

SECTION -1

SCOPE, SPECIFIC TECHNICAL REQUIREMENT & QUANTITIES

1 INTRODUCTION

- 1.1 The scope of work under this specification is Detailed survey, ERT Testing, route profiling, design and engineering of transmission line for re-routing and diversion of existing 220kV and 132kV transmission lines emanating from existing PTPS generation switchyard at 3x800MW Patratu Thermal Power Station Expansion Phase-I being executed by BHEL for Patratu Vidyut Utpadan Nigam Limited (A Subsidiary of NTPC Ltd in Joint Venture with Jharkhand Bijli Vitran Nigam Ltd).
- 1.2 Total seven nos. charged 220kV and 132kV transmission line are passing through the area proposed to be used for PTPS expansion Phase-I project. These lines are required to be diverted to start site enabling activities.
- 1.3 Detail of transmission lines to be diverted:
 - (i) 220kV PTPS –Hatia D/C Transmission Line
 - (ii) 220kV PTPS-Tenughat S/C Transmission Line
 - (iii) 132kV PTPS-Hatia D/C Transmission Line
 - (iv) 132kV PTPS-Ramgarh D/C Transmission Line
- 1.4 Existing route of the above lines alongwith the location where these respective lines are crossing the land boundary of PTPS station alongwith suggestive corridor to be used for diversion of these transmission lines are indicated in preliminary survey report/drawing attached at **Annexure-B**
- 1.5 Since the space available for line diversion is limited. Multi-circuit towers (separate multi-circuit towers for 220kV and 132kV) with extra height in order to accommodate these lines in the allocated space wherever necessary. Scope of work shall also include reconnection of the diverted portion of the lines to the towers of original lines outside plant boundary by providing necessary gantries/Dead End towers and replacement of existing towers along with stringing outside plant boundary (if necessary). Provision for adequate space for this purpose shall also be kept by contractor in the layout developed by them.
- 1.6 Location of project: Patratu Thermal Power station (PTPS) is located just outside the coal belt of South Karanpura in Ramgarh District of Jharkhand State. The nearest Railway Station is Patratu which is at a distance of about 4 km on Barkakhana-Barwadih Railway line. The nearest commercial airport is Ranchi at about 45 km by road.

2 SCOPE

2.1 The detailed scope of work shall be as per following:

- (a) Carrying out detailed survey including modification in preliminary route alignment, site clearance/ jungle clearing/tree cutting to make approach for survey work, adjustment in section details to achieve better average span, profiling, collecting actual field data along the selected route (marking of salient land features like crossing of rivers, nalla, road, railway lines, other transmission / distribution line, nearby buildings/structures, etc.), tower spotting & providing tower schedule, sag template, tree enumeration, etc. & submission of detailed survey report alongwith route profile drawing, all complete as per technical specification & directions of Engineer-in-charge including its approval from BHEL/Customer.
- (b) Conducting Electrical Resistivity Test of soil at various tower locations including submission of test report for approval of BHEL/Customer including mobilization of necessary equipment, tools, manpower etc complete as per relevant IS Code, Technical specification and Instruction of Engineer-In-charge.
- (c) Carrying out check-survey for route alignment to locate and peg mark tower positions conforming to approved profile, tower schedule and technical specifications. Changes, if required in tower schedule after detailed survey, shall be carried out and thereafter submit revised tower schedule for approval. The tower schedule shall show co-ordinates of all towers, type of towers, span length, type of foundation for each tower and the deviation. (Check survey to be done jointly in presence of civil work agency finalised by BHEL)
- (d) Preparation & submission of design documents of towers and their foundations, fabrication drawings including stub, template and tower extensions, bill of material of all members, hardware etc. The detailed design & drawing work shall include, but not limited to :
 - Verification of all data, criteria and information contained in the contract documents.
 - Generation of all data, criteria and information required for the completion of work including liaison and interface with BHEL/Customer.
 - Analysis and design on standard software like STAADpro etc. and /or in house generated Excel or other programs by qualified and experience personnel. All calculations shall be prepared in a neat, sequential, comprehensive form and properly checked to ensure their correctness and completeness.
 - Design and Drawings of foundation for towers for different soil types including Dry, Wet, Partially Submerged, Fully Submerged, etc including Foundation loading data,

- Preparation of construction drawings with sufficient detailing so that no difficulty is faced by site engineers during execution.
- (e) Getting all the works mentioned above approved by BHEL/Customer.
- 2.2 Preparation and submission including its approval from BHEL/Customer of the following drawing/documents:
 - (a) Bill of Material for transmission line material including conductor, conductor accessories, earthwire/OPGW, earth wire/OPGW accessories, stringing hardware, disc insulators etc,
 - (b) Erection Key Diagram of each line,
 - (c) Stringing chart of all spans,
 - (d) Earthing details of towers
 - (e) Any other drawing/documents required for successful completion of the work.
- 2.3 The Bidder shall depute his engineer(s) to Site or BHEL's/Customer's office/Supplier's works for any clarification etc. as required by BHEL/Customer. Bidder shall also depute his engineer(s) to site for check surveys also.

3 SPECIFIC TECHNICAL REQUIREMENTS

- 3.1 The specific technical requirements shall be as per project specific input provided by BHEL from time to time after award of work.
- 3.2 The Bidder shall interact closely with BHEL engineering group for any input/clarification and finalize details across the table. There may be certain cases when on account of revision or change of inputs, certain survey/ design / drawing may be required to be redone. **No claim on account of this shall be entertained.** Only suitable time extension shall be granted on account of above.

4 SCHEDULE/BOQ OF ITEMS

- 4.1 The Schedule/BOQ of Items shall be as per **Annexure A**. The Bidder is required to quote his most competitive rate for these items.

5 DOCUMENTATION

- 5.1 All design documents including computer outputs shall be neatly typed, produced on A4 size paper and shall have a 'Cover Sheet' (To be provided later).
- 5.2 All drawings shall be prepared in AutoCAD as per standard sizes (viz. A0, A1, A2, A3 & A4) and shall have a 'Title Block' (To be provided later).

- 5.3 The number of copies of design documents & drawings required to be submitted shall be as follows:

At each stage of Submission/Revision.(Soft Copy)

- | | |
|---|----------|
| i) Reports/Design Documents (incl excel & Staad file) | 01 sets. |
| ii) Drawings (incl AutoCAD & pdf file) | 01 sets. |

6 COMPLETION SCHEDULE:

- 6.1 The work under this scope of work must be completed within 3 months after placement of order except check survey.
- 6.2 The check survey shall be done along with civil construction agency after finalization of civil construction agency by BHEL and intimation by Site in charge. Check survey should be completed within 2 Weeks including Check survey report.

7 PAYMENT SCHEDULE:

<u>Condition</u>	<u>Payment</u>
After conducting survey work, report preparation, submission and approval of reports/design documents/ drawings	
(i) Cat 2 i.e approved with comments)	80%
(ii) Cat 1 i.e approved	10%
After completion of activities under scope of works including check survey and BOM, approval of all Drawings/Document in Cat-1, submission of all drawings/documents.	Balance 10%

SECTION - 2

STANDARD TECHNICAL SPECIFICATION

(N.A.)


SECTION - 3

ENCLOSURES TO THE SPECIFICATION


(A) CUSTOMER'S TECHNICAL SPECIFICATION


(B) PRELIMINARY SURVEY REPORT (DONE BY CUSTOMER)


(C) TENDER DRAWINGS


CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<p style="text-align: right;">Annex-C</p> <p style="text-align: center;"><u>TRANSMISSION LINE CIVIL WORKS</u></p> <p>1.00.00 This specification covers design, fabrication and supply of all types of transmission line towers including bolts, nuts and washers, step bolts, hangers, D-shackle and all type of tower accessories like phase plate, number plate, danger plates, anti-climbing devices etc, foundation design 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 etc. All materials including cement, reinforcement steel and structural steel etc shall be provided by the bidder.</p> <p>1.01.00 Type tested towers which are already designed and tested for equal or higher loads are preferred. However for tested towers, bidder shall furnish foundation design and drawing meeting the requirements of this technical specification.</p> <p>In case type tested towers are not available, the design of towers shall be carried out for the applicable transverse, longitudinal, vertical and other loads as per IS 802 and CBIP manual with an increased factor of safety of 1.5 as testing of towers are not envisaged in view of the time constraint associated with route diversion works for this project.</p> <p>1.02.00 The transmission line towers shall be fully galvanized self-supporting lattice type mild/high tensile steel structure designed to carry the line conductors with necessary insulators, earth wires and all fittings under all loading conditions as per IS 802 and CBIP manual. Bolts and nuts with spring washers shall be used for connections. The towers shall be classified as per IS 802 Part 1 Section 1.</p> <p>1.03.00 The towers shall be designed so as to be suitable for adding 3M, 6M and 9M body extension for maintaining adequate ground clearance without reducing the specified factor of safety in any manner. Special type of towers with higher extensions wherever required, shall also be provided by the bidder.</p> <p>1.04.00 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 stub setting template for each type of tower shall be supplied to the Owner on completion of the project.</p> <p>1.05.00 The minimum thickness of angle sections to be used shall not be less than 5 mm for main corner leg members including the groundwire peak & main cross arm and 4mm for all other members.</p> <p>1.06.00 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.</p> <p>1.07.00 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. Further more than two (2) grades of steel will not be permitted for any structure.</p>			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X 800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO. : 9585-001-2.	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	PAGE 1 OF 1	

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
1.08.00	All connection bolts shall conform to IS: 6639 and IS: 12427. The minimum diameter of bolt shall be of 16 mm and of property class 5.6 as specified in IS: 1367 and matching nut of property class 5 as specified in IS:1367. Bolts should be provided with washer face in accordance with IS:1363 to ensure proper bearing. To ensure uniformity of galvanizing, bolts and nuts should be galvanized by high temperature hot-dip galvanizing. The diameter of the hole shall be equal to the diameter of bolt plus 1.5mm.			
1.09.00	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.			
1.10.00	Fabrication of structure shall conform to IS:802 (Part-II). 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.			
1.11.00	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.			
1.12.00	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.			
1.13.00	The tower structures shall be accurately fabricated to connect together easily at site without any undue strain on the bolts.			
1.14.00	No angle member shall have the two leg flanges brought together by closing angle.			
1.15.00	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.			
1.16.00	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			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X 800MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO. : 9585-001-2.	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	PAGE 2 OF 2

CLAUSE NO.	TECHNICAL REQUIREMENTS			
<p>1.17.00</p> <p>2.00.00</p> <p>2.01.00</p> <p>2.02.00</p> <p>2.03.00</p> <p>2.04.00</p> <p>2.05.00</p> <p>2.06.00</p>	<p>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.</p> <p>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. 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.</p> <p>TOWER FOUNDATIONS:</p> <p>Reinforced concrete footing shall be provided for all type of tower in conformity with the IS Codes and the specifications. All the four footings of the tower and their extension shall be similar, irrespective of down thrust and uplift. The over load factor for foundation design shall be 1.10 for all loads except dead loads. 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. Structural design of the foundations shall be done by limit State method conforming to IS 456.</p> <p>For foundation design purposes:</p> <p>(a) The angle of repose shall be considered as zero.</p> <p>(b) Water table shall be considered up to the ground level.</p> <p>(c) Net safe bearing capacity shall be considered as 12.5T/m² at a founding level of 3.0 M below NGL.</p> <p>Pile foundation, wherever necessitated as per site conditions, shall be provided by the bidder.</p> <p>The minimum grade of concrete used for the tower foundations shall be of grade M20 (nominal mix) with 20mm coarse aggregate. All the properties of concrete regarding its strength under compression tension, shear, punching and bending etc. as well as workmanship will conform to IS:456. The water used for mixing concrete shall be fresh, clean and free from oil, acids and alkalies, organic materials or other deleterious substances.</p> <p>The material properties for cement, aggregate and reinforcement steel shall be as specified in “Switchyard Civil Works” chapter.</p> <p>The chimney should have all around clearance of 150mm from any part of stub angle. However, minimum 450mm square chimney/pedestal shall be provided. 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.</p> <p>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.</p> <p>The portion of the stub in the chimney and foundation slab shall be designed to take full down-thrust or uplift loads by the cleats combined with the bond between stub angles and concrete. The Contractor shall furnish the calculation for uprooting of stub along with the foundation design.</p>			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X 800MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO. : 9585-001-2.	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	PAGE 3 OF 3

CLAUSE NO.	TECHNICAL REQUIREMENTS			
<p>2.07.00</p> <p>2.08.00</p> <p>2.10.00</p> <p>2.11.00</p> <p>3.00.00</p>	<p>Minimum 50mm thick pad of lean concrete corresponding to 1:3:6 nominal mix shall be provided.</p> <p>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. Stub templates for standard towers and towers with extension upto 9 M shall be of adjustable type.</p> <p>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 compacted properly before another layer is deposited.</p> <p>All necessary protections including stone revetments, RCC retaining walls etc shall be provided wherever required for protection of foundations close to or in nallah, river bed, water ways, hilly region etc.</p> <p>Design criteria for equipments and gantry structures associated with re-routing of existing 220kV/132 kV Transmission lines outside switchyard area.</p> <p>a) Design and fabrication of Structures shall be carried out as per IS 802, IS 806 and other relevant codes.</p> <p>b) For design of foundations, soil parameters shall be as specified at clause no. 3.01.00 of this chapter.</p>			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO. : 9585-001-2.	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	PAGE 4 OF 4	

CLAUSE NO.	SCOPE OF SUPPLY AND SERVICES			
1.25.00	Scope related to diversion of existing transmission lines			
	The Scope of work is related to the Re-routing and diversion of existing transmission lines emanating from existing PTPS generation switchyard. Contractor shall be responsible for complete Survey, design, engineering, supply and execution of rerouting work as mentioned below. Total Seven Nos. charged 220kV and 132kV transmission lines are passing through the area proposed to be used for PTPS Expansion Phase-I project. These lines are required to be diverted to start site enabling activities. Contractor shall ensure completion schedule of line diversion and re-routing works, matching with site enabling work schedule.			
	Transmission lines at 220kV:		Transmission lines at 132kV:	
	i) PTPS-Hatia D/C line		i) PTPS-Hatia D/C transmission line	
	ii) PTPC Tenughat S/C line		ii) PTPS-Ramgarh D/C transmission line	
	Existing route of the above lines along with the locations where these respective lines are crossing the Land boundary of PTPS Station along with suggestive corridors to be used for diversion of these transmission lines are indicated in preliminary survey drawing attached at annex-A to this document.			
	Since the space available for line diversion is limited, Contractor may also use multi circuit towers (separate multi-circuit towers for 220kV & 132kV lines) with extra height in order to accommodate these lines in the allocated space wherever necessary. Scope of work shall also include reconnection of the diverted portion of the lines to the towers of original lines outside plant boundary by providing necessary gantries/Dead End towers and replacement of existing towers along with stringing outside plant boundary (if necessary). Provision for adequate space for this purpose shall also be kept by contractor in the layout developed by them.			
	In order to create sufficient space for line diversion in existing switchyard area following activities shall also have to be done as required:			
	1) Shifting of bay for 2 nos. 220kV DC Hatia line to 220kV bays as marked in SLD. Bay details of the existing switchyard are shown in the switchyard Single Line diagram associated with Patratu STPS in drawing attached at annex-B to this document. Any EHV equipment and structure which is required for shifting of the above line bays shall be provided by contractor. Further supply, installation and commissioning of protection panels in line with stipulations in Sub-section B-13, Part B, section VI of technical specifications for line protection and modification of existing control panel shall also be in scope of contractor.			
	2) Connection of ICT's through 220kV and 132kV cables and dismantling of existing connection gantries of ICT's to create adequate space for line diversion. EHV cable along with necessary cable terminations and any other equipment required (such as LA, BPI, Link box etc.) for this purpose shall be in the scope of contractor. EHV cables shall meet technical requirements stated in Sub-sections B-26 and B-28, Part B, section VI of the technical specifications.			
After diversion of these lines and successful interconnection to existing towers, the defunct tower of these lines in the main plant area be dismantled in line with the scope of work of the project as mentioned elsewhere in the specifications.				
The equipment and materials to be supplied by the Contractor shall form complete transmission line re-routing work as per above. All the equipment and services as required for the above scope of work shall be in the scope of the Contractor.				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X 800MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO. : 9585-001-2.		SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS
				PAGE 1 OF 2

CLAUSE NO.	<div style="text-align: center;">SCOPE OF SUPPLY AND SERVICES</div> <div style="text-align: right;"></div>		
	<p>Transmission line work shall conform to the requirement specified in CBIP Transmission line manual and Indian Standards except to the extent explicitly modified elsewhere in the specification. Contractor shall refer Annex-C to this document for civil works related to transmission line diversion.</p> <p>It is not the intent to specify all the aspect of design, specification and construction of equipment mentioned herein. The system, sub systems and equipment shall confirm in all respect to high standards of engineering, design and workmanship and shall be capable of performing its desired duty. Offered equipment shall confirm to IEC/IS and shall also confirm to type test requirement as per relevant standards.</p> <p>Time frame for the execution of this work is the essence of the contract so, it is in the interest of the contractor to acquaint himself with the site conditions, scope and access the quantum of work involved for line diversion activities before submission of offer. No extra claim shall be entertained due to any change in the scope of supply (Cables, Gantries, Towers and equipment etc.) for this work. The survey drawing attached at annex-A is preliminary in nature for showing conceptual plan for Re-routing of 132 kV and 220 kV transmission lines and defining the scope of work to be done by contractor under this package. However, contractor shall be responsible for carrying out its own detailed survey and tower spotting for line diversion works and any indications in the survey report shall not absolve the contractor from any of its responsibilities related to line diversion works as indicated above.</p>		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X 800MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO. : 9585-001-2.	SUB-SECTION-IIB ELECTRICAL SYSTEM / EQUIPMENTS	PAGE 2 OF 2

PATRATU VIDYUT UTPADAN NIGAM LIMITED

(Government of INDIA, Undertaking)



CONCEPTUAL PLAN

SHIFTING OF ROUTE ALIGNMENT FOR 7 NOS. 3 PHASE TRANSMISSION LINE

**TO ACCOMMODATE SPACE FOR ELECTRICAL CORIDOR □ OUT SIDE CONNECTIVITY IN
CONSULTATION WITH JUSNL.**

SHIFTING & OUTSIDE BOUNDARY CONNECTIVITY PLAN

- a) 132 kV D/C PATRATU- RAMGARH TRANSMISSION LINE.
- b) 132 kV D/C PATRATU- HATIA TRANSMISSION LINE.
- c) 220kVD/C PATRATU- HATIATRANSMISSION LINE.
- d) 220 kV S/C PATRATU- TENUGHAT TRANSMISSION LINE.

PATRATU VIDYUT UTPADAN NIGAM LIMITED

Name of Transmission Line:

SHIFTING & OUTSIDE BOUNDARY CONNECTIVITY PLAN

- a) 132 kV D/C PATRATU- RAMGARH TRANSMISSION LINE.
- b) 132 kV D/C PATRATU- HATIA TRANSMISSION LINE.
- c) 220 kV D/C PATRATU- HATIA TRANSMISSION LINE.
- d) 220 kV S/C PATRATU- TENUGHAT TRANSMISSION LINE.

Block : Patratu
District : Ramgarh
State: : Jharkhand

Programmed Implementing Unit:

PVUNL

VIDE PO NO 5500026□1□ DTD.01.06.2017

Prepared by:-

GLOBAL PROJECTS & ENGINEERING CONSULTANTS

58/D, ROAD NO-01

Ashok Nagar , Ranchi, Jharkhand,834002

TABLE OF CONTENTS

- 1. CERTIFICATE OF COMPLETION**
- 2. INTRODUCTION**
- 3. PROJECT DESCRIPTION**
- 4. ASSUMPTIONS**
- 5. PROCESS OF FINALIZATION**
- 6. FINAL TRANSMISSION LINE ENGINEERING**
- 7. AERIAL SURVEY**
- 8. SITE SURVEY**
- 9. GEOTECHNICAL SERVICES**
- 10. MATERIAL SUPPLIERS**
- 11. CONSTRUCTION SERVICES**
- 12. EPC PROJECT MANAGEMENT**
- 13. PROPOSED TOWER SPOTTING DETAILS &
DISMANTLE & DESTRINGING TOWER.**
- 14. INDEX MAP SHOWING PROPOSED ROUTE ALIGNMENT OF
TRANSMISSION LINE & DISMANTLING EXISTING LINES.**

CERTIFICATE

THIS IS TO CERTIFY THE PROJECT AWARDED VIDE PO NO 5500026□1□ DTD.01.06.2017 BY PVUNL IS COMPLETED IN ALL RESPECT. THE ALL SUGGESTIONS GIVEN BY PVUNL □ JUSNL TIME TO TIME DURING EXECUTION OF THIS PROJECT INCORPORATED. THERE IS NO FURTHER SCOPE OF AMMENDMENT WHATSOEVER AGAINST THIS CONTRACT IS FEASIBLE.

SIGNATURE

**ON BEHALF OF
GLOBAL PROJECTS & ENGINEERING CONSULTANTS**

INTRODUCTION

Global Projects & Engineering. Consultants, Ranchi conducted a preliminary engineering study to develop a conceptual design (Shifting Plan) for rerouting of 7 Nos. 3 Phase transmission line of from the Existing Switch Yard as the existing lines are crossing the upcoming main plant area of 3x800 MW Power Plant. This project has explored the options for rerouting the existing lines without crossing upcoming main plant area passing through the minimal space available between existing switchyard and upcoming main plant area. The project is critical in view of unavailability of sufficient space for line corridor. The study against this PO is limited up to boundary wall of PVUNL. However, this will provide the scheme for connectivity from plant boundary to external tower. This report includes a general description of the project, the assumptions made during engineering, and a detailed description of the preliminary design developed during this project.

Our Team have already designed 132 kV line to 1200 kV line in India & abroad.

PROJECT DESCRIPTION

The purpose of this project is to develop a conceptual design (Tower Spotting) and provide opinion of probable route alignment & fixing of transmission line as PVUNL showing space of Electrical Corridor Engineering planning of proposed PVUNL plant area.

The proposed 132kV & 220kV transmission line Proposed tower line will be designed to support single circuits, Double Circuit, Multi circuit. The line will cross over owned properties (PTPS/JUSNL). The proposed line route has been discussed & Co-ordinated with PVUNL (NTPC) & JUSNL. The detailed study is attached to this report in INDEX MAP. (Drawing No-01/option-3/ date -10/06/2017).

The line study performed evaluated transmission line routes from the view of Shifting of Existing Patratu-Hatia, Patratu-Ramgarh & Patratu-Tenughat route of a 132kV & 220kV transmission line.

After studying the options with available space & with coordination of PVUNL & NTPC & JUSNL & GE. Consultants developed Suitable routes for connection showing INDEX MAP details of the final options of selection of Route Alignment of shifting Transmission Line.

PROCESS OF FINALIZATION OF ROUTE SHIFTING ALIGNMENT OF TRANSMISSION LINE.

Due to proposed upcoming PVUNL power plant at Patratu in existing Plant area ,existing 132 kv & 200 kv lines are rerouted, in view of conceptual alignment with JUSNL & PVNL (As per discussion and meeting with JUSNL & PVNL (NTPC) engineering team dated _____)

We try to find out best route in your provided electrical corridor and upcoming features like Railway & other which is showing in layout drg.

Due to narrow corridor we proposed 2 alternatives---

OPTION-1 we already submitted proposal-1 ,all narrow base tower & D/C near the existing 132 kv/220kv lines and that is through with MCT line which through correct outside boundary wall.

OPTION-2 we are did minor modification as per joint discussion with client officials ,now Ramgarh 132 kv & Hatia 132kv Dead end tower proposed near the existing DE tower, which will be used new connectivity, both dc connect through MCT up to near boundary wall and after MCT again both lines are divide into DCT.

We change a small modification in 220 kv Hatia line in view of upcoming rail line.

The same orientation is adopted in 220 kv lines, Tenughat 220 kv line is single CKT gantry to be used, and 220 double CKT Hatia also used existing Gantry and it through MCT .MCT line through upto boundary ,again it divide into DC tower.

After discussion with JVUNL & PVNL & NTPC has **OPTION-2** Finalized & may be adopted in future.

Due to narrow corridor all MCT towers we proposed with Narrow Base/ Monopole may use. FDN volume may increase but it may suit & safe with the narrow corridor.

ASSUMPTIONS

Some notable assumptions were made during the preliminary engineering of this line. Descriptions of these are listed here: • Conceptual Design – The contents of this report are for conceptual and budgetary purposes only and are not intended to be used for final design purposes. • Local transmission utility Standards – Structure type, conductor and shield wire types as well as stringing strength and ruling spans conform to local transmission utility standards.

LAND ACQUISITION

Land Acquisition was not included as part of this project. PVUNL will be providing land acquisition services for both permanent and construction services.

CONCEPTUAL LINE DESIGN

Global Projects & Eng. Consultants performed the process of conceptual line designing with respect to the direction of PVUNL (NTPC). A picture of final line route can be seen in Appendix – A (Index Map). The proposed line utilizes Indian Electric model engineering and (CBIP) Manual. The standards referenced can be found in Appendix B (Typical Section).

Consultants created plan and profile drawings which are located in Appendix C (Profile Map). Global Projects provide Lattice Tower steel structures to support the single circuit, double circuit line & Multi circuit. The tangent structure used is Transmission Overhead Material specification IER 5613.

We are finalized the Route alignment as your providing space for Electrical Co-corridor from your provided Layout Drawing in soft copy in NTPC PVUNL Project & as well maintained Standard IE Design Rule & (CBIP Manual) in Road Crossing.

The Conductors were selected as per IS: 3031 & IS: 1565 standards, The conductor selected was a **ACSR MOOSE**. The power conductor shall conform to the following Indian/ International Standards. Purity of Aluminum Rods, 99.5% Minimum, Percentages of Carbon in steel wire/rods, 0.50 to 0.85 (Preferably 0.65%), Purity of Zinc, 99.95%.

Global Projects phase power equation to calculate the capacity of the line to ensure that connecting to shifting purposes, it would be sufficient for existing connection needs of 132 kV & 220kV Lines. The conductor information can be found in specification IS: 3031 & IS: 1565. As part of this study consultants investigated the blowout of this conductor to determine the right of way width needed. The shield wire proposed is a GSW ground wire. The shield wire attribute information can be found in specification IS 5613.

PVUNL 132kV & 220kV Transmission Line was modeled in PLS CADD. The model utilizes a basic digital elevation model purchased by Global Projects. A more detailed model would be obtained by aerial survey which would be used to produce a final design. Elevation and global plane information was used to create a three dimensional map where the Lattice Tower structures are placed. The aerial maps were then viewed and structures were moved along the decided path to avoid existing obstacles. Global Projects traveled to Project Site- PATRATU to verify preliminary structure locations and take pictures of areas of concern. After all the locations of the towers were confirmed, the conductors were placed into the model and tower heights were adjusted to satisfy ground clearance requirements. In a final engineering model, new structures for each height will be placed in the model to obtain reactions to pass on to a material supplier for design and fabrication. This number was taken from the (IE-1957) Rule Design Clearances for Overhead Transmission Lines which can be found in Appendix B.

Minimum Ground Clearance & other Technical specification follows Per IE-1956(Rule 77) & CBIP Rules, which Global Projects rounded up and added an additional buffer requirement as per common industry practice.

- Minimum Ground Clearance As Per IE-1956(Rule 77):-

Minimum Ground Clearance As Per IE-1956(Rule 77)	
V_{min} KV	T_{min} M
132	6.1
220	7
400	8.84
800	12.4

- Minimum Working Clearance:-

Minimum Working Clearance:		
OUTDOOR SWITCHYARD		
V_{min} KV	T_{min} M	B_{min} M
11	2750	2500
33	3700	2800
66	4000	3000
132	4600	3500
220	5500	4500

- Minimum Electrical Clearance As Per BS:162.

Minimum Electrical Clearance As Per BS: 162.		
OUTDOOR		
V_{min} KV	P_{min} M	P_{min} M
6.6	139.7	177.8
11	177.8	228.6
22	279.4	330.2
33	381	431.8
66	685.8	787.4
110	863.6	990.6
132	1066.0	1210.2
220	1778	2057.4

- Minimum Clearance between Lines Crossing Each Other (IE-1957)

Minimum Clearance between Lines Crossing Each Other (IE-1957)				
S_{min} V_{min}	132KV	220KV	400KV	800KV
Low & Medium	3.05	4.58	5.49	7.94
11-66KV	3.05	4.58	5.49	7.94
132KV	3.05	4.58	5.49	7.94
220KV	4.58	4.58	5.49	7.94
400KV	5.49	5.49	5.49	7.94
800KV	7.94	7.94	7.94	7.94

- Minimum Height above Railway As Per IE-1957**

Voltage	Minimum Clearance
Above 66KV up to 132KV	14.60 Meter
Above 132KV up to 220KV	15.40 Meter
Above 220KV up to 400KV	17.90 Meter
Above 400KV up to 500KV	19.30 Meter
Above 500KV up to 800KV	23.40 Meter

- Various Air clearances to be provided as per IE rule 64**

Various Air clearances to be provided as per IE rule 64.					
Voltage KV	33KV	66KV	110KV	220KV	400KV
BIL (KVp)	170	325	550	1050	1425
P-E (cm)	30	63	115	240	350
P-P(cm)	40	75	135	210	410
P-G (Meter)	3.7	4	4.6	5.5	8
Section Clearance(Mt)	2.8	3	3.5	4.3	6.5

- Clearances from Buildings of HT and EHT voltage lines IE Rule 80**

Clearances from Buildings of HT and EHT voltage lines IE Rule 80	
Voltage	
High voltage lines up to 33KV	3.7 Meter
Extra High Voltage	3.7 Meter + Add 0.3 meter for every additional 33KV
Height of buildings	
High Voltage Up to 11 KV	1.2 Meter
11KV To 33KV	2.0 Meter
Extra High Voltage	2.0 Meter + Add 0.3 meter for every additional 33KV

- Clearance above ground of the lowest conductor As per IE Rule 77**

Clearance above ground of the lowest conductor As per IE Rule 77	
Overhead Lines	
Low and Medium Voltage	5.8 Meter
High Voltage	6.1 Meter
Overhead Lines with Poles	
Low and Medium Voltage	5.5 Meter
High Voltage	5.8 Meter
Overhead Lines with Wires or Cables	
Low/Medium /HT line up to 11KV If Bare Conductor	4.6 Meter
Low/Medium /HT line up to 11KV If Insulated Conductor	4.0 Meter
Above 11 KV Line	5.2 Meter
Above 33KV Line	5.8 Meter + Add 0.3 meter for every additional 33KV

- **Clearance between conductors and Trolley / Tram wires (IE Rule 78)**

Clearance between conductors and Trolley / Tram wires (IE Rule 78)	
Low and Medium Voltage	1.2 Meter
High Voltage Line Up to 11KV	1.8 Meter
High Voltage Line Above to 11KV	2.5 Meter
Extra High Voltage Line	3.0 Meter

- **Clearances from Buildings of low & medium voltage lines(IE Rule 79)**

Clearances from Buildings of low & medium voltage lines(IE Rule 79)	
For Feeder and Overhead Lines	
Line Passes Over Building Vertical Clearance	2.5 Meter
Line Passes Adjustment of Building Horizontal Clearance	1.2 Meter
For Cables	
Line Passes Over Building Vertical Clearance	2.5 Meter
Line Passes Adjustment of Building Horizontal Clearance	

Both circuits were strung in the model to ensure that Towers will be designed to support future expansion. After structures were modeled, a typical foundation size was calculated. IE & CBIP Rules require Lattice Tower for 132 kV & 220kV lines are placed on foundations. Different size structures have different size foundations. A structure check was performed inside the PLS CADD model to obtain base reactions on a typical tangent structure. These base reactions were inserted into PLS Caisson along with some conservative values for soil properties. The size of dead end foundations will be larger. Both tangent and dead end foundations will need to be designed with specific soil properties obtained from a geotechnical study.

FINAL TRANSMISSION LINE ENGINEERING

The final transmission line engineering will be done in accordance with the IE and/or applicable codes such as CBIP Rules. This work will expand on the conceptual design discussed above and develop the complete and final transmission line design. The design will include such items as: • Route verification • Survey coordination • Structure placement • Structure loading • Foundation design • Conductor stringing Transmission Line • Material selection • Permit coordination • Construction coordination • Project close out including as-built Engineering deliverables would include: • Stringing charts • Staking reports • Specifications of Material procurement, Construction, Geotechnical • Bill of materials • Drawings of Structure load and design of Plan and profile of Hardware assemblies Consultants has developed an estimate to complete this design. This estimate incorporates all tasks and deliverables mentioned above. It also includes time and expenses for meeting attendance, phone conferences, site visits, and contacting and supporting other subcontractors. Anticipated site visits would include; initial route walk down, follow up review of areas that require special considerations, and verification of staking locations.

AERIAL SURVEY

Various companies were contacted to provide estimates for aerial survey and topographic mapping activities for the final engineering. An aerial survey company will provide color digital imagery of line area and data files for PLS model production. The current survey map used for PLS CADD model is accurate enough for proposals but the data is spread out and of a general variety. It is important when designing large expensive structures that the information used is as accurate as possible because small discrepancies can result in expensive redesign. Two different methods to produce this survey information are Photogrammetric and Lidar. Photogrammetric is a method of obtaining topographic information using aerial photograph to develop terrain information. Lidar is a traditional method for collecting topographic information using a laser to scan the area to produce point coordinates. Both technologies have the ability to develop elevation contours in 0.3 M intervals. They take the collected data and convert it into 132kV & 220kV Transmission Line, that can be placed into a PLS CADD model. It also separates out the different ground points into various features such as vegetation, roads, ground features and bodies of water. There are many other features that can be collected by aerial survey. Some of these features include taking video of the route, taking still pictures of structures in the line area, converting data to a GIS format and many other services.

SITE SURVEY

Site survey is another necessary activity for design and construction of the final transmission line. Survey activities will include: • Real-estate investigation • Survey and determine property lines & owners • New easement exhibits for the owners • Verification of aerial obstacles • Staking activities for the right of way as well as two occasions of construction staking. Various companies were contacted to provide budgetary estimates for site survey activities which can be seen in Appendix E. The approximate price for site survey can be seen in the cost summary. To be conservative the highest budgetary estimate was used.

GEOTECHNICAL SERVICES

Various companies were contacted to provide estimates for soil boring and soil lab activities. It is important to perform testing on soils in the location of each structure because soil conditions vary from location to location. Different locations will show different conditions over the 14-mile line and a foundation could be sufficient for one location and not for another. Standard practice is to obtain a general condition that works for a majority of the tangent structures and custom design the dead end foundations and other outliers. To obtain estimates, contractors were asked to estimate costs of approximately 28 soil borings to a depth of 20 M or refusal. The typical foundation depth will not be greater than 10 M, but deeper foundations will be utilized at dead end locations. The contractors were asked to include all associated cost with producing a geotechnical report of the encountered conditions and provide foundation recommendations. Subcontractors were informed that all locations would be staked, cleared and that access approvals would be provided to perform work. The estimates we received covered a wide range therefore a calculated cost was derived by averaging the highest two estimates to be conservative. Adjustments can be made to the scope of soil study such as soil borings can be taken at less frequent intervals to cut costs. The approximate price for geotechnical services is included in the cost summary.

MATERIAL SUPPLIERS

Various companies were contacted to provide estimates for total material cost. The materials included in these estimates are conductors, optical shield wire, Lattice Tower, grounding, insulators, and other hardware. It is important to note that prices of these items will fluctuate, especially the Lattice Tower. Materials also vary by when delivery is needed. Prices in this section reflect a projected value of steel for mid-2017 with an average delivery time, approximately 20 weeks. The most significant cost will be the Lattice Tower. The estimated cost is shown in the cost summary. From the estimates we received, one contractor appeared to have the best understanding of the needs for this project. Therefore, their value was used for all hardware. For Lattice Tower a cost was averaged from suppliers with similar estimates.

CONSTRUCTION SERVICES

Various companies were contacted to provide estimates for construction services. Construction activities are as follows: • Unloading and storage of materials • Constructing foundations • Framing poles • Setting poles • Pull/string conductor • Restoration of area Included with construction costs & the clearing cost. Consultants contacted clearing subcontractors and obtained a cost of clearing from two different contractors. The right of way must be cleared for various reasons, one of the most important being electrical clearance. Trees represent hazards to the transmission line. Construction, surveying, and soil boring activities are all greatly impeded by non-cleared locations. Construction costs will differ depending on soil conditions and structure size. Poor soil conditions will result in larger foundations. Large structure sizes result in larger foundations as well as added difficulty in placement. Some contractors have broken up estimates for specific activities such as pole framing and pole setting while other contractors elected to submit an estimate as a cost per mile of construction. Approximate price for construction services can be seen on the cost summary. In determining the final budgetary estimate one contractor was abnormally low and was therefore not included in our determination. The remaining two contractors' numbers were similar and were averaged and combined with the clearing cost.

EPC PROJECT MANAGEMENT

Project management for this project consists of working with all parties communicating PVUNL(NTPC) needs. The engineer will purchase required materials and contract the subcontractors. Project management would also develop and maintain a construction schedule. The estimated total time to complete this project is 6 to 12 months. One of the most critical tasks is ordering the materials. The lead time on Lattice Tower alone is approximately 10 weeks. Other crucial tasks include aerial and site survey because they need to be completed before most of the engineering can be done. The total cost of this activity is a percentage of the various project activities and can be viewed in the project cost summary.

TOWER SPOTTING DETAILS

PRPOPOSED TOWER DETAILS:-

132KV RAMGARH & HATIA ROUTE					
In Boundary Part					
SL NO	LOC NO	COMMENT	TWR TYP	ANGLE	SPAN(mtr)
1	1R-N-3	COMMON MCT PORTION	MD+0 (MCT-D TYPE)	12D	
					185
2	1R-N-4		MD+0(MCT-D TYPE)	47D	
					218
3	1R-N-5		MA+0(MCT-SUSPENSION)	0D	
					241
4	1R-N-6		MA+0(MCT-SUSPENSION)	0D	
					306
5	1R-N-7		MD+0(MCT-D TYPE)	0D	
					104
6	1H-N-2		D60+0 (DCT) AUX -X ARM	90D	
					50
7	GTU				
TOTAL LENGTH:-					
8	1H-N-1		MD+0(DCT- SUSPENSION)	17D	
					77
7	1H-N-2		D60+0 (DCT) AUX -X ARM	74D	
					27
7	GTU				
TOTAL LENGTH:-					104

220 KV PAT/ TENUGHAT (IN BND) New Route					REMARK
SL NO	LOC NO	TWR TYP	ANGLE	SPAN(mtr)	
1	220-TENNU-N-7	D60+0	3D		
				172	
2	2H-N2	MD+0 (MCT)	8D		COMMON PART
				271	
3	2H-N3	MD+0(MCT)	0		
				182	
4	2H-N4	MD+0(Aux-X-Arm)(MCT)	90D		
				79	
5	2T-N5	DD+0	90D		
				40	
6	GTY	EXISTING			
TOTAL LENGTH:-				744	

220 KV HATIA (IN BND) New Route					REMARK
SL NO	LOC NO	TWR TYP	ANGLE	SPAN(mtr)	
1	2H-N-1C	D60+0	34D		
				295	
2	2H-N-1B	D60+0	45D		
				151	
3	(IN)2H-N-1A	D60+0	56D		
	Rly Xing			246	
4	(IN)2H-N1	D60+0	34D		
				189	
5	2H-N2	MD+0 (MCT)	8D		COMMON PART
				271	
6	2H-N3	MD+0(MCT)	0		
				182	
7	2H-N4	MD+0(Aux-X-Arm)(MCT)	90D		
				40	
8	GTY	EXISTING			
TOTAL LENGTH:-				1374	

DISMANTLE & DESTSTRINGING TOWER DETAILS B&D R P:-

132 KV HATIA (IN BND) Dismantle & Destringing				
SL NO	LOC NO	TWR TYP	ANGLE	SPAN(mtr)
1	2H0a	D0 (SUSPENSION)	0	
				350
2	2H0	D60+0	67D	
				168
3	2H1	D30+0	8D	
				177
4	2H2	D0 (SUSPENSION)	0D	
				220
5	2H3	D60+0	58D	
				310
6	2H4	D60+0	53D	
				96
7	2H5	D60+0(DEAD END)	24D	
				280
8	GTU			
TOTAL LENGTH:-				1601













220 KV TENUGHAT (IN BND) Dismantle & Destringing				
SL NO	LOC NO	TWR TYP	ANGLE	SPAN(mtr)
1	2T5	D60+0	17D	203
				132
2	2T6	D0+0	0D	
				182
3	2T7	D30+0	14D	
				87
4	2T8	D60+0(DEAD END)	0D	
TOTAL LENGTH:-				634

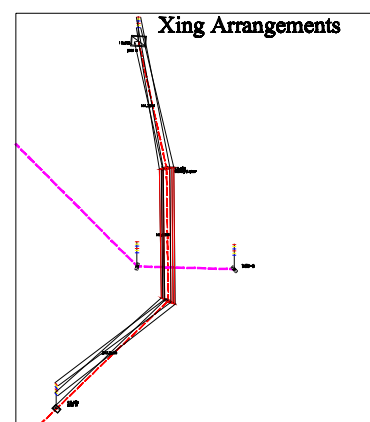
132 KV RAMGARH (IN BND) Dismantle & Destringing				
SL NO	LOC NO	TWR TYP	ANGLE	SPAN(mtr)
1	1R2	D0+0	0D	
				322
2	1R3	D0+0	5D	
				223
3	1R4	D0+0	0D	
				225
4	1R5	D60+0	70D	
				242
5	1R6	D0+0	0D	
				256
6	1R7	D60+0(DEAD END)	0D	
TOTAL LENGTH:-				1168

132 KV HATIA (IN BND) Dismantle & Destringing				
SL NO	LOC NO	TWR TYP	ANGLE	SPAN(mtr)
1	1H2	D0+0	0D	
				340
2	1H3	D0+0	0D	
				329
3	1H4	D0+0	0D	
				254
4	1H5	D60+0	69D	
				205
5	1H6	D30+0	1D	
				207
6	1H7	D60+0(DEAD END)	60D	
TOTAL LENGTH:-				1335

**14. INDEX MAP SHOWING PROPOSED ROUTE ALIGNMENT OF
TRANSMISSION LINE & DISMANTLING EXISTING LINES.**

LEGEND

- | | | |
|-----|---|---|
| 1. | EXIST. SWITCH YARD AREA |  |
| 2. | PROPOSED PUVNL PLANT AREA |  |
| 3. | PROPOSED EXT. ASH DYKE AREA |  |
| 4. | HOUSE HOLDS AREA / VILLAGE AREA |  |
| 5. | ROAD |  |
| 6. | RAILWAY LINE |  |
| 7. | EXT. TRANSMISSION LINE |  |
| 8. | PROPOSED TRANSMISSION LINE |  |
| 9. | FUTURE 220 KV SWITCH YARD |  |
| 10. | FUTURE TRANSMISSION LINE FOR 220 KV SWITCH YARD |  |
| 11. | DOUBLE CIRCUIT TOWER |  |
| 12. | MULTI CIRCUIT TOWER |  |

[illegible][illegible]

DISMANE TOWER DETAILS						
	150	180	200	225	250	275
132 IN GA/VA-1	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275
132 IN GA/VA-2	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275
132 IN GA/VA-3	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275
132 IN GA/VA-4	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275
132 IN GA/VA-5	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275
	150	180	200	225	250	275

REROUTING DETAILS 132 kV(Panther)									
LINE RANGES:	LINE	TYPE	STATUS	DATE	REASON	APPROVAL	REMARKS	DATE	REMARKS
132V RANGEM:	132V-1	132V-1	132V-1	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-2	132V-2	132V-2	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-3	132V-3	132V-3	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-4	132V-4	132V-4	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-5	132V-5	132V-5	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-6	132V-6	132V-6	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-7	132V-7	132V-7	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-8	132V-8	132V-8	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-9	132V-9	132V-9	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-10	132V-10	132V-10	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-11	132V-11	132V-11	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-12	132V-12	132V-12	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-13	132V-13	132V-13	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-14	132V-14	132V-14	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-15	132V-15	132V-15	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-16	132V-16	132V-16	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-17	132V-17	132V-17	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-18	132V-18	132V-18	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-19	132V-19	132V-19	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-20	132V-20	132V-20	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-21	132V-21	132V-21	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-22	132V-22	132V-22	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-23	132V-23	132V-23	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-24	132V-24	132V-24	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-25	132V-25	132V-25	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-26	132V-26	132V-26	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-27	132V-27	132V-27	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-28	132V-28	132V-28	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-29	132V-29	132V-29	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-30	132V-30	132V-30	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-31	132V-31	132V-31	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-32	132V-32	132V-32	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-33	132V-33	132V-33	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-34	132V-34	132V-34	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-35	132V-35	132V-35	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-36	132V-36	132V-36	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-37	132V-37	132V-37	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-38	132V-38	132V-38	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-39	132V-39	132V-39	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-40	132V-40	132V-40	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-41	132V-41	132V-41	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-42	132V-42	132V-42	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-43	132V-43	132V-43	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-44	132V-44	132V-44	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-45	132V-45	132V-45	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-46	132V-46	132V-46	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-47	132V-47	132V-47	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-48	132V-48	132V-48	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-49	132V-49	132V-49	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-50	132V-50	132V-50	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-51	132V-51	132V-51	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-52	132V-52	132V-52	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-53	132V-53	132V-53	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-54	132V-54	132V-54	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-55	132V-55	132V-55	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-56	132V-56	132V-56	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-57	132V-57	132V-57	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-58	132V-58	132V-58	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-59	132V-59	132V-59	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-60	132V-60	132V-60	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-61	132V-61	132V-61	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-62	132V-62	132V-62	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-63	132V-63	132V-63	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-64	132V-64	132V-64	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-65	132V-65	132V-65	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-66	132V-66	132V-66	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-67	132V-67	132V-67	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-68	132V-68	132V-68	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-69	132V-69	132V-69	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-70	132V-70	132V-70	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-71	132V-71	132V-71	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-72	132V-72	132V-72	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-73	132V-73	132V-73	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-74	132V-74	132V-74	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-75	132V-75	132V-75	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-76	132V-76	132V-76	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-77	132V-77	132V-77	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-78	132V-78	132V-78	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-79	132V-79	132V-79	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-80	132V-80	132V-80	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-81	132V-81	132V-81	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-82	132V-82	132V-82	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-83	132V-83	132V-83	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-84	132V-84	132V-84	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-85	132V-85	132V-85	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-86	132V-86	132V-86	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-87	132V-87	132V-87	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-88	132V-88	132V-88	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-89	132V-89	132V-89	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-90	132V-90	132V-90	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-91	132V-91	132V-91	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-92	132V-92	132V-92	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-93	132V-93	132V-93	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-94	132V-94	132V-94	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-95	132V-95	132V-95	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-96	132V-96	132V-96	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-97	132V-97	132V-97	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-98	132V-98	132V-98	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-99	132V-99	132V-99	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-100	132V-100	132V-100	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-101	132V-101	132V-101	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-102	132V-102	132V-102	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-103	132V-103	132V-103	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-104	132V-104	132V-104	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-105	132V-105	132V-105	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-106	132V-106	132V-106	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-107	132V-107	132V-107	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-108	132V-108	132V-108	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-109	132V-109	132V-109	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-110	132V-110	132V-110	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-111	132V-111	132V-111	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-112	132V-112	132V-112	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-113	132V-113	132V-113	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-114	132V-114	132V-114	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-115	132V-115	132V-115	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-116	132V-116	132V-116	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-117	132V-117	132V-117	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-118	132V-118	132V-118	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-119	132V-119	132V-119	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-120	132V-120	132V-120	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-121	132V-121	132V-121	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-122	132V-122	132V-122	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-123	132V-123	132V-123	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-124	132V-124	132V-124	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-125	132V-125	132V-125	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-126	132V-126	132V-126	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-127	132V-127	132V-127	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-128	132V-128	132V-128	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-129	132V-129	132V-129	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-130	132V-130	132V-130	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-131	132V-131	132V-131	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-132	132V-132	132V-132	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-133	132V-133	132V-133	1994	Revised 2nd		Off to be installed		2 double-end-Grounding
	132V-134	132V-134	132V-134	1994	Revised 2nd		Off to be installed		2 double-end-Grounding

[illegible][illegible]

SLNO	LOCITY	THW	THP	AMGE	SPRNGM
1	132 CNC 4.1 (East) (cont)			520	
2	132 CNC 4.1 (East)		140		528
3	132 CNC 4.2 (cont)			180	
	132 CNC 4.2 (cont)		180		528
4	132 CNC 4.3 (cont)		200		
	132 CNC 4.3 (cont)		200		504
5	132 CNC 4.4 (cont)		400		
	132 CNC 4.4 (cont)		300		525
6	132 CNC 4.5 (cont)				500
7	132 CNC 4.6 (cont)		110		
	132 CNC 4.6 (cont)		100		540
	132 CNC 4.6 (cont)				500
9	132 CNC 4.6 (cont)		110		
	132 CNC 4.6 (cont)		110		262
10	132 CNC 4.7 (cont)		110		
	132 CNC 4.7 (cont)				99
11	132 CNC 4.8 (East) (cont)		100		

[illegible]

220 KV HATTA (OUTER BND) New Route						
SL NO	LOC NO	220-PAT-HAT-N	TH W T R	ANGLE	SPAN	
1	220-PAT-HAT-E-5	A=0	A=0			
2	220-PAT-HAT-N-1	D=0	320			201
3	220-PAT-HAT-N-2	A=0	00			215
4	220-PAT-HAT-N-3	A=0	00			274
5	220-PAT-HAT-N-4	D=0	450			318
6	220-PAT-HAT-N-5	D=25	180			320
7	220-PAT-HAT-N-6	D=25	560			370
8	220-PAT-HAT-N-7	D=0	170			304
9	220-PAT-HAT-E-1	A=0	00			
						550

SEMO	LOC MO	TYPE TYP	SPRINGER	REMARKS
1	1.00 JAV. (-) 34			NOT
2	1.00 JAV. (-) 34			NOT
3	1.00 JAV. (-) 34			NOT
4	1.00 JAV. (-) 34			NOT
5	1.00 JAV. (-) 34			NOT
6	1.00 JAV. (-) 34			NOT
7	1.00 JAV. (-) 34			NOT
8	1.00 JAV. (-) 34			NOT

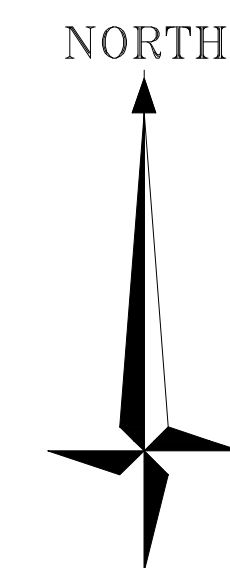
132 KV RATED COUNTER-BRICK OUTLET LINE					
3. NO	132 KV NO	TRANS TYP	TRANS	3. NO	3.
1	132-PAS-TRANS-1				302
2	132-PAS-TRANS-2				303
3	132-PAS-TRANS-3				304
4	132-PAS-TRANS-4				305
5	132-PAS-TRANS-5				306
6	132-PAS-TRANS-6				307
7	132-PAS-TRANS-7				308
8	132-PAS-TRANS-8				309

220 KV HATA (OUTER BINS) Elements & Devices				
SL NO	LOC NO	TWISTY	SPAN	REMARKS
1	220-PAT-HAT-E-5	A+0	378	
2	220-PAT-HAT-E-4	A+0	301	
3	220-PAT-HAT-E-3	A+0	350	
4	220-PAT-HAT-E-2	A+0	333	
5	220-PAT-HAT-E-1	A+0	323	
6	220-PAT-HAT-E-0	A+0	1666	

POWER GRID (CGL)
SWITCH YARD (220 KV)
CGL
220/400 KV

VARNPUR CEMENT

PVUNL & JUSNL



1:10000
73 E/6

**CONCEPTUAL PLAN FOR 132 KV & 220 KV TRANSMISSION LINE SHIFTING
AT PATRATU FROM EXISTING PTSP SWITCH YARD TO OUT OF BOUNDARY OF PURPOSED PUVNL
& CONNECTING TO JUSNL, PATRATU, JHARKHAND**

Drawing No-01/option-3/ dated-10/06/2017

<p>CONCEPTUAL ROUTE PLAN FOR 132 KV & 220 KV TRANSMISSION LINE SHIFTING</p> <p>PUVNL, PATRATU, JHARKHAND</p> <p>CLIENT:- JHARKAHDN URJA SANCHARAN NIGAM LTD.</p> <p>PREPARED BY:- GLOBAL PROJECTS & ENGINEERING CONSULTANTS, RANCHI</p>

