

**ASSAM ELECTRICITY GRID CORPORATION LIMITED**

OFFICE OF THE MANAGING DIRECTOR

Regd. Office:(FIRST FLOOR), BIJULEE BHAWAN, PALTANBAZAR; GUWAHATI - 781001

**CIN: U40101AS2003SGC007238 GSTIN: 18AAFCA4973J9Z3****PHONE: 0361-2739520 Web: [www.aegcl.co.in](http://www.aegcl.co.in)****REQUEST FOR EXPRESSION OF INTEREST**

(Consultancy Services – Firm Selection)

**No. AEGCL/MD/RITES/ADMIN/20****Dated 18.01.2024**

Project name	<b>Execution of Preliminary Survey, Route Alignment and Detailed Survey for Construction of 132 KV Transmission Line from 132/33 KV Umrangso GSS, AEGCL to Langting TSS</b>
Type of contract	Consultancy
Type of notice	Request for Expression of Interest (REoI)
Issue date	19.01.2024
Closing date	02.02.2024

The scope of work shall broadly include the **execution of preliminary survey, route alignment, detailed survey including profiling, tower spotting using modern survey techniques, detailed soil investigation along the transmission line route (Severely Hilly Terrain) including approach road to the tower locations for construction of transmission line from 132/33 KV Umrangso GSS, AEGCL to Langting TSS.**

The Chief General Manager (PP&D), AEGCL, now invites eligible reputed and financially sound engineering firms/contractors to indicate their interest in carrying out the work as stated above. Interested parties should provide information demonstrating that they have the required qualifications and relevant experiences to perform the work. The shortlisting criteria are:

- A. Documentary Evidence of Experience:** The firm/contractor should have carried out and successfully completed similar nature of work during the last 10 years from the date of issue of this REoI (To be submitted with supporting WO copy, completion certificate etc.)  
*Documentary evidence of experience in works of similar nature and volume are to be submitted for each such work during the last ten years including details of works presently under way or contractually committed and their respective clients.*  
*Similar nature of work refers to execution of preliminary survey, route alignment, detailed survey including profiling, tower spotting using modern survey techniques, detailed soil investigation for construction of transmission line.*
- B. Financial Documents to be submitted:**
- Audited financial statements for the last five financial years.
  - Cash Flow statement in prescribed format of ICAI.
  - CA certified average annual turnover of the last five years
- C. Additional Documents to be submitted:**
- Each proposal shall be accompanied by a statement declaring that he/she/it is a bona-fide engineering contractor/firm and has in possession adequate equipment, qualified personnel to fill positions required for execution of the work.
  - The contractor/firm shall submit information of the key personnel, design & engineering staff, support staff, field staff etc. proposed for the work along with details of their experience in similar nature of work.
  - The contractor/firm shall also submit documents substantiating availability (either owned or leased) of the tools, tackles, spare parts etc. for carrying out the works.

- d) Experience of Key Personnel to be submitted with supporting documents/declaration.
- e) Qualification of Key Personnel to be submitted with supporting qualifying certificates.

**Expression of Interest shall not be more than 30 pages and must include the following:**

- Introductory letter on letter head (with complete contact details – name of the contact person, mailing address, telephone, fax, e-mail etc.)
- Organization profile alongwith all substantiating documents as per requirement of this EoI
- Documents substantiating details of experience as per requirement of this EoI
- Financial Statements as per requirement of this EoI
- Additional documents to be submitted as per requirement of this EoI
- Proposed methodology with Bill of Quantity (BoQ) depicting estimated cost

A brief background along with the draft scope of work and the evaluation criteria is placed at **Annexure-I**, and **Annexure-II** respectively for reference of the interested parties. Technical Specifications for the work to be executed under scope of this REoI is placed at **Annexure-III**.

Further information can be obtained at the address below during office hours, i.e., 10:00 to 17:00 hours.

Expressions of Interest (EoI) should be submitted either through email or by courier to the undersigned on or before **02.02.2024 (14:00 Hrs)**.

**Sd/-**

**Chief General Manager (PP&D)**  
**Assam Electricity Grid Corporation Limited**  
**1<sup>st</sup> Floor, Bijulee Bhawan, Paltanbazar**  
**Guwahati-781001, Assam, India**  
**Email id: cgm.ppd@aegcl.co.in**

Memo No: AEGCL/MD/RITES/ADMIN/20(a)-(b)

Date: 18.01.2024

Copy to:

1. IT Cell, O/o the MD, AEGCL, for publication of the REoI in AEGCL's Website
2. PR Cell, O/o the MD, AEGCL for paper publication of the REoI in leading newspapers: a) The Assam Tribune and b) The Times of India

**Sd/-**

**Chief General Manager (PP&D)**  
**Assam Electricity Grid Corporation Limited**

## ANNEXURE – I

The scope of work includes the **execution of preliminary survey, route alignment, detailed survey including profiling, tower spotting using modern survey techniques, detailed soil investigation along the transmission line route (Severely Hilly Terrain) including approach road to the tower locations for construction of transmission line from 132/33 KV Umrangso GSS, AEGCL to Langting TSS**. The line length is approximately 46 Kms. However, the actual quantity can be ascertained only after identification and completion of necessary survey works. It may be mentioned here that the terrain where the works are to be executed is a highly difficult terrain with no accessibility of road at major parts of the route. Firms/Contractors are requested to take into consideration the difficult site conditions, availability of experienced and qualified personnel along with required tools/techniques for modern survey execution prior to the submission of proposal for this EoI. Also, the work shall be completed within **60 days** from the date of issue of NoA/WO.

Draft Scope of Work						
Sl. No.	Item description	Qty	Units	Unit Rate	GST	Amount
	<b>Severely Hilly Terrain</b>					
1	Preliminary/walkover survey using GPS for identification of three alternate routes and finalization of most economic, optimum route (including approach road to the tower locations) and digitalization of the route map showing the topographical and other features and indicating the final selected route alignment (including approach road to the tower locations) and submission of reports as mentioned in the Technical Specifications at Annexure-III	46	Kms			
2	Detailed survey (after approval of route) using GPS, total work station, digital theodolite/ALTM including profiling, tower spotting and optimization of locations (including approach road to the tower locations) using computer aided techniques as well as other activities in the scope of work along with soil resistivity measurement of tower location, tree enumeration of tower corridor, etc. as per Technical Specifications mentioned at Annexure-III	46	Kms			
<i>Please Note: The quantity mentioned is tentative. The actual quantity can be ascertained only after identification and completion of necessary survey works.</i>						

## **ANNEXURE – II**

- The proposals will be evaluated on the basis of both quality as well as cost (QCBS mode).
- The total **Technical Score (Ts)** shall be calculated on the basis of following marking system for evaluation of the technical proposals:

Sl. No.	Criteria		Maximum Marks
1	General Experience (Date of completion of the most recent contract from the date of issue of this REoI)	0 to 5 years – 33 marks 5 to 7 years – 28 marks 7 to 10 years – 23 marks <i>*If the firm/contractor has experience in execution of preliminary survey, route alignment, detailed survey including profiling, tower spotting using modern survey techniques, detailed soil investigation along transmission line route in Hilly Terrain, 2 extra marks shall be added. Supporting documents in this regard (WO copies, completion certificates, etc.) with details of work executed in hilly terrain must be submitted.</i>	35
2	Average Annual Turnover	< 20 lakhs – 15 marks 20 – 25 lakhs – 18 marks ≥ 25 lakhs – 20 marks	20
3	Key Personnel Experience	2 years – 15 marks 3 years – 20 marks 4 years – 22 marks ≥ 5 years – 25 marks	25
4	Key Personnel Qualification (professional qualification of minimum two nos. of representatives)	<b>Civil Engineer:</b> Diploma – 5 marks Graduate – 7 marks Post Graduate and above – 8 marks <i>*If the person has qualification in Structural Engineering or equivalent degree, 2 extra marks shall be added.</i>  <b>Electrical Engineer:</b> Diploma – 5 marks Graduate – 8 marks Post Graduate and above – 10 marks	20
	<b>Total</b>		<b>100</b>

- The bidders with a minimum Technical Score of 60 shall be shortlisted.
- Following this, sealed financial bids shall be invited from the shortlisted firms.
- The financial bids with the lowest amount will be given the **Financial Score (Fs)** of 100.  
The other financial bids shall be scored as follows:  

$$Fs = (\text{Amount of lowest financial bid} / \text{Amount of financial bid}) \times 100$$
- The total score shall be obtained by weighing the technical and financial scores and adding them.  
The weight given to the technical and financial proposals are:  
 Technical Proposal: 0.6  
 Financial Proposal: 0.4  

$$\text{i.e., Total Score} = Ts \times 0.6 + Fs \times 0.4$$
- The bidder scoring the highest combined technical and financial score may be invited for negotiation.  
The aim is to reach an agreement on all points and finalize the draft contract.

**Annexure-III**  
**TECHNICAL SPECIFICATIONS FOR REFERENCE OF THE BIDDERS**

**1.1 Preliminary/Walkover Survey**

- 1.1.1 Identification of three alternative route alignments & selection of optimized route alignment. This shall be done using low resolution satellite imageries of NRSA, Google images and Survey of India maps. The output shall be in the form of digitized route alignment drawing with latest topographical and other details/features up to 8 kms on either sides of selected route alignment (both in hard and soft copies).
- 1.1.2 Digital terrain modelling along the selected route using contour data from topographical maps. Digitization can be done manually and automatically using software. For this purpose, ArcGIS Editor, Arc View, ERDAS, AutoCAD, R2V etc. are to be used.
- 1.1.3 For selection of routes, the statutory clearances as per Relevant Standards should be complied with and clearly mentioned in the reports.
- 1.1.4 Walk-over Survey of the route alignment (finalized in consultation with AEGCL).
- 1.1.5 The following areas, however, are to be avoided as far as possible while selecting the routes of the line:
  - a) Tough inaccessible areas where approach is difficult
  - b) Towns and villages, leaving sufficient margin for their growth.
  - c) Areas subject to floods, gushing nalas during rainy seasons, tanks, ponds, lakes, etc. and natural hazards.
  - d) Wooded areas with high trees or fruit bearing trees involving payment of heavy compensations for cutting of the trees. Swamps and shallow lands subject to flood, marshy areas, low lying lands, river beds and earth slip zones, etc. involving risk to stability to foundations.
  - e) High hillocks / hilly areas / sand dunes and areas involving abrupt changes in levels and requiring too many long spans.
  - f) Series of irrigation wells.
  - g) Shooting areas and other protected areas such as army / defence installations/ ammunition depots, areas of archaeological importance, forest areas and wild life sanctuary.
  - h) Areas which involve risk to human life, damage to public & private properties, religious places, cremation grounds, quarry sites and underground mines, gardens, orchards and plantations.
  - i) Areas which will create problems of right of way and way leaves.
  - j) Buildings / Storage areas for explosives or inflammable materials, bulk oil storage tanks, oil or gas pipelines, etc.
- 1.1.6 Preliminary survey is to transfer the route to the ground with such deviations as may be necessary as per field constraints. Instruments like Survey chains, tapes, theodolite, total station etc. are to be used.
- 1.1.7 Preliminary survey involves:
  - i. Fixing of angle points of the towers
  - ii. Identification of crossings of all electrical lines & details of the lines
  - iii. Finalizing of crossing points of Railway Tracks & details of such points
  - iv. Finalizing of crossing points of major rivers & details of such points
  - v. Finalizing of crossing points of roads, national highways & details of such points
  - vi. General classifications of soils, land including forest area (if any)
  - vii. Measurement of route length etc.
  - viii. Pegging of locations.
  - ix. Following points may be noted in this regard:

- (a) Measurements of the angles of deviation at all angle / section points are made. Resurvey of parts of the line route is done wherever it is possible to reduce the number of angle points and / or the magnitude of the angles of deviation.
- (b) The length of the line route is measured with the use of survey chains or with the theodolite. When using survey chains for measuring the length of the line route, the chain should be kept horizontal in uneven or undulating land so that horizontal distances are measured and not the distances along the contours of the land.
- (c) The number of consecutive spans between two angle / section points shall not exceed 15 (fifteen) in plain terrain and 10 (ten) spans in hilly terrain.
- (d) The length of any section of the line, i.e., between two angle / section points, shall not exceed 5 km in plain terrain and 3 km in hilly terrain. In case longer sections are available, then cut points / section points shall be provided by using "B" type tower.
- (e) If the terrain & line route permit, attempts can be made so that the section lengths are, as far as possible, in multiples of the basic span of the towers for the relevant voltage class.
- (f) The Preliminary survey report shall be prepared and submitted by the surveyor to the AEGCL.
- (g) After approval is given, the surveyor shall go ahead with the detailed survey.

#### 1.1.8

##### Requirement of Transmission Line Routing

- i. The alignment of the transmission line shall be most economical from the point of view of construction and maintenance.
- ii. Routing of transmission line through protected/reserved forest area should be avoided. In case it is not possible to avoid the forests or areas having large trees completely, then keeping in view of the overall economy, the route should be aligned in such a way that cutting of trees is minimum.
- iii. The route should have minimum crossings of Major river, Railway lines, National/State highways, overhead EHV power line and communication lines.
- iv. The number of angle points shall be kept to a minimum.
- v. The distance between the terminal points specified shall be kept shortest possible, consistent with the terrain that is encountered.
- vi. Marshy and low lying areas, river beds and earth slip zones shall be avoided to minimize risk to the foundations.
- vii. It would be preferable to utilize level ground for the alignment.
- viii. Alignment will be kept at a suitable distance from power lines to avoid induction problems on the lower voltage lines.
- ix. Crossing of communication line shall be minimized and it shall be preferably at right angle. Proximity and parallelism with telecom lines shall be eliminated to avoid danger of induction to them.
- x. Areas subjected to flooding such as Nalah shall be avoided
- xi. Restricted areas such as civil and military airfield shall be avoided. Care shall also be taken to avoid aircraft landing approaches.
- xii. All alignment should be easily accessible both in dry and rainy seasons to enable maintenance throughout the year.
- xiii. Certain areas such as quarry sites, tea, tobacco and saffron fields and rice plantations, gardens & nurseries which will present the AEGCL problems in acquisition of right of way and way leave clearance during construction and maintenance, should be avoided as far as possible.

- xiv. Angle points should be selected such that shifting of the point within 100 m radius shall be possible at the time of construction of the line.
  - xv. The line routing should avoid large habitations, densely populated areas, Forest, Animal/Bird sanctuary, reserve coal belt areas, oil pipe line / underground inflammable pipe lines etc. to the extent possible.
  - xvi. The areas requiring special foundations and those prone to flooding should be avoided as far as possible.
  - xvii. In case of Tower Types, foundations, modern techniques like Monopoles, Multi-Circuit Towers, Narrow Based Towers, etc. shall be explored.
- 1.1.9 For examination of the alternatives & identification of the most appropriate route, besides making use of information/data/details available/extracted through Survey of India Topographical maps and computer-aided processing of NRSA's satellite imagery.
- 1.1.10 The contractor shall submit his preliminary observations & suggestions along with various information/data /details collected and also processed satellite imagery data, scanned topographical map data marked with the alternative routes etc. The final evaluation of the alternative routes shall be conducted by the contractor in consultation with AEGCL's representatives and optimal route alignment shall be proposed by the contractor. Site visit and field verification shall be conducted by the contractor for the proposed route alignment.
- 1.1.11 Final digitized route alignment drawing with latest topographical and other details/features including all rivers, railway lines, canals, roads etc. up to 8 kms on both sides of selected route alignment shall be submitted by the contractor for AEGCL's approval along with report containing other information/details as mentioned above.
- 1.1.12 The co-ordinates of all the angle points as well as other important crossings, landmarks etc. shall be recorded using GPS instrument.

## **1.2 Detailed Survey**

- 1.2.1 The detailed survey shall be carried out using GPS, total stations, digital theodolites etc. along the approved route alignment. As an alternative, the contractor may also use ALTM (Airborne Laser Terrain Modeling) techniques of equal or better accuracy for the detailed survey and plotting on topo sheet to fix up angle point.
- 1.2.2 Soil resistivity, along the route alignment shall be measured in dry weather by four electrode method keeping inter – electrode spacing of 50 mtrs. For calculating soil resistivity formula  $2\pi ar$  (where  $a=50$  m and  $r$ =megger reading in ohms) shall be adopted. In case of soil characteristics changes within 2 to 3 km, values shall have to be measured at intermediate locations also. Megger reading and soil characteristics should also be indicated in the soil resistivity results.
- 1.2.3 **Route Marking:**  
The route of the transmission line shall be recorded using GPS of positional accuracy less than 3m. The co-ordinates of all the angle points as well as other important crossings, landmarks etc. shall be recorded using GPS for easy relocating. At the starting point of the commencement of route survey the co-ordinates shall be recoded. The co-ordinates of the location of the survey instrument shall also be recorded. Further, the co-ordinates at prominent position at intervals of not more than 750 meter along the transmission line to be surveyed up to the next angle point shall also be recorded. Wherever the line alignment crosses the EHT line, Railway line, P&T line or roads, the contractor shall record co-ordinates on the points of crossing. Wherever line route alignment passes over permanent land marks such as rock, boulders, culverts etc. suitable white paint marks with directional and AEGCL markings shall be made and co-ordinates recorded. Surveyor should provide

concrete block of size 1000x150x150 mm buried to a depth of at least 750 mm with AEGCL's name embossing on the concrete block at all angle point locations and important crossings etc.

1.2.4 Profiling:

1.2.4.1 The complete profiling along the route shall be carried out using surveying equipment viz. total stations, GPS, digital theodolite, long range scanners etc. Reference levels at every 20 meters along the route are to be recorded. R/Ls at other undulations along the route as well as in the route plan and other enroute details viz. crossings, building & structures, trees & other infrastructure etc. shall also be recorded. Areas along the route, which in the view of the contractor, are not suitable for tower spotting, shall also be marked.

1.2.4.2 The complete profiling details shall be digitized and the data shall be prepared & stored in the format compatible to computer – aided tower spotting software.

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

1.2.5 Optimization of tower location / tower spotting:

1.2.5.1 Optimization of tower locations shall be done by the Contractor using computer-aided tower spotting software (PLS CADD). In order to verify the results of computer aided tower spotting, the contractor shall supply the AEGCL, one soft copy of tower spotting & optimization report.

1.2.5.2 The sag-tension characteristics of the conductor as well as tower spotting data, sag template curves, if any required for tower spotting shall be prepared by the contractor on acrylic sheet indicating cold curve, hot curve, ground clearance curve and support footing curve.

1.2.5.3 Tower Spotting: While profiling & spotting the towers, the following shall to be borne in mind:

(a) Span: The number of consecutive spans between the section points shall not exceed 15 spans or 5 km in plain terrain and 10 spans or 3 km in hilly terrain for 220KV line. A section point shall comprise of tension point with minimum angle of deviation type towers as applicable.

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

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

(d) Road/NH Crossing: At all important road crossings, the tower shall be fitted with double suspension or tension insulator strings depending on the type of tower but the ground clearance at the roads under maximum temperature and in still air shall be such that even with conductor broken an adjacent span, ground clearance of the conductor from the road surfaces will not be less than 9 Mtrs for 220KV & 132kV line. At all national highways tension towers shall be utilized and crossing span shall not be more than 250 meters.

(e) Railway Crossings: All the railway crossings coming enroute the transmission line shall be identified by the contractor. At the time of detailed survey, the railway crossings shall be finalized as per the regulation laid down by the Railway Authorities. The following are the important features of the prevailing regulations (revised in 1987).



- i. The crossing shall be supported on large angle type tower on either side depending on the merits of each case.
    - ii. The crossing shall normally be at right angle to the railway track.
    - iii. 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.
    - iv. No crossing shall be located over a booster transformer, traction switching station, traction sub-station or a track cabin location in an electrified area.
    - v. Minimum ground clearance above rail level of the lowest portion of any conductor under condition of maximum sag shall be maintained at 15.40 Mtrs for 220KV line. And 14.6 Mtrs for 132KV line.
    - vi. The crossing span will be limited to 80% of Normal Span or 250 meters whichever is less.
  - (f) River Crossings: In case of major river crossings, towers shall be of suspension type and the anchor towers on either side of the main river crossing shall be large angle Y/ D 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). Minimum ground clearance above the highest flood level river and lowest point of conductor shall be 3 Mtrs. for 220KV line.
  - (g) Power line crossings: Where this line is to cross over another line of the same voltage or lower voltage, R / A type tower with suitable extensions 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 / Indian Electricity Act, 2003 as amended up to date. In order to reduce the height of the crossings towers it may be advantageous to remove the ground wire of the line to be crossed (if this is possible, and permitted by the AEGCL of the line to be crossed). For power line crossings of voltage level of 132 KV and above, an angle towers shall be provided on either side of tangent R / A type tower which can be temporary dead end condition with proper guying.
  - (h) Telecommunication Line Crossings: The angle of crossing shall be as near to 90 degrees possible. However, deviation to the extent of 30 degrees may be permitted under exceptionally difficult situations. When the angle of crossing has to be below 60 degrees, the matter will be referred to the authority in charge of the telecommunication system. On a request from the contractor, the permission of the telecommunication authority may be obtained by the 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.
  - (i) Details in route: All topographical details, permanent features, such as trees, buildings etc. 17.5Mtr (Total 35Mtr) for 220KV line on either side of the alignment and 8Mtr (Total 16Mtr.) for 132KV Line on either side of the alignment shall be detailed on the profile plan.
- 1.2.5.4 Clearance from Ground, Building, Trees etc.
- (a) Clearance from ground, buildings, trees and telephone lines shall be provided in conformity with the Indian Electricity Rules, 1956 / Indian Electricity Act, 2003 as amended up to date.
  - (b) The contractor shall count, mark and put proper numbers with suitable quality of paint at his own cost on the trees that are to be cut by the AEGCL at the time of actual execution of the work as detailed below. Contractor may please note that AEGCL shall not pay any compensation for any loss or damage to the properties or for tree cutting due to contractor's work.

- (c) To evaluate and tabulate the trees and bushes coming within 17.5 Mtrs. for 220KV line and 8 Mtrs. For 132KV line on either side of the central line alignment the trees will be numbered and marked with quality paint serially from angle point 1 (1) onwards and the corresponding number will be painted on the stem of trees at a height of 1 meter from ground level.
  - (d) The trees list should contain the following:
    - i. Girth (circumstances) measured at a height of 1 meter from ground level.
    - ii. Approximate height of the tree with an accuracy of +2 meters.
    - iii. Name of the type of the species / trees.
    - iv. The bushy and under growth encountered in the 35 Mtrs. Belt for 220KV line and 16Mtr for 66KV line should also be evaluated with its type, height, girth and area in square meters, clearly indicating the growth in the tree / bush statement.
    - v. The contractor shall also intimate the AEGCL, his assessment about the likely amount of tree & crop compensation etc. required to be paid by the AEGCL during execution stage. This assessment shall be done considering prevailing practices / guidelines, local regulations and other enquiries from local authorities.
- 1.2.5.5 The profile sheets showing the locations of the towers together with preliminary schedules of quantities indicating tower types, wind & weight spans, angle of deviation, crossing & other details etc. shall be submitted by the contractor for review & approval by AEGCL's site in charge.
- 1.2.5.6 Types of tower shall be A, B, C, D as per IS 5613 and other relevant standard for transmission lines.
- 1.2.5.7 Conductor to be used for 220 KV and 132 KV lines shall be AAA Zebra and panther conductor respectively.
- 1.2.5.8 Tower Schedule submitted shall be as per specifications mentioned.
- 1.2.5.9 Detailed survey of tower locations:
- (a) The detailed survey shall be conducted to locate the tower locations on ground conforming to the profile and tower schedule.
  - (b) The co-ordinates of all the tower locations shall also be recorded using GPS of positional accuracy less than 3m for easy relocating. The positions of all tower locations shall be marked in the final digitized route alignment drawing with relative distances from any permanent bench mark in the area.
  - (c) The contractor shall also collect required data at each tower location in respect of soil strata, ground water level, history of water table in adjacent areas / surface water and classify the suitable type of foundation at each tower location based on the data collected at each location and detailed soil investigations carried out at selected locations etc.
  - (d) The levels up or down of each pit Centre with respect to Centre of tower location shall be recorded at intervals of 2m using total stations / GPS / digital theodolite and digitized contour plans shall be made. Based on the digitized elevation plans, the quantities of benching & protection work vis-à-vis possible unequal leg extensions shall be optimized using suitable computer aided techniques / softwares.

The changes desired by the AEGCL in the preliminary tower schedule or as may be required based on detailed survey of tower locations & contouring by the contractor, shall be carried out by the contractor and the final tower schedule shall be submitted for approval of AEGCL. The tower schedule shall show position of all type of towers, span length, type of foundation for each tower, benching & revetment requirement, unequal leg extensions, deviation at all angles, crossings & other details etc.

**1.2.5.10 Multiple photographs with geotagging, topographical survey along with KML file of route and each tower locations (including accessibility to tower locations) must be submitted. Type of soil/ presence of rock at each tower locations (including accessibility to tower locations) must be accessed and report submitted.**

- 1.2.5.11** Revetment of tower locations must be accessed and waterway must be avoided. However, if waterway is unavoidable, type of protection suitable shall be accessed and indicated such as revetment, PCC topping, water diversion drain, etc.
- 1.2.5.12** Demarcation of type of land, forest, revenue, govt. etc., along with geographical coordinates must be indicated & KML file of locations (towers including accessibility to tower locations) must be submitted.