalification bid or technical bid may RESULT IN REJECTION of the tender.

d) Tenders shall be uploaded with all relevant PDF/zip format. The relevant tender documents should be uploaded by an authorized person having Class 3- SHA2- 2048 BIT- SIGNING & ENCRYPTION digital signature certificate (DSC).

3. **EMD is not applicable for this tender.**

4. **Bidders may please note that no other mode of bid submission shall be considered for evaluation apart from Clause no. 02 to 03 mentioned above.**

5. The prospective bidders who have downloaded the tender documents from our website are requested to send their acknowledgement and willingness to participate in the tender to the undersigned, through fax or email.

6. Offers should be strictly in accordance with the Tender Specifications and General Instructions to Tenderer enclosed herewith.

7. Reverse Auction (RA) is not applicable for this Tender.

8. All documents submitted with the offer shall be signed and stamped in each page by authorized representative of the bidder.

9. Clarifications, if any, can be obtained from the undersigned but such requests should be submitted well before the due date for submission of tenders. Due date for submission and opening of tenders will not be extended on such grounds.

10. Drawings & FQP enclosed with the NIT (if provided) are for tender purpose only. Drawings & FQP may get change during execution stage and work to be carried as per latest RFC drawings & Field Quality Plan (FQP).

11. Construction/ RFC drawing/ Fronts (if applicable) shall be furnished progressively as per project requirement and no claim towards idling charges/ project overheads etc. borne by the contractor on account of non-availability of drawings/ fronts shall be entertained.

12. Completion period of the work has been envisaged under best possible conditions. Any changes/ deviation during execution shall be dealt as per relevant clauses mentioned in terms and conditions of contract.

13. The offers of the bidders who are under suspension as also the offers of the bidders, who engage the services of the banned firms, shall be rejected. The list of banned firms is available on BHEL web site www.bhel.com.

14. Integrity commitment, performance of the contract and punitive action thereof:

18.1. Commitment by BHEL:

BHEL commits to take all measures necessary to prevent corruption in connection with the tender process and execution of the contract. BHEL will during the tender process treat all Bidder(s) in a transparent and fair manner, and with equity.

18.2. Commitment by Bidder/ Supplier/ Contractor:

18.2.1. The bidder/ supplier/ contractor commits to take all measures to prevent corruption and will not directly or indirectly influence any decision or benefit which he is not legally entitled to nor will act or omit in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860 or any other law in force in India.

18.2.2. The bidder/ supplier/ contractor will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract and shall adhere to relevant guidelines issued from time to time by Govt. of India/ BHEL.

18.2.3. The bidder/ supplier/ contractor will perform/ execute the contract as per the contract terms & conditions and will not default without any reasonable cause, which causes loss of business/ money/ reputation, to BHEL.

If any bidder/ supplier/ contractor during pre-tendering/ tendering/ post tendering/ award/ execution/ post-execution stage indulges in mal-practices, cheating, bribery, fraud or and other misconduct or formation of cartel so as to influence the bidding process or influence the price or acts or omits in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860 or any other law in force in India, then, action may be taken against such bidder/ supplier/ contractor as per extant guidelines of the company available on www. bhel.com and/or under applicable legal provisions".

15. Also, offer of the bidders who are suspended (under hold/ delist) for business dealings by BHEL, TBG shall not be considered. Please note that lifting/ restoration of suspension (Ban/Hold/ De-list) of business dealing is not automatic after expiry of specified suspension period. Hence, vendor shall be considered as suspended for business till suspension is lifted by BHEL in writing on specific request of the vendor as per extant guidelines.

16. BHEL Fraud Prevention Policy, "The Bidder along with its associate/ collaborators/ sub-contractors/ sub-vendors/ consultants/ service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website http://www.bhel.com and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to their notice."

17. Offers will be scrutinized based on the qualifying requirements and only those who are technically and financially capable to execute the Job and who fulfil the Pre-Qualifying Requirements (PQR) are eligible to quote against the above NIT. However, final acceptance of the bidder/ offer shall be subject to acceptance of our customer.

18. The evaluation currency for this tender shall be INR.

19. In the course of evaluation, if more than one bidder happens to occupy L-1 status, effective L-1 will be decided by soliciting discounts from the respective L-1 bidders.

    In case more than one bidder happens to occupy the L-1 status even after soliciting discounts, the L-1 bidder shall be decided by toss/ draw of lots, in the presence of the respective L-1 bidder(s) or their representative(s).

    Ranking will be done accordingly. BHEL's decision in such situations shall be final and binding.

20. Technical Bid will be opened in the office of undersigned. If required, technical discussions will be held with only those bidders who have taken any deviations. The price bids will be opened subsequently, after Technical Bids of all the bidders have been evaluated and freezed. Bidders should quote their most competitive rates as there will not be any price negotiation. However, if felt necessary by BHEL, price negotiation will be held with lowest bidder (L-1) only.

21. In case any adverse information is received concerning performance, capability or conduct of the bidder after issue of tender enquiry, BHEL reserves the right to reject the offer at any stage as deemed fit.

22. Integrity Pact (IP) is not applicable for this tender.

23. Any materials (if required) for works have to be procured from Customer approved sources only. It will be the bidder's responsibility to get the approval of materials and vendors for materials.

24. The purchase preference for central P.S.U.s shall be given as per the prevailing Government policy.

25. In case an offer is not being submitted by the prospective bidders against this tender, they may send their "regret" letter to this office, for information.

26. Details of qualifying work(s) executed by the bidder will be forwarded to the principal employer for verification of the work with respect to completion, commencement & completion date and value of the work executed. Performance feedback of the bidder will also be sought from the principal employer.

27. The bidder representative may be called for discussion with the committee. His originals may be verified by the committee. In addition to above their organisation chart and detail list of manpower, tools & plants and technically capability will be discussed and ascertained by the committee.

28. **The rates shall be for design and drawings for SINGLE PROJECT USE for NTPC Lara project only.**

29. **Conflict of Interest among bidders/Agents:** -

"A bidder shall not have conflict of interest with other bidders. Such conflict of interest can lead to anti-competitive practices to the detriment of Procuring Entity's interests. ***The bidder found to have a conflict of interest shall be disqualified****. A bidder may be considered to have a conflict of interest with one or more parties in this bidding process, if:*

a) they have controlling partner (s) in common; ***or***

b) they receive or have received any direct or indirect subsidy/ financial stake from any of them; ***or***

c) they have the same legal representative/agent for purposes of this bid; ***or***

d) they have relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the bid of another Bidder; ***or***

e) Bidder participates in more than one bid in this bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all bids in which the parties are involved. However, this does not limit the inclusion of the components/ sub-assembly/ Assemblies from one bidding manufacturer in more than one bid; ***or***

f) In cases of agents quoting in offshore procurements, on behalf of their principal manufacturers, one agent cannot represent two manufacturers or quote on their behalf in a particular tender enquiry. One manufacturer can also authorise only one agent/dealer. There can be only one bid from the following:

1. The principal manufacturer directly or through one Indian agent on his behalf; and

2. Indian/foreign agent on behalf of only one principal;

or

g) A Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the contract that is the subject of the Bid; ***or***

h) *In case of it holding company having more than one independently manufacturing units, or more than one unit having common business ownership/management, only one unit should quote. Similar restrictions would apply to closely related sister companies. Bidders must proactively declare such sister/ common business/ management units in same/ similar line of business.* "

Thanking you,

Yours faithfully,
For and on behalf of BHEL,

(Ashok Kumar Meena)
Sr. DGM /TBSM

TO BE FILLED BY TENDERER OVER THEIR LETTERHEAD

ANNEXURE - X

REF.: TBSM/LARA/DESIGN CONSULTANCY SERVICES/TENDER/24-25 **DATE: 30.01.2025**

SUB: TENDER FOR "PROVIDING DESIGN CONSULTANCY SERVICES FOR TYPE TESTED 400KV TRANSMISSION LINE TOWER DESIGN SUITABLE FOR DOUBLE CIRCUIT QUAD MOOSE CONDUCTOR FOR WIND ZONE -III AT 2 X 800 MW NTPC LARA STAGE -II, CHHATTISGARH".

It is certified that General Instructions and Information for tenderer have been read/ complied/ agreed to and each page of tender offer has been initialled and stamped.

Also It is being declares that we (……Bidder Name ……) will not enter into any illegal or undisclosed agreement or understanding, whether formal or informal with other Bidder(s). This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competiveness or to introduce cartelization in the bidding process.

In case, the Bidder is found having indulged in above activities, suitable action shall be taken by BHEL as per extant policies/ guidelines

(Signature of Tenderer)

Name and Designation of Authorised person (s)
Signing the tender on behalf of the tenderer

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS GROUP, NOIDA
PRE-QUALIFYING REQUIREMENTS

REF.: TBSM/LARA/DESIGN CONSULTANCY SERVICES/TENDER/24-25 **DATE: 30.01.2025**

SUB: TENDER FOR "Providing Design Consultancy Services for Type tested 400kV Transmission Line Tower Design Suitable for Double Circuit Quad Moose Conductor for Wind Zone -III at 2 X 800 MW NTPC Lara Stage -II, Chhattisgarh".

Tenders (Under two-part bid system) are invited from competent contractors for subject works. Only those who are technically and financially capable to execute the Job and who fulfil the Pre-Qualifying Requirements [PQR] given under are eligible to quote against the above NIT. Tenderers should submit their offer as per the procedure specified in tender documents. The PQR of contractor for tender submission shall be is as under:

Sl. No.	Criteria	Description
A	Turn Over	Bidders should have a minimum average annual turnover (Annual Gross Revenue from operations/ Gross operating income as incorporated in the profit & loss account excluding Other Income) of **₹ 20,84,100**/- for last three fin. Years (2021-22, 2022-23 & 2023-24) and should submit audited Balance sheet and Profit & Loss Account Sheet of these years. The audited financial statements must be signed by the owner and the auditor. Auditors seal, Name, Membership No., Firm Registration No. & firm name (if applicable), UDIN and the capacity in which he is signing (Proprietor/Partner), must be mentioned on the Profit & Loss A/c and Balance Sheet. In case of proprietorship and partnership firms where Audited Profit & Loss A/c and Balance Sheet is not mandatory as per extant rules, CA certificate certifying turnover and profit for the required financial years must be submitted. CA certificate must be on his letter head mentioning his/her name, Membership No., Firm Registration No. & firm name (if applicable), UDIN, capacity in which he is signing (Proprietor/Partner), date and place of signing.
B	Profit & Networth	Bidder should have earned profit in at least one financial year during the period of last three Financial Years as per Sl. No. A above and Net worth of the Bidder based on the latest Audited Accounts as furnished for 'A" above should be positive. Net worth = Paid up share capital + Reserves. (Net worth is required to be evaluated in case of companies)
C	Similar Work	Bidder should have **A) "Provided Design Consultancy Services for Transmission Line tower of 400kV & above to any Power utility"** **OR** **B) "Designed & executed (through itself or EPC contractor) Transmission Line Tower of 400kV in its own project"** during last seven years ending on **03.03.2023** and should be either of the

		following: i. Three similar jobs costing (except service tax/GST) not less than **₹ 27,78,800/-** each. OR ii. Two similar jobs costing (except service tax/GST) not less than **₹ 34,73,500/-** each. OR iii. One similar job costing (except service tax/GST) not less than **₹ 55,57,600/-**

Note:

1. The Bidder shall submit the Contract Agreement/Work Order/LOI, BOQ and Performance/completion/execution certificate issued by customer/contractor along with technical bid in support of qualification.
2. Only those work Credentials will be considered that already completed.
3. In order to technically qualify in this tender, bidder should meet all criteria i.e. A, B & C mentioned above.
4. If the job is completed in the last seven-year period, as specified above, even if it has been started earlier, the same will also be considered meeting the qualifying requirements.
5. Consortium/ JV bidding is not allowed for this Tender.
6. BHEL reserves the right to:
   (a) Accept or reject any bid received at its discretion without assigning any reasons whatsoever.
   (b) Postpone the above-mentioned date, split and distribute the work among more than one bidder without assigning any reason whatsoever.
   (c) May ask for further qualification during techno commercial scrutiny of bids received.
   (d) May ask for further proofs including TDS certificates/ Form 26AS/ Final bill/ payment detail for the said job for cross- verification.
7. BHEL shall not be responsible for any delay, loss, damage for bids sent by post.
8. BHEL shall not be liable for any expenses incurred by bidder in preparation of bid irrespective of whether it is accepted or not.
9. Quotations received from bidders who do not fulfil the PQR shall be summarily rejected without any further evaluation and information to bidders.
10. Canvassing i.e. soliciting favour, seeking advantage etc. in any form is strictly prohibited and any bidder found to have engaged in canvassing shall be liable to have his bid rejected summarily.
11. If the bidder deliberately gives any wrong information in his tender to create in circumstances for the acceptance to his bid, BHEL reserves the right to reject such application.

12. Bidder's selection is subject to approval of BHEL's customer for this work. The approval/acceptance of bidders from Customer is mandatory requirement for subject tender.
13. All corrigenda, addenda, amendments and clarifications to this Tender will be hosted in web page, www.bhel.com and https://eprocurebhel.co.in and not in the newspaper. Bidders shall keep themselves updated with all such amendments.

PROJECT INFORMATION

1.0 CUSTOMER:

M/s NTPC Limited

2.0 PROJECT LOCATION AND DETAILS:

TENDER FOR "PROVIDING DESIGN CONSULTANCY SERVICES FOR TYPE TESTED 400KV TRANSMISSION LINE TOWER DESIGN SUITABLE FOR DOUBLE CIRCUIT QUAD MOOSE CONDUCTOR FOR WIND ZONE -III AT 2 X 800 MW NTPC LARA STAGE -II, CHHATTISGARH".

SITE ADDRESS:

NTPC Limited
Lara Super Thermal Power Project
Stage-II (2x800 MW)
P.O. – Pussore, Village – Chhapora,
Raigarh, Chhattisgarh-496440
(The project site is approachable from NH-200
(Raigarh/Sarangarh) via Kondatarai through State PWD
Road.)

3.0 CONTACT PERSON: FOR CONTRACTUAL ISSUES

ASHOK KUMAR MEENA
Sr. DGM (TBSM)
SUBCONTRACTS MANAGEMENT,
TRANSMISSION BUSINESS GROUP,
Plot No. 25, Sector-16A, Noida,
Distt. Gautambudh Nagar, UP-201301

PHONE: 0120-674-8545/ 98310 38136
E-mail: akmeena@bhel.in

CONTACT PERSON: FOR ENGINEERING ISSUES

Manvender Singh Pundir
Manager (TBEM)
TRANSMISSION BUSINESS GROUP,
Plot No. 25, Sector-16A, Noida,
Distt. Gautambudh Nagar, UP-201301
PHONE: 0120-674- 8512/ 9916366333
E-mail: manvender@bhel.in

CONTACT PERSON: FOR CONTRACT EXECUTION ISSUES

Ratheen Sarkar
SrDGM & Sector Head (TBES-Construction)
TRANSMISSION BUSINESS GROUP,
Plot No. 25, Sector-16A, Noida,
Distt. Gautambudh Nagar, UP-201301

PHONE: 0120-674-8228/ 8140714999
E-mail: **ratheen@bhel.in**

TERMS AND CONDITIONS OF CONTRACT

The following terms and conditions shall form a part of the tender document.

A. Terms and Condition of Contract:

A.1. GENERAL INSTRUCTION

A.1.1. **All pages of the tender documents shall be duly signed, stamped and submitted along with the offer in token of complete acceptance thereof.** The information furnished shall be complete by itself. The tenderer is required to furnish all the details and other documents as required in the following pages.

A.1.2. Tenderers are advised to study all the tender documents carefully. Any submission of tender by the tenderer shall be deemed to have been done after careful study and examination of the tender documents and with the full understanding of the implications thereof. Should the tenderers have any doubt about the meaning of any portion of the Tender Specification or find discrepancies or omissions in the drawings or the tender documents issued are incomplete or shall require clarification on any of the technical aspect, the scope of work etc., tenderer shall at once, contact the authority inviting the tender well in time (so as not to affect last date of submission) for clarification before the submission of the tender. Tenderer's request for clarifications shall be with reference to Sections and Clause numbers given in the tender documents. The specifications and terms and conditions shall be deemed to have been accepted by the tenderer in his offer. Non-compliance with any of the requirements and instructions of the tender enquiry may result in the rejection of the tender.

A.2. PROCEDURE FOR SUBMISSION OF SEALED TENDERS

A.2.1. Bidders may please refer Cl no. 02 to Cl no. 03 of the Notice inviting tender.

A.2.2. The tenders received after the specified time of their submission shall be treated as 'Late Tenders' and shall not be considered under any circumstances.

A.2.3. Tenders shall be opened by the officers concerned of BHEL at the time, date and venue as specified in the tender enquiry. Tenderer or their authorized representative may witness the bid opening.

A.2.4. The tenderer shall closely pursue all the clauses, specifications and drawings indicated in the Tender Documents before quoting. Should the tenderer have any doubt about the meaning of any portion of the Tender Specifications or find discrepancies/omission in the drawings or the tender documents issued are incomplete or shall require clarification on any of the technical aspect, scope of work etc. he shall at once contact the authority inviting the tender for clarification before the submission of the tender.

A.2.5. Before submission of offer, the tenderer is advised to inspect the work & the environments and be well acquainted with the actual working and other prevalent conditions, facilities available, sourcing of material and labour, means of transport and access to site, accommodation, etc. No claim will be entertained later on the grounds of lack of knowledge on any of these conditions/ resources.

A.2.6. Tenderer must fill up all the schedules and furnish all the required information as per the instructions given in various sections of the tender specification. Each and every page of the Tender Specification must be SIGNED AND SUBMITTED ALONG WITH THE OFFER by the Tenderer in token of complete acceptance thereof the information furnished shall be complete by itself.

A.2.7. The tenderer shall quote the rates in English Language and international numerals.

Total price offered should be entered in figures as well as in words. For the purpose of the tender, the metric system of units shall be used.

A.2.8. The tenderer shall quote a percentage above/ below/At Par the rates shown in the "Bill of Quantities Cum Price Schedule (Annexure-I)" of subject tender.

A.2.9. The quoted percentage will apply to the individual items of "Annexure-I i.e. Bill of Quantity Cum Price Schedule" uniformly.

A.2.10. All entries in the tender shall either be typed or be written legibly in ink. Erasing and overwriting are not permitted and may render such tender liable for rejection. All cancellations and insertions shall be duly attested by the tenderer.

A.2.11. The tenderer must provide the registered e-mail of their registered office along with the addresses and authorised phone/mobile nos.

A.3. **ADJUSTMENT PRICE DISCREPANCY (IES): - Not Applicable being e procurement.**

A.4. **EVALUATION OF TECHNICAL BIDS**

A.4.1. Technical Bids submitted by the tenderer will be opened first and evaluated for fulfilling the Pre-Qualification criteria and other conditions in NIT/Tender documents, based on documentary evidences submitted along with the offer.

The bidder's qualification shall be subject to submission of documentary proof. BHEL reserves the right to ask for further proofs including submission of TDS certificates/ for the said job.

A.4.2. In case the qualifying experience is claimed by private organizations based on Work Order and completion certificates from another private organization, BHEL reserves the right to ask for further proofs including submission of TDS certificates/ form 26AS /bills for the said job.

A.4.3. Credentials of all the bidders participating in open tender will be scrutinized thoroughly by the nominated committee w.r.t. the pre-qualifying requirement for the tender.

A.4.4. Details of qualifying work(s) executed by the bidder will be forwarded to the principle employer for verification of the work with respect to completion, commencement & completion date, scope and value of the work executed. Performance feedback of the bidder will also be sought from the principle employer.

A.4.5. BHEL may conduct onsite verification of at least one of the qualifying works to verify completion of the work and evaluate capability and performance of the bidder.

A.4.6. The bidder representative may be called for the discussion with the committee. His originals may be verified by the committee. In addition to above their organization chart and detailed list of manpower, tools & plants and technical capability may be discussed and ascertained by the committee.

A.5. **EVALUATION OF PRICE BIDS**

A.5.1. Price Bids of unqualified bidders shall not be opened.

A.5.2. The offers will be evaluated on the basis of total price basis (refer "BILL OF QUANTITY AND PRICE SCHEDULE) as shown in the price bid.

A.5.3. Reasons for rejection of the bid shall be intimated in due course after issue of LOI/LOA to successful bidder and receipt of unconditional acceptance of LOI /LOA from the successful bidder.

A.6. **DOCUMENTS TO BE ENCLOSED:**

Full information shall be given by the tenderer in respect of the following.

A.6.1. Tenders shall be signed by persons duly authorized/empowered to do so. An attested copy of the Power of Attorney to be submitted in all cases except where the sole proprietor is the signatory to the tender documents.

A.6.2. *PERMANENT ACCOUNT NUMBER:*

Certified copies of Permanent Account Numbers as allotted by Income Tax Department for the Company / Firm / Individual Partners, etc. shall be furnished along with tender.

A.6.3. AUDITED BALANCE SHEET AND INCOME TAX RETURN:

Copy of Audited Balance sheets and income tax return for last Five financial years (financial years as specified in PQR).

A.6.4. SOLVENCY CERTIFICATE:

If asked in NIT, bidder should submit solvency certificate (not older than 12 months from date of tender notification) issued by any scheduled bank.

A.6.5. DOCUMENT RELATED TO INCORPORATION OF BUSINESS ENTITY:

A.6.5.1. IN CASE OF INDIVIDUALTENDERER:

His/her full name, address and place & nature of business.

A.6.5.2. *IN CASE OF PARTNERSHIP FIRMS:*

The names of all the partners with address. A copy of the partnership deed/instrument of partnership duly certified by the Notary shall be enclosed.

A.6.5.3. *IN CASE OF COMPANIES:*

Date & place of registration including date of commencement certificate in case of Public Companies and the nature of business carried on by the company. Certified copies of Memorandum and Articles of Association are also to be furnished.

A.6.6. Offer forwarding letter over the letterhead.

A.6.7. *Declaration sheets (As per Prescribed format) over the letter head*.

A.6.8. *No Deviation certificates (As per Prescribed format) over the letterhead.*

A.6.9. GST Registration certificate: -

All the data required to be enclosed with the tender need to be furnished neatly typed, signed & stamped in the given formats only (in the form of separate sheets)

failing which the tender may be considered as incomplete and is liable for rejection. Documentary proof wherever necessary also need to be enclosed.

A.7. **VALIDITY OF OFFER**

The rates in the Tender shall be kept valid for acceptance for a minimum period of **Four Months** from latest due date of offer submission (including extension(s), if any). In case BHEL (Bharat Heavy Electricals Limited) calls for negotiations, such negotiations shall not amount to cancellation or withdrawal of the original offer which shall be binding on the tenderer.

A.8. **REJECTION OF TENDER & OTHER CONDITIONS:**

A.8.1. The decision of acceptance of tender will rest with BHEL which does not bind itself to accept the lowest tender or any tender and reserves to itself full rights for the following without assigning any reasons whatsoever:

a) To reject any or all of the tenders.

b) To split up the work amongst two or more Tenderer as per NIT

c) To award the work in part as per NIT

d) In either of the contingencies stated in (b) and (c) above to modify the time for completion suitably.

A.8.2. Conditional tenders, unsolicited tenders, containing abnormally low/ unworkable rates & amounts, tenders which are incomplete or not in the form specified or defective or have been materially altered or not in accordance with the tender conditions, specifications etc. are liable to be rejected.

A.8.3. Tenders are liable to be rejected in case of unsatisfactory performance of the tenderer with BHEL, or tenderer under suspension (hold / banning / delisted) by any unit / region / division of BHEL or tenderers who do not comply with the latest guidelines of Ministry / Commissions of Govt. of India. BHEL reserves the right to reject a bidder in case it is observed that they are overloaded and may not be in a position to execute this job as per the required schedule in line with 'NIT'. The decision of BHEL will be final in this regard.

A.8.4. In case of any adverse information is received concerning performance, capability or conduct of the tenderer after issue of tender enquiry or opening of tender or award of work, BHEL reserves the right to reject the offer at any stage as deemed fit.

A.8.5. If a tenderer who is a proprietor expires after the submission of his tender or after the acceptance of his tender, BHEL may at its discretion, cancel such tender. If a partner of a firm expires after the submission of the tender or after the acceptance of the tender, BHEL may cancel such tender at its discretion unless the firm retains its character.

A.8.6. BHEL will not be bound by any Power of Attorney granted by the tenderer or by changes in the composition of the firm made subsequent to the execution of the contract. BHEL may, however, recognise such Power of Attorney and changes after obtaining proper legal advice, the cost of which will be chargeable to the contractor concerned.

A.8.7. If the tenderer deliberately gives wrong information in his tender, BHEL reserves the right to reject such tender at any stage or to cancel the contract, if awarded, and forfeit the Earnest Money/Security Deposit/any other moneys due.

A.8.8. Canvassing in any form in connection with the tender is strictly prohibited and the tenders submitted by the tenderer who resorts to canvassing are liable to be rejected.

A.8.9. In case the Proprietor, Partner or Director of the Company / Firm submitting the Tender, has any relative or relation employed in BHEL, the authority inviting tender shall be informed to the fact as per specified format along with the offer, failing this, BHEL may, at its sole discretion reject the tender or cancel the contract and forfeit the Earnest Money/ Security Deposit.

A.8.10. The successful tenderer should not sub-contract the part or complete work detailed in the tender specifications without written permission of BHEL.

A.8.11. Unsolicited discount received after the due date and time of Bid Submission shall not be considered for evaluation. However, if the party who has submitted the unsolicited discount/rebate becomes the L-I party, then the awarded price i.e. contract value shall be worked out after considering the discount so offered.

A.8.12. BHEL shall not be liable for any expenses incurred by the bidder in the preparation of the tender irrespective of whether the tender is accepted or not.

A.9. Consortium/ JV bidding is not allowed under this NIT.

B. EARNEST MONEY DEPOSIT (EMD)

EMD is not applicable for this Tender.

C. SECURITY DEPOSIT

Security Deposit is not applicable for this Tender.

D. Overall Quantity variation-

The individual quantity can vary to any extent or may be deleted for which no compensation will be payable to the contractor and the rates will remain firm. Also the rate of each item remains firm as long as the variation in the total value of work executed under the contract including extra items (if any) remains within plus/minus 30 percent of the contract value. In case the actual value of executed work including extra work on completion of work becomes less than 70% of the basic/original contract value than the following method shall be adopted.

The actual executed value shall be raised by 7% (For arriving at the final payment against work executed) subject to the condition that total value of work executed plus increase by 7% as above shall be limited to 70% of the basic/original contract value. The rate quoted shall be firm irrespective of any upward variation in the contract price.

It is further clarified that the enhancement/rate revision on the basic rate as per PVC clause shall not be accounted for the purpose of operating this clause.

E. INCOME TAX/SALES TAX/WORKS TAX

E.1. All taxes (except GST), duties, charges, royalties, cess and any other levies by Central/ State/local authorities for the execution of the contract shall be borne by the contractor and shall not be payable extra. Any increase of the same at any stage during execution of the contract shall be borne by the contractor. Quoted price of the same shall be inclusive of all such requirements.

E.2. Contractors have to make their own arrangement at their cost for completing the formalities, if required with relevant taxation authorities, for bringing their material, plant and machinery at site for the execution of the contract. Road permits / way bill, if required shall be arranged by the contractor.

E.3. The Contractor is responsible to furnish documentary evidence towards GST Registration of the State wherein the site is located or any other documents as per GST Act which may be required from time to time. BHEL will not be held to be responsible for any non-compliance of the Contractor in respect of GST laws as framed from time to time.

E.4. Goods and Service Tax (GST) will be reimbursed to the Contractor subject to the following conditions: -

(i) Submission of valid GST Compliant Tax Invoice as per the GST Invoice Rules.

(ii) The Invoice raised by the Contractor should indicate the BHEL GST Registration Number.

(iii) Contractor declaring such invoices in GSTR-1 and the same should be available to BHEL in the form GSTR -2A/ 2B electronically through GST portal.

(iv) Confirmation of payment of GST thereon by contractor on GST portal.

E.5. The GST amount shall get reflected within prescribed time limit in the GSTN for BHEL to avail the input credit. If the GST Credit is reversed/ denied/ delayed to BHEL due to non-receipt/delayed receipt of Services and/or tax invoice or due to expiry of timeline prescribed in GST law or due to any other factor for availing such Input Tax Credit (ITC) or for any other reason arising out of the act directly attributable to the Contractor, GST amount shall be recoverable from Contractor from any dues payable to the Contractor along with any interest levied/ leviable on BHEL.

E.6. Statutory variation, if any, on account of GST will be payable by BHEL at actuals on submission of documentary evidence.

E.7. TDS under Income Tax Act/ GST Act shall be deducted as per applicable rates unless Exemption certificate, if applicable, from the appropriate Authority is furnished to BHEL along with the Invoice.

E.8. **New Taxes & duties (Introduced after tender opening date):**

If any new tax or duty is levied by the Central/State Government/Municipality/Local Authority and becomes directly applicable on items specified in the Bill of Quantities, full reimbursement shall be made subject to submission of documentation as per statute.

F. "Over run charges"

No overrun charges are payable under the contract.

G. "secured advance"

No advance on materials shall be payable under the contract.

H. "Price Variation"

Price Variation Clause in not Applicable for this tender.

I. (Delay and Extension of Time) of Conditions of Contract has been mentioned as below

I.1. If, in the opinion of the Engineer, the work is delayed

(i) by reason of abnormally bad weather, or

(ii) by reason of serious loss or damage by fire, or

(iii) by reason of civil commotion, local combination of workmen, strike or lockout, affecting any of the trades employed on the work, or

(iv) by delay on the part of the agency or tradesman engaged by the BHEL in executing work not forming part of the contract, or

(v) By reason of any other cause which in the absolute discretion of the Engineer is beyond the contractor's control, then in any such case, the Engineer (or higher authority) may make fair and reasonable extension in the completion dates of the individual items of work of the contract as whole. Such extension which will be communicated to the contractor by the Engineer in writing shall be final and binding on the contractor. No other claim in this respect for compensation, idle labour or otherwise howsoever is admissible. Upon the happening of any such event causing delay the contractor shall immediately give notice thereof in writing to the Engineer but shall nevertheless use constantly his best endeavour to prevent or make good the delay and shall do all that may reasonably be required to the satisfaction of the Engineer to proceed with the work.

I.2. In case of delay in completion of work BHEL reserve the right to grant time extension under the following options depending upon the performance of the vendor:

a) Time extension without levy of LD in case it is found that delay is not attributable to the vendor

b) Time extension with deduction of applicable LD in line with Liquidity Damage clause if the delay is solely attributable to the vendor.

c) In case facts of delay is not settled, BHEL reserve the right to grant provisional time extension for delay in completion of total work or part thereof and running/ interim payments to the vendor will be released without deduction of LD subject to submission of additional Bank guarantee equivalent to maximum LD amount valid till completion of work under their scope and grant of final time extension.

During provisional time extension period ORC/ PVC shall not be payable to the contractor. The Final Delay analysis shall be prepared on completion of the work. In case of delay is not attributable to contractor as per final delay analysis the ORC/ PVC shall be released along with the final bill without any interest charges attributable to BHEL.

In case of delay attributable to contractor, LD shall be deducted for that period in line with clause “Compensation/ LD/ Penalty for delay in execution” of conditions of contract and balance ORC/ PVC (if any) shall be released along with the final bill without any interest charges attributable to BHEL.

J. RIGHTS OF BHEL: -

BHEL reserves the following rights in respect of this contract during the original contract period or its extensions if any, as per the provisions of the contract, without entitling the contractor for any Compensation.

1. To withdraw any portion of work and/or to restrict/alter quantum of work as indicated in the contract during the progress of work and get it done through other agencies to suit BHEL's commitment to its customer or in case BHEL decides to advance the date of completion due to other emergent reasons/ BHEL's obligation to its customer.
   In case of inadequate manpower deployed by the contractor, BHEL reserves the right to deploy additional manpower through any other agency for expediting activities in the interest of the project. Supplied manpower shall be put on job by the contractor and payments and other statutory compliances related to manpower shall be the contractor's responsibility. In case of contractor's failure to fulfill his obligations in respect of such manpower, BHEL reserves the right to take necessary action as per contract conditions.

2. Breach of Contract, Remedies and Termination

2.1. The following shall amount to breach of contract:

I. Non-supply of material/ non-completion of work by the Supplier/Vendor within scheduled delivery/ completion period as per contract or as extended from time to time.

II. The Supplier/Vendor fails to perform as per the activity schedule and there are sufficient reasons even before expiry of the delivery/ completion period to justify that supplies shall be inordinately delayed beyond contractual delivery/ completion period.

III. The Supplier/Vendor delivers equipment/ material not of the contracted quality.

IV. The Supplier/Vendor fails to replace the defective equipment/ material/ component as per guarantee clause.

V. Withdrawal from or abandonment of the work by the Supplier/Vendor before completion as per contract.

VI. Assignment, transfer, subletting of Contract by the Supplier/Vendor without BHEL's written permission resulting in termination of Contract or part thereof by BHEL.

VII. Non-compliance to any contractual condition or any other default attributable to Supplier/Vendor.

VIII. Any other reason(s) attributable to Vendor towards failure of performance of contract. In case of breach of contract, BHEL shall have the right to terminate the Purchase Order/ Contract either in whole or in part thereof without any compensation to the Supplier/Vendor.

IX. Any of the declarations furnished by the contractor at the time of bidding and/ or entering into the contract for supply are found untruthful and such declarations were of a nature that could have resulted in non-award of contract to the contractor or could expose BHEL and/ or Owner to adverse consequences, financial or otherwise.

X. Supplier/Vendor is convicted of any offence involving corrupt business practices, antinational activities or any such offence that compromises the business ethics of BHEL, in violation of the Integrity Pact entered into with BHEL has the potential to harm the overall business of BHEL/ Owner.

Note-Once BHEL considers that a breach of contract has occurred on the part of Supplier/Vendor, BHEL shall notify the Supplier/Vendor by way of notice in this regard. Contractor shall be given an opportunity to rectify the reasons causing the breach of contract within a period of 14 days.

In case the contractor fails to remedy the breach, as mentioned in the notice, to the satisfaction of BHEL, BHEL shall have the right to take recourse to any of the remedial actions available to it under the relevant provisions of contract.

LD against delay in executed work in case of Termination of Contract:

LD against delay in executed work shall be calculated in line with respective clause K LIQUIDATED DAMAGES/PENALTY CLAUSE, for the delay attributable to contractor. For limiting the maximum value of LD, contract value shall be taken as Executed Value of work till termination of contract.

Method for calculation of "LD against delay in executed work in case of termination of contract" is given below.

i) Let the time period from scheduled date of start of work till termination of contract excluding the period of Hold (if any) not attributable to contractor = T1
ii) Let the value of executed work till the time of termination of contract= X
iii) Let the Total Executable Value of work for which inputs/fronts were made available to contractor and were planned for execution till termination of contract = Y
iv) Delay in executed work attributable to contractor i.e. T2=[1-(X/Y)] x T1
v) LD shall be calculated in line with clause K LIQUIDATED DAMAGES/PENALTY CLAUSE for the delay attributable to contractor taking "X" as Contract Value and "T2" as period of delay attributable to contractor.

2.2 **Remedies in case of Breach of Contract is established:**

i) Wherein the period as stipulated in the notice issued under clause "**BREACH OF CONTRACT, REMEDIES AND TERMINATION"** of GCC has expired and Contractor has failed to remedy the breach, BHEL will have the right to terminate the contract on the ground of "Breach of Contract" without any further notice to contractor.
ii) Upon termination of contract, BHEL shall be entitled to recover an amount equivalent to 10% of the Contract Value for the damages on account of breach of contract committed by the Contractor. This amount shall be recovered by way of encashing the security instruments like performance bank guarantee etc available with BHEL against the said contract. In case the value of the security instruments available is less than 10% of the contract value, the balance amount shall be recovered from other financial remedies (i.e. available bills of the contractor, retention amount, from the money due to the Contractor etc. with BHEL) or the other legal remedies shall be pursued.
iii) wherever the value of security instruments like performance bank guarantee available with BHEL against the said contract is 10% of the contract value or more, such security instruments to the extent of 10% contract value will be encashed. In case no security instruments are available or the value of the security instruments available is less than 10% of the contract value, the 10% of the contract value or the balance amount, as the case may be, will be recovered in all or any of the following manners:
iv) In case the amount recovered under sub clause (a) above is not sufficient to fulfil the amount recoverable then; a demand notice to deposit the balance amount within 30 days shall be issued to Contractor.
v) If Contractor fails to deposit the balance amount within the period as prescribed in demand notice, following action shall be taken for recovery of the balance amount:
    a. from dues available in the form of Bills payable to defaulted Contractor against the same contract.

b. If it is not possible to recover the dues available from the same contract or dues are insufficient to meet the recoverable amount, balance amount shall be recovered from any money(s) payable to Contractor under any contract with other Units of BHEL including recovery from security deposits or any other deposit available in the form of security instruments of any kind against Security deposit.

c. In-case recoveries are not possible with any of the above available options, Legal action shall be initiated for recovery against defaulted Contractor.

vi) It is an agreed term of contract that this amount shall be a genuine pre-estimate of damages that BHEL would incur in completion of balance contractual obligation of the contract through any other agency and BHEL will not be required to furnish any other evidence to the Contractor for the purpose of estimation of damages.

vii) In addition to the above, imposition of liquidated damages, debarment, termination, de-scoping, short-closure, etc., shall be applied as per provisions of the contract.

Note:

1) The defaulting contractor shall not be eligible for participation in any of the future enquiries floated by BHEL to complete the balance work. The defaulting contractor shall mean and include:

(a) In case defaulted contractor is the Sole Proprietorship Firm, any Sole Proprietorship Firm owned by same Sole Proprietor.

(b) In case defaulted contractor is The Partnership Firm, any firm comprising of same partners/ some of the same partners (but not including any new partner); or sole proprietorship firm owned by any partner(s) as a sole proprietor.

2.3 In case Contractor fails to deploy the resources as per requirement informed by BHEL in writing to expedite the work, BHEL can deploy own/hired/otherwise arranged resources and recover the expenses incurred from the dues payable to contractor. Recoveries shall be actual expenses incurred plus 5% overheads or as defined in TCC.

2.4 To terminate the contract or to restrict the quantum of work and pay for the portion of work executed in case BHEL's contract with their customer are terminated for any reason, whatsoever.

2.5 Whenever any Claim or Claims for payment of any sum of money(s) arises under this or any other contract against the contractor, BHEL shall be entitled to withhold and also have a lien to retain such sum of money(s) in whole or in part from any money(s) payable to contractor and/or security deposits furnished or deducted in cash from the bills of contractor, (if any) under this contract. In the event of the securities or the amounts payable to Contractor, being insufficient to cover BHEL claims, then BHEL shall be entitled to withhold and have a lien to the extent of such claims from any sum or sums found payable or which at any time thereafter may become payable to the contractor under this or any other contract with BHEL.

a) Claim or Claims for payment of any sum of money(s) arising from the Contractor under this or any other contract against the contractor, shall mean, the sum of money(s) actually incurred by BHEL in fulfilling the contractual responsibilities of contractor under the contract, to which he

has failed to fulfil plus applicable overheads (@ 5%) along with interest as applicable under the Contract on total amount (i.e. money actually incurred plus overheads)

b) It is an agreed term of the contract that, the sum or sums of money so withheld or retained under the lien by BHEL will be kept withheld or retained as such by BHEL till the claims arising out of this or any other contract are finally adjudicated wither through Arbitration or a Court of competent jurisdiction as the case may be in accordance with the terms of contract. Intimation given by the BHEL Engineer regarding withholding of such money(s) shall be considered as sufficient and relevant date for all purposes. No Interest shall be payable on such sum(s) of money which becomes due or as the case may be adjudged to be due from BHEL to Contractor, whether under contract or otherwise.

c) Where the contractor is a partnership firm, BHEL shall be entitled to withhold and also have a lien to retain towards such claims in whole or in part, from any other money(s) payable to any partner, whether in his individual capacity or otherwise.

d) If any money(s) shall, as a result of any claim or application made under the relevant provisions of any Labour Welfare Act and/ or Rules, including but not limited to Contract Labour Regulation & Abolition Act, Minimum Wages Act, Payment of Gratuity Act, BOCW (RE&CS) Act, Provident Fund Act, Employee State Insurance Act, be directed to be paid by the BHEL, such money shall be deemed to be moneys payable to the BHEL by the Contractor.

e) Where the Contractor fails to repay to BHEL such moneys along with applicable overheads (@ 5%) and interest, as aforesaid within seven days of being demanded, BHEL shall be entitled to recover the same from Contractor's bills/ Security Deposit or any other money(s) payable to Contractor under this Contract or any other Contract with BHEL.

2.6 While every endeavor will be made by BHEL to this end, yet BHEL cannot guarantee uninterrupted work due to conditions beyond its control. The Contractor will not be normally entitled for any compensation/extra payment on this account unless otherwise specified elsewhere in the contract.

2.7 BHEL may permit or direct contractor to demobilize and remobilize at a future date as intimated by BHEL in case of following situations for reasons other than Force majeure conditions and not attributable to contractor:

i) suspension of work(s) at a Project either by BHEL or Customer,
or

ii) where work comes to a complete halt or reaches a stage wherein worthwhile works cannot be executed and there is no possibility of commencement of work for a period of not less than three months

In such cases, charges towards demobilization and remobilization shall be as decided by BHEL after successful remobilization by contractor at site, and decision of BHEL shall be final and binding on the contractor. After remobilization, all conditions as per contract shall become applicable. In case Contractor does not remobilize with adequate resources or does not start the work within the period as intimated, then BHEL reserves the right to terminate the contract and effect remedies under Clause "Remedies in case of Breach of Contract" In case of any conflict, BHEL decision in this regard shall be final and binding on the contractor.

2.8 In the unforeseen event of inordinate delay in receipt of materials, drawings, fronts etc. due to which inordinate discontinuity of work is anticipated, BHEL on its own or

contractor's request at its discretion may consider to short close the contract in any of the following cases:

a) The balance works (including but not limited to Trial Operation, PG Test etc.) are minor vis a vis the scope of work envisaged as per the contract.
b) There has been no significant work in past 6 months OR no significant work is expected in next 6 months (example in Hydro projects or in projects where work has stopped due to reasons beyond the control of BHEL).
c) The balance works cannot be done within a reasonable period of time as they are dependent on unit shut down or on other facilities of customer or any other such reasons not attributable to the contractor.

At the point of requesting for short closure, contractor shall establish that he has completed all works possible of completion and he is not able to proceed with the balance works due to constraints beyond his control. In such a case, the estimated value of the unexecuted portion of work (or estimated value of services to be provided for carrying out milestone/stage payments like Trial Operation/PG Test etc.) as decided by BHEL, shall however be reduced from the final contract value.

Note: The Contractor shall not be eligible for any compensation on account of Quantity Variation arising out of short-closure of contract as per clause above.

K. <u>LIQUIDATED DAMAGES/PENALTY CLAUSE:</u>

In case the contractor fails to complete the work within the time specified in the tender specification or any extension thereof subject to force majeure condition, the contractor shall be liable to pay by way of LD/Penalty a sum equal to the half percent of the contract price including PVC, per calendar week or part thereof by which the completion of work is delayed, subject to ceiling of 10 % of the contract price. Once the maximum limit of delay is reached (i.e. 20 week of delay) BHEL may consider termination of the contract and forfeit the Security deposit without prejudice to the other remedies under the contract.

Amended/ revised contract value (excluding Extra Works, Supplementary /Additional Items) shall be considered for calculating LD/ penalty.

L. <u>PERFORMANCE MONITORING</u>:

The Contractors performance shall be continuously monitored during execution of work at site.

In case of contractor's performance is found not satisfactory during the execution of work at site, BHEL may take alternate remedial measures and may not consider the contractor for further tenders, if the contractor performance is not improved in spite of opportunities given by BHEL.

M. FACILITIES PROVIDED TO MSEs

Vide office memorandum F.No.21(8)/2011-MA dated 09.11.2016, Office of AS&DC, Ministry of MSME has issued clarification regarding definition of Goods and Services under the Public Procurement Policy of MSEs order-2012, In accordance with the Public Procurement Policy for MSEs order-2012 and OM regarding definition of Goods and Services issued by Ministry of MSME, it is clarified that benefits as envisaged in Public Procurement Policy for MSEs Order 2012 are to be provided in respect of the procurements related to the Goods and Services produced and provided by Micro and Small Enterprises (MSEs) only and no benefits is to be given in Case of Works Contracts.

N. TERMS OF PAYMENT:

N.1. No advance shall be paid.

N.2. 90% of contract item price after approval of drawings and documents by Customer (NTPC) as mentioned at (Scope) of section-1 of 'Technical Specification'. Payment shall be released upon submission of invoice and copy of approval as certified by BHEL engineer.

N.3. The balance 10% of contract item price shall be paid on submission of drawings and documents as mentioned at 'Technical Specification'. Payment shall be released upon submission of invoice and certification of submission of drawings/ documents by BHEL engineer.

O. NO INTEREST PAYABLE TO CONTRACTOR:

Notwithstanding anything to the contrary contained in any other document comprising in the Contract, no interest shall be payable by BHEL to Contractor on any moneys or balances including but not limited to the Security Deposit, EMD, Retention Money, RA Bills or the Final Bill, or any amount withheld and/or appropriated by BHEL etc., which becomes or as the case may be, is adjudged to be due from BHEL to Contractor whether under the Contract or otherwise.

P. CLOSING OF CONTRACTS

The Contract shall be considered completed and closed upon completion of contractual obligations and settlement of Final Bill or completion of Guarantee period whichever is later. Upon closing of Contract, BHEL shall issue a performance/ experience certificate as per standard format, based on specific request of Contractor as per extant BHEL guidelines through the online portal available at https://siddhi.bhel.in only.

Q. SUSPENSION OF BUSINESS DEALINGS

BHEL reserves the right to take action against Contractors who either fail to perform or Tenderers/Contractor who indulge in malpractices, by suspending business dealings with them in line with BHEL guidelines issued from time to time.

The offers of the bidders who are under suspension as also the offers of the bidders, who engage the services of the banned firms / principal / agents, shall be rejected. The list of banned firms is available on BHEL web site www.bhel.com.

If any bidder / supplier / contractor during pre-tendering / tendering / post tendering / award / execution / post-execution stage indulges in any act, including but not limited to, mal-practices, cheating, bribery, fraud or and other misconduct or formation of cartel so as to influence the bidding process or influence the price or tampers the tendering process or acts or omits in any manner which tantamount to an offence punishable under any provision of the Indian Penal Code, 1860 or any other law in force in India, or does anything which is actionable under the Guidelines for Suspension of Business dealings, action may be taken against such bidder / supplier / contractor as per extant guidelines of the company available on www.bhel.com and / or under applicable legal provisions. Guidelines for suspension of business dealings is available in the webpage: http://www.bhel.com/vender_registration/vender.php

R. SETTLEMENT OF DISPUTE

If any dispute or difference of any kind whatsoever shall arise between BHEL and the Contractor, arising out of the contract for the performance of the work whether during the progress of contract termination, abandonment or breach of the contract, it shall in the first place referred to for resolution by the Designated Engineer (to be nominated by BHEL for settlement of disputes arising out of the contract) who within 60 days after being requested shall give written notice of his decision to the contractor. Save as hereinafter provided, such decision in respect of every

matter so referred shall forthwith be given effect to by the contractor who shall proceed with the work with all due diligence, whether he or BHEL desires to resolve the dispute as hereinafter provided or not.

If after the Designated Engineer has given written notice of this decision to the party and no intention to pursue the dispute has been communicated to him by the affected party within 30 days from the receipt of such notice, the said decision shall become final and binding on the parties. In the event the Supplier/Vendor being dissatisfied with any such decision or if amicable settlement cannot be reached then all such disputed issues shall be resolved through conciliation in terms of the BHEL Conciliation Scheme 2018 as per Clause "Conciliation" of GCC.

R.1. **Conciliation:**

Any dispute, difference or controversy of whatever nature howsoever arising under or out of or in relation to this Agreement (including its interpretation) between the Parties, and so notified in writing by either Party to the other Party (the "Dispute") shall, in the first instance, be attempted to be resolved amicably in accordance with the conciliation procedure as per BHEL Conciliation Scheme 2018. The proceedings of Conciliation shall broadly be governed by Part-III of the Arbitration and Conciliation Act 1996 or any statutory modification thereof and as provided in - "Procedure for conduct of conciliation proceedings" (as available in www.bhel.com)).
Note: Ministry of Finance has issued OM reference No. 1/2/24 dated 03.06.2024 regarding "Guidelines for Arbitration and Mediation in Contracts of Domestic Public Procurement. In the said OM it has been recommended that Government departments/
Entities/agencies are to encourage mediation under the Mediation Act. 2023 . The said Act has not yet been notified by the Government. Therefore, the clause "Settlement of Disputes" shall be modified accordingly as and when the Mediation Act 2023 gets notified.

R.2. **ARBITRATION:**

R.2.1. Except as provided elsewhere in this Contract, in case Parties are unable to reach amicable settlement (whether by Conciliation to be conducted as provided in Clause "Conciliation" herein above or otherwise) in respect of any dispute or difference; arising out of the formation, breach, termination, validity or execution of the Contract; or, the respective rights and liabilities of the Parties; or, in relation to interpretation of any provision of the Contract; or. in any manner touching upon the Contract (hereinafter referred to as the 'Dispute'), then, either Party may, refer the disputes to Arbitral Institution i.e. "India International Arbitration Centre (IIAC) Delhi" and such dispute to be adjudicated by Sole Arbitrator appointed in accordance with the Rules of said Arbitral Institution.

R.2.2. A party willing to commence arbitration proceeding shall invoke Arbitration Clause by giving notice to the other party in terms of section 21 of the Arbitration & Conciliation Act, 1996 (hereinafter referred to as the 'Notice') before referring the matter to arbitral institution. The Notice shall be addressed to the Executive Director, TBG, BHEL, Noida, executing the Contract and shall contain the particulars of all claims to be referred to arbitration with sufficient detail and shall also indicate the monetary amount of such claim including interest, if any.

R.2.3. After expiry of 30 days from the date of receipt of aforesaid notice, the party invoking the Arbitration shall submit that dispute to the Arbitral Institutions and that dispute shall be adjudicated in accordance with their respective Arbitration Rules. The matter shall be adjudicated by a Sole Arbitrator who shall necessarily be a Retd Judge having considerable experience in commercial matters to be appointed/nominated by the respective institution. The cost/expenses pertaining to the said Arbitration shall also be governed in accordance with the Rules of the respective Arbitral Institution. The decision of the party invoking the Arbitration for reference of dispute to a specific Arbitral institution for adjudication of that dispute shall be final and binding on both the parties and shall not be subject to any change thereafter. The institution once selected at the time of invocation of dispute shall remain unchanged.

R.2.4. The fee and expenses shall be borne by the parties as per the Arbitral Institutional rules.

R.2.5. The Arbitration proceedings shall be in English language and the seat and venue of Arbitration shall be Delhi.

R.2.6. Subject to the above, the provisions of Arbitration & Conciliation Act 1996 and any amendment thereof shall be applicable. All matters relating to this Contract and arising out of invocation of Arbitration clause are subject to the exclusive jurisdiction of the Court(s) situated at Delhi.

R.2.7. Notwithstanding any reference to the Designated Engineer or Conciliation or Arbitration herein, a. the parties shall continue to perform their respective obligations under the Contract unless they otherwise agree. Settlement of Dispute clause cannot be invoked by the Contractor, if the Contract has been mutually closed or 'No Demand Certificate' has been furnished by the Contractor or any Settlement Agreement has been signed between the Employer and the Contractor.

R.2.8. The Mechanism of resolution of disputes through arbitration shall be available only in the cases where the value of the dispute is less than Rs. 10 Crores.

R.2.9. In case the disputed amount (Claim, Counter claim including interest is Rs. 10 crores and above, the parties shall be within their rights to take recourse to remedies other than Arbitration, as may be available to them under the applicable laws after prior intimation to the other party. Subject to the aforesaid conditions, provisions of the Arbitration and Conciliation Act, 1996 and any statutory modifications or re-enactment thereof as amended from time to time, shall apply to the arbitration proceedings under this clause.

R.2.10. In case, multiple arbitrations are invoked (whether sub-judice or arbitral award passed) by any party to under this contract, then the cumulative value of claims (including interest claimed or awarded) in all such arbitrations shall be taken in account while arriving at the total claim in dispute for the subject contract for the purpose of clause R.2.9. Disputes having cumulative value of less than 10 crores shall be resolved through arbitration and any additional dispute shall be adjudicated by the court of competent jurisdiction.

R.3. **In case of Contract with Public Sector Enterprise (PSE) or a Government Department, the following shall be applicable:**

In the event of any dispute or difference relating to the interpretation and application of the provisions of commercial contract(s) between Central Public Sector Enterprises (CPSEs)/ Port Trusts inter se and also between CPSEs and Government Departments/Organizations (excluding disputes concerning Railways, Income Tax, Customs & Excise Departments), such dispute or difference shall be taken up by either party for resolution through AMRCD (Administrative Mechanism for Resolution of CPSEs Disputes) as mentioned in DPE OM No. 05/0003/2019-FTS-10937 dated 14-12-2022 as amended from time to time.

S. PROGRESSIVE PAYMENT/ FINAL PAYMENT:

S.1. **Documents required for Bill:**

a) GST Complied Invoice of the work done as per approved BOQ.
b) Deviation statement showing the Executed quantities and quantities as per the contract.
c) Power of Attorney for representative signing MBs etc, if not submitted earlier.
d) Final Delay Analysis, if applicable.
e) Any other documents as per customer requirement/statutory requirement.

T. LIMITATION ON LIABILITY:

Notwithstanding anything to the contrary in this Contract or LOA or any other mutually agreed document between the parties, the maximum liability, for damages, of the contractor, its servants or agents, shall under no circumstances exceed an amount equal to the Price of the Contract or the Work Order. The Contractor shall not in any case be liable for loss of profit or special, punitive,

exemplary, indirect or consequential losses whatsoever. This shall not be applicable on the recoveries made by Customer from BHEL on account of Contractor, any other type of recoveries for workmanship, material, T&P etc. due from the contractor.

U. FORCE MAJEURE

U.1. "Force Majeure" shall mean circumstance which is:

a) beyond control of either of the parties to contract,

b) either of the parties could not reasonably have provided against the event before entering into the contract,

c) having arisen, either of the parties could not reasonably have avoided or overcome, and

d) is not substantially attributable to either of the parties

And

Prevents the performance of the contract,

Such circumstances include but shall not be limited to:

i) War, hostilities , invasion, act of foreign enemies.
ii) Rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war.
iii) Riot, commotion or disorder by persons other than the contractor's personnel and other employees of the contractor and sub-contractors.
iv) Strike or lockout not solely involving the contractor's personnel and other employees of the contractor and sub-contractors.
v) Encountering munitions of war, explosive materials, ionizing radiation or contamination by radio-activity, except as may be attributable to the contractor's use of such munitions, explosives, radiation or radio- activity.
vi) Natural catastrophes such as earthquake, tsunami, volcanic activity, hurricane or typhoon, flood, fire, cyclones etc.
vii) Epidemic, pandemic etc.

U.2. The following events are explicitly excluded from Force Majeure and are solely the responsibilities of the non-performing party: a) any strike, work-to-rule action, go-slow or similar labour difficulty (b) late delivery of equipment or material (unless caused by Force Majeure event) and (c) economic hardship.

U.3. 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 15 (fifteen) days after the occurrence of such event.

U.4. 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 by a period of time equal to period of delay caused due to such Force Majeure event.

U.5. Delay or non-performance by either party hereto caused by the occurrence of any event of Force Majeure shall not

a) Constitute a default or breach of the Contract.

Give rise to any claim for damages or additional cost expense occasioned thereby, if and to the extent that such delay or non-performance is caused by the occurrence of an event of Force Majeure

U.6. BHEL at its discretion may consider short closure of contract after 1 year of imposition of Force Majeure in line with extant guidelines. In any case, Supplier/Vendor cannot consider deemed short-closure after 1 year of imposition of Force Majeure

INDEMNITY BOND

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

This Indemnity Bond executed by <_____name of company> having their Registered Office at <_____> in favour of M/s Bharat Heavy Electricals Limited, a Company incorporated under the Companies Act, 1956, having its Registered Office at BHEL House, Siri Fort, Asiad, New Delhi - 110049 through its unit - TBG, 5th Floor, BHEL Sadan, Plot No. 25, Sector-16A, Noida-201301 (UP). (Hereinafter referred to as the Company)

And whereas the Company has entered into a Contract with M/s_____, the executants of this Deed (hereinafter referred to as the Contractor) as its contractor in respect of the work of "_____".

AND WHEREAS under the provisions of GCC further stipulates that the Contractor shall indemnify the Company against all claims of whatever nature arising during the course of execution of Contract including defects liability period of <_____Months > i.e till <_____>

Now this deed witness that in case the Company is made liable by any Authority including Court to pay any claim or compensation etc. in respect of all labourers or other matters at any stage under or relating to the Contract with the Contractor , the Contractor hereby covenants and agrees with the Company that they shall indemnify and reimburse the Company to the extent of such payments and for any fee, including litigation charges, lawyers' fees, etc, penalty or damages claimed against the Company by reason of the Contractor falling to comply with Central/States Laws, Rules etc, or his failure to comply with Contract (including all expenses and charges incurred by the Company).

The Contractor further indemnifies the Company for the amount which the Company may be liable to pay by way of penalty for not making deductions from the Bills of the Contractor towards such amount and depositing the same in the Government Treasury.

The Contractor further agree that the Company shall be entitled to withhold and adjust the Security Deposit and/or withhold and adjust payment of Bills of Contractor pertaining to this Contract against any payment which the Company has made or is required to make for which the Contractor is liable under the Contract and that such amount can be withheld, adjusted by the Company till satisfactory and final settlement of all pending matters and the Contractor hereby gives his consent for the same.

The Contractor further agrees that the terms of indemnity shall survive the termination or completion of this contract.

The contractor further agrees that the liability of the contractor shall be extended on actual basis notwithstanding the limitations of liability clause, in respect of :

1. breach of terms of contract by the contractor

2. breach of laws by the contractor
3. breach of Intellectual property rights by the contractor
4. breach of confidentiality by the contractor

Nothing contained in this deed, shall be construed as absolving or limiting the liability of the Contractor under said Contract between the Company and the Contractor. That this Indemnity Bond is irrevocable and the condition of the bond is that the Contractor shall duly and punctually comply with the terms and the conditions of this deed and contractual provisions to the satisfaction of the Company.

In witness where of M/s _____ these presents on the day, month and year first, above written at _____ by the hand of its signatory Mr._____.

Signed for and on behalf of
M/s _____

Witness:

1.

2.

BILL OF QUANTITY CUM PRICE SCHEDULE (ANNEXURE-I)

Name of Project : 2 X 800 MW NTPC LARA STAGE -II

Name of Work : PROVIDING DESIGN CONSULTANCY SERVICES FOR TYPE TESTED 400KV TRANSMISSION LINE TOWER DESIGN SUITABLE FOR DOUBLE CIRCUIT QUAD MOOSE CONDUCTOR FOR WIND ZONE -III AT 2 X 800 MW NTPC LARA STAGE -II, CHHATTISGARH

Tender Spec. No.: TBSM/LARA/DESIGN CONSULTANCY SERVICES/TENDER/24-25 DATE: 30.01.2025

Sl. No.	Description of Item	Quantity	Unit	Unit Rate	Amount
1	Providing Type tested Drawings for 400kV D/C Quad Moose (Wind Zone-3) DD type Tower & Foundation which shall include: 1) Structural Drawing of Normal/Narrow tower (DD type) with 3M, 6M, 9M, 18M and 25M extension. 2) Shop Drawings. 3) Bill of Material. 4) Drawings of Stub, Stub setting templates. 5) Tower Spotting Data as per IS 802-2015 6) Drawing of Foundation for DD type normal tower including extensions (Max 8 no. per tower i.e., Soil type-Dry, Wet, Partially submerged, Fully submerged, Dry Fissured Rock, Wet Fissured Rock, Wet Black cotton & Submerged Fissured rock) and foundation loads. 7) Type test reports from accredited lab	1	Lot	₹ 69,47,000.00	₹ 69,47,000.00
				Total Amount (Excluding GST)	**₹ 69,47,000.00**

Note - The rates shall be for design and drawings for SINGLE PROJECT USE for NTPC Lara project only.

Validate Print Help

Percentage BoQ

Tender Inviting Authority: BHEL, TBG- SubContracting Department, Sector 16A Noida, UP

Name of Work: PROVIDING DESIGN CONSULTANCY SERVICES FOR TYPE TESTED 400KV TRANSMISSION LINE TOWER DESIGN SUITABLE FOR DOUBLE CIRCUIT QUAD MOOSE CONDUCTOR FOR WIND ZONE -III AT 2 X 800 MW NTPC LARA STAGE -II, CHHATTISGARH

Contract No: TBSM/LARA/DESIGN CONSULTANCY SERVICES/TENDER/24-25 DATE: 30.01.2025

Name of the Bidder/ Bidding Firm / Company :						
PRICE SCHEDULE **(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**	**Estimated Rate in Rs. P**	**TOTAL AMOUNT Without Taxes in Rs. P**	**TOTAL AMOUNT In Words**
1	**2**	**4**	**5**	**6**	**53**	**55**
1	Total amount as per rates in BOQ (as per Annexure-I) for "PROVIDING DESIGN CONSULTANCY SERVICES FOR TYPE TESTED 400KV TRANSMISSION LINE TOWER DESIGN SUITABLE FOR DOUBLE CIRCUIT QUAD MOOSE CONDUCTOR FOR WIND ZONE -III AT 2 X 800 MW NTPC LARA STAGE -II, CHHATTISGARH" - Excluding GST	1.000	Nos	6947000.00	**6947000.00**	INR Sixty Nine Lakh Forty Seven Thousand Only
Total in Figures					**6947000.00**	INR Sixty Nine Lakh Forty Seven Thousand Only
Quoted Rate in Figures			**Select**		**0.000**	INR Zero Only
Quoted Rate in Words		**INR Zero Only**				

BHARAT HEAVY ELECTRICALS LIMITED
TRANSMISSION BUSINESS ENGINEERING MANAGEMENT, NEW DELHI.

DOCUMENT No.	**TB-423-607-000-TL-PKG-II**	**R0**	PREPARED	CHECKED	APPROVED
TYPE OF DOC.	**TECHNICAL SPECIFICATION**	NAME	**MSP**	**SKS**	**SKS**
TITLE		SIGN			
Providing Design Consutlancy services for Type tested 400kV Transmission LineTower design suitable for Double Circuit Quad Moose conductor for Wind Zone-III		DATE			
		GROUP	**TBEM**	**TBEM**	**TBEM**
CUSTOMER	**NTPC LIMITED**				
PROJECT	**2 X 800 MW NTPC LARA STPS STAGE-II SWITCHYARD**				

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Rev No.	**Date**	**Altered**	**Checked**	**Approved**

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	Copies	1	1		

SECTION -1

SCOPE, SPECIFIC TECHNICAL REQUIREMENT & QUANTITIES

1.0 SCOPE

The scope of this specification is to specify all details required by bidder for providing Type tested Drawings for 400kV D/C Quad Moose (Wind Zone-3) DD type Tower & Foundation which shall include:

(i) Structural Drawing of Normal/Narrow tower (DD type) with 3M, 6M, 9M, 18M and 25M extension.

(ii) Shop Drawings.

(iii) Bill of Material.

(iv) Drawings of Stub, Stub setting templates.

(v) Tower Spotting Data as per IS 802-2015

(vi) Drawing of Foundation for DD type normal tower including extensions (Max 8 no. per tower i.e., Soil type-Dry, Wet, Partially submerged, Fully submerged, Dry Fissured Rock, Wet Fissured Rock, Wet Black cotton & Submerged Fissured rock) and foundation loads.

(vii) Type test reports from accredited lab.

The scope of work included submission and approval of above drawings from customer.

The above drawing/documents shall be used by BHEL for the purpose of construction of one no. project (Single Use).

2.0 SPECIFIC TECHNICAL REQUIREMENTS:

Refer enclosed Specification of NTPC at Section-2 for detailed specification.

a) The Towers which shall be offered shall be of type tested design. During detail engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification. The validity period of reports shall be as per CEA Guidelines for the validity period of Type test(s) conducted on Major Electrical Equipment in power Transmission- May2020 & with latest amendments for the from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the

test(s) should have been either conducted at an independent laboratory or should have been witnessed by a Client.

b) However if contractor is not able to submit report of the type test(s) conducted as per CEA Guidelines for the validity period of Type test(s) conducted on Major Electrical equipment in power Transmission-May2020 & with latest amendments from the **date of bid opening (03-03-2023),** or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/ owners representative and submit the reports for approval.

c) All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

3.0 SCHEDULE/BOQ OF ITEMS

S. No.	Item / Work description	Unit	Quantity
1	**Design consultancy services for 400kV Transmission Line Tower**		
(a)	Providing Type tested Drawings for 400kV D/C Quad Moose (Wind Zone-3) DD type Tower & Foundation which shall include: 1. Structural Drawing of Normal/Narrow tower (DD type) with 3M, 6M, 9M, 18M and 25M extension. 2. Shop Drawings. 3. Bill of Material. 4. Drawings of Stub, Stub setting templates. 5. Tower Spotting Data as per IS 802-2015 6. Drawing of Foundation for DD type normal tower including extensions (Max 8 no. per tower i.e., Soil type-Dry, Wet, Partially submerged, Fully submerged, Dry Fissured Rock, Wet Fissured Rock, Wet Black cotton & Submerged Fissured rock) and foundation loads. 7. Type test reports from accredited lab	SET	1

Notes:	
1	Rates quoted shall be for **"Single project use" by BHEL.**

11.00.00	**400KV TRANSMISSION LINES – GENERAL**
11.01.00	**SCOPE AND GENERAL INFORMATION** In addition to the project information and scope of work given in Part-A, of this specification, the following is the scope of work for overhead Transmission line work:
11.01.02	This specification covers detailed survey, tower spotting, optimization of tower location, soil resistivity measurements and geo-technical investigation, tower design, fabrication and supply of all types of transmission line towers including tower which are already designed and tested for equal or higher loads as specified in this specification, bolts, nuts and washers, hanger, D-shackle and all type of tower accessories like phase plate, number plate, danger plate, anti-climbing device, etc.; foundation design, selecting type of foundation for different towers and casting of foundation for towers and erection of towers, tack welding of bolts and nuts along with subsequent application of zinc coating on the welded portion, supply and application of zinc rich paint, tower earthing, fixing of insulator string, stringing of conductors and earth wires along with all necessary line accessories and testing and commissioning of the erected transmission lines. Further for type tested towers bidder shall furnish design calculation for transmission line tower structures along with foundation design and drawing meeting the requirements of this technical specification.
11.01.03	This specification includes the design and supply of insulator and their hardware conductor, OPGW and earthwire, earthwire suspension and tension clamps and all the other lien accessories to be incorporated in the towers during erection and stringing.
11.01.04	All the raw materials such as steel, zinc for galvanising, reinforcement steel and cement for foundation, coke and salt for earthing, bird guards, anti climbing devices, bolts, nuts, washers, D-shackles, hangers, links, danger plates, phase plate, number plate etc. required for tower manufacture and erection shall be included in the scope of supply.
11.01.05	The entire stringing work of conductor and earthwire shall be carried out as per standard stringing practice.
11.01.06	The Contractor shall carry out the detailed survey and shall submit report/results for employer approval. No other details except those included in tender documents shall be furnished by the Owner. Also no topographical maps shall be furnished by Owner. However, Owner's assistance may be given in obtaining these maps from Survey of India.
11.01.07	The tree-cutting shall be responsibility of the Contractor. 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. Contractor may note that Owner shall not pay any compensation for any loss or damage to the properties or for tree cutting due to Contractor's work.

11.02.00 ROUTE AND TERRAIN

11.02.01 Right of way and way leave clearance shall be arranged by the Owner.

To evaluate and tabulate the trees and bushes coming within 26 meters on either side of the central line alignment, the trees will be numbered and marked with quality paint serially from angle point 1 onwards and the corresponding number will be painted on the stem of trees at a height of one meter from ground level. The trees list should contain the following:

a) Girth (circumference) measured at a height of 1 meter from ground level.
b) Approximate height of the tree with an accuracy of + 2 meters.
c) Name of the type of the species/tree.
d) The bushy and under growth encountered in the 1.5 meters belt should also be evaluated with its type, height, girth and area in square meters, clearly indicating the growth in the tree/bush statement.

11.02.02 Payment of compensation towards the clearances, etc. will be the responsibility of the Owner.

11.03.00 DETAILED SURVEY

11.03.01 The detailed survey shall be carried out along the Transmission Line alignment by successful bidder/contractor. The report shall be in line with CBIP-Manual-Transmission line -323 guidelines.

11.03.02 **Route Marking**

At the starting point of the commencement of route survey, an angle iron spike of 65 x 65 x 6 mm section and 1000 mm long shall be driven firmly into the ground to project only 150 mm above the ground level. A punch mark on the top section of the angle iron shall be made to indicate location of the survey instrument. Teak wood peg 50 x 50 x 650 mm size shall be driven at prominent position at intervals of not more than 750 meter along the transmission line to be surveyed upto the next angle point. Nails of 100 mm length should be fixed on the top of these pegs to show the location of instrument. The pegs shall be driven firmly into the ground to project 100 mm only above ground level. At angle position stone/concrete pillar with “NTPC” marked on them shall be put firmly on the ground for easy identification.

11.03.03 Profile Plotting & Tower Spotting

From the field book entries the route plan with route details and level profile shall be plotted and prepared as per approved procedure. Reference levels at every 20 meters along the profile are also to be indicated on the profile besides R/Ls at undulations. Areas along the profile, which in the view of the Contractor are not suitable for tower spotting, shall also be clearly marked on the profile plots. If the

difference in levels is too high, the chart may be broken up according to requirement. A 10mm overlap shall be shown on each following sheet. The chart shall progress from left to right. Sheet shall be in accordance with the IS Standard. For `as built' profile these shall be A1 size.

11.03.04 Sag Template

Necessary data in respect of conductor, earthwire and insulator have been given in the specifications. On the basis of these, the Contractor shall prepare the sag template drawing and tower spotting data and submit the same alongwith sag tension calculations for the approval of the Owner. Sag template prepared based on the approved sag-template curve drawing shall only be used for tower spotting on the profiles. Two numbers of the approved template, prepared on rigid transparent plastic sheets, shall be provided by the Contractor to the Owner for the purpose of checking the tower spotting. The templates shall be on the same scale as that of the profile.

11.03.05 Tower Spotting

With the help of approved sag template and tower spotting data, tower locations shall be marked on the profiles. While locating the towers on the profile sheet, the following shall be borne in mind:

a) Span

The number of consecutive spans between the section points shall not exceed 15 spans Section point shall comprise of tension point with B type, C type or D Type towers as applicable. For all crossing spans such as major road crossings, railway crossings, power line crossings etc. the span shall not exceed 80% of design span.

b) Extension

An individual span shall be as near to the normal design span as far as possible. In case an individual span becomes too short with normal supports on account of undulations in ground profile, one or both the0 supports of the span may be extended by inserting standard body extension designed for the purpose according to technical specification.

c) Road Crossing

At all important road crossings, the towers shall be fitted with double tension insulator strings depending on the type of towers 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 shall be in line with IE rules. At all national highway crossings, tensions towers shall be used.

d) Railways Crossings

i)At the time of detail survey all the railway crossings coming enroute the transmission line shall be finalised as per the regulation laid down by the Railway Authorities. The following are the important features of the prevailing regulations (revised in 1987):

ii)The crossing shall be supported on D type tower on either side of railway line with double tension insulator strings.

iii)The crossing shall normally be at right angle to the railway track.

iv)The crossing span shall be limited to 80% of design span.

v)The minimum distance of the crossing tower shall be at least equal to the height of the tower plus 6 meters away measured from the centre of the nearest railway track.

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

vii)Minimum ground clearance above rail level of the lowest portion of any conductor under condition of maximum sag shall be maintained as per IE rules.

viii)The approval for crossing railway track shall be obtained by the Owner from the Railway Authority. However, six copies of profile and plan, tower and foundation design and drawings, required for the approval from the Railway Authority shall supplied by the Contractor to the Owner.

e) River Crossings

In case of major river crossing, towers shall be of suspension type and the anchor towers on either side of the main river crossing shall be C type tower. Clearance required by navigation authority shall be provided. For non navigable river, clearance shall be reckoned with respect to highest flood level (HFL).

f) Power Line Crossing

Where this line is to cross over another line of the same voltage or lower voltage, towers with suitable extension shall be used. Provisions to prevent the possibility of its coming into contact with other overhead lines shall be made in accordance with the Indian Electricity Rules, 1956. The Contractor may be required to under-cross higher voltage lines by erecting gantry structures.

g) Telecommunication Line Crossing

The angle of crossing shall be as near 90 degree as 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 degree, the matter will be referred to the authority incharge of the telecommunication system. On a request from the Contractor, the permission of the telecommunication authority may be obtained by the Owner. 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.

h) Details Enroute

All topographical details, permanent features, such as trees, building etc. 13.5m on either side of the alignment shall be detailed on the profile plan.

i) Ash Pipe Line (If applicable)

Adequate clearances shall be maintained from ash pipe line and adjacent road.

11.03.06 Clearance from Ground, Building, Trees, etc.

Clearance from ground, buildings, trees and telephone lines shall be provided in conformity with the Indian Electricity Rules, 1956 as amended upto date.

11.04.00 **PRELIMINARY LINE SCHEDULE**

The profile sheets, duly spotted, alongwith preliminary schedules indicating type of towers, wind span, weight span, angle of deviation, river, power line, railway or road crossing and other details shall be submitted for the approval of the Owner. After approval, the Contractor shall submit six more sets of the approved reports along with two sets in soft copy of final profile drawings to the Owner for record purpose.

11.05.00 CHECK SURVEY OF TOWER LOCATIONS

11.05.01 The detailed survey shall be conducted to locate and peg mark the tower positions on ground conforming to the approved profile and tower schedule. In the process, it is necessary to have the pit centers marked according to the excavation marking charts. The levels, up or down of each pit center with respect to the center of the tower locations shall be noted and recorded for determining the amount of earthwork required to meet the approved design parameters.

11.05.02 Changes, if required, after detailed survey in the preliminary tower schedule shall be carried out by the Contractor and he shall thereafter submit a final tower schedule for the approval of Owner. The tower schedule shall show position of all towers, type of towers, span length, type of foundation for each tower and the deviation at all angles as set out with other details.

11.06.00 ELECTRICAL SYSTEM DATA

Nominal voltage	400 kV
Maximum system voltage	420kV
Lighting Impulse	1425 kVp
Switching Impulse	1050KVp
Power frequency withstand voltage (wet)	630 kV (rms)

LIST OF STANDARDS

1.	IS:209	Specification for Zinc	ISO/R/752-1968 AST, B6
2.	IS:2062	Structural Steel (Standard Quality)	ISO/R/6F30-1967 CAN/CSA G40.21 BS 4360
3.	IS:269	Ordinary rapid hardening & low heat Portland Cement.	ISO/R/597-1967
4.	IS:278	Specification for barbed wire	ASTM A 121
5.	IS:383	Coarse and fine aggregates from natural sources for concrete.	CSA A 23.1/A 23.2
6.	IS:398	Alum. Condr. galvanised steel reinforced	
7.	IS:406	Methods of Chemical Analysis of Slab Zinc	
8.	IS:432 (Part 1 & 2)	Mild steel and medium tensile bars and hard drawn steel wire for concrete reinforcement	CSA-G-30
9.	IS:456-1978	Code of practice for plan and reinforced concrete	
10.	IS:731-1971	Porcelain Insulators for Overhead Power lines with a Nominal Voltage greater than 1000 volts	BS:137-1973 (I & II) IEC:274-1968 IEC:383-1976
11.	IS:800-1984	Code of practice for use of structural steel in general Building construction	CSA STEAM 16.1
12.	IS:802	Code of practice for use of structural steel in overhead transmission Line. (Load, Permissible stresses. Fabrication, Galvanising, Inspection, and Packing and Testing)	IEC 826 ASCE 52 BS 8100
13.	IS:1139-1966	Hot rolled mild steel medium tensile steel and high yield strength deformed Bars for concrete reinforcement	CAN / CSA G 30 18
14.	IS:1367-1967	Technical supply conditions for threaded fasteners	
15	IS:1489-1991	Portland Pozzolena Cement	ISO/863-1968

16.	IS:1521-1972	Method of Tensile Testing of Steel wire	
17.	IS:1573-1976	Electroplated Coating of Zinc on Iron & Steel	
18.	IS:1778-1980	Reels and Drums of Barewire	
19.	IS:1786-1985	High strength deformed steel bars and wires for concrete reinforcement	
20	IS:1893-1984	Criteria of Earthquake resistant design of structures.	IEEE 693
21.	IS:2016-1967	Plain Washers	ISO/R/887-1968 ANSI B 18.22.1
22.	IS:2070- 1962	Method of impulse voltage testing	
23.	IS:2071	Method of high voltage testing	
24.	IS:2121-1981 Part-I Part-II	Specification for conductors and earthwire Accessories for Overhead Power Lines Armour Rods Mid-span joints & repair sleeves for conductors	
25.	IS:2131-1967	Method of Standard penetration test for soils.	ASTM D 1883
26.	IS:2551-1982	Danger Notice Plates	
27.	IS:2486	Specification for Insulator Fittings for overhead Power Lines with a nominal voltage greater than 1000 volts Part- I General Requirements and Tests Part-II Dimensional Requirements Part-III Locking Devices	 BS:3288-1972 IEC:120-1960 IEC:372-1976
28.	IS:2629-1985	Recommended practice for hot dip galvanising of iron & steel.	ASTM A 123 CAN/CSA G 164
29.	IS:2633-1986	Method of testing uniformity of coating of zinc coated articles.	ASTM A 123 CAN/CSA G 164
30.	IS:3043-1987	Code of Practice for earthing (with amendment No. 1 & 2).	
31.	IS:3063-1994	Single Coil Rectangular Section spring	DIN - 127-1970

		washers for bolts, nuts, screws.	
32.	IS:3138-1966	Hexagonal bolts and nuts	ISO/R 947 and ISO/R 272
33.	IS:3188-1980	Characteristics of string insulator units	IEC:305-1906
34.	IS:4091-1979	Code of practice for design and construction of foundation for transmission line tower and poles.	ASCE / IEEE 691
35.	IS:4218-1976	Metric Screw Threads.	ISO:68-1969 R-26-1963, R-262-1969 R-965-1965
36.	IS:4826-1979	Galvanised coatings on round steel wire	BS:443-1969
37.	IS:5300-1980	Porcelain Guy strain insulators	
38.	IS:5358-1969	Hot dip galvanised coatings on fasteners	ASTM A 153 CAN/CSA G 164
39.	IS:5613 (Part-II) 1985	Code of practice for Design, installation & maintenance of overhead power lines	
40.	IS:6610-1972	Specification for heavy washers for steel structures.	
41.	IS:6639 -1972	Hexagonal bolts for structure	ASTM A 394 CSA B 33.4
42.	IS:6745-1972	Methods for determination of weight of Zinc coated iron and steel articles	ASTM A 90
43	Pub. No. 19 (N)/ 700-1963	Regulation for Electrical Crossing of Railway Tracks.	
44.	IS:7814-1985	Phosphor bronze sheet, strip and foil	BS:2870-1968
45.	IS:8263-1976	Method of Radio Interference tests on high voltage insulators	NEEMA:107 – 1964 CISPR/IEC:437-1973
46.	IS:8269-1976	Method of switching impulse test on high voltage insulators	IEC:506-1975
47.	IS:8500-1991	Specification for weld-able structural steel (Medium and High strength qualities).	BS : 4360

48.	IS:9708-1993	Specifications for Stockbridge Vibration Dampers for overhead power lines	
49.		Thermal mechanical performance test and mechanical performance test on String insulator units	IEC: 575-1974

12.00.00 GENERAL DESCRIPTION OF TOWERS

12.01.01 The towers shall be of self supporting lattice steel type, designed to carry the line conductors with necessary insulators, earth wires and all fittings under all loading conditions.

12.01.02 The tower shall be of a fully galvanised structure, using structural mild steel sections for members. Bolts and nuts with spring washers shall be used for connections.

12.01.03 Bidders can also use high tensile steel and cold formed steel for fabrication of towers provided they furnish the justification for use of such steel with reference to national or international standards. However, the factors of safety, limitation on member length, requirement of fasteners and galvanisation shall be as specified in this specification.

The towers shall be classified as given in Table -1

Table T-1

Type of Tower	Deviation limit (Degrees)	Typical use
A	0 to 2	To be used as tangent/suspension tower
B	0 to 15 0	a) Angle towers/Tension tower with tension insulator string. b) To be used where the towers are subject to uplift loads. c) To be used as section tower
C	15 to 30	a) Angle tower/Tension tower with tension insulator string
		b) To be used where the towers are subject to uplift loads.
		c) To be used as section tower
	NA	d) Complete dead end. (for 33kV line only)
D	30 to 60	a) Angle tower/Tension tower with tension insulator string
		b) To be used where the towers are subject to uplift loads.

		c) To be used as section tower
	0	d) Complete dead end.

NOTE:
1) For double circuit tower types, A, B, C and D shall be prefixed by 'D'.
2) Special type of tower/ higher voltage class towers, wherever required shall also be provided by the bidder under the contract at no extra cost.

12.01.04 **Extension**

The single and double circuit tower shall be designed with 9 M body extension so as to be suitable for adding 3M, 6M and 9M body extension. In case of requirement of higher body extensions, the tower shall be designed for the highest extension required.

For under line crossing of EHV transmission lines the bidder extensions to D type tower or provide tower-gantry arrangement.

12.01.05 **Stub Setting templates.**

Stub templates shall be designed and arranged by the contractor at his own cost for all types of tower with or without extension and also for leg extension. Stub templates for standard towers and tower with extension shall be of adjustable type. The stub templates shall be painted. One set of each type of stub setting template for single and double circuit tower shall be supplied to the Owner, on completion of the project, at no extra cost.

12.02.00 **SPANS AND CLEARANCES**

12.02.01 **Ruling Span**

The normal ruling span of the line shall be 400 meters for 400 KV towers.

12.02.02 **Wind Span**

The wind span is the sum of the two half spans adjacent to the support under consideration. For normal horizontal spans this equals to normal ruling span.

12.02.03 **Weight Span**

The weight span is the horizontal distance between lowest point of the conductors on the two spans adjacent to the tower. For design of structures, the span limits given below shall prevail.

Tower type	Normal Condition		Broken Wire Condition	
	Max. (m)	Min. (m)	Max. (m)	Min. (m)
A,	600	-200	360	-100
B, C	600	0	360	-200
D	600	0	360	-300

12.02.04 Electrical Clearance

A) Ground clearance

The minimum ground clearance from the bottom conductor shall be as per IE rules at the maximum sag conditions i.e. at maximum temperature and still air. However, to achieve the above clearance the height of tower shall be increased in the following manner:

a) Allowance of 150 mm shall be provided to account for errors in stringing.

b) Conductor creep shall be compensated by over tensioning the conductor at a temperature lower than the ambient temperature. The creep correction temperature along with calculations shall be furnished by the Contractor.

c) Minimum spacing
The minimum electrical clearance between conductors shall be as per relevant standards.

B) Rail Crossing

In case of rail crossing the min. height above rail level of the lowest portion of any conductor under condition of max. sag, in accordance with the regulations for Electrical Crossing of Railway tracks as prevailing at the time of construction of line shall be applicable.

C) Power Line Crossing

Minimum clearance between power line to power line crossing shall be as per IE rules.

D) Live Metal Clearance

The minimum live metal clearance to the provided between the live parts and steel work of super-structure shall be as per relevant standards.

NOTE:
i) Bidder shall adopt same cross arm design where jumper is projecting outside of cross-arm for `D' type tower to be used as dead end and angle tower.

ii) The design of the tower shall be such that it will satisfy all the conditions when clearances are measured from any live point of the strings.

E) Angle of Shielding

The angle of shielding is defined as the angle formed by the line joining the center lines of the earthwire and outer power conductor, in still air, at tower supports, to the vertical line through the center line of the earthwire. Bidders shall design the tower in such a way that the angle of shielding does not exceed 30 deg for double circuit tower.The drop of the earthwire clamp, which is in the scope of contractor supplied items, should be considered while calculating the minimum angle of protection. For estimating the minimum angle of protection the drop of earth wire suspension clamp alongwith shackle shall be taken as 150mm.

F) Mid Span Clearance

The minimum vertical mid span clearance between the earthwire and the nearest power conductor shall be as per IE/relevant rules, which shall mean the vertical clearance between earthwire and the nearest conductor under all temperatures and still air condition in the normal ruling span. Further, the tensions of the earthwires and power conductors, shall be so co-ordinated that the sag of earthwires shall be at least 10% less than that of power conductors under all temperature loading conditions.

12.03.00 **LOADING CONDITIONS**

12.03.01 **Loads at Conductor And Earthwire Points**

Contractor shall consider the ultimate external loadings at conductor and earthwire points base on IS 802-1, 1995. The Contractor shall develop the tower designs considering these loadings. The towers are to be designed to cater for the following loads:

a) Reliability Loads (Normal condition)
b) Security Loads (Broken wire condition)
c) Safety Loads (Construction & Maintenance loads)

12.03.02 **Suspension towers shall be designed for full wind load under security condition**

Wind Loads on Tower Body

The wind load on tower body shall be calculated by the Contractor as per IS:802, Part-I, 1995.

12.03.03 **Maximum Tension**

Maximum tension shall be based on either of the following (whichever is more stringent):

a) at 0 deg C with 36% full wind pressure., or
b) at 32 deg C with full wind pressure

The value of drag co-efficient (Cd) shall be 1.2 for conductor/earthwire if the diameter of the conductor/earth is 15mm or less.

12.03.04 Sag tension calculation for design purpose shall be calculated considering normal ruling span.

12.03.05 The initial conductor and earthwire tension at 32 degree C and without wind shall be 22% of the ultimate tensile strength of the conductor and 20% of the ultimate tensile strength of the Earthwire.

12.03.06 Limiting Tensions of conductor & Earthwire

The ultimate tension of conductor and ground wire shall not exceed 70 per cent of the ultimate tensile strengths.

12.03.07 **Broken Wire Condition**

The loads for broken wire conditions shall be considered as per clause 16 of IS 802 (Part I/ Sec 1): 1995. The tower type B & C shall be considered as small and medium angle towers whereas tower type D shall be considered as large angle tension tower/ dead end tower.

12.03.08 **Design Loads**

Owner's requirement for most stringent design longitudinal and transverse loads is summarized in Table T1-2.

12.04.00 **DESIGN OF TOWERS**

12.04.01 **Design Criteria**

Towers shall be designed based on spans and clearances, and loading conditions as detailed above.

12.04.02 **Design Temperatures**

The following temperature range for the conductors and ground wires shall be adopted for line design:

a)	Minimum temperature	:	0 deg.C
b)	Everyday temperature of conductor	:	32 deg.C
c)	Max. temperature of Conductor	:	75 deg.C
d)	Max. temperature of Earthwire exposed to sun	:	53 deg.C

12.04.03 **Redundant Design**

All redundants in the towers are to be triangulated. Redundants, having an angle of 15 deg or less with horizontal are to be designed for a concentric vertical ultimate load of 1.5 KN acting at center of the unsupported length. The Contractor has to furnish the calculation for the same. The redundants shall also be designed for 2.5% of max. axial load of connecting members (i.e. leg members, bracing members etc.).

12.04.04 **Steel Sections**

For designing of towers, preferably rationalised steel sections shall be used. During execution of the project, if any particular section is not available same shall be substituted by higher section at no extra cost to Owner and the same shall be borne by the Contractor. However, design approval for such substitution shall be obtained from the Owner before any substitution.

12.04.05 **Thickness of Members**

The minimum thickness of angle sections used in the design of tower, unless otherwise specified elsewhere in this Specification, shall be kept not less than the following values:

a) Main corner leg members including the groundwire peak and main cross arm : 5 mm
b) For all other members : 4 mm

12.04.06 **Bolts & Nuts**

A) The minimum bolt spacing and rolled edge distance and sheared edge distance from the centers of the bolt holes to be maintained are given below:

a)	Diameter of bolts	16 mm
b)	Hole diameter	17.5 mm
c)	Min. bolt spacing	40 mm
d)	Min. rolled distance	20 mm
e)	Min. sheared edge distance	23 mm

B) Bolts sizes mentioned above shall only be used. The minimum width of the flanges without bolt holes shall be 30mm.

C) For the purpose of calculating shearing stress and bearing stress for bolts, IS:802-Part-II-1993 may be referred.

12.04.07 **Slenderness Ratio**

A) Slenderness ratio for members shall be computed in accordance with IS:802, Part-II, 1993. Slenderness ratio for compression and tension members shall not exceed the values specified therein.

B) The following maximum limit of the slenderness ratio i.e. the ratio of unsupported length of the section in any plane to the appropriate radius of gyration will be adopted:

a)	For main corner leg members including the corner members of earthwire peak and the lower corner members of the cross-arms	120
b)	For other members having calculated stresses	200
c)	For redundant members	250
d)	For members having tensile stress only	400

C) The bracing pattern, including that of secondary bracings (redundants) shall be identical on transverse and longitudinal faces of the tower, i.e. staggering of primary and secondary bracings are not permitted. Primary bracings and redundants shall be properly triangulated, i.e. the overall pattern of bracing on tower body and cross arms shall be triangular only.

12.04.08 **Erection Stress**

Where erection stress combined with other permissible co-existent stresses could produce a working stress in any member appreciably above the specified working stress, such other provisions are to be made as may be necessary to bring the working stress within the specified limit.

12.05.00 **TOWER MATERIALS**

12.05.01 **Tower Steel Sections**

IS steel sections of tested quality in conformity with IS: 2062 are to be used in towers, extensions and stub setting templates. No individual member shall be longer than 6000mm. The Bidder can also use most efficient grades of structural steel angle sections and plates conforming to latest international standards. However, the Bidders are permitted to opt for not more than two (2) grades of steel for any particular package.

12.05.02	**Fasteners: Bolts, Nuts and Washers**
A)	All bolts and nuts shall conform to IS: 6639. All bolts and nuts shall be galvanised and shall have hexagonal head and nuts, the heads being forged out of the solid, truly concentric, and square with the shank, which must be perfectly straight.
B)	The bolt shall be of 16 mm dia and of property class 5.6 as specified in IS:1367 (Part-III) 1979 and matching nut of property class as specified in IS:1367 (Part-VI).
C)	Bolts upto M16 and having length upto 10 times the diameter of the bolt should be manufactured by cold forging and thread rolling process to obtain good and reliable mechanical properties and effective dimensional control. The shear strength of bolts for 5.6 grade should be 310 MP a minimum as per IS:12427. Bolts should be provided with washer face in accordance with IS:1363 Part-I to ensure proper bearing.
D)	To ensure uniformity of galvanizing, bolts and nuts should be galvanised by high temperature hot-dip galvanizing.
E)	Nuts should be double chamfered as per the requirement of IS:1363 Part-III. It should be ensured by the manufacturer that nuts should not be overtapped beyond 0.4 MM oversize on effective diameter for size upto M16.
F)	Fully threaded bolts shall not be used. The length of bolts shall be such that the threaded portion will not extend into the place of contact of the members.
G)	All bolts shall be threaded to take the full depth of the nuts and threaded enough to permit firm gripping of the members, but not further. It shall be ensured that the threaded portion of each bolt protrudes not less than 3 mm and not more than 8mm when fully tightened. All nuts shall fit and tight to the point where the shank of the bolt connects to the head.
H)	Flat and tapered washers shall be provided wherever necessary. Spring washers shall be provided for insertion under all nuts. These washers shall be of steel electro-galvanised, positive lock type and 3.5mm in thickness for 16mm dia.
I)	The Bidder shall furnish bolt schedules giving thickness of members connected, the nut and the washer and the length of shank and the threaded portion bolts and sizes of holes and any other special details of this nature.
J)	To obviate bending stress in bolts or to reduce to minimum, no bolt shall connect aggregate thickness of more than three (3) times its diameter.
K)	The bolt positions is assembled towers shall be as per IS:5613 (Part-II/Section-2).
L)	Bolts at the joints shall be so staggered that nuts may be tightened with spanners without fouling.
12.06.00	**Tower Accessories**
12.06.01	**Step Bolts & ladders**

Each tower shall be provided with step bolts of not less than 16mm diameter and 175 mm long, spaced not more than 450mm apart and extending from about 3.5 meters above the ground level to the top of the tower. Step bolt shall be provided with two nuts on one end to fasten the bolt securely to the tower and button head at the other end to prevent the feet from slipping away. The step bolts shall be capable of withstanding a vertical load not less than 1.5 KN. For special structures, where the height of the super structure exceeds 50 meters, ladders along with protection rings shall be provided in continuation of the step bolts on one face of the tower from 30 meters above ground level to the top of the special structure. From 3.5 m to 30 m height of super structure step bolts shall be provided. Suitable railing for access from step bolts to the ladder and from the ladder to each cross arm tip and the groundwire support shall be fixed on tower by using countersunk bolts.

12.06.02 **Insulator Strings and Earthwire Clamps Attachments**

a) For the attachment of suspension insulator string a suitable dimensioned swinging hanger on the tower shall be provided so as to obtain requisite clearance under extreme swinging conditions and free from swinging of the string. The hanger shall be designed to withstand an UTS equivalent to that of insulators. The supply of design & supply of hanger is in the scope of the Contractor.

b) At tension towers strain plates of suitable dimensions on the underside of each cross-arm tip and at the top of earthwire peak, suitable plate should be provided for taking the hooks or D-Shackle of the tension insulator strings or earthwire tension clamps, as the case may be. Full details of the attachments shall be submitted by the bidder for Owner's approval before starting the mass fabrication.

12.06.03 Earthwire peaks/crossarms are to be suitably designed to accommodate the shackle of the suspension clamp/tension clamps.

12.06.04 **Anti-climbing Device**

Barbed wire type anti-climbing device shall be provided and installed by the Contractor for all towers. The height of the anti-climbing device should be provided approximately 3m above ground level. The barbed wire shall conform to IS-278-1978. The barbed wires shall be given chromating dip as per procedure laid down in IS:1340-1959.

12.06.05 Danger plate, Number plates, Circuit Plate, Phase plate & Bird Guards.

Danger, Number Plates, Phase Plates & Bird Guards shall be provided and installed by the Contractor:

a) Each tower shall be fitted with a number plate, and danger plate. Each tension tower shall be provided with a set of phase plates also. The arrangement for fixing these accessories shall not be more than 4.5m above the ground level.
b) The letters, figures and the conventional skull and bones of data plates shall conform to IS:2551-1963 and shall be in a single red on the front of the plate.
c) The corners of the number and danger plate shall be rounded off to remove sharp edges.
d) To prevent birds from perching immediately above the suspension insulator strings and thus fouling it with droppings suitable birdguards shall be provided at cross arm tips of all suspension towers. The arrangement shall conform to IS:5613 part-2/Sec.I.

12.07.00 **TOWER FABRICATION**

12.07.01	Except where hereinafter modified, details of fabrication shall conform to IS:802 (Part-II) or the relevant international standards.
12.07.02	Butt splices shall be used and the inside Angle and outside plate shall be designed to transmit the load and inside cleat angle, shall not be less than half the thickness of the heavier member connected plus 2mm. Lap splice may be used for connecting members of unequal size and the inside angle of lap splice shall be rounded at the heel to fit the fillet of the outside angle. All splices shall develop full stress in the member connected through bolts. Butt as well as lap splice shall be made as above and as close to the main panel point as possible.
12.07.03	Joints shall be so designed as to avoid eccentricity as far as possible. The use of gusset plates for joining tower members shall be avoided as far as possible. However, where the connections are such that the elimination of the gusset plates would result in eccentric joints, gussets plates and spacer plates may be used in conformity with modern practices. The thickness of the gusset plates required to transmit stress shall not be less than that of members connected.
12.07.04	The use of filler in connection shall be avoided as far as possible. The diagonal web members in tension may be connected entirely to the gusset plate wherever necessary to avoid the use of filler and it shall be connected at the point of intersection by one or more bolts.
12.07.05	The tower structures shall be accurately fabricated to connect together easily at site without any undue strain on the bolts.
12.07.06	No angle member shall have the two leg flanges brought together by closing angle.
12.07.07	The diameter of the hole shall be equal to the diameter of bolt plus 1.5mm.
12.07.08	The structure shall be designed so that all parts shall be accessible for inspection and cleaning. Drain holes shall be provided at all points where pockets depression are likely to hold water.
12.07.09	All similar parts shall be made strictly inter-changeable. All steel sections before any work is done on them, shall be carefully leveled, straightened and made true to detailed drawings by methods which will not injure the materials so that when assembled, the adjacent matching surfaces are in close contact through out. No rough edges shall be permitted in the entire structure.
12.07.10	**Drilling and Punching**
A)	Before any cutting work is started all steel sections shall be carefully straightened and trued by pressure and not by hammering. They shall again be trued after being punched and drilled.
B)	Holes for bolts shall be drilled on punched with a jig but drilled holes shall be preferred. The following maximum tolerance of accuracy of punched holes is permissible.
a)	Holes must be perfectly circular and no tolerance in this respect permissible.
b)	The max. allowable difference in diameter of the holes on the two sides of plates or angle is 0.8mm. i.e. the allowable taper in a punched holes should not exceed 0.8mm on diameter.
c)	Holes must be square with the plates or angles and have their walls parallel.

C) All burrs left by drills or punch shall be removed completely. When the tower members are in position the holes shall be truly opposite to each other. Drilling or reaming to enlarge holes shall not be permitted.

12.07.11 **Erection mark**

A) Each individual member shall have erection mark conforming to the component number given to it in the fabrication drawings. This mark shall be marked with marking dies of 16mm size before galvanising and shall be legible after galvanising.

B) Erection Mark shall be "A - BB- CC – DDD", where

A = Owner's code assigned to the Contractor Alphabet.
BB = Contractor's Mark-Numerical
CC = Tower Type-Alphabet
DDD = Number mark to be assigned by Contractor.

12.07.12 **Quantities and Weights**

A) The unit weight of each type of tower, stubs and extensions shall be furnished by the bidder. The weight of tower shall mean the weight of tower calculated by using the black sectional (i.e. un-galvanised) weight of steel members of the size indicated in the approved fabrication drawings and bills of materials, without taking into consideration the reduction in weights, holes, notches and bevel cuts etc, but taking into consideration the weight of the fasteners, anti-climbing devices etc.

12.07.13 **Galvanising**

Fully galvanised towers and stub shall be used for the line. Galvanisation of the member of the towers shall conform to IS:2629 and IS:4759. The minimum weight of galvanisation shall be 610 gms/sqm. The galvanisation shall be done after all fabrication work is completed, except that the nuts may be tapped or re-run after galvanising. Threads of bolts and nuts shall have a neat fit and shall be such that they can be turned with finger throughout the length of the threads of bolts and they shall be capable of developing full strength of the bolts. Spring washers shall be electro-galvanised as per Grade 4 of IS:1573.

12.07.14 **TOWER EARTHING**

The footing resistance of all towers shall be measured by the Contractor in dry weather after tower erection but before the stringing of earthwire. All the tower are to be earthed. In no case tower footing resistance shall exceed 10 ohms. Pipe type earthing and counterpoise type earthing wherever required shall be provided in accordance with the stipulations made in IS:3043-1987 and IS:5613 (part-II/Section-2) 1985. The details for pipe and counterpoise type earthing are given in drawing enclosed with the specification.

12.08.00 **INSPECTION AND TESTS**

12.08.01 All standard tests, including quality control tests, in accordance with appropriate Indian/International standard, shall be carried out unless otherwise specified herein.

12.08.02 **Inspection**

In addition to the provisions as specified elsewhere in this specification, the following shall also apply:

A) The Contractor shall keep the Owner informed in advance about the time of starting and the progress of manufacture and fabrication of various tower parts at various stages, so that arrangements could be made for inspection.

B) The acceptance of any part of items shall in no way relieve the Contractor of any part of his responsibility for meeting all the requirements of the Specification.

C) The Owner or his representative shall have free access at all reasonable times to those parts of the Contractor's works which are concerned with the fabrication of the Owner's material for satisfying himself that the fabrication is being done in accordance with the provisions of the specifications.

D) Unless specified otherwise inspection shall be made at the place of manufacture prior to dispatch and shall be conducted so as not to interfere unnecessarily with the operation of the work.

E) Should any member of the structure be found not to comply with the approved design, it shall be liable to rejection. No member once rejected shall be resubmitted for inspection, except in cases where the Owner or his authorised representative considers that the defects can be rectified.

F) Defect which may appear during fabrication shall be made good with the consent of, and according to the procedure proposed by the Contractor and approved by the Owner.

G) All gauges and templates necessary to satisfy the Owner shall be supplied by the manufacturer.

H) The correct grade and quality of steel shall be used by the Contractor. To ascertain the quality of steel used the inspector may at his discretion get the material tested at an approved laboratory.

12.08.03 **Tower Load Tests**

A) The Contractor shall submit one set of shop drawings alongwith the bill of materials. Further, Contractor shall submit one copy of test reports and final tracings of shop drawings and Bill of materials for Owner's reference and record.

B) The Contractor shall ensure that the specification of materials and workmanship of all towers actually supplied conform strictly to the towers which have successfully under gone the tests. In case any deviation is detected, the Contractor shall replace such defective towers free of cost to the Owner. All expenditure incurred in erection, to and fro transportation and any other expenditure or losses incurred by the Owner on this account shall be fully borne by the Contractor. No extension in delivery time shall be allowed on this account.

12.08.04 **Tower Testing Procedure**

The testing of towers shall be as per the procedure described below:

A) **Bolt Slip Test**

In the bolt slip test, the test loads shall be gradually applied up to the 50% of design loads under normal condition and held for two (2) minutes at that loads and then released gradually.

The initial and final readings on the scales (for measurement of defection) before application and after the release of Loads respectively shall be taken with the help of theodolite. The difference between these readings gives the values of the bolt slip.

B) **Normal/Broken Wire Load Tests**

All the loads, for a particular load-combination test shall be applied gradually upto the full design loads in the following steps and shall also be released in the similar manner:

50 percent
75 percent
90 percent
95 percent
100 percent

C) **Observation Periods**

a) Under normal and broken wire load tests, the tower shall be kept under observation for sign of any failure for two minutes (excluding the time for adjustment of loads) for all intermediate steps of loading upto and including 95 per cent of full design loads.

b) For normal, as well as broken wire tests, the tower shall be kept under observation for five (5) minutes (excluding the time for adjustment of loads) after it is loaded upto 100 percent of full design loads.

c) While the loading operation are in progress, the tower shall be constantly watched, and if it shows any tendency of failure anywhere, the loading shall be immediately stopped, released and then entire tower shall be inspected. The reloading shall be started only after the corrective measures are taken.

d) The structure shall be considered to be satisfactory, if it is able to support the specified full design loads for five (5) minutes, with no visible local deformation after unloading (such as bowing, buckling etc.) and no breakage of elements or constituent parts.

e) Ovalization of holes and permanent deformation of bolts shall not be considered as failure.

D) **Recording**

The deflection of the tower shall be recorded at each intermediate and final stage of normal load and broken wire load tests by means of a theodolite and graduated scale. The scale shall be of about one meter long with marking upto 5 mm accuracy.

E) **Destruction Test**

a) The destruction test shall be carried out under normal condition or broken wire condition. The Owner at the time of approval of rigging chart/test data sheet shall intimate the contractor. Under which load condition the destruction test is to be carried out.

b) The procedure for application of load for normal/broken wire test shall also be applicable for destruction test. However, the load shall be increased in steps of five (5) percent after the full design loads have been reached.

12.09.00 **PACKING**

12.09.01 The packings shall be properly done to avoid losses/damages during transit. Each bundle or package shall be appropriately marked.

12.10.00 DESIGN CALCULATION AND DRAWINGS

12.10.01 The following design calculation and drawings are required to be furnished during detailed engineering.

a) Computation of wind load
b) Sag-tension calculation
c) Tower loading
d) Single line diagram of towers slowing electrical clearances and steel sections.

12.10.02 The Contractor shall also furnish following to the owner:

a) Detailed design calculation and drawing for towers and foundations.
b) Detailed structural drawings indicating section size, length of members sizes of plate along with hole to hole distance, joint details etc.
c) Bill of materials, indicating cutting and bending details against each member.
d) Shop drawings showing all details relevant to fabrication.
e) All the drawings for the tower accessories.

TABLE-T1-2
DESIGN LOADS

S.No	400 kV	Longitudinal Loads		Transverse Loads	
		Reliability Condition	Security Condition	Reliability Condition	Security Condition
1	2	3	4	5	6
a.	A	0.0	0.5 x MT For Conductor). 1.0 x MT (For Earth Wire)	WC + WI + DY	0.6 WC + WI +0.25 DY (For Conductor) 0.6 WC + 0.5 DY (For Earth Wire)
b.	B (Section Tower- 0° Deviation)	0.0	1.0 x MT	WC + WI + DY	0.6 WC + WI +0.5 DY
c.	B (15° Deviation)	0.0	1.0 x MT x Cos Φ/2	WC + WI + DY	0.6 WC + WI +0.5 DY
d.	C (Section Tower- 0° Deviation)	0.0	1.0 x MT	WC + WI + DY	0.6 WC + WI +0.5 DY
e.	C (30° Deviation)	0.0	1.0 x MT x Cos Φ/2	WC + WI + DY	0.6 WC + WI +0.5 DY
f.	D (60° Deviation)	0.0	1.0 x MT x Cos Φ/2	WC + WI + DY	0.6 WC + WI +0.5 DY
g.	D (90° Deviation)	0.0	1.0 x MT x Cos Φ/2	WC + WI + DY	0.6 WC + WI +0.5 DY
h.	D Complete Dead End	MT	1.0 x MT	WC + WI	0.1 WC + WI

DESCRIPTION	SYMBOL	REMARKS
Maximum Tension Of Conductor/ Earth Wire under everyday temperature & full wind condition or minimum temperature & 36% 0f max. wind which ever is more stringent	MT	
Wind On Conductor	WC	Wind Span shall be the normal ruling span.
Wind On Insulator	WI	In case of Double String Insulators, both their strings shall be considered
Angle Of Deviation (Degrees)	Φ	
Load Due To Deviation Of Tower	DY= 2 x MT x Sin Φ/2	

Note:
1. Vertical loads shall conform to IS 802 – Part I, 1995. Weight spans as furnished under Clause 2.03.00 shall be considered for computation of vertical loads.

2. Safety loads and Anti-cascade loads as specified in IS 802- Part I, 1995 shall also be considered for design of Towers.

3. Wind loads on the towers shall be considered in transverse loads as per clause 11, 12 and 13 of IS: 802 (Part-I/ Sec. I)- 1995.

4. Any additional loads apart from the loads mentioned above, as required as per IS: 802-1995 shall be considered for design purpose.

13.00.00 TOWER FOUNDATIONS

13.01.00 **TYPES OF FOUNDATION**

13.01.01 General

A) Reinforced concrete footing shall be used for all type of normal tower in conformity with the present day practice followed in the country and the specifications laid herein. All the four footings of the tower and their extension shall be similar, irrespective of down thrust and uplift.

B) Foundation includes supply of materials such as cement, sand, coarse aggregates, reinforcement steel etc., and all work related to construction of foundations including excavation and backfilling, form work, stub setting, placing of reinforcement, concreting etc.

13.01.02 Design criteria for Foundations

The foundation shall be designed for the actual soil parameters based on the soil investigation carried out by the bidder and approved by the owner. For design purposes:

(a) The angle of repose shall be considered as two-third (2/3) of the value as obtained from the soil investigation

(b) Water table shall be considered up to the ground level.

(c) The weight of soil shall be considered as 1440 Kg/m^3 under dry condition and 940 Kg/m^3 under wet condition.

Well foundation or pile foundation shall be provided by the bidder wherever necessitated.

13.02.00 **SOIL INVESTIGATION**

13.02.01 The Contractor is required to carry out detailed soil investigation at various tower locations along the corridor, one borehole at centre of the tower, angle points, crossings, etc. and also where soil strata is different from the other locations

investigated. In addition the soil investigation may be required to be carried at other locations at the discretion of the Engineer.

The investigation comprises of field and laboratory testing. Field investigation includes boreholes, Standard Penetration Test (SPT), Static Cone Penetration Test (SCPT), Dynamic Cone Penetration Test (DCPT), collection of disturbed samples (DS) and undisturbed soil samples (UDS), Trial Pits (TP), Plate Load Tests (PLT), Electrical Resistivity Test (ERT), collection of water samples, etc. Laboratory tests shall include, Physical, chemical and engineering properties of soil/rock.

13.02.02 This specification covers technical requirements for geotechnical investigation and preparation of a detailed geotechnical report. It shall include mobilization of necessary equipment, providing necessary engineering supervision and technical personnel, carrying out field investigation and tests, laboratory tests, analysis and interpretation of data and results, collecting data regarding change of course of rivers from local sources, velocity, scour, etc., giving flood details of the area (past history), safe bearing capacity for different sizes of foundations, different founding strata for the various locations along the transmission lines and preparation of geotechnical report.

13.02.03 The diameter of borehole shall be minimum 150 mm in soil and 76 mm in rock. Depth of bore holes at river/bridge crossings shall be 40m, at angle points depth shall be 15.0m and at the centre of tower along the corridor depth of BH shall be 10.0m. Boring shall be terminated at the above specified depth or 3.0m continuous in rock with RQD>25% for river crossings and for balance areas 3.0m in refusal whichever is earlier. Refusal means SPT 'N' value greater than 100.

SPT shall be carried out in all types of soil deposits and in all rock formations with core recovery up to 20%, met within a borehole. This test shall be conducted at every 3.0 m interval or at change of strata, up to the final depth. At refusal penetration shall be measured and the same shall be reported in Borelog. UDS shall be collected at every 3.0 m interval or at change of strata up to depth of borehole. UDS may be replaced by additional SPT, if SPT'N' value in the strata is above 50. The diameter of UDS sampler shall be 100 mm minimum.

13.02.04 Laboratory tests shall be done as per relevant IS codes. The laboratory tests, not be limited to the following shall be conducted on disturbed and undisturbed soil samples, rock samples & water samples collected during field investigations in sufficient numbers.

a) Laboratory Tests on Soil Samples

Laboratory tests shall be carried out on disturbed and undisturbed soil samples for Grain Size Analysis, Hydrometer Analysis, Atterberg Limits, Triaxial Shear Tests (UU), Natural Moisture Content, Specific Gravity and Bulk Unit Weight, Consolidation Tests, Unconfined Compression Test, Free swell Index, Shrinkage Limit, Swell Pressure Test, Chemical Analysis test on soil and water samples to determine the carbonates, sulphates, chlorides, nitrates, pH, organic matter and any other chemicals harmful to concrete and reinforcement/ steel.

b) Laboratory Tests on Rock Samples

Moisture content, porosity & density, Specific Gravity, Hardness, Soundness, Slake durability index, Unconfined compression test (Both at saturated and in-situ water content), Point load strength index and deformability test (Both at saturated and in-situ water content) shall be carried out on rock samples.

13.02.05 The laboratory tests shall be carried out progressively during the field work after sufficient numbers of samples have reached the laboratory in order that the test results of the initial boreholes can be made use of in planning the later stages of the field investigation and quantum of laboratory tests. All samples brought from field, whether disturbed or undisturbed shall be extracted/prepared and examined by competent technical personnel and the tests shall be carried out as per the procedures laid out in the latest editions of the relevant IS codes. Soil shall be classified as per the provisions of Indian standards.

13.02.06 On completion of all field & laboratory work, geotechnical investigation report shall be submitted for Owner's review/approval. The Geotechnical investigation report shall contain geological information of the region, procedure adopted for investigation, field & laboratory observations/ data/ records, analysis of results & recommendations on type of foundation envisaged for all areas of work with supporting calculations. Recommendations on treatment for soil, foundation, based on subsoil characteristics, soft soils, aggressive chemicals, expansive soils, etc.

13.02.07 The Geotechnical report shall include, but not limited to the following:

a) Borelogs: A true cross section of all individual boreholes with reduced levels and coordinates, showing the classification and thickness of individual stratum, position of ground water table, details of various in-situ tests conducted and samples collected at different depths and the rock stratum, wherever met with.

b) Results of all laboratory tests summarized for each Borehole along with a consolidated table giving the layer wise soil and rock properties. All the relevant charts, tables, graphs, figures, supporting calculations, conditions and photographs of representative rock cores shall be furnished.

c) Recommendations : The report should contain specific recommendations on type of foundations to be adopted for various structures, duly considering the sub soil characteristics, water table, total/ differential settlement permissible for structures and equipments, minimum depth and width of foundation. The observation/recommendations shall include but not limited to the following:

i) Geological information of the area, past observations or historical data, if available, for the area and for the structures in the nearby area, fluctuations of water table etc.

ii) Net safe allowable bearing pressure on the soil at various depths for different sizes of the foundations based on shear strength and settlements characteristics of soil with supporting calculations for the recommendations.

iii) Based on the chemical nature of soil and ground water and exposure condition, recommendations for protective measures on concrete and steel shall be mentioned.

iv) If expansive soil is met with, recommendation and removal or retainment of the same under structures/ roads etc. shall be given. In the later case detailed specification of any special treatment required including specifications for materials to be used, construction method, equipments to be deployed, etc. shall be furnished.

iv) Additional investigation other then specified above, if any, the same shall be carried out by the bidder at no extra cost to owner.

13.02.08 Indian Standard References

IS:1498 Classification and Identification of Soils for general Engineering Purposes.

IS:1892 Code of practice for Subsurface Investigation for Foundation.

IS:1904 Code of practice for design and construction of foundations in Soils: General Requirements.

IS:2131 Method of Standard Penetration Test for Soils.

IS:2132 Code of practice for Thin walled Tube Sampling of Soils.

IS:2470 Code of practice for design and construction of SepticTanks.

(Part-I)

IS:2720 Method of Test for Soils (Relevant Parts).

IS:5313 Guide for Core Drilling Observations.

IS:4968 Method for subsurface Sounding for Soils - Dynamic

(Part-II) method using Cone and Bentonite slurry.

IS:4968 Method for subsurface Sounding for Soils- Static Cone Penetration

(Part-III) Test

13.04.00 **LOADS ON FOUNDATIONS**

13.04.01 The foundations shall be designed to withstand the specific loads of the superstructure and for the full footings reactions obtained from the structural stress analysis in conformity with the relevant over load factors. The over load factor for foundation design shall be 1.10 for all loads except dead loads.

13.04.02 The reactions on the footings shall be composed of the following type of loads for which these shall be required to be checked :

i) Max. tension or uplift along the leg slope.
ii) Max. compression or down-thrust along the leg slope.
iii) Max. horizontal shear or side thrust.

13.04.03 The base slab of the foundation shall be designed for additional moments developing due to eccentricity of the loads.

13.04.04 The additional weight of concrete in the footing below ground level over the earth weight and the full weight of concrete above the ground level in the footing and embedded steel parts will also be taken into account adding to the down thrust.

13.05.00 **STABILITY ANALYSIS**

13.05.01 In addition to the strength design, stability analysis of the foundation shall be done to check the possibility of failure by over-turning, uprooting, sliding and tilting of the foundation.

13.05.02 The following primary type of soil resistance shall be assumed to act in resisting the loads imposed on the footing in earth:

A) Resistance against uplift

The uplift loads will be assumed to be resisted by the weight of earth in an inverted frustum of a conical pyramid of earth as per relevant formula on the footing pad whose sides make an angle equal to the angle of repose of the earth with the vertical, in average soil. The weight of concrete embedded in earth and that above the ground will also be considered for resisting the uplift. In case where the frustum of earth pyramids of two adjoining legs super-impose each other, the earth frustum will be assumed truncated by a vertical plane passing through the center line of the tower base.

B) Resistance against down thrust

The down-thrust load combined with the additional weight of concrete above earth will be resisted by bearing strength of the soil assumed to be acting on the total area of the bottom of the footings.

C) Resistance against side-thrust

The chimney portion of the foundation shall be designed as per limit load method described at clause 38.6 of IS-456-1978, or as per any other international standard, considering the chimney as a column subjected to axial loads (down thrust loads) and biaxial bending moments resulting from side thrust forces. The passive earth pressure (as per Rankine's formula) shall be considered for the design of chimney against side thrust. If uplift and down thrust are computed in vertical direction for the foundation design, full resultant horizontal shear shall be taken at footing tip for design of the footing to resist side thrust.

13.06.00 **PROPERTIES OF CONCRETE**

13.06.01 The cement concrete used for the foundations shall be of grade M-20 corresponding to 1:1½:3 nominal mix ratio with 20mm coarse aggregate.

13.06.02 All the properties of concrete regarding its strength under compression tension, shear, punching and bend etc. as well as workmanship will conform to IS:456-1978.

13.06.03 The material properties for cement, aggregate and reinforcement steel shall be as specified elsewhere in the specification

13.06.04	The water used for mixing concrete shall be fresh, clean and free from oil, acids and alkalies, organic materials or other deleterious substances. Portable water is generally preferred.
13.07.00	**DESIGN OF FOUNDATIONS**
134.07.01	Structural design of the foundations shall be done by limit State method conforming to IS 456.
13.07.02	The chimney should have all around clearance of 150mm from any part of stub angle limiting to 450mm sq. minimum.
13.07.03	The chimney top or muffing must be at least 225 mm above ground level and also the coping shall be extended upto lower most joint level between the bottom lattices and the main corner legs of the tower.
13.07.04	Minimum thickness of foundation shall be 300 mm.
13.07.05	The minimum distance between the lowest edge of the stub angle and the bottom surface of concrete footing shall not be less than 150 mm or more than 200mm.
13.07. 06	The total depth of foundations below the ground level shall not be less than 1.5 meters. To maintain the interchangeability of stubs for all types of foundations, for each type of tower, the same depths of foundations shall be used for different types of foundations.
13.07.07	The portion of the stub in the pyramid (or slab) shall be designed to take full down-thrust or uplift loads by the cleats combined with the bond between stub angles and pyramid concrete. The Contractor shall furnish the calculation for uprooting of stub along with the foundation design.
13.07.08	Minimum 50mm thick pad of lean concrete corresponding to 1:3:6 nominal mix shall be provided to avoid the possibility of reinforcement rod being exposed due to unevenness of the bottom of the excavated pit.
13.07.09	Over Load Factor The overload factor for foundations shall be considered as 1.1 i.e. the reaction except due to dead loads on foundations shall be increased by 10 per cent.
13.08.00	**CONSTRUCTION OF TOWER FOUNDATION**
13.08.01	**Excavation** Excavation work must not be started until the tower schedule & profile and foundation drawing are approved by the Owner. Except specified otherwise, all excavation for footing shall be made to the lines and grades of the foundation. All excavation shall be protected so as to maintain a clean subgrade, until the footing is placed, using timbering/shuttering, shoring etc., if necessary. Any sand, mud, silt or other undesirable materials which may accumulate in the excavated pit shall be removed by the Contractor before placing concrete.

13.08.02 **Rock excavation requiring Blasting**

Wherever blasting is required for excavation in rock, the same shall be done after obtaining license from the competent authority. Following shall be adhered to:

i) All provisions of explosive acts shall be adhered to.

ii) The magazine for the storage of explosive shall be to suit as per the requirements of explosive department.

iii) Where blasting is required, same shall be controlled blasting.

iv) Contractor shall prepare the detailed blasting scheme and get the same approved from Engineer-in-charge before carrying out the blasting operation. All blasting shall be done as per the approved blasting scheme.

v) The Contractor shall obtain Licenses from Competent Authorities for undertaking blasting work as well as for procuring, transporting to site and storing the explosives as per explosives act. The Contractor shall be responsible for the safe transport, use, custody and proper accounting of the explosive Materials.

vi) The Contractor shall also observe any specific instructions given by the Engineer-in-charge. The Contractor shall be responsible and liable for any accident and injury / damage which may occur to any person or property of the project or public on account of any operations connected with the storage, transportation, handling or use of explosives and the blasting operations. The Engineer-in-charge or his authorised representative shall frequently check the Contractor's compliance with these precautions and the manner of storing and accounting of explosives. The Contractor shall provide necessary facilities for this the above.

vii) Controlled blasting shall be done by a specialised agency duly approved by Engineer-in-charge. All controlled blasting shall be done by using time delay detonators (i.e. excel type).

viii) All rules under the Explosives Act and other local rules in force shall be fully observed. All blasting works shall be done in accordance with the stipulations contained in IS: 4081.

13.08.03 Setting of Stubs

A) The stubs shall be set correctly in accordance with approved method at the exact location and alignment and precisely at correct levels with the help of stub setting templates and leveling instrument. Stubs shall be set in the presence of Owner's representative available at site where required and for which adequate advance intimation shall be given to the Owner by the Contractor.

B) Setting of stub at each location shall be approved by the Owner's representative.

C) Stub setting templates shall be designed and arranged by the Contractor at his own cost for all types of towers with or without extension and also for leg extension. Stub templates for standard towers and towers with extension upto 6M shall be of adjustable type. The stub templates shall be painted. Generally for each

transmission line tower package, following numbers of stub setting templates shall be deployed by the Contractor:

For each A type tower : 3 Nos.
For each of B and C type : 2 Nos.

However, if Owner feels that more number of templates are required for timely completion of a particular line the Contractor shall have to deploy the same without any extra cost to Owner.

D) One set of each type of stub setting template as applicable, shall be supplied to the Owner, on completion of the project at no extra cost to Owner.

13.08.04 Mixing, Placing and Compacting of Concrete

A) The concrete shall be mixed in a mechanical mixer. However, in case of difficult terrain hand mixing may be permitted at the discretion of Owner. The water for mixing concrete shall be fresh, clean and free from oil, acids and alkalies. Saltish or blackish water shall not be used.

B) Mixing shall be continued until there is uniform distribution of material and the mix is uniform in colour and consistency, but in no case the mixing be done for less than two minutes. Normally mixing shall be done close to the foundation, but in case it is not possible the concrete may be mixed at the nearest convenient place. The concrete shall be transported from the place of mixing to the place of final deposit as rapidly as practicable by methods which shall prevent the segregation or loss of any ingredient. The concrete shall be placed and compacted before setting commences.

C) Form boxes shall be used for casting all type of foundations. The concrete shall be laid down in 150mm layers and consolidated well, so that the cement cream works up to the top and no honey-combing is left in the concrete. The mechanical vibrator shall be employed for compaction of the concrete. However, in case of difficult terrain, manual compaction may be permitted at the discretion of Owner. After concreting the chimney portion to the required height, the top surface should be finished smooth with a slight slope towards the outer edge, to drain off any rain water falling on the coping.

D) In wet locations, the site must be kept complete de-watered, both during the placing of the concrete and for 24 hours thereafter. There should be no disturbance of concrete by water during this period.

E) After the form-work has been removed if the concrete surface is found to be defective, the damage shall be repaired with rich cement and sand mortar to the satisfaction of the Owner's representative before the foundation pits are backfilled.

13.08.05 Back-Filling and Removal of Stub Template

A) After opening of form-work and removal of shoring and timbering, if any, backfilling shall be started, after repairs, if any, to the foundation concrete. Backfilling shall normally be done with excavated soil, unless it consists of large boulders/stones, in which case the boulders shall be broken to a maximum size of 80 mm. At such locations where borrowed earth is required for backfilling, shall be done by the Contractor at his own cost, irrespective of lead.

B) The backfilling materials should be clean and free from organic or other foreign materials. The earth shall be deposited in maximum 200 mm layers, leveled and wetted and tempered properly before another layer is deposited. Care shall be taken that the backfilling is started from the foundation ends of the pits, towards the outer ends. After the pits have been backfilled to full depth, the stub template may be removed.

C) The backfilling and grading shall be carried to an elevation of about 75 mm above the finished ground level to drain out water. After backfilling 50 mm high earthen embankment (bandh) will be made along the sides of excavation pits and sufficient water will be poured in the backfilled earth for atleast 24 hours.

13.08.06 Curing

The concrete after setting for 24 hours shall be cured by keeping the concrete wet continuously for a period of 10 days after laying. The pit may be back filled with selected earth sprinkled with necessary amount of water and well consolidated in layers not exceeding 200 mm of consolidated thickness after a minimum period of 24 hours and thereafter both the backfilled earth and exposed chimney top shall be kept wet for the remainder of the prescribed time of 10 days. The uncovered concrete chimney above the backfilled earth shall be kept wet by providing empty cement bags dipped in water fully wrapped around the concrete chimney for curing and ensuring that the bags are kept wet by the frequent pouring of water on them.

13.08.07 Benching

When the line passes through hilly/undulated terrain, for a few tower locations it may be required to level the ground for casting of tower footings on same elevation. All the activities related to make the required area of ground in same elevation for casting of foundation, shall be termed as benching work. Benching work shall include cutting of excess earth and removing the same to a suitable point of disposal as required by the Owner. Benching shall be resorted to only after getting specific approval from the Owner. Volume of the earth to be cut shall be measured before cutting and got approved from the Owner. This volume of earth shall be considered for the purpose of payment against the head of benching work. The earth removed for setting of stub template or for casting of foundation with difference of elevations of 1M between the tower legs shall not be entitled for payment.

13.08.08 Protection of Tower Footing

A) The work shall include all necessary stone revetments, concreting and earth filling above ground level and the clearance from stacking on the site of all surplus excavated soil, special measures for protection of foundation close to or in nallahas, river bed hilly/undulated terrain etc, by providing suitable revetments or galvanised wire netting and meshing packed with boulders. The top seal cover of the stone revetments shall be done with M-15 concrete (1:2:4:mix). The Contractor shall furnish recommendations for providing protection at these locations wherever required.

B) The quantity of excavated earth obtained from a particular location shall generally be utilised in back-filling work in protection of tower footing of same locations, unless it is unsuitable for such purpose. In the latter case, the back-filling shall be done with

borrowed earth of suitable quality irrespectively of lead as per the rate provided in the letter of award. The consolidation of earth shall however be done after backfilling free of cost.

14.00.00 TOWER LINE ERECTION AND STRINGING

14.01.00 GENERAL REQUIREMENTS

14.01.01 The details of the scope of erection work shall include the cost of labour, all tools and plants like tension stringing equipment and all other incidental expenses in connection with erection and stringing work.

14.01.02 The Contractor shall be responsible for transportation of all the materials to be provided by the Contractor as per the scope of work to site, proper storage and preservation at their own cost till such time the erected line is taken over by the Owner.

14.02.00 TREATMENT OF MINOR GALVANISING DAMAGE

In case any minor damage to galvanising is noticed, the same shall be treated with zinc rich paint (having at least 90% zinc content) before erection.

14.03.00 ASSEMBLY

14.03.01 The method followed for the erection of towers, shall ensure the points mentioned below :

a) Straining of the members shall not be permitted for bringing them into position. It may, however, be necessary to match hole positions at joints and to facilitate this, tommy bars not more than 450 mm long may be used.

b) Before starting erection of an upper section, the lower section shall be completely braced and all bolts provided and tightened adequately in accordance with approved drawings to prevent any mishap during tower erection.

c) All plan diagonals relevant to a section of tower shall be placed in position before assembly of upper section is taken up.

d) The bolt position in assembled towers shall be as per IS:5613 (Part-II/Section 2)-1976.

e) Tower shall be fitted with number plate, danger plate, phase plate and anti-climbing device as described.

f) All bank holes, if any left, after complete erection of the tower, are to be filled up by bolts and nuts of correct size.

14.03.02 Tightening and Punching of Bolts and Nuts

A) All nuts shall be tightened properly using correct size spanner/torque wrench. Before tightening, it shall be ensured that filler washers and plates are placed in gaps

between members wherever applicable, bolts of proper size and length are inserted, and one spring washer is inserted under each nut. In case of step bolts, spring washers shall be placed under the outer nut. The tightening shall progressively be carried out from the top downwards, care being taken that all bolts at every level are tightened simultaneously. The threads of bolts projecting outside the nuts shall be punched at their position on the diameter to ensure that the nuts are not loosened in course of time. If during tightening a nut is found to be slipping or running over the bolt threads, the bolt together with the nut shall be replaced.

B) The threads of all the bolts projected outside the nuts shall be welded at two diametrically opposite places. The welding shall be provided from ground level to waist level for single circuit towers and to bottom cross arm level for double circuit towers. After welding, cold galvanised paint having at least 90% Zinc content shall be applied to the welded portion. At least two coats of the paint shall be applied. The cost of welding and paint including application of paint shall be deemed to be included in the erection price.

C) In addition to the tack welding of nuts with bolts, as described above, the Contractor can also propose some alternative arrangements, like use of epoxy resin adhesive which can serve the purpose of locking the nut permanently with the bolt and thus preventing pilferage of the tower members.

14.04.00 **INSULATOR HOISTING**

Suspension insulator strings shall be used on suspension towers and tension insulator strings on angle and dead end towers. These shall be fixed on all the towers just prior to the stringing. Damaged insulators and fittings, if any, shall not be employed in the assemblies. Before hoisting, all insulators shall be cleaned in a manner that will not spoil, injure or scratch the surface of the insulator, but in no case shall any oil be used for the purpose. Corona control rings/arching horn shall be fitted in an approved manner. The yoke arrangements be horizontal for tensions strings. Torque wrench shall be used for fixing different line materials and their components, like suspension clamp for conductor and earthwire, etc., whenever recommended by the manufacturer of the same of river crossing towers.

14.05.00 **HANDLING OF CONDUCTOR AND EARTHWIRE**

14.05.01 The Contractor shall be entirely responsible for any damage to the towers or conductors during stringing. While running out the conductors, care shall be taken that the conductors do not touch or rub against the ground or objects which could cause scratches or damages to the strands. The conductors shall be run out of the drums from the top in order to avoid damage due to chafing. Immediately after running out, the conductor shall be raised at the supports to the levels of the clamps and placed into the running blocks. The groove of the running blocks shall be of such a design that the seat is semi-circular and larger than the diameter of the conductor earthwire and it does not slip over or rub against the sides. The grooves shall be lined with hard rubber or neoprene to avoid damage to conductor and shall be mounted on properly lubricated bearings.

14.05.02 The running blocks shall be suspended in a manner to suit the design of the crossarm. All running blocks, especially those at the tension end, will be fitted on the cross-arm with jute cloth wrapped over the steel work and under the slings to avoid

damage to the slings as well as to the protective surface finish of the steel work. In case suspension, or section towers are used even for temporary terminations, if this be unavoidable, they shall be well guyed and steps shall be taken by the Contractor to avoid damage. Guying proposal alongwith necessary calculations shall be submitted by the Contractor to Owner by the Contractor for checking the tensions in the guy made available to the Owner by the Contractor for checking the tensions in the guy wires. The drums shall be provided with a suitable braking device to avoid damages, loose running out and kinking of the conductor. The conductor shall be continuously observed for loose or broken strands or any other damage. When approaching end of a drum length, at least three coils shall be left when the stringing operations are to be stopped. These coils are to be removed carefully, and if another length is required to be run out, a joint shall be made as per the recommendations of the manufacturers.

14.05.03 Repairs to conductors, if necessary, shall be carried out during the running out operations, with repair sleeves. Repairing of conductor surface shall be done only in case of minor damage, scuff marks etc. keeping in view both electrical and mechanical safe requirements. The final conductor surface shall be clean smooth and without any projections, sharp points, cuts, abrasions etc.

14.05.04 Conductor splices shall be so made that they do not crack or get damaged in the stringing operation. The contractor shall use only such equipment/methods during conductor stringing which ensures complete compliance in this regard.

14.05.05 Derricks shall be used where roads, rivers, channels, telecommunication or overhead power lines, railway lines, fences or walls have to be crossed during stringing operations. It shall be seen that normal services are not interrupted or damage caused to property. Shut down shall be obtained when working at crossing of overhead power lines. The Contractor shall be entirely responsible for the proper handling of the conductor, earth-wire and accessories in the field.

14.05.06 The sequence of running out shall be from top to downwards i.e. the earthwire shall be run out first, followed by the conductors in succession. Unbalances of loads on towers shall be avoided as far as possible.

14.05.07 The proposed 66 kV transmission line may run parallel for certain distance with the existing Transmission lines which may remain energised during the stringing period. As a result there is a possibility of dangerous voltage build up due to electromagnetic and electrostatic coupling in the pulling wire, conductors and earthwires, which although comparatively small during normal operations can be severe during switching. It shall be the Contractor's responsibility to take adequate safety precautions to protect his employees and others from this potential danger.

14.05.08 B and C type of towers are not designed for one side stringing. Therefore proper guying arrangement shall be made for B and C type of towers during stringing on one section while the other section is not strung. The Contractor has to submit the detailed proposal along with the calculation for guying which shall be approved by the Owner. Proper T&P shall be made available to the Owner by the Contractor for checking the tensions in the guy wires. All the expenditure on account of the above work is deemed to be included in the bid price and no extra payment shall be made for the same.

14.06.00 **STRINGING OF CONDUCTOR AND EARTHWIRE**

14.06.01 The stringing of the conductor shall be done by standard stringing method.

14.06.02 After being pulled the conductor/earthwire shall not be allowed to hang in the stringing blocks for more than 96 hours before being pulled to the specified sag.

14.06.03 Conductor creep are to be compensated by over tensioning the conductor at appropriate temperature for which calculations are to be submitted by the contractor for Owner's approval.

14.06.04 The Bidder shall give complete details of the stringing methods which be proposes to follow. Before the commencement of stringing the Contractor shall submit the stringing charts for the conductor and earthwire for various temperatures and span alongwith equivalent spans for the approval of the Owner.

14.06.05 Jointing

A) All the joints on the conductor and earthwire shall be of compression type, in accordance with the recommendations of the manufacturer for which all necessary tools and equipment like compressors, dies, processes etc. shall have to be arranged by the Contractor. Each part of the joint shall be cleaned by wire brush to make it free of rust or dirt etc. and properly greased with anti- corrosive compound if required, and as recommended by the contractor before the final compression is done with the compressors.

B) All joints or splices shall be made at least 30 meters away from the structures. No joints or splices shall be made in spans crossing over main road, railways, small rivers with tension spans. During compression or splicing operation the conductor shall be handled in such a manner as to prevent lateral or vertical bearing against the dies. After pressing the joint the aluminium sleeve shall have all corners rounded, burrs and sharp edges removed and smoothened.

C) During stringing of conductor to avoid any damage to the joint, the Contractor shall use a suitable protector with mid span compression joints in case joints are to be passed over pulley blocks/aerial rollers. The size of the groove of the pulley shall be such that the joint along with protection can be passed over it smoothly.

14.07.00 Sagging-in-Operation

14.07.01 The conductor shall be pulled upto the desired sag and left in running blocks for atleast one hour after which the sag shall be re-checked and adjusted, if necessary before transferring the conductor from the running blocks to the suspension clamps. The conductors shall be clamped within 36 hours of sagging in.

14.07.02 The sag will be checked in the first and the last span of the section in case of sections upto eight spans and in one intermediate span also for sections with more than eight spans. The sag shall also be checked when the conductors have been drawn up and transferred from running blocks to the insulator clamps.

14.07.03 The running blocks, when suspended from the transmission structure for sagging shall be so adjusted that the conductors on running blocks will be at the same height as the suspension clamp to which it is to be secured,

14.07.04 At sharp vertical angles, the sags and tensions shall be checked on both sides of the angle, he conductor and earthwire shall be checked on the running blocks for equality of tension on both sides. The suspension insulator assemblies will normally assume vertical positions when the conductor is clamped.

14.07.05 Tensioning and sagging operations shall be carried out in clam weather when rapid changes in temperatures are not likely to occur.

14.07.06 Tensioning and Sagging of Conductors and Earthwire

The tensioning and sagging shall be done in accordance with the approved stringing charts before the conductors and earthwire are finally attached to the tower through the earthwire clamps for the earthwire and insulator strings for the conductor. The `Initial' stinging chart shall be used for the conductor and `final' stringing chart for earth-wire should be employed for this purpose. Dynamometers shall be employed for measuring tension in the conductor and earthwire. The dynamometers employed shall be periodically checked and calibrated with the standard dynamometer.

14.07.07 Clipping In

A) Clipping of the conductors in positions hall be done in accordance with the recommendations of the manufacturer. Conductor shall be fitted with armour rods where it is made to pass through suspension clamps.

B) The jumpers at the section and angle towers shall be formed to parabolic shape to ensure maximum clearance requirements and shall match the jumper drops shown in the tower drawings.

C) Fasteners in all fittings and accessories shall be secured in position. The security clip shall be properly opened and sprung into position.

14.07.08 Fixing of Conductor and Earthwire Accessories

Vibration dampers for conductor and earthwire and other conductor and earthwire accessories shall be installed by the Contractor as per the design requirement and respective manufacturer's instructions within 24 hours of the conductor/earthwire clamping. While installing the conductor and earthwire accessories, proper care shall be taken to ensure that the surfaces are clean and smooth and no damage shall occur to any part of the accessories.

14.08.00 **REPLACEMENT**

14.08.01 If any replacements are to be effected after stringing and tensioning or during maintenance, leg members and bracings shall not be removed without reducing the tension on the tower with proper guying or releasing the conductor. If the replacement of cross arms becomes necessary after stringing, the conductor shall be suitably tied to the tower at tension points or transferred to suitable roller pulleys as suspension points.

14.08.02 The Contractor shall not be required to return to the Owner, empty conductor and earthwire drums and shall dispose off the same at his cost except for steel drums which shall be returned to Owner.

14.09.00 **FINAL CHECKING TESTING AND COMMISSIONING**

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

a) Sufficient backfilled earth is lying over each foundation pit and it is adequately compacted.

b) Concrete chimneys and their copings are is good finally shaped conditions.

c) All the tower members are correctly used, strictly according to final approved drawing and are free of any defect or damage, whatsoever.

d) All bolts are properly tightened and punched/tack welded.

e) The stringing of the conductors and earthwire has been done as per the approved sag and tension charts and desired clearances are clearly available.

f) All conductor and earthwire accessories are properly installed.

g) All other requirements to complete the work like fixing of danger plate, phase plate, number plate, anti climbing device etc., are properly installed.

h) Wherever required it should be ensured that revetment is provided.

i) The original tracings of profile route alignment and tower, design, structural drawings, bill of material, shop drawings of all towers are submitted to the Owner for reference and record.

j) The insulation of line as a whole is tested by the Contractor by providing his own equipment, labour etc. to the satisfaction of the Owner.

k) All towers are properly grounded.

l) The line is tested satisfactorily for commissioning purpose.

15.00.00 TRANSMISSION LINE MATERIAL

15.01.00 **GENERAL**

15.01.01 All the equipment shall be of the latest design and conform to the best modern practice adopted in the extra high voltage field. The Bidder shall offer only such equipment as guaranteed by him to be satisfactory and suitable for 400 kV AC Double circuit transmission with quad moose conductor and will give continued good performance.

15.01.02 The design, manufacturing process and quality control of all the materials shall be such as to give maximum factor of safety, maximum possible working load, highest mobility, elimination of sharp edges and a good finish.

15.01.03 All ferrous parts shall be hot dip galvanised, after all machining has been completed, nuts may, however, be tapped (threaded) after galvanising and the threads oiled. Spring washers shall be electrogalvanised. The bolt threads shall be under cut to take care of increase in diameter due to galvanising . Galvanising shall be done in accordance with IS:2629-1972. Fasteners shall withstand four dips while spring washers shall withstand three dips. Other galvanised materials shall be guaranteed to withstand at least six dips each lasting one minute under the standard preece tests for galvanising.

15.01.04 The zinc coating shall be perfectly adherent, of uniform thickness, smooth, reasonably bright, continues and free from imperfection such as flux, ash, rust stains, bulky white deposits and blisters. The zinc used for galvanising shall be of grade Zn. 99.95 as per IS:209-1966.

15.02.00 **EARTHWIRE**

15.02.01 The galvanised steel earthwire shall generally conform to the specification of ACSR core wire as mentioned in IS 398 (Part-II)-1976 except where otherwise specified herein.

15.02.02 Parameters of the earthwire

(a) Size (strands & wire diameter)	7/3.15 mm
(b) Overall diameter	9.45 mm
(c) Stranded weight	428 Kg/km
(d) Minimum ultimate tensile strength	56 kN

15.02.03 The earthwire shall be pre-formed and post-formed to avoid opening of strands at the time of cutting or joining. The finished material shall have minimum brittleness, as it will be subject to appreciable vibration while in use. It shall withstand 3 and ½ number of one minute dips in the standard preece test.

15.02.04 There shall be no joint of any kind in the finished steel wire strand entering into the manufacture of the earthwire. There shall be no strand joints or strand splicer in any length of the completed stranded earthwire.

15.03.00 **CONDUCTOR**

15.03.01 The conductor shall be Aluminium Core Steel Reinforced (ACSR) type. The conductor shall confirm to IS:398 (Part-II) except where otherwise specified herein.

15.03.02 Parameters of the conductor

a)	Code and standard	IS 398
b)	Name	MOOSE ACSR
c)	Overall diameter	31.77 mm
d)	Weight	2.004 kg/m
e)	Ultimate tensile strength	161.2 kN minimum
f)	Strands and wire diameter of	
	- Aluminium	54 / 3.53 mm
	- Steel	7 / 3.53 mm

15.03.03 The steel strands shall generally comply with the requirements stipulated for earthwire at clause 16.02.00 above.

15.03.04 Joints shall be permitted in the individual Aluminium wires in all layers except the outer most layer of the finished conductor. These joints shall be made by cold pressure butt-welding and shall be such that no two such joints are within 15 metres of each other in the complete stranded conductor.

15.03.05 The standard length of the conductor shall be 1600 meters for conductor and 2x2000 metres for earth wire. A tolerance of ± 5% on the standard length offered by the bidder shall be permitted. All lengths outside this limit of tolerance shall be treated as random lengths. Random lengths will be accepted provided no length is less than 70% of the standard length and the total quantity of random lengths shall not be more than 10% of the total quantity ordered.

15.04.00 **CONDUCTOR ACCESSORIES**

15.04.01 **Mid Span Compression Joint for Conductor**

As per details given in IS:2121 Part-2..

15.04.02 **Repair Sleeve**

Repair Sleeve of compression type shall be used to repair conductor with not more than two strands broken in the outer layer. The sleeve shall be manufactured from 99.5% pure aluminium and shall have a smooth surface. The repair sleeve shall comprise of two pieces with a provision of seat for sliding of the keeper piece. The edges of the seat as well as the keeper piece shall be of rounded that the conductor strands are not damaged during installation.

15.04.03 The Bidder shall clearly specify the before and after compression dimensions of the mid span compression joint and repair sleeve for owner's review. The compression pressure shall also be indicated by the Bidder.

15.04.04 **Vibration Damper for conductor and Earthwire**

A) Vibration dampers of 4 R-Stock bridge type with four (4) different resonance spread within the specified aeolian frequency bandwidth shall be used at all suspension and tension points on each span to damp out the Aeolean vibrations of the conductors to the specified level as mentioned hereinafter. Two dampers minimum on each side per conductor/earthwire shall be used at tension points and one damper minimum on each side per conductor at suspension points for ruling design span.

B) The clamp of the vibration damper shall be made of high strength aluminium alloy of type LM-6 or equivalent.

C) The messenger cable shall be made of high strength galvanised steel/stainless steel with a minimum strength of 135 kg/mm^2. It shall be of pre-formed and post-formed quality in order to prevent subsequent droop of weight and to maintain consistent flexural stiffness of the cable in service. The number of strands in messenger cable shall be 19. The messenger cable other than stainless steel shall be hot dip galvanised in accordance with the recommendations of IS:4826-1979 for heavily coated wires.

D) The manufacturer must indicate the clamp bolt tightening torque to ensure that the slip strength of the clamp is maintained between 2.5 KN and 5KN. The clamp when

installed on the conductor shall not cause excessive stress concentration on the conductor leading to permanent deformation of the conductor strands and premature fatigue failure in operation.

E) The vibration damper for conductor shall not have magnetic power loss more than 0.5 watt at 350 amps at 50 Hz alternating current.

F) The vibration analysis of the system, with and without damper and dynamic characteristics of the damper shall have to be submitted by the Bidder .

G) The damper placement chart shall be submitted by the Bidder. All the placement charts should be duly supported by relevant technical documents and sample calculations.

H) The damper placement charts shall include the following:

i) Location of the dampers for various combinations of spans and line tensions clearly indicating the number of dampers to be installed per conductor/earthwire per span.

ii) Placement distances clearly identifying the extremities between which the distances are to be measured.

iii) Placement recommendation depending upon type of suspension clamp (viz Free centre type, Armour grip type, etc.)

iv) The influence of mid span compression joints, repair sleeves and armour rods (standard and AGS) in the placement of dampers.

15.05.00 **EARTHWIRE ACCESSORIES**

15.05.01 Mid Span Compression Joint for Earthwire

It shall be used for joining two lengths of earthwire. The joint shall be made of mild steel. The steel sleeve should not crack of fail during compression in it or service period. The Brinnel Hardness of steel should not exceed 200. The steel sleeve shall be hot dip galvanised. The joints shall not permit slipping off, damage to , of failure of the complete earthwire or any part thereof at a load not less than 95% of the ultimate tensile strength of the earthwire. The joint shall have resistivity less than 75% of resistivity of equivalent length of earthwire. The details of the joint shall be submitted for owners approval.

15.05.02 **Vibration Damper For Earthwire**

Refer Clause 16.04.04 detailed above.

15.05.03 **Flexible Copper Bond**: As detailed in is:2121 part3.

15.05.04 Suspension Clamp for Earthwire : As Detailed in IS:2121 Part3

15.05.05 **Tension Clamp for Earthwire**

The details shall be as per IS:2121 part-3. Only Compression type tension clamp shall be used to hold galvanised steel earthwire. Anchor shackle shall be supplied which shall be suitable for attaching the tension clamp to strain plates. The strain plates supplied with the towers will have a minimum thickness of 8 mm with a hole

of 17.5 mm diameter. Suitable lugs for jumper connection shall also be supplied alongwith necessary bolts and nuts.

15.06.00 **HARDWARE FITTINGS**

15.06.01 The hardware fittings shall be as per the specification and IS/IES standards

15.06.02 Each hardware fittings shall be supplied complete in all respects and include the following hardware parts:

a) Ball hook for suspension hardware fittings suitable for attaching to V-hanger of the tower. Anchor shackle shall be supplied, which shall be suitable for attaching the tension hardware fittings to strain plate, of the tower.

b) Suitable yoke plates

c) Suspension and dead end assembly to suit conductor size.

d) Other necessary fittings such as eye links, ball clevis, socket clevis, clevis eye, U-clevis, ball link, arcing horn etc. to make the hardware fittings complete.

e) 2.5% extra fasteners shall be supplied along with the hardware fittings.

f) Socket fittings shall be provided with only R-shaped security clip in accordance with IS-2486 (part-II).

15.07.00 **ANTI FOG DISC INSULATOR**

15.07.01 The size of disc insulator, the number to be used in different type of strings, their electromechanical strength and minimum creepage distance shall be as follows :

Type of String	Size of disc insulator (mm)	Min. creepage distance of each disc (mm)	No. of standard discs	Electro-mechanical strength of insulator string (kN)
Single Suspension	255/280 x 145	430	1x 23	120
Double Suspension	-do-	-do-	2x 24	2 x 120
Double tension	-do-	-do-	2x 24	2 x 120
Single tension	-do-	-do-	1x 24	120

Note: Single Suspension (Pilot) string will be used for jumpers of tension type towers. It will be similar to single suspension type except the clamp of the conductor.

A) Disc Insulator: The insulator shall be pin and cap ; ball and socket type. The disc insulator shall conform to IS:731.

B) Ball and Socket Designation

The dimensions of the balls and sockets shall be of 20 mm designation, for 90KN/120KN disc insulator in accordance with the standard dimensions stated in IS:2486-(Part-II)/IEC:120.

As alternate contractor may also offer long rod composite insulator for the above application.

15.07.02 **Materials**

A) Porcelain : The porcelain used in the manufacture of shells shall be sound, free from defects thoroughly vitrified and smoothly glazed.

B) Glaze: The finished porcelain shall be glazed in brown colour. The glaze shall cover all exposed parts of he insulator and shall have a good lustre, smooth, surface and good performance under the extreme weather conditions of a tropical climate. It shall not be cracked or chipped by ageing under the normal service conditions. The glaze shall have the same co-efficient of expansion as of the porcelain body throughout the working temperature range.

C) Toughened Glass: In case of glass insulator, the glass used for the shells shall be sound, free from defects such as flows, bubbles, inclusions etc. and be of uniform toughness over its entire surface. All exposed glass surfaces shall be smooth.

D) Cement: Cement used in the manufacture of the insulator shall not cause fracture by expansion or loosening by contraction. The cement shall not give rise to chemical reaction with metal fittings and its thickness shall be as small and uniform as possible. Proper care shall be taken to correctly centre and locate individual parts during cementing.

E) Pins and Caps: Pins and Caps shall be made of drop forged steel and malleable cast iron/spheriodal graphite iron/drop forged steel respectively, duly hot dip galvanised and shall not be made by jointing, welding, shrink fitting or any other process from more than one piece of material.

F) Security Clips: Security clips shall be made of good quality stainless steel or phosphor bronze as per IS:1385-1968 2.5% extra Security clip shall be provided.

15.07.03 OPTICAL GROUND WIRE AND ACCESSORIES

General

This specification covers the provision of one peak of 400kV tower with Optical Fiber (OPGW). This optical fiber cable will be connected to suitable optical line terminal and multiplex equipment to form part of the Plant's overall communications transmission system. Any expected variation shall be clearly identified in the Bidder's Proposal. Bidder to ensure that optical fiber characteristic of the OPGW cable to be supplied shall be compatible with the existing OPGW cable if any.

Physical Characteristic

Dual-Window Single mode (DWSM), G.652D optical fibres (minimum 24 fibres) shall be provided in the fibre optic cables. DWSM optical fibres shall meet the requirements defined in Table 1-1(a).

Attenuation

The attenuation coefficient for wavelengths between 1525 nm and 1575 nm shall not exceed the attenuation coefficient at 1550 nm by more than 0.05 dB/km. The attenuation coefficient between 1285 nm and 1330 nm shall not exceed the attenuation coefficient at 1310 nm by more than 0.05 dB/km. The attenuation of the fibre shall be distributed uniformly throughout its length such that there are no point discontinuities in excess of 0.10 dB. The fibre attenuation characteristics specified in table 1-1 (a) shall be "guaranteed" fibre attenuation of any & every fibre reel. The overall optical fibre path attenuation shall not be more than calculated below:

- Maximum attenuation @ 1550nm: 0.21 dB/km x total km + 0.05 dB/splice x no. of splices + 0.5 dB/connector x no. of connectors
- Maximum attenuation @ 1310nm: 0.35dB/km x total km + 0.05 dB/splice x no. of splices + 0.5 dB/connector x no. of connectors

Construction

The OPGW (Optical Ground Wire) cable is proposed to be installed on the EHV transmission lines. The design of cable shall account for the varying operating and environmental conditions that the cable shall experience while in service. The OPGW cable to be supplied shall be designed to meet the overall requirements of all the transmission lines. The Bidder shall design the OPGW requirements to suit each span in the system, based on the applicable drawings and field surveys. The Bidder's proposal shall stipulate the characteristics of the OPGW required for each span in the system.

Optical Fibre Identification

Individual optical fibres within a fibre unit and fibre units shall be identifiable in accordance with EIA/TIA 598 or IEC 60304 or Bellcore GR-20 colour-coding scheme.

Colouring utilized for colour coding optical fibres shall be integrated into the fibre coating and shall be homogenous. The colour shall not bleed from one fibre to another and shall not fade during fibre preparation for termination or splicing.

Each cable shall have traceability of each fibre back to the original fibre manufacturer's fibre number and parameters of the fibre. If more than the specified number of fibres is included in any cable, the spare fibres shall be tested by the cable manufacturer and any defective fibres shall be suitably bundled, tagged and identified at the factory by the vendor.

Table1-1(a)
DWSM Optical Fibre Characteristics

Fibre Description:	Dual-Window Single-Mode
Mode Field Diameter:	8.6 to 9.5 µm (± 0.6µm)
Cladding Diameter:	125.0 µm ± 1 µm
Mode field concentricity error	≤ 0.6µm
Cladding non-circularity	≤ 1%
Cable Cut-off Wavelength λ_{cc}	≤ 1260 nm
1550 nm loss performance	As per ITU-T G.652 D
Proof Test Level	≥ 0.69 Gpa
Attenuation Coefficient:	@ 1310 nm ≤ 0.35 dB/km @ 1550 nm ≤ 0.21 dB/km
Chromatic Dispersion; Maximum: Zero Dispersion Wavelength: Zero Dispersion Slope:	18 ps/(nm x km) @ 1550 nm 3.5 ps/(nm x km) 1288-1339nm 5.3 ps/(nm x km) 1271-1360nm 1300 to 1324nm 0.092 ps/(nm2xkm) maximum
Polarization mode dispersion coefficient	≤ 0.2 ps/km^½
Temperature Dependence:	Induced attenuation ≤ 0.05 dB (-60°C - +85°C)
Bend Performance:	@ 1310 nm (75±2 mm dia Mandrel), 100 turns; Attenuation Rise ≤ 0.05 dB @ 1550 nm (30±1 mm radius Mandrel), 100 turns; Attenuation Rise ≤ 0.05 dB @ 1550 nm (32±0.5 mm dia Mandrel, 1 turn; Attenuation Rise ≤ 0.50 dB

Buffer Tube Loose tube construction shall be implemented. The individually coated optical fibre(s) shall be surrounded by a buffer for protection from physical damage during fabrication, installation and operation of the cable. The fibre coating and buffer shall be strippable for splicing and termination. Each fibre unit shall be individually identifiable utilizing colour coding. Buffer tubes shall be filled with a water-blocking gel.

Optical Fibre Strain & Sag-Tension chart

The OPGW cable shall be designed and installed such that the optical fibres experience no strain under all loading conditions defined in IS 802. Zero fibre strain condition shall apply even after a 25 year cable creep.

While preparing the Sag-tension charts for the OPGW cable the following conditions shall be met:

- The Max Allowable Tension (MAT) / max strain shall be less than or equal to the MWT/ Strain margin of the cable.
- The sag shall not exceed the earth wire sag in all conditions.
- The Max Allowable Tension shall also be less than or equal to 0.4 times the UTS.
- The 25 year creep at 25% of UTS (creep test as per IEEE 1138) shall be such that the 25 year creep plus the cable strain at Max Allowable Tension (MAT) is less than or equal to the cable strain margin.
- The everyday tension (EDT) shall not exceed 20% of the UTS for the OPGW cable.

2.13.01
The Sag-tension chart of OPGW cable indicating the maximum tension, cable strain and sag shall be calculated and submitted for owners review.

Cable Materials

The materials used for optical fibre cable construction, shall meet the following requirements:

Filling Materials

The interstices of the fibre optic unit and cable shall be filled with a suitable compound to prohibit any moisture ingress or any water longitudinal migration within the fibre optic unit or along the fibre optic cable. The water tightness of the cable shall meet or exceed the test performance criteria as per IEC 60794-1-F-5.

The filling compound used shall be a non-toxic homogenous waterproofing compound that is free of dirt and foreign matter, nonhygroscopic, electrically nonconductive and non-nutritive to fungus. The compound shall also be fully compatible with all cable components it may come in contact with and shall inhibit the generation of hydrogen within the cable.

The waterproofing filling materials shall not affect fibre coating, colour coding, or encapsulant commonly used in splice enclosures, shall be dermatologically safe, non-staining and easily removable with a non-toxic cleaning solvent.

Metallic Members

When the fibre optic cable design incorporates metallic elements in its construction, all metallic elements shall be electrically continuous.

Optical Ground Wire (OPGW)

OPGW cable construction shall comply with IEEE-1138, 2009. The cable provided shall meet both the construction and performance requirements such that the ground wire function, the optical fibre integrity and optical transmission characteristics are suitable for the intended purpose. The cable shall consist of optical fibre units as defined in this specification. There shall be no factory splices

within the cable structure of a continuous cable length.

The composite fibre optic overhead ground wire shall be made up of multiple buffer tubes embedded in a water tight aluminium/aluminium alloy/stainless steel with aluminium coating protective central fibre optic unit surrounded by concentric-lay stranded metallic wires in single or multiple layers. Each buffer tube shall have maximum 12 no. of fibres. All fibres in single buffer tube or directly in central fibre optic unit is not acceptable. The dual purpose of the composite cable is to provide the electrical and physical characteristics of conventional overhead ground wire while providing the optical transmission properties of optical fibre.

Central Fibre Optic Unit

The central fibre optic unit shall be designed to house and protect multiple buffered optical fibre units from damage due to forces such as crushing, bending, twisting, tensile stress and moisture. The central fibre optic unit and the outer stranded metallic conductors shall serve together as an integral unit to protect the optical fibres from degradation due to vibration and galloping, wind and ice loadings, wide temperature variations, lightning and fault current, as well as environmental effects which may produce hydrogen.

The OPGW design of dissimilar materials such as stainless steel tube with aluminium or aluminium –clad-steel wire strands are not allowed. Central fibre optic unit may be of aluminium or stainless steel tube with aluminium protective coating. In case of aluminium protective coating, the coating must completely cover the tubes leaving no exposed areas of tubing that can make electrical contact either directly or indirectly through moisture, contamination, protrusions, etc with the surrounding stranded wires. The tube may be fabricated as a seamless tube, seam welded, or a tube without a welded seam.

Basic Construction

The OPGW cable construction shall conform to the applicable requirements of this specification, applicable clauses of IEC 61089 related to stranded conductors and Table given below for OPGW Mechanical and Electrical Characteristics. In addition, the basic construction shall include bare concentric-laystranded metallic wires with the outer layer having left hand lay. The wires may be of multiple layers with a combination of various metallic wires within each layer. The direction of lay for each successive layer shall be reversed. The finished wires shall contain no joints or splices unless otherwise agreed to by the Employer and shall conform to all applicable clauses of IEC 61089 as they pertain to stranded conductors.

The wires shall be so stranded that when the complete OPGW is cut, the individual wires can be readily regrouped and then held in place by one hand.

Breaking Strength

The rated breaking strength of the completed OPGW shall be taken as no more than 90 percent of the sum of the rated breaking strengths of the individual wires,

calculated from their nominal diameter and the specified minimum tensile strength.

The rated breaking strength shall not include the strength of the optical unit. The fibre optic unit shall not be considered a load bearing tension member when determining the total rated breaking strength of the composite conductor.

Electrical and Mechanical Requirements

Below table provides OPGW Electrical and Mechanical Requirements for the minimum performance characteristics.For the purposes of determining the appropriate Max Working Tension limit for the OPGW cable IS 802:1995 and IS 875: 1987 shall be applied.

OPGW Electrical and Mechanical Requirements

Everyday Tension	≤ 20% of UTS of OPGW
D.C. Resistance at 20ºC:	< 1.0 ohm/Km
Short Circuit Current	≥ 6.32 kA for 1.0 second

Since OPGW shall be located at the top of the transmission line support structure, it will be subjected to Aeolian vibration, Galloping and Lightning strikes. It will also carry ground fault currents. Therefore, its electrical and mechanical properties shall be same or similar as those required of conventional ground conductors.

Assemblies and Line Accessories

a. General

The OPGW assemblies and line accessories shall consist of the hardware indicted herein. All hardware and accessories shall be made of aluminum, aluminum alloy, malleable iron, steel (metal mold of drop forging process), stainless steel, or non-ferrous metal, unless otherwise specified. In addition, all hardware and accessories shall have an ultimate tensile strength equal to or exceeding the rated ultimate tensile strength of the overhead ground wire. All metal shall be free from burrs, sharp edges, lumps and dross and shall be smooth so that interconnecting parts will fit properly, and so that the parts maybe assembled and readily.

All bolts and other fasteners shall be installed according to manufacturer's recommendations. Materials no specifically covered herein by detailed specifications shall be of standard commercial quality suitable for the intended use. The Contractor shall determine the most suitable type of clamp to be used at each and every transmission tower location.

b. Suspension Clamps

The suspension clamps for the OPGW shall be of bolt or performed type. The bolt type suspension clamps shall be complete with bolts, keeper pieces, and other

required parts. Each clamp shall be capable of holding the OPGW without slipping under an unbalanced tension of 25% of the ultimate tensile strength of the OPGW.

c. Tension Clamps

The tension clamps shall be of bolt or performed type, and cable of holding the OPGW without slipping or damaging the OPGW under a tension of 75% of the OPGW ultimate tensile strength. A suitable piece shall be of same material as the clamp body. Bolts, nuts and washers shall be hot-dipped galvanized malleable iron or steel.

d. Grounding clamps and Parallel Groove Clamp

Each clamp shall be capable holding the OPGW using bolts and nuts.

e. Vibration dampers

Stock bridge type vibration dampers, suitable for use on the OPGW shall be supplied. The dampers shall have an aluminum, clamping bolts, or other suitable device, on the galvanized wire between the weights, and be suitable for attachment to the OPGW. The damper clamp shall be designed to permit installation and removal using hot line tools. Each damper weight, subject to the accumulation of moisture, shall be provided with one drain hold positioned at the bottom of the weight when the damper is installed in the vertical plane. Damper weights shall be made of hot dip galvanized case iron or zinc.

f. Armor rods

The armor rods for the OPGW shall be of the preformed type. They shall be smooth and fee from corrosion, splitting, cracking, or any other defects. They shall be designed to effectively protect the OPGW from fatigue caused by vibration.

Armor rods may or may not be employed, as per OPGW manufacturer recommendations, however the use of armor rods is preferred by the Employer.

g. The joint box shall be air-tight, water-proof. The cover shall be securely fastened to the case by non-loosening fasteners. Both the case and the cover shall be made of non-corrosive aluminum alloy or hot dip galvanized steel or approved materials. The joint box shall be sufficiently rugged and sturdy to withstand outdoor climatic and environmental conditions. The joint box shall accommodate sheath protected arc-fusion splices and up to 1.5 m of additional fiber on each side of the splice; guides shall be provided to keep the extra fiber well above the allowable bending radius of the fiber. The spliced parts of the optical fiber within the joint box shall be reinforced and free from tension after completion of the splicing.

The contractor shall provide one set of terminating materials with every joint box for optical fiber connection.

All splices shall be encased in Fibre Optic Splice Enclosures. Suitable splice enclosures shall be provided to encase the optical cable splices in protective, moisture and dust free environment. Splice enclosures shall comply with ingress protection class IP 66 or better. The splice enclosures shall be designed for the storage and protection of required number of optical fibre splices and equipped with

sufficient number of splice trays for splicing all fibres in the cable. No more than 12 fibres shall be terminated in a single splice tray. They shall be filled with suitable encapsulate that is easily removable should re-entry be required into the enclosures.

Splice enclosures shall be suitable for outdoor use with each of the cable types provided under this contract. Splice enclosures shall be appropriate for mounting on transmission line towers above anti-climb guard levels at about 10 metres from top of the tower and shall accommodate pass-through splicing. Contractor shall be responsible for splicing of fibres and installation of splice enclosures.

15.07.04 **Hot Line Maintenance**

The insulators offered shall be suitable for employment of hot line maintenance technique so that the usual hot line operations can be carried out with ease, speed and safety.

Bidders shall indicate the methods generally used in the routine hot and dead line maintenance of HV lines for which similar insulator have been supplied by them. Bidders shall also indicate the recommended periodicity of such maintenance.

16.00.00 TESTS FOR TRANSMISSION LINE MATERIAL

16.01.00 GENERAL REQUIREMENTS

16.01.01 The materials shall conform to all the type tests as per relevant standards. The acceptance, routine tests and tests during manufacturer shall be carried out on the line material as per relevant standards.

DETAILED SURVEY REPORT OF 400KV TRANMISSION LINE AT 2X800MW NTPC LARA STAGE-II, CHATTISGARH		
Comment Resolution Sheet		
S.No.	**NTPC Comments dtd 20/09/24**	**Reply 31/12/24**
1	PLEASE LIST OUT AND TABULATE TREES IN THE TRANSMISSION LINE CORRIDOR AS PER CLAUSE NO. 11.02.00 OF SUB-SECTION B-17 OF TECHNICAL SPECIFICATIONS.	Tree counting details & schedule is enlosed in the report at Annexure B. Geotech report to be submitted separately.
2	ALSO LIST OUT ALL PERMANENT FACILITIES SUCH AS TREES, BUILDINGS, PIPES ETC. WITHIN 13.5 M ON BOTH SIDES OF ALIGNMENTARE TO BE INCLUDED.	Updated & revised.
3	ALSO FURNISH CONCURRENCE OF NTPC SITE ON ROUTE SURVEY.	NTPC to kinldy inform if any further changes are required
4	ALSO PROVIDE COORDINATES AS PER THE PLANT COORDINATE SYSTEM AND GPS (LAT/LONG). MARK ALL EXISTING FACILITIES IN THE ROW.	Updated & revised.
5	MARK HORIZONTAL AND VERTICAL CLEARANCE/DISTANCE FROM EXISTING FACILITIES LIKE ATMS, POWER LINES, ROAD, TOWERS, TREES, BOUNDARY ETC. ETC.	Updated & revised.
6	PLS Correct?	Updated & revised.
7	Check of Clearance??	Updated & revised.
8	Add Row for remark on Permanent Faclities at different chainages.	Updated & revised.
9	Indicate Permanent featureswithing 13.5m on both sides of route.	Updated & revised.
10	Mark elevation in terms of reduced level. Wrong benchmark considered.	Updated & revised.
11	Please check for clearance with existing66kV line.	Updated & revised.
12	mark transmission line corridor in plan. Also, check with existing and new pipeline routig.	Updated & revised.
13	OPTION OF SHIFTING THIS TOWER INSIDE PLANT BOUNDARY COULD ALSO BE EXPLORED IN CASE OF CLEARANCE AND SPACE CONSTRAINTS,	Updated & revised.
14	AP-3 Pls explore in this area.	Updated & revised.
15	Check clearance from existing line.	Updated & revised.
16	Check for location of telecom tower in this area.	Updated & revised.
17	Please re-route to avoid fouling with existing parking	Updated & revised.
18	Explore AP-2 location in this area.	Updated & revised.
19	MARK LEGEND FOR ALL FACILITIES, LIKE ROAD, POWER LIKES, TELECOM TOWER, ATM, BUILDING BOUNDARY LINE, DRAIN, NALLAH ETC IN PLAN.	Updated & revised.

REV1

DETAILED SURVEY REPORT OF 400KV TRANMISSION LINE AT 2X800MW NTPC LARA STAGE-II, CHATTISGARH

SEPT, 2024

Survey Consultants

THE DESIGNERS CONSORTIUM

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1 PROJECT DESCRIPTION

1.1 INTRODUCTION

National Thermal Power Corporation (NTPC) is currently in the process of setting up LARA STPP -II which shall be the extension project of LARA STPP-I (2X800 MW) and would comprise of two (2) Nos. of coal fired unit of capacity 800 MW each. Step up/power evacuation voltage of Stage-I of the project is 400KV. Under Stage-I of the project, provision of One no. 400kV twin D/C line up to Raigad Kotra pooling station has been considered for connectivity. One no. 400kV Quad D/C line to Champa pooling has also been kept for evacuation of power as finalized in Western Region Standing Committee Meeting/LTA& Connectivity meeting.

Under stage-II, two more units of 800 MW units are considered making the ultimate project capacity as 3200 MW. A number of IPPs are coming in this vicinity of Raigarh-Korba complex of Chhattisgarh., the bulk power generated in this region shall be exported to power deficit region of WR and NR. Major 765 kV/400 kV pooling stations in this vicinity are being implemented by Central Transmission utility for bulk transmission of power through high capacity 765 kV and 800 kV HVDC corridors to facilitate exchange of the quantum of power from generation projects proposed to be located in eastern part of WR to Central/Western part of WR and NR. Considering above aspect, the step up/power evacuation voltage for stage-II has been considered at 400 kV for interconnection to stage-I.

Bharat Heavy Electricals (BHEL) has been awarded by the job of design, engineering, manufacture, supply, construction, erection, testing & commissioning with civil & structural works for the EPC package with steam generator capable of biomass co-firing, steam turbine, generator & auxiliaries, emission control systems, control and instrumentation, balance of plant packages etc.

For preparing the transmission lines bill of quantities before the actual construction work takes place, detailed survey along with details of features en-route, details of obligatory point and important crossing is an essential requirement. Keeping above in view, the

contractor BHEL in consultation with owner proposed to conduct a detailed survey of the proposed transmission line.

While planning the above transmission lines, various alternative routes and feasible alignments for these transmission lines were examined in detail. For undertaking such studies, the major requirement is to obtain adequate information regarding topography, terrain, physical constraints, environmental factors, etc. along the route of the line so that optimum solution is identified.

As transmission lines traverse across the country, for evacuation of power from generating station to load/distribution centres, the topographical & geographical nature of the terrains play significant influence in the project cost and implementation time. Hence it is essential that at the planning stage itself various alternative routes and technical solutions for transmission lines be examined in detail. For undertaking such studies, the major requirement is to obtain adequate information regarding physical constraints, environmental factors, etc. along the route so that optimum solutions are identified. Subsequently, during implementation of the project, it is required to obtain details about terrain, soil conditions, ground water level, etc. along the route for proper resource planning, costing, etc. as well as reduction in implementation time. In recent times, remote sensing technology is being used in this field by means of satellite imageries and GPS equipments. Using GPS devices, it is possible to navigate any location on the ground with reasonable accuracy out to sub centimetre level

1.2 OBJECTIVE

The detailed survey and route alignment features have been covered to address the environmental and social needs of the area affected by the transmission line. The key features of the detailed survey & route alignment objective are

- Minimize transmission length
- Minimize vegetation loss,
- Minimize disturbance to plain & mountain ecosystem;
- Protect soils and minimize slope instability,

- Avoid settlements and economic land use.
- Minimize future operating & maintenance cost.

The key design features adopted for the transmission line are presented in the following table considering all engineering aspects and environmental and social parameters.

Table: Key Design Features

Item Description	400kV D/C Transmission Line for interconnection
Line length (km)	1.178km
Number of Towers/Gantry	5 tower & 2 gantry
Average span (m)	176.38m
Right of way width (ROW)	46m

Proposed 'Right of Way' for the transmission line is 23m on either side. During survey, effort has been made to take the line away from settlements and to minimize infringement of forest area, to the extent possible. This can be achieved easily by careful selection of route. Conventionally lands are not acquired for ROW in India except at the base of the towers where compensation has to be given. There will not be any problem in continuing the normal agricultural activities where minimum vegetation clearances are maintained.

1.3 LINE CLEARANCES

Minimum Ground Clearance

The minimum clearance above ground as per sub rule 4 of Rule 77 of IE Rules 1956 (latest revision) for 400 kV AC system and for 400 kV HVDC systems as adopted in India are as under:

Nominal Voltage	66	132	220	400	800	± 500
Minimum Ground Clearance (mm)	5500	6100	7000	8800	12400	12500

To the above clearance, an additional clearance of 150 mm is added to provide for uneven ground profile and possible sagging error.

Minimum Clearance above River/Lakes

The minimum clearance of Power Conductor over the highest flood level in case of non-navigable rivers shall be as follows:

Nominal Voltage	Minimum clearance above HFL (mm)
66	3650
132	4300
Nominal Voltage	Minimum clearance above HFL (mm)
220	5100
400	6400
800	9400
± 500	6750

For navigable rivers, clearances are fixed in relation to the tallest mast in consultation with the concerned navigational/port authorities.

Minimum Clearance above Buildings:

As per Indian Electricity Rules 1956 (rule 80) - Minimum vertical clearance from building

- For HV lines up to & including 33 KV – 3.7 m
- For EHV lines 33kV > 3.7 m +0.3 m for every additional 33 KV or part of thereof

Minimum horizontal clearance between the nearest conductor and building on any part of such building on the basis of maximum deflection due to wind pressure be not less than

- For HV lines up to & including 11 KV > 1.2 m
- For HV line above 11 KV & up to – 2.0 m
- For EHV lines above 11kV > 2.0 m +0.3 m for every additional 33 KV or part of thereof

For above clearances term “building” should deem to include any structure whether permanent or temporary.

Power Lines Crossing Each Other:

The minimum electrical clearances between the lowest power conductor of crossing line over the crossed line as per Rule 87 of IE Rule 1956 is given as under:

Nominal Voltage	Minimum Clearance (in m) between line crossing each other					
	Low & Medium	11-66 KV	110-132 KV	220 KV	400 KV	800 KV
11-66 KV	2.44	2.44	3.05	4.58	5.49	7.94
110-132 KV	3.05	3.05	3.05	4.58	5.49	7.94
220 KV	4.58	4.58	4.58	4.58	5.49	7.94
400 KV	5.49	5.49	5.49	5.49	5.49	7.94
800 KV	7.94	7.94	7.94	7.94	7.94	7.94

Power line crossing Communication Lines

The minimum clearances to be maintained between power lines and communication lines as per “Code of Practice for Protection of Telecommunication Line Crossings with Overhead Power Lines” should be as follows:

Nominal Voltage	11-66 KV	110-132 KV	220 KV	400 KV	800 KV
Minimum clearance between power conductor crossing telecommunication line (mm)	2440	2750	3050	4480	7900

Power Line Crossing Railway Tracks:

The minimum vertical clearance between the lowest conductors of a power line crossing the railway track as per "Regulations for Power Line Crossings of Railway Tracks – 1987" shall be as follows:

The minimum vertical clearances above rail track as also the highest working point of the jib when crane is deployed and the lowest point of any conductor of crossing including ground wire under condition of maximum sag are given as under:-

Nominal Voltage	Minimum Clearance (mm)	
	Above Rail Track	Above Crane
66	14100	2000
132	14600	2500
220	15400	3500
400	17900	6000
800	22000	9500

Power Line Running Along or Across the Roads:

The minimum clearance above ground for 66 kV and higher voltage power lines running along or across the road shall be 6.1 m as per Rules 77 of IE Rule 1956. As per electrostatic field effect of EHV transmission lines, the minimum clearance for line passing over the road shall be corresponding to field gradient of 10kV/m. It should not cause a short circuit current of more than 5 MA through an individual on touching a vehicle standing below the line.

2 PHILOSOPHY OF DETAILED SURVEY

2.1 Route Selection - Assessment & Management Process

Route Selection is the major criteria for any transmission line. At the system planning stage itself one of the factors that govern the evolution of system is the possible infringement with the forest. Wherever such infringements are substantial, different alternative options are considered. While identifying the transmission system for a generation project or as a part of National Grid, preliminary route selection is done based on the Topographical sheets collected from Survey of India and Forest Atlas (Govt. of India Publication). During route alignment all possible efforts are made to avoid the forest area involvement and to keep it to the barest minimum. Moreover, in forest areas trees are felled only below each conductor to facilitate stringing. On completion of construction only one such strip is maintained for O&M purpose. Therefore the actual loss of forest is restricted to some selected area only. However, as per the requirement of Forest (Conservation) Act 1980, approval of Ministry of Environment & Forest, Government of India for diversion of forest land shall be taken and compensatory afforestation shall be done on double the area of degraded forest land to compensate the loss of vegetation.

For the proposed lines there is minimum forest involvement and the most criteria to take the alignment in optimum way by avoiding habitation and good connectivity by roads for ease of construction and operation & maintenance purpose.

2.2 Study of Alternatives

Approach towards Route selection

For selection of optimum route, the following points are taken into consideration:

- The route of the proposed transmission line does not infringe any human habitation.
- The route of the transmission line does not affect any monument of cultural or historical importance.
- The proposed route of transmission line does not create any threat to the survival of any community with special reference to Tribal Community.

- The proposed route of transmission line does not affect any public utility services like playgrounds, schools, other establishments etc.
- The line route does not pass through any sanctuaries, National Park etc.
- The line route does not infringe with area of natural resources.

Sensitive areas and settlements at execution stage

- As a rule, alignments are generally kept 10-15 km away from major towns, whenever possible, making a provision for future urban expansion.
- Similarly, forests are avoided to the extent possible, and when it is unavoidable, a route is selected in consultation with the local Divisional Forest Officer, that causes minimum damage to existing forest resources.
- Selected Alignments do not infringe wetlands and unstable areas for both financial and environmental reasons. Additional care has to be taken to avoid National parks and sanctuaries and any other forest area inhabited by wild life.
- The following types of towers shall be used:
    - A. Type up to - 0 - 2 Degree
    - B. Type up to - 2 - 15 Degree
    - C. Type up to - 15 -30 Degree
    - D. Type up to - 30- 60 Degree

Keeping above factors in mind various alternative routes were studied and most optimum route was provided for the detailed survey and covered in this report. All such different alternatives were studied with the help of Govt. published data like Forest atlas, Survey of India topo maps, satellite imageries etc. to arrive at most optimum route which was taken up for detailed survey and assessment of environmental & social impacts for their proper management.

2.3 Detailed Survey

Once the route alignment is optimized, the detailed survey has been done by picking up levels at every 100m interval or less, depending upon the terrain. The data has been collected in such a fashion that it is being capable to be used by suitable software on

Auto CAD platform for the tower optimization. During the course of detailed survey, following points also kept in consideration:

- Requirement of special tower, if any, for river/power line crossing or actual site conditions demand.
- From the centerline of the route alignment 13meter strip on both side of centre line to be shown in protected/reserved forest area where tree cutting is involved, classification of trees, its full dimension is to furnished.
- Details of existing HV/LV Power Line and river crossings shall be taken.
- Geographical details such as river flooding areas, water reservoir or other settlement, agricultural lands, forest etc.
- Data for clearance from PTCC.
- Soil classification, recommendation on type of foundations including special foundation for different types of towers en-routed the line including water table.
- Identification of landslide zone and land settlement zones to ascertain tendency of sinking of foundation.

2.4 Profiling & Tower Spotting

Ground profile and tower spotting has been done using PLSCADD. The route plan and level profile has been plotted and prepared to the scale of 1:2000 horizontal and 1:200 vertical as per established procedure. If the difference in levels were too high, the chart may be broken up according to requirement. The chart shall progress from left to right. The estimation of different type of tower foundations and towers, their quantities, extensions if required, suitable ground clearance, observing requisite safety clearance from buildings & power lines etc. along with requirement of special tower, if any, for river/power line crossing or actual site conditions demand has been considered.

Sag Tension report along with Wind & Weight Span Report of the two lines are enclosed at Annexure ‘A’ & ‘B’ respectively.

2.5 Salient Feature of Routes

Route I

400kV Double Circuit Line		
Route Length	:	1313.45m

No. of Angle Points	:	5 Nos.
Bee Line Length	:	1.048km
Major Crossings	:	
High Tension Lines	:	1 crossing
Medium Voltage Lines	:	2 crossing
Road	:	2 crossing
Railway Lines	:	Nil
National Highways	:	Nil
State Highways	:	Nil
River Crossings	:	Nil
Forest Area	:	Nil
Coal Belt	:	Nil

Route II

400kV Double Circuit Line		
Route Length	:	1259.87m
No. of Angle Points	:	5 Nos.
Bee Line Length	:	1.048km
Major Crossings	:	
High Tension Lines	:	1 crossing
Medium Voltage Lines	:	3 crossing
Major Road	:	2 crossing
Railway Lines	:	Nil
National Highways	:	Nil
State Highways	:	Nil
River Crossings	:	Nil
Forest Area	:	Nil
Coal Belt	:	Nil

3 SALIENT FEATURES OF TRANSMISSION LINE

3.1 General

The primary consideration for design and estimation of transmission lines is walkover survey, which is carried out based on topographical map/forest map of India and with help of GPS. Also type of terrain, i.e., plain, hilly, forest stretch etc. likely to be encountered has been taken into consideration by visual inspection while estimating the quantities.

3.2 The Wind Zone

The identification of the wind zone is based on the wind zone map given in IS: 875 (part-I)/IS: 802.

3.3 Design Criteria

The design parameters are generally based on the report of standardization committee of CEA. The details of equipment have been given in subsequent clauses. The conductor maximum temperature of 85^0C has been considered to have higher thermal capacity.

3.4 Line Configuration

Double Circuit (D/C) 400kV line shall have vertical configuration of conductors. The configuration of suspension insulator shall have “I” Type Configuration.

3.5 Towers

Self-supporting latticed bolted steel towers, fabricated from structural steel angle section shall be used. Tower components and bolts & nuts shall be hot dip galvanized. Normally the following four types of double circuit towers shall be used in these lines:

- A type suspension towers for 0-degree angle of deviation in plain terrain only.
- B type tension towers up to 15-degree angle of deviation. These may also be used as section towers.

- C type tension towers up to 30-degree angle of deviation. These may also be used as section towers and also as transposition towers.
- D type tension towers up to 60-degree angle of deviation and suitable for dead end condition. These may also be used for terminal locations.

In addition to above, special towers for major river crossing (if any), power line crossing and the places where the terrain is particularly different, such as approach to the sub-station; forest stretches etc. shall also be used. All standard and special towers shall be designed in accordance with the latest edition of IS: 802 (part I).

3.6 Conductors

For 400 kV DC lines, Moose ACSR conductors of overall diameter 31.77mm shall be used per phase.

3.7 Earthwire

Two 7/3.15mm galvanized steel earthwire shall be used on the line so that it can withstand two successive lightning stroke of 150 kA. Shielding angles of 30 degree is considered for transmission lines.

3.8 Grounding

The tower footing resistance shall be kept below 10 ohms. Normally pipe type grounding shall be used. In case of rocky ground where the ground resistance is high, counterpoise earthing shall be used to bring the tower footing resistance down to acceptable level.

3.9 Insulator and Hardware Fittings

High strength glazed electro porcelain/toughened glass disc insulators/ Porcelain long rod insulators shall be used. In case of disc insulators, the following types of insulator strings along with hardware fittings shall be used

	No of discs	Diameter	Ball to ball spacing	Nominal creepage distance	Electro-mechanical strength	
					Disc	String
		(mm)	(mm)	(mm)	(kN)	(kN)
a) 1x23 single 'I' suspension	23	255/280	145	315	120	120

b) 1x24 single tension	24	255/280	145	315	120	120

Note: Equivalent porcelain long rod insulators/composite insulators shall also, to be considered for use based on the result of detailed studies

Item (a) and (b) are mostly used for suspension and tension towers respectively. Item (b) also shall be used in heavy angle towers (C/DC & D/DD types) to restrict jumper movement. Suitable hardware fittings shall be used for attachment of the insulators with the tower at one end and also for supporting the conductors at the other end. Grading rings will be used for improving voltage distribution across the insulator discs. The voltage across any disc shall not exceed 9% in case of suspension type and 10% in case of tension type of the line to the earth voltage. This will reduce aging and also minimize radio interference.

3.10 Line Accessories

Mid span compression joint for conductor/earthwire: Mid span compression joint suitable for conductor/earthwire shall be used for joining two lengths of conductor/earthwire. The minimum slipping strength of the joint after compression shall not be less than 95% of UTS of conductor/earthwire.

Repair sleeve for conductor: Repair sleeve shall be used only for repairing not more than two strands broken in the outer layer of conductor. It shall be of compression type in two parts with provision of seat sliding of keeper piece.

Flexible copper bond for earthwire: Flexible copper bonds shall be used for good electrical continuity between the earthwire and the tower. Two bonds per suspension tower and four bonds per tension tower shall be used.

Vibration dampers for conductor/earthwire: Stockbridge vibration dampers shall be used to reduce the maximum dynamic strain caused by Aeolian vibrations to a value of 150 micro-strains.

3.11 Power line, Railway line, Road and P&T line crossing

The transmission lines shall be crossing power lines, railway lines, roads and P&T line for which suitable extension of towers shall be used. The standard extensions for normally used for various types of towers are as follows:

A & D: 3m, 6m, 9m, 18m, 25m

B & C: 3m, 6m, 9m

_____x_____

ANNEXURE 'A'

DETAILED SURVEY OF 400 KV T/L FOR LARA
TOWER SCHEDULE (OPTION-1)

SL. No.	Location No.	Type of Tower	Angle of Deviation	Span Length (m)	Cumulative chanage (m)	Reduced Level (m)	Wind Span (m)	Weight Span Hot (m)			Weight Span Cold (m)			PLANT		UTM COORDINATES		COORDINATES		Crossing Details / Remarks
								Left	Right	Total	Left	Right	Total	Easting	Northing	Easting	Northing	Lat	Long	
1	Gantry	Gantry				202.00	59.52	0.00	59.89	59.89	0.00	59.89	59.89	31.54	-1242.58	754069.45	2408514.55	21.76206	83.45679	
				119.05																
2	AP1	DD+0	88 d 13 ' 27 " L		119.05	202.00	163.29	59.16	40.55	99.71	59.16	17.06	76.22	31.54	-1123.53	754081.34	2408633.01	21.76313	83.45692	Auxiliary Crossarm
				207.53																Road, Drain
3	AP2	DD+9	27 d 40 ' 39 " L		326.58	201.70	290.18	166.98	154.05	321.03	190.47	142.03	332.50	-175.90	-1117.10	753875.59	2408660.11	21.76341	83.45494	
				372.83																**2 Nos. 33kV Line, 66kV Line**
4	AP3	DD+18	25 d 54 ' 06 " R		699.41	200.70	280.62	218.77	80.61	299.38	230.79	75.55	306.34	-511.27	-1279.96	753525.63	2408531.55	21.76230	83.45154	
				188.42																
5	AP4	DD+18			887.83	202.40	246.74	107.82	181.44	289.26	112.87	192.19	305.06	-699.69	-1279.96	753338.15	2408550.36	21.76249	83.44973	
				305.05																**66 Kv Line, Road**
6	AP5	DD+9	90 d 00 ' 00 " L		1192.88	205.55	212.81	123.60	91.17	214.77	112.86	91.17	204.03	-1004.74	-1279.96	753034.62	2408580.82	21.76281	83.44680	Auxiliary Crossarm
				120.58																**33 kV Line,** Road
7	Gantry	Gantry			1313.45	207.00	60.29	29.40	0.00	29.40	29.40	0.00	29.40	-1004.74	-1400.54	753022.59	2408460.84	21.76173	83.44666	

ANNEXURE 'A'

DETAILED SURVEY OF 400 KV T/L FOR LARA
TOWER SCHEDULE (OPTION-2)

SL. No.	Location No.	Type of Tower	Angle of Deviation	Span Length (m)	Cumulative chanage (m)	Reduced Level (m)	Wind Span (m)	Weight Span Hot (m)			Weight Span Cold (m)			PLANT		UTM COORDINATES		COORDINATES		Crossing Details / Remarks
								Left	Right	Total	Left	Right	Total	Easting	Northing	Easting	Northing	Lat	Long	
1	Gantry	Gantry			0.00	202.00	59.52	0.00	59.89	59.89	0.00	59.89	59.89	31.54	-1242.58	754069.50	2408514.60	21.76206	83.45679	
				119.05																
2	AP-1	DD+0	88 d 13 ' 27 " L		119.05	202.00	163.29	59.16	40.55	99.71	59.16	17.06	76.22	31.54	-1123.53	754081.30	2408633.00	21.76313	83.45692	Auxiliary Crossarm
				207.53																Road, Drain
3	AP-2	DD+9	27 d 40 ' 39 " L		326.58	201.70	290.18	166.98	154.05	321.03	190.47	142.03	332.50	-175.90	-1117.10	753875.60	2408660.10	21.76341	83.45494	
				372.83																**2 Nos. 33kV Line, 66kV Line**
4	AP-3	DD+18	25 d 54 ' 06 " R		699.41	200.70	280.62	218.77	200.66	419.43	230.79	240.20	470.99	-511.27	-1279.96	753525.60	2408531.60	21.76230	83.45154	
				188.42																
5	AP-4	DD+3	10 d 59 ' 59 " L		887.83	202.40	249.59	-12.23	135.48	123.25	-51.78	128.09	76.31	-699.69	-1279.96	753338.20	2408550.40	21.76249	83.44973	
				310.76																**33 kV Line,** Road
6	AP-5	DD+3	79 d 00 ' 01 " L		1198.59	206.50	186.02	175.27	50.29	225.56	182.67	50.29	232.96	-1004.74	-1339.25	753028.70	2408521.80	21.76228	83.44673	Auxiliary Crossarm
				61.29																
7	Gantry	Gantry			1259.87	207.00	30.64	11.00	0.00	11.00	11.00	0.00	11.00	-1004.74	-1400.54	753022.60	2408460.80	21.76173	83.44666	

1
GANTRY
STA=0.00
X=31.54
Y=-1242.58
HT=23.00 ELE=202.00
WEIGHT SPAN HOT =59.89
LEFT =0, RIGHT =59.89
WEIGHT SPAN COLD =59.89
LEFT =0, RIGHT =59.89
WIND SPAN =59.52

2
AP-1
DD+0 (Auxiliary Crossarm)
STA=119.05
X=31.54
Y=-1123.53
HT=22.91 ELE=202.00
WEIGHT SPAN HOT =99.71
LEFT =59.15, RIGHT =40.55
WEIGHT SPAN COLD =76.22
LEFT =59.16, RIGHT =17.06
WIND SPAN =163.29

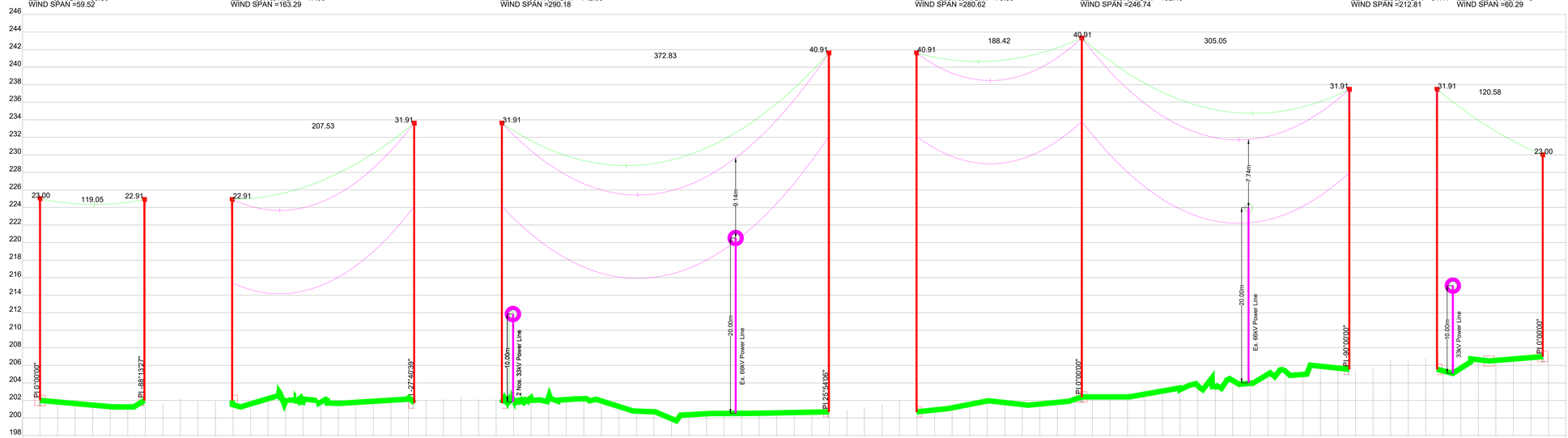
3
AP-2
DD+9
STA=326.58
X=-175.89
Y=-1117.10
HT=31.91 ELE=201.70
WEIGHT SPAN HOT =321.03
LEFT =166.98, RIGHT =154.05
WEIGHT SPAN COLD =332.5
LEFT =190.47, RIGHT =142.03
WIND SPAN =290.18

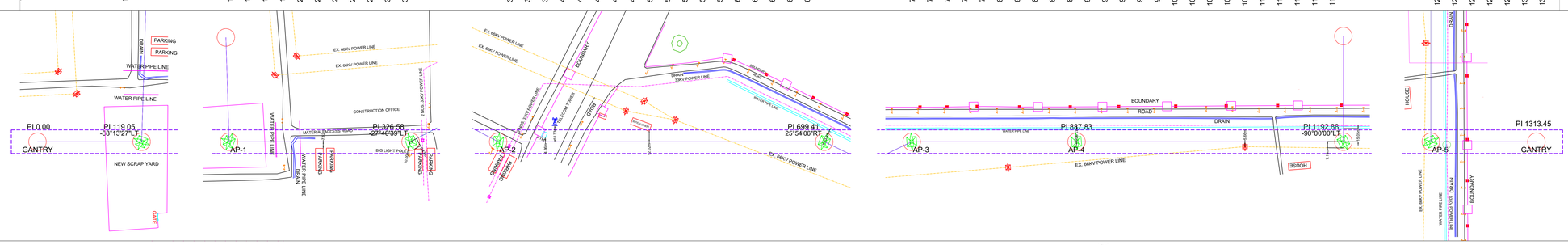
4
AP-3
DD+18
STA=699.41
X=-511.27
Y=-1279.96
HT=40.91 ELE=200.70
WEIGHT SPAN HOT =299.38
LEFT =218.77, RIGHT =80.61
WEIGHT SPAN COLD =306.34
LEFT =230.79, RIGHT =75.55
WIND SPAN =280.62

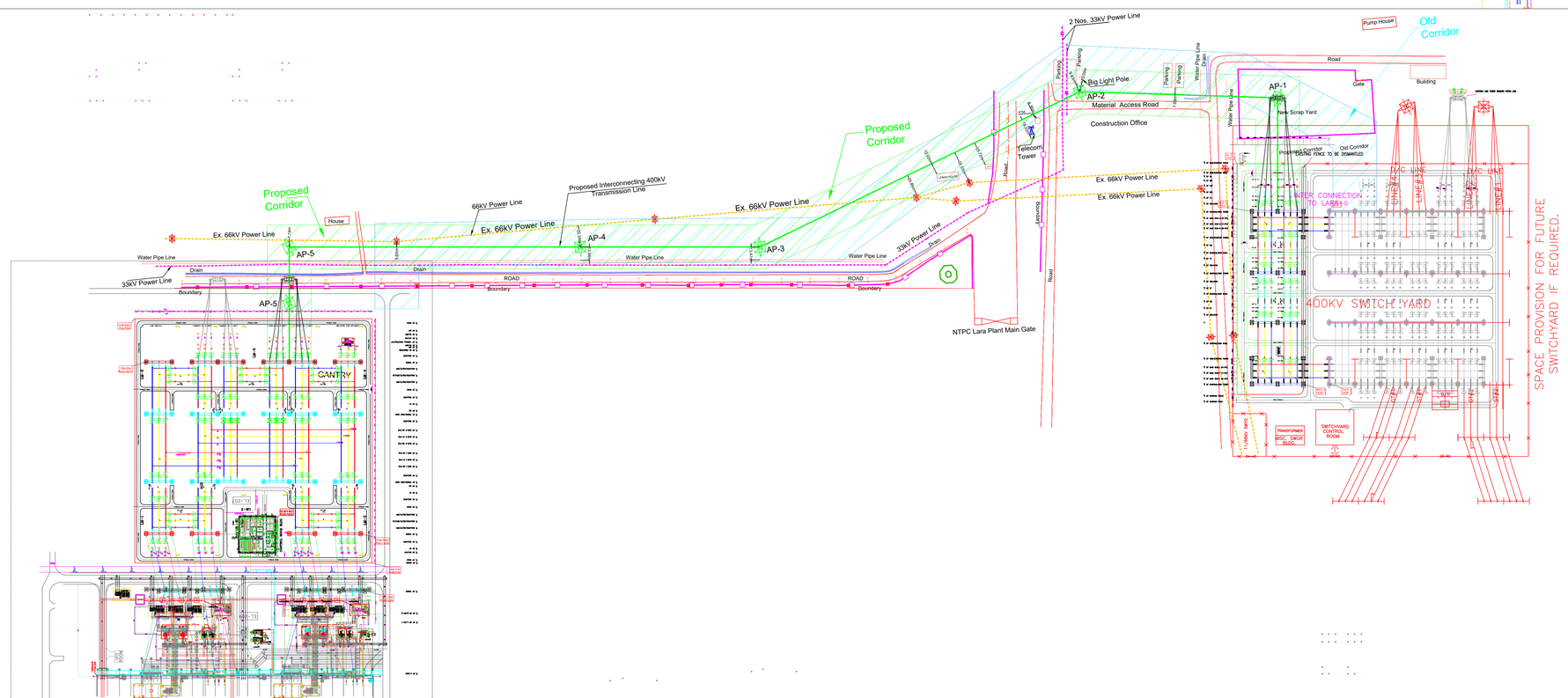
5
AP-4
DD+18
STA=887.83
X=-699.69
Y=-1279.96
HT=40.91 ELE=202.40
WEIGHT SPAN HOT =289.26
LEFT =107.82, RIGHT =181.44
WEIGHT SPAN COLD =305.06
LEFT =112.87, RIGHT =192.19
WIND SPAN =246.74

6
AP-5
DD+9 (Auxiliary Crossarm)
STA=1192.88
X=-1004.74
Y=-1279.96
HT=31.91 ELE=205.55
WEIGHT SPAN HOT =214.77
LEFT =123.6, RIGHT =91.17
WEIGHT SPAN COLD =204.03
LEFT =112.86, RIGHT =91.17
WIND SPAN =212.81

7
GANTRY
STA=1313.45
X=-1004.74
Y=-1400.54
HT=23.00 ELE=207.00
WEIGHT SPAN HOT =29.4
LEFT =29.4, RIGHT =0
WEIGHT SPAN COLD =29.4
LEFT =29.4, RIGHT =0
WIND SPAN =60.29







1. ROAD	
2. GATE	
3. BUILDING	
4. OLD CORRIDOR	
5. BOUNDARY	
6. 33kV POWER LINE	
7. WATER PIPE LINE	
8. 400kV TRANSMISSION LINE	
9. 66kV POWER LINE	
10. TELECOM TOWER	
11. DRAIN	
12. ATM/STRUCTURE	
13. LIGHT POLE	

Option-1

CONDUCTOR PARAMETERS

1. NAME	:	ACSR "MOOSE"
2. DIAMETER (mm)	:	31.77
3. UNIT WEIGHT(Kg/m)	:	2.004
4. AREA (Sq.mm)	:	597

CONDITION

1. NORMAL RULING SPAN (m)	:	400
2. GROUND CLEARANCE (m)	:	9.5
3. MAXIMUM SAG (85° NW) (m)	:	13.263
4. TENSION AT 0°C NO WIND	:	4144.81Kg.
5. TENSION AT 85°C NO WIND	:	3022.04Kg.
6. SAG ERROR (m)	:	0.15
7. CONDITION OF AIR	:	STILL

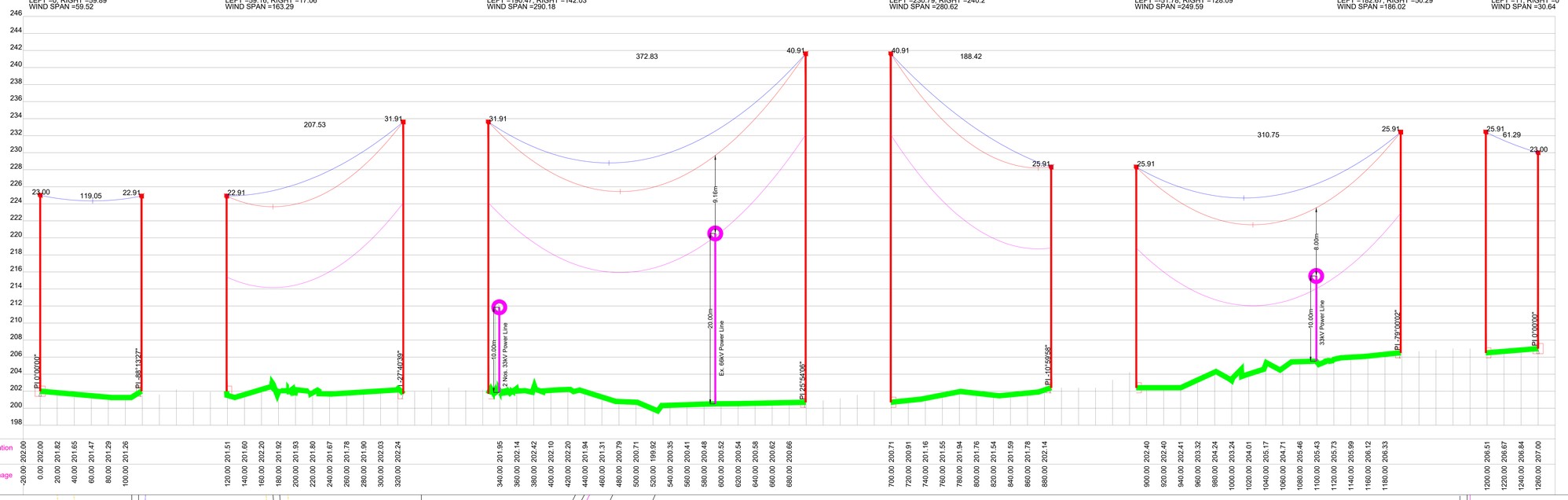
Rev. No.	Date	Description	Prepared	Checked	Approved

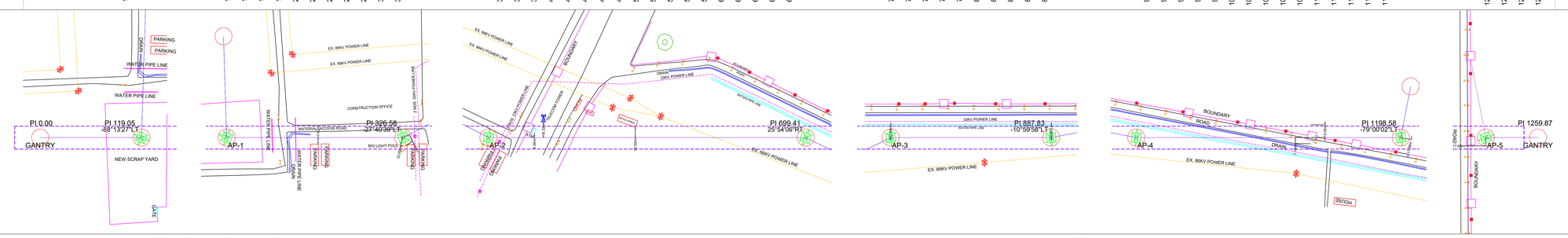
Owner:

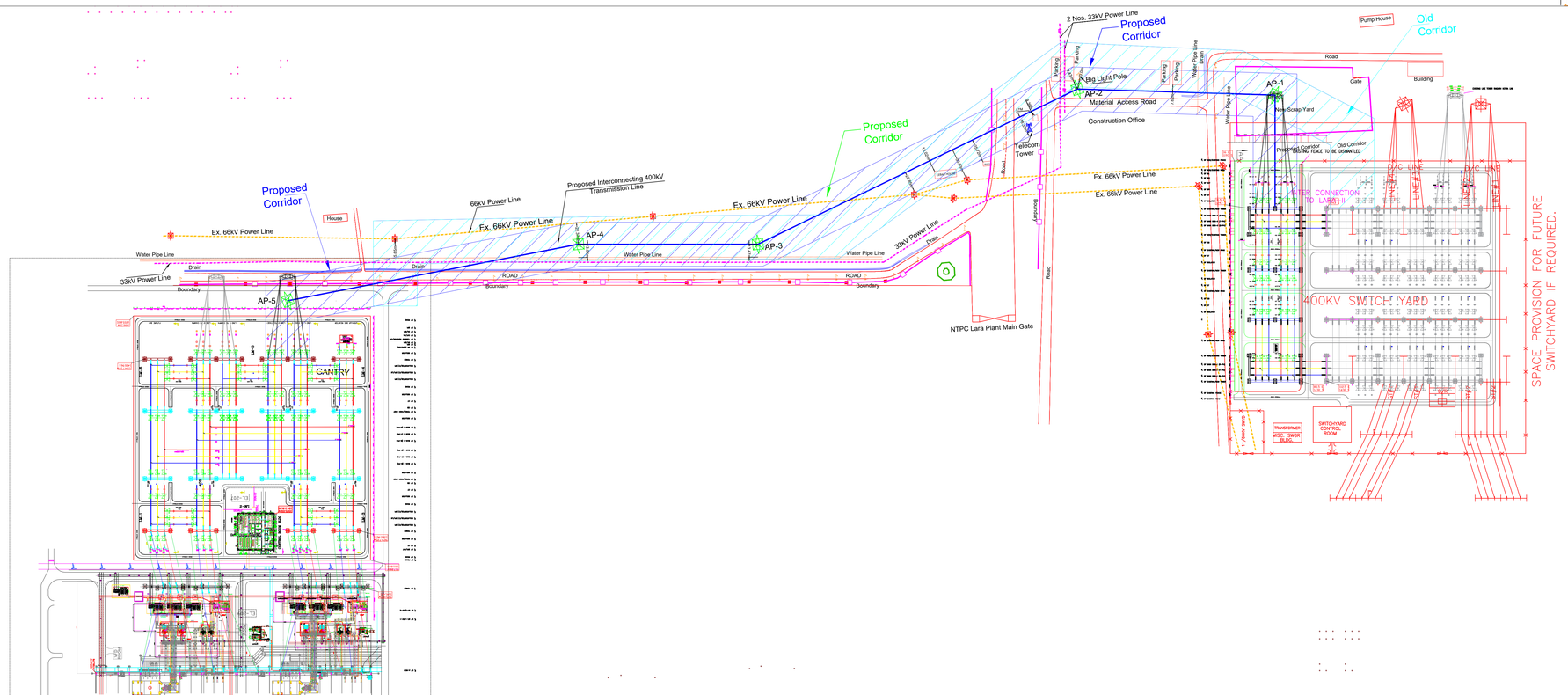
Contractor: The Designer Consortium
New Delhi, India

Project: *Longitudinal Ground Profile & Plan of 400kV Transmission Line for Lara substation*

Prepared By: -----	Date:23.12.2024	Title:	
Checked By: -----	Date:23.12.2024		
Approved By: -----	Date:23.12.2024	SHEET:	REV.
SHEET SIZE: A0	Scale NTS	DRG NO.	







1. ROAD	
2. GATE	
3. BUILDING	
4. OLD CORRIDOR	
5. BOUNDARY	
6. 33kV POWER LINE	
7. WATER PIPE LINE	
8. 400kV TRANSMISSION LINE	
9. 66kV POWER LINE	
10. TELECOM TOWER	
11. DRAIN	
12. ATM/STRUCTURE	
13. LIGHT POLE	

Option-2

CONDUCTOR PARAMETERS		
1. NAME	:	ACSR "MOOSE"
2. DIAMETER (mm)	:	31.77
3. UNIT WEIGHT(Kg/m)	:	2.004
4. AREA (Sq.mm)	:	597

CONDITION		
1. NORMAL RULING SPAN (m)	:	400
2. GROUND CLEARANCE (m)	:	9.5
3. MAXIMUM SAG (85° NW) (m)	:	13.263
4. TENSION AT 0°C NO WIND	:	4144.81Kg.
5. TENSION AT 85°C NO WIND	:	3022.04Kg.
6. SAG ERROR (m)	:	0.15
7. CONDITION OF AIR	:	STILL

Rev. No.	Date	Description	Prepared	Checked	Approved

Owner:

Contractor: The Designer Consortium, New Delhi, India

Project: *Longitudinal Ground Profile & Plan of 400kV Transmission Line for Lara substation*

Prepared By: ----	Date:23.12.2024	Title:	
Checked By: ----	Date:23.12.2024		
Approved By: ----	Date:23.12.2024	SHEET:	
SHEET SIZE: A0	Scale NTS	DRG NO.	REV.

AP6 TO AP5				
TREE HEIGHT (m)	TREE GIRTH (m)	LOCAL NAME	SCIENTIFIC NAME	TAG NO
3	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	1
2	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	2
3	0.4	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	3
3	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	4
3	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	5
2	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	6
2	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	7
2	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	8
4	0.55	Sheesham	*Dalbergia sissoo*	9
3	0.4	Sheesham	*Dalbergia sissoo*	10
3	0.42	Sheesham	*Dalbergia sissoo*	11
3	0.44	Sheesham	*Dalbergia sissoo*	12
3	0.345	Sheesham	*Dalbergia sissoo*	13
3	0.37	Sheesham	*Dalbergia sissoo*	14
2	0.78	Sheesham	*Dalbergia sissoo*	15
2	0.345	Sheesham	*Dalbergia sissoo*	16
2	0.337	Sheesham	*Dalbergia sissoo*	17
3.5	0.4	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	18
3	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	19
3.5	0.4	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	20
3.2	0.4	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	21
4.55	0.6	Sarai/Sal	*Shorea robusta*	22
3	0.675	Sarai/Sal	*Shorea robusta*	23
2	0.36	Sarai/Sal	*Shorea robusta*	24
3	0.38	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	25
3	0.48	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	26
3	0.56	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	27
2	0.445	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	28
3	0.46	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	29
3	0.3	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	30
3	0.346	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	31
3	0.348	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	32
3	0.481	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	33
3	0.45	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	34
3.5	0.4	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	35
4	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	36
4	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	37
3	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	38
3	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	39
3	0.5	Sarai/Sal	*Shorea robusta*	40
3	0.6	Sarai/Sal	*Shorea robusta*	41
3	0.4	Sarai/Sal	*Shorea robusta*	42
4	0.55	Sarai/Sal	*Shorea robusta*	43
4.5	0.34	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	44
4	0.346	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	45
3	0.38	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	46
3	0.67	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	47
3	0.555	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	48
4	0.6	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	49

AP6 TO AP5				
TREE HEIGHT (m)	TREE GIRTH (m)	LOCAL NAME	SCIENTIFIC NAME	TAG NO
3	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	50
3	0.656	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	51
3	0.3	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	52
3	0.345	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	53
3	0.381	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	54
3	0.34	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	55
3	0.485	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	56
3	0.611	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	57
3	0.557	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	58
4	0.7	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	59
4	0.455	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	60
3	0.377	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	61
3	0.416	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	62
3.5	0.38	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	63
4.5	0.43	Sarai/Sal	*Shorea robusta*	64
3	0.444	Sarai/Sal	*Shorea robusta*	65
2	0.3	Sarai/Sal	*Shorea robusta*	66
2	0.3	Sarai/Sal	*Shorea robusta*	67
2.5	0.2	Sarai/Sal	*Shorea robusta*	68
4.5	0.4	Sarai/Sal	*Shorea robusta*	69
3	0.46	Sarai/Sal	*Shorea robusta*	70
3	0.567	Sarai/Sal	*Shorea robusta*	71
3	0.5	Sarai/Sal	*Shorea robusta*	72
3	0.5	Sarai/Sal	*Shorea robusta*	73
3	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	74
3	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	75
3	0.558	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	76
4	0.68	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	77
4	0.445	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	78
4	0.477	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	79
4	0.312	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	80
4	0.319	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	81
4	0.48	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	82
4	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	83
4	0.3	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	84
4	0.344	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	85
4	0.344	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	86
3	0.3	Sarai/Sal	*Shorea robusta*	87
3	0.3	Sarai/Sal	*Shorea robusta*	88
3	0.377	Sarai/Sal	*Shorea robusta*	89
3	0.411	Sarai/Sal	*Shorea robusta*	90
3	0.5	Sarai/Sal	*Shorea robusta*	91
3	0.441	Sarai/Sal	*Shorea robusta*	92
3	0.577	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	93
3	0.435	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	94
3	0.347	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	95
3	0.3	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	96
3	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	97
3.5	0.474	Sarai/Sal	*Shorea robusta*	98

AP6 TO AP5				
TREE HEIGHT (m)	TREE GIRTH (m)	LOCAL NAME	SCIENTIFIC NAME	TAG NO
3.5	0.357	Sarai/Sal	*Shorea robusta*	99
3.5	0.454	Sarai/Sal	*Shorea robusta*	100
4	0.3	Sarai/Sal	*Shorea robusta*	101
4	0.341	Sarai/Sal	*Shorea robusta*	102
3	0.305	Sarai/Sal	*Shorea robusta*	103
3.5	0.4	Sarai/Sal	*Shorea robusta*	104
3	0.45	Sarai/Sal	*Shorea robusta*	105
3	0.457	Sarai/Sal	*Shorea robusta*	106
2.5	0.355	Sarai/Sal	*Shorea robusta*	107
2.5	0.377	Sarai/Sal	*Shorea robusta*	108
3.5	0.48	Sarai/Sal	*Shorea robusta*	109
3.5	0.39	Sarai/Sal	*Shorea robusta*	110
4	0.4	Sarai/Sal	*Shorea robusta*	111
4	0.4	Sarai/Sal	*Shorea robusta*	112
4	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	113
4	0.49	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	114
4	0.38	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	115
3	0.378	Sarai/Sal	*Shorea robusta*	116
3	0.444	Sarai/Sal	*Shorea robusta*	117
3.5	0.512	Sarai/Sal	*Shorea robusta*	118
3.5	0.478	Sarai/Sal	*Shorea robusta*	119
3.5	0.388	Sarai/Sal	*Shorea robusta*	120
3	0.3	Sarai/Sal	*Shorea robusta*	121
3	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	122
3	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	123
3	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	124
3	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	125
3	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	126
3	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	127
3	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	128
3	0.405	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	129
3	0.377	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	130
3	0.43	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	131
3	0.311	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	132
3	0.45	Sarai/Sal	*Shorea robusta*	133
3	0.47	Sarai/Sal	*Shorea robusta*	134
3.5	0.3	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	135
4	0.34	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	136
4	0.38	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	137
4	0.418	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	138
4	0.322	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	139
4	0.428	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	140
4	0.48	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	141
5	0.471	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	142
3	0.301	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	143
3	0.369	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	144
3	0.387	Sarai/Sal	*Shorea robusta*	145
4	0.358	Sarai/Sal	*Shorea robusta*	146
4	0.3	Sarai/Sal	*Shorea robusta*	147

AP6 TO AP5				
TREE HEIGHT (m)	TREE GIRTH (m)	LOCAL NAME	SCIENTIFIC NAME	TAG NO
3	0.371	Sarai/Sal	*Shorea robusta*	148
3	0.345	Sarai/Sal	*Shorea robusta*	149
3	0.455	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	150
3	0.41	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	151
3	0.318	Sarai/Sal	*Shorea robusta*	152
3	0.3	Sarai/Sal	*Shorea robusta*	153
3	0.444	Sarai/Sal	*Shorea robusta*	154
4	0.356	Sarai/Sal	*Shorea robusta*	155
3	0.386	Sarai/Sal	*Shorea robusta*	156
3	0.345	Sarai/Sal	*Shorea robusta*	157
4	0.311	Sarai/Sal	*Shorea robusta*	158
5	0.411	Sarai/Sal	*Shorea robusta*	159
3	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	160
3	0.6	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	161
3	0.571	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	162
3.5	0.541	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	163
3.5	0.581	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	164
3.7	0.578	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	165
3	0.541	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	166
4	0.56	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	167
4	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	168
4	0.349	Sarai/Sal	*Shorea robusta*	169
3	0.3	Sarai/Sal	*Shorea robusta*	170
3	0.4	Sarai/Sal	*Shorea robusta*	171
3	0.4	Sarai/Sal	*Shorea robusta*	172
3	0.4	Sarai/Sal	*Shorea robusta*	173
3	0.4	Sarai/Sal	*Shorea robusta*	174
3	0.4	Sarai/Sal	*Shorea robusta*	175
3	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	176
3	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	177
3.5	0.55	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	178
3.5	0.3	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	179
2.5	0.34	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	180
4	0.351	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	181
4.5	0.447	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	182
4.5	0.336	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	183
4	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	184
4	0.31	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	185
4	0.349	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	186
3	0.4	Sheesham	*Dalbergia sissoo*	187
6	0.45	Sheesham	*Dalbergia sissoo*	188
4	0.46	Sheesham	*Dalbergia sissoo*	189
6	0.47	Sheesham	*Dalbergia sissoo*	190
5	0.49	Sheesham	*Dalbergia sissoo*	191
5	0.396	Sheesham	*Dalbergia sissoo*	192
5	0.5	Sheesham	*Dalbergia sissoo*	193
5	0.55	Sheesham	*Dalbergia sissoo*	194
5	0.6	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	195
4.5	0.7	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	196

AP6 TO AP5				
TREE HEIGHT (m)	**TREE GIRTH (m)**	**LOCAL NAME**	**SCIENTIFIC NAME**	**TAG NO**
4.5	0.75	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	197
4.5	0.6	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	198
3.5	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	199
3	0.55	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	200
3	0.7	Sarai/Sal	*Shorea robusta*	201
3.5	0.677	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	202
4	0.565	Sarai/Sal	*Shorea robusta*	203

AP5 TO AP4				
TREE HEIGHT (m)	**TREE GIRTH (m)**	**LOCAL NAME**	**SCIENTIFIC NAME**	**TAG NO**
	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	1
	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	2
3	0.4	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	3
3	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	4
3	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	5
2	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	6
2	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	7
2	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	8
4	0.55	Sheesham	*Dalbergia sissoo*	9
3	0.4	Sheesham	*Dalbergia sissoo*	10
3	0.47	Sheesham	*Dalbergia sissoo*	11
3	0.44	Sheesham	*Dalbergia sissoo*	12
3	0.345	Sheesham	*Dalbergia sissoo*	13
3	0.37	Sheesham	*Dalbergia sissoo*	14
2	0.78	Sheesham	*Dalbergia sissoo*	15
2	0.345	Sheesham	*Dalbergia sissoo*	16
2	0.337	Sheesham	*Dalbergia sissoo*	17
3.5	0.4	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	18
3	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	19
3.5	0.4	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	20
3.2	0.4	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	21
4.5	0.5	Sarai/Sal	*Shorea robusta*	22
3	0.675	Sarai/Sal	*Shorea robusta*	23
2	0.36	Sarai/Sal	*Shorea robusta*	24
3	0.38	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	25
3	0.48	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	26
3	0.56	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	27
2	0.445	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	28
3	0.46	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	29
3	0.3	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	30
3	0.346	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	31
3	0.348	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	32
3	0.481	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	33
3	0.45	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	34
3.5	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	35
4	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	36
4	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	37
3.5	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	38
3	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	39
3	0.6	Sarai/Sal	*Shorea robusta*	40
3	0.4	Sarai/Sal	*Shorea robusta*	41
3.5	0.55	Sarai/Sal	*Shorea robusta*	42
4	0.34	Sarai/Sal	*Shorea robusta*	43
4.5	0.346	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	44
4	0.38	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	45
3	0.37	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	46
3	0.67	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	47
3.5	0.555	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	48
4	0.6	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	49
3	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	50
3	0.656	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	51
3	0.3	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	52
3	0.345	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	53

AP5 TO AP4				
TREE HEIGHT (m)	**TREE GIRTH (m)**	**LOCAL NAME**	**SCIENTIFIC NAME**	**TAG NO**
3	0.381	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	54
3	0.34	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	55
3	0.485	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	56
3	0.611	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	57
3	0.557	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	58
4	0.7	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	59
4	0.455	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	60
3	0.377	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	61
3	0.416	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	62
3.5	0.38	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	63
4.5	0.43	Sarai/Sal	*Shorea robusta*	64
3	0.444	Sarai/Sal	*Shorea robusta*	65
2	0.3	Sarai/Sal	*Shorea robusta*	66
2	0.3	Sarai/Sal	*Shorea robusta*	67
2.5	0.28	Sarai/Sal	*Shorea robusta*	68
4.5	0.4	Sarai/Sal	*Shorea robusta*	69
3	0.46	Sarai/Sal	*Shorea robusta*	70
3	0.567	Sarai/Sal	*Shorea robusta*	71
3	0.5	Sarai/Sal	*Shorea robusta*	72
3	0.5	Sarai/Sal	*Shorea robusta*	73
3	0.6	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	74
3	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	75
3	0.55	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	76
4	0.6	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	77
4	0.445	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	78
4	0.477	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	79
4	0.312	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	80
4	0.319	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	81
4	0.48	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	82
4	0.55	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	83
4	0.3	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	84
4	0.344	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	85

AP4 TO AP3				
TREE HEIGHT (m)	**TREE GIRTH (m)**	**LOCAL NAME**	**SCIENTIFIC NAME**	**TAG NO**
3	0.3	Sarai/Sal	*Shorea robusta*	1
3	0.3	Sarai/Sal	*Shorea robusta*	2
3	0.377	Sarai/Sal	*Shorea robusta*	3
3	0.411	Sarai/Sal	*Shorea robusta*	4
3	0.5	Sarai/Sal	*Shorea robusta*	5
3	0.441	Sarai/Sal	*Shorea robusta*	6
3	0.577	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	7
3	0.435	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	8
3	0.347	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	9
3	0.3	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	10
3	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	11
3.5	0.474	Sarai/Sal	*Shorea robusta*	12
3.5	0.357	Sarai/Sal	*Shorea robusta*	13
3.5	0.454	Sarai/Sal	*Shorea robusta*	14
4	0.3	Sarai/Sal	*Shorea robusta*	15
4	0.341	Sarai/Sal	*Shorea robusta*	16
3	0.305	Sarai/Sal	*Shorea robusta*	17
3.5	0.4	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	18
3	0.45	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	19
3	0.417	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	20
2	0.355	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	21
2	0.357	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	22
3.5	0.48	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	23
3.5	0.39	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	24
4	0.4	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	25
4	0.4	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	26
4	0.55	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	27
4	0.49	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	28
4	0.38	Sarai/Sal	*Shorea robusta*	29
3	0.378	Sarai/Sal	*Shorea robusta*	30
3	0.444	Sarai/Sal	*Shorea robusta*	31
3.5	0.512	Sarai/Sal	*Shorea robusta*	32
3.5	0.478	Sarai/Sal	*Shorea robusta*	33
3.5	0.388	Sarai/Sal	*Shorea robusta*	34

AP3 TO AP2				
TREE HEIGHT (m)	**TREE GIRTH (m)**	**LOCAL NAME**	**SCIENTIFIC NAME**	**TAG NO**
3	0.4	Sheesham	*Dalbergia sissoo*	1
6	0.45	Sheesham	*Dalbergia sissoo*	2
4	0.45	Sheesham	*Dalbergia sissoo*	3
6	0.47	Sheesham	*Dalbergia sissoo*	4
5	0.49	Sheesham	*Dalbergia sissoo*	5
5	0.396	Sheesham	*Dalbergia sissoo*	6
5	0.5	Sheesham	*Dalbergia sissoo*	7
5	0.55	Sheesham	*Dalbergia sissoo*	8
5	0.6	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	9
4.5	0.7	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	10
4.5	0.75	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	11
4.5	0.6	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	12
3.5	0.5	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	13
3	0.55	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	14
3	0.4	Sarai/Sal	*Shorea robusta*	15
3.5	0.677	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	16
4	0.565	Sarai/Sal	*Shorea robusta*	17
3	0.8	Sheesham	*Dalbergia sissoo*	18
4	0.7	Sheesham	*Dalbergia sissoo*	19
5	0.65	Sheesham	*Dalbergia sissoo*	20
5	0.766	Sheesham	*Dalbergia sissoo*	21
5	0.45	Sheesham	*Dalbergia sissoo*	22
4	0.6	Sheesham	*Dalbergia sissoo*	23
4	0.6	Sheesham	*Dalbergia sissoo*	24
5	0.301	Sheesham	*Dalbergia sissoo*	25
5	0.322	Sheesham	*Dalbergia sissoo*	26
4	0.4	Sheesham	*Dalbergia sissoo*	27
4	0.506	Sheesham	*Dalbergia sissoo*	28
5	0.4	Sheesham	*Dalbergia sissoo*	29
5	0.33	Sheesham	*Dalbergia sissoo*	30
5	0.449	Sheesham	*Dalbergia sissoo*	31
5	0.5	Sheesham	*Dalbergia sissoo*	32
5	0.7	Sheesham	*Dalbergia sissoo*	33
4	0.88	Sheesham	*Dalbergia sissoo*	34
3	0.5	Sarai/Sal	*Shorea robusta*	35
3	0.5	Sarai/Sal	*Shorea robusta*	36
3	0.5	Sarai/Sal	*Shorea robusta*	37
3	0.5	Sarai/Sal	*Shorea robusta*	38
3	0.5	Sheesham	*Dalbergia sissoo*	39
3	0.5	Sheesham	*Dalbergia sissoo*	40
3	0.6	Sheesham	*Dalbergia sissoo*	41
3	0.6	Sheesham	*Dalbergia sissoo*	42
3	0.6	Sheesham	*Dalbergia sissoo*	43
3	0.6	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	44
4	0.6	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	45
4	0.6	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	46
3	0.6	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	47
3	0.7	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	48
3	0.8	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	49
3	0.751	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	50
3	0.6	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	51
4	0.5	Sarai/Sal	*Shorea robusta*	52
3	0.4	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	53

AP3 TO AP2				
TREE HEIGHT (m)	TREE GIRTH (m)	LOCAL NAME	SCIENTIFIC NAME	TAG NO
3	0.45	Sarai/Sal	*Shorea robusta*	54
5	0.55	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	55
5	0.7	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	56
6	0.8	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	57
4	0.3	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	58
3	0.35	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	59
4	0.455	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	60
4	0.65	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	61
5	0.7	Sarai/Sal	*Shorea robusta*	62
4	0.301	Sarai/Sal	*Shorea robusta*	63
5	0.329	Sarai/Sal	*Shorea robusta*	64
4	0.42	Sarai/Sal	*Shorea robusta*	65
3	0.507	Sarai/Sal	*Shorea robusta*	66
4	0.477	Sarai/Sal	*Shorea robusta*	67
5	0.395	Sarai/Sal	*Shorea robusta*	68
4	0.3	Sheesham	*Dalbergia sissoo*	69
4	0.4	Sheesham	*Dalbergia sissoo*	70
4	0.3	Sheesham	*Dalbergia sissoo*	71
4	0.3	Sheesham	*Dalbergia sissoo*	72
4	0.3	Sheesham	*Dalbergia sissoo*	73
4	0.78	Sheesham	*Dalbergia sissoo*	74
4	0.4	Sheesham	*Dalbergia sissoo*	75
4	0.55	Sheesham	*Dalbergia sissoo*	76
4	0.3	Sheesham	*Dalbergia sissoo*	77
4	0.4	Sheesham	*Dalbergia sissoo*	78
4	0.6	Sheesham	*Dalbergia sissoo*	79
4	0.8	Sheesham	*Dalbergia sissoo*	80
4	0.8	Sheesham	*Dalbergia sissoo*	81
4	0.3	Sheesham	*Dalbergia sissoo*	82
3	0.34	Sheesham	*Dalbergia sissoo*	83
3	0.37	Sheesham	*Dalbergia sissoo*	84
3	0.4	Sheesham	*Dalbergia sissoo*	85
3	0.4	Sheesham	*Dalbergia sissoo*	86
3	0.4	Sheesham	*Dalbergia sissoo*	87
3	0.4	Sheesham	*Dalbergia sissoo*	88
3	0.4	Sheesham	*Dalbergia sissoo*	89
3	0.4	Sheesham	*Dalbergia sissoo*	90
3	0.4	Sheesham	*Dalbergia sissoo*	91
3	0.4	Sheesham	*Dalbergia sissoo*	92
3	0.4	Sheesham	*Dalbergia sissoo*	93
3	0.4	Sheesham	*Dalbergia sissoo*	94
3	0.4	Sheesham	*Dalbergia sissoo*	95
3	0.3	Sheesham	*Dalbergia sissoo*	96
3	0.7	Sheesham	*Dalbergia sissoo*	97
3	0.8	Sheesham	*Dalbergia sissoo*	98
3	0.9	Sheesham	*Dalbergia sissoo*	99
2	0.9	Sheesham	*Dalbergia sissoo*	100
2	0.7	Sheesham	*Dalbergia sissoo*	101
2	0.3	Sheesham	*Dalbergia sissoo*	102
5	0.777	Sheesham	*Dalbergia sissoo*	103
5	0.796	Sheesham	*Dalbergia sissoo*	104
4	0.3	Sheesham	*Dalbergia sissoo*	105
4	0.4	Sheesham	*Dalbergia sissoo*	106

AP3 TO AP2				
TREE HEIGHT (m)	**TREE GIRTH (m)**	**LOCAL NAME**	**SCIENTIFIC NAME**	**TAG NO**
4	0.5	Sheesham	*Dalbergia sissoo*	107
5	0.5	Sheesham	*Dalbergia sissoo*	108
5	0.5	Sheesham	*Dalbergia sissoo*	109
4	0.4	Sheesham	*Dalbergia sissoo*	110
4	0.7	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	111
3	0.8	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	112
3	1.2	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	113
3	1.3	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	114
3	0.9	Nilgiri / Ukali Potash / Safeda	*Eucalyptus globulus*	115
4	0.8	Sarai/Sal	*Shorea robusta*	116
3	0.7	Sarai/Sal	*Shorea robusta*	117
3	0.6	Sarai/Sal	*Shorea robusta*	118
4	0.3	Sarai/Sal	*Shorea robusta*	119

FORMAT OF NO DEVIATION CERTIFICATE

(To be submitted in the bidder's letter head)

REF: …… **Dated**…….

BHARAT HEAVY ELECTRICALS LIMITED,
TRANSMISSION BUSINESS GROUP,
6th Floor, BHEL SADAN,
Plot No- 25, Sector- 16A, Noida,
Distt. Gautambudh Nagar, UP-201301

TENDER REF.: TBSM/LARA/DESIGN CONSULTANCY SERVICES/TENDER/24-25 DATE: 30.01.2025

SUB: TENDER FOR "PROVIDING DESIGN CONSULTANCY SERVICES FOR TYPE TESTED 400KV TRANSMISSION LINE TOWER DESIGN SUITABLE FOR DOUBLE CIRCUIT QUAD MOOSE CONDUCTOR FOR WIND ZONE -III AT 2 X 800 MW NTPC LARA STAGE -II, CHHATTISGARH".

Dear Sir,

With reference to above, this is to confirm that as per tender conditions, we have visited subject site before submission of our offer and noted the job content & site conditions etc.

We also confirm that we have not changed / modified the tender documents as appeared in the website and in case of observance at any stage, it shall be treated as null and void. We hereby confirm that we have not taken any deviation from tender clauses together with other references as enumerated in the above referred NIT and we hereby convey our unqualified acceptance to all terms and conditions as stipulated in the tender and NIT. In the event of observance of any deviation in any part of our offer at a later date whether implicit or explicit, the deviations shall stand null & void.

We confirm to have submitted offer strictly in accordance with tender instructions.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized representative of the bidder)

DECLARATION FOR RELATION IN BHEL

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder failing which the offer of Bidder is liable to be summarily rejected)

Ref: **Date……..**

To,
Sr. DGM/TBSM
Transmission Business Group,
Bharat Heavy Electricals Limited,
6th Floor, BHEL SADAN,
Plot No. 25, Sector-16A, Noida,
Distt. – Gautam Buddh Nagar, UP-201301

Dear Sir,

Sub: Declaration for relation in BHEL

Ref: 1) NIT/Tender Specification No.: TBSM/LARA/DESIGN CONSULTANCY SERVICES/TENDER/24-25 DATE: 30.01.2025

I/We hereby submit the following information pertaining to relation/relatives of Proprietor/ Partner(s)/Director(s) employed in BHEL

Tick (√) any one as applicable:

1. The Proprietor, Partner(s), Director(s) of our Company/Firm DO NOT have any relation or relatives employed in BHEL

OR

2. The Proprietor, Partner(s), or Director(s) of our Company / Firm HAVE relation / relatives employed in BHEL and their particulars are as below:

a)

b)

Signature of the Authorized Signatory

Note:

1) Attach separate sheet, if necessary.
2) If BHEL Management comes to know at a later date that the information furnished by the Bidder is false, BHEL reserves the right to take suitable against the Bidder/ Contractor.

DECLARATION BY AUTHORISED SIGNATORY OF BIDDER

(To be typed and submitted in the Letter Head of the Company/Firm of Bidder)

To,

Sr. DGM/TBSM
Transmission Business Group,
Bharat Heavy Electricals Limited,
6th Floor, BHEL SADAN,
Plot No. 25, Sector-16A, Noida,
Distt. – Gautam Buddh Nagar, UP-201301

Dear Sir,

Sub: Declaration by Authorized Signatory regarding Authenticity of submitted documents.

Ref: 1**) NIT/Tender Specification No: TBSM/LARA/DESIGN CONSULTANCY SERVICES/TENDER/24-25 DATE: 30.01.2025**

2) **All other pertinent issues till date.**

I/We, hereby certify that all the documents submitted by us in support of possession of "Qualifying Requirements" are true copies of the original and are fully compliant required for qualifying / applying in the bid and shall produce the original of same as and when required by Bharat Heavy Electricals Limited.

I / We hereby further confirm that no tampering is done with documents submitted in support of our qualification as bidder. I / We understand that at any stage (during bidding process or while executing the awarded works) if it is found that fake / false / forged bid qualifying /supporting documents / certificates were submitted, it would lead to summarily rejection of our bid / termination of contract. BHEL shall be at liberty to initiate other appropriate actions as per the terms of the Bid / Contract and other extant policies of Bharat Heavy Electricals Limited.

Yours faithfully,

(Signature, Date & Seal of Authorized
Signatory of the Bidder)

Date:

Place

FORMATS FOR EPAYMENTS

To,

~~Sr.~~DGM (Finance)
Transmission Business Group
BHEL, TBG Finance,
Plot no. - 25, Sector - 16A
Noida - 201301; U.P.

Subject: E-Payments vide RTGS/NEFT

I/We request and authorise you to effect Epayment vide any of the above two modes to my/our bank account as per the details given below:

Vendor Name	:
Title/Name of Account in the bank	:
Account Type(Saving /current)	:
Bank Account Number	☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐
Name & address of Bank	
Bank /Branch contact person's name	:
Bank /Branch Tele Numbers with STD code	:
Bank Branch MICR code	☐☐☐☐☐☐☐☐☐
	(please enclose a copy of a cheque. This cheque should not be a payable at par cheque)
Bank Branch RTGS IFSC code	☐☐☐☐☐☐☐☐☐☐☐
Bank Branch NEFT IFSC code	☐☐☐☐☐☐☐☐☐☐☐
	(you can obtain this from branch where you have your account)
Your Email address	: **(not more than 20 character)**
Name of the Authorised Signatory	: (Please mention here name of person from your organization signing this letter.)
Contact Person's name	: (please mention here the name of a person in your company/organization)

I/We confirm that information provided above is correct & any consequences due to any mistake in above will be borne by us.

Thanking you

For
(Autorised Signatory)

We confirm that we are enabled for receiving RTGS/NEFT credits and we further confirm that the account number of (Please mention here name of the account holder), the signature of the authorised signatory and the MICR and IFSC Codes of our branch mentioned above are correct.

Bank's Verification
(Manager's/Officers signature under
bank Stamp)

Note:- Please attach cancelled original Cheque leaf.