



BIA and BMP for 400 kV Transmission Line Corridor Passing through Protected area of Karnataka State

M/s. Goa Tamnar Transmission Project
Limited (GTTPL)

Final Report

21 December 2020

Project No.: 0476969

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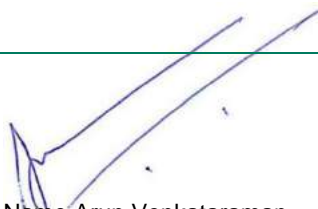
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Final Report



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Acronyms and Abbreviations

Name	Description
ATV	All-Terrain Vehicle
BIA	Biodiversity Impact Assessment
BMP	Biodiversity Management Plan
BMWS	Bhagwan Mahaveer Wildlife Sanctuary
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CR	Critically Endangered
DD	Data Deficient
EHV	Extra High Voltage
EN	Endangered
EPMs	Environmental Protection Measures
EPS	Electric Power Survey
ERM	ERM India Private Limited
GoI	Government of India
GTTPL	Goa Tamnar Transmission Projects Limited
IUCN	International Union for Conservation of Nature
IVI	Importance value Index
KPTCL	Karnataka Power Transmission Corporation Limited
LC	Least Concern
LILO	Line In Line Out
NA	Not assessed
NGO	Non-Governmental Organisation
NT	Near Threatened
PCCF (WL)	Principal Chief Conservator of Forests (Wildlife)
PGCIL	Power Grid Corporation of India Limited
ROW	Right of Way
SPV	Special Purpose Vehicle
VU	Vulnerable
WLS	Wildlife sanctuary

1. INTRODUCTION

Goa Tamnar Transmission Projects Limited (GTTPL) is developing the project, “Additional 400 kV feed to Goa and Additional System for Power Evacuation from Generation Projects pooled at Raigarh (Tamnar) Pool” which is awarded to them through tariff based competitive bidding process.

The transmission line proposed route is passing through the Dandeli Wildlife Sactuary (DWS which attracts wildlife clearance from the State Wildlife Board of Karnataka and National Wildlife Board at Ministry of Environment, Forest and Climate Change, Government of India.

GTTPL has entrusted ERM India Private Limited (ERM) to undertake a Biodiversity Impact Assessment study and prepare a biodiversity management plan for the project. The current study assesses the biological impacts of the transmission line project of the flora and fauna of the wildlife sanctuary and presents the biodiversity management plans to be implemented during the construction and operation phase of the project.

1.1 Project Background

The peak demand met by Goa during the year 2014-15 was 489 MW and as per the 18th EPS, the peak demand of 815 MW was expected by the end of 12th Plan (2016-17) and 1192 MW by the end of 13th plan (2021-22).

At present demand of Goa is mainly catered through Mapusa 3x315 MVA, 400/220 kV substation, which gets a feed from Kolhapur 400 kV substation through a 400 kV D/c line. Goa system is also connected with Maharashtra and Karnataka through 220 kV lines.

To supply the projected power requirement of Goa with reliability, an additional 400 kV in the feed to Goa was required. The matter was discussed in the 38th meeting of Standing Committee on Power System Planning in Western Region, held on 17th July 2015 at New Delhi wherein the provision for a new 400kV S/s in Goa at Xeldem along with its interconnections with the Inter-State Transmission System was agreed. Accordingly, following transmission system was discussed and approved in the 39th & 40th SCM of WR held on 30th November 2015 & 01st June 2016 respectively and 39th & 40th SCM of SR held on 28th and 29th December 2015 and 19th November 2016 respectively.

1.2 Project Brief

The project is a part of “Additional 400 kV feed to Goa and Additional system for Power Evacuation from Generation Projects Pooled at Rajgarh (Tamnar) Pool”. PFC Consulting Limited (A wholly owned subsidiary of Power Finance Corporation Limited) on behalf of Ministry of Power (GoI) entrusted Goa Tamnar Transmission Project Ltd. to construct the transmission projects in Goa, Karnataka & Chhattisgarh state for “Additional Feed of 400 kV to Goa State”.

The project component for this transmission line project is presented in **Table 1.1** below

Table 1.1 Transmission Line Project Components

Sn	Transmission System for “Additional 400kV feed to Goa”
1.	LILO of one ckt. of Narendra (existing) – Narendra (New) 400kV D/C quad line at Xeldem
2.	Xeldem – Mapusa 400kV D/C (quad) line
3.	Establishment of 2x500MVA, 400/220kV substation at Xeldem <u>400kV</u>

Sn	Transmission System for “Additional 400kV feed to Goa”
	<ul style="list-style-type: none"> ■ ICTs : 2x500MVA, 400/220kV ■ ICT bays: 2 nos. ■ Line bays: 4 nos. (2 nos. for Xeldem – Mapusa 400kV D/c (quad) line & 2 nos. for LILO of one ckt of Narendra (existing) – Narendra (New) 400kV D/c quad line at Xeldem) ■ Bus Reactor: 1x125MVAR ■ Bus Reactor Bay: 1 no ■ Space for 2x500MVA, 400/220kV ICTs (future) ■ Space for ICT bays (future): 2 nos. ■ Space for Line bays along with Line Reactors (future): 4 nos. ■ 1x63MVAR switchable line reactor along with 500 Ohms NGR and its auxiliaries (for Narendra (existing) – Xeldem 400kV line formed after LILO of one ckt of Narendra (existing) – Narendra (New) 400kV D/c quad line at Xeldem) ■ 1x80MVAR switchable line reactor along with 500 Ohms NGR and its auxiliaries (for Narendra (New) –Xeldem 400kV (quad) line formed after LILO of one ckt of Narendra (existing) – Narendra (New) 400kV D/c quad line at Xeldem) <p><u>220kV</u></p> <ul style="list-style-type: none"> ■ 220kV inter-connection with Xeldem (existing) substation ■ ICT bays: 2 nos. ■ Line bays: 6 nos. ■ Space for ICT bays (future): 2 nos. ■ Space for Line bays (future): 6 nos.

1.3 Project Justification

The construction of 400 kV D/C Xeldem- Narendra is an additional feed to Goa State to meet arising power deficit through the present network system. The Project shall be implemented through the Special Purpose Vehicle (SPV) named Goa-Tamnar Transmission Project Limited which shall be the complete owner and operator of the project. This project is part of National Grid Development.

During a survey of this transmission line, it was known that the line passes through several forest patches of Goa and Karnataka Forest Division. Transmission line projects are environmentally friendly and do not involve any disposal of solid effluents and hazardous substances in land, air, and water. The constructional features of 400 kV Transmission line are such that it is not affecting the environment as it's not dividing the existing forest because of long spans between the towers (400 Mtrs). The layout of transmission line follows along the forest road/forest block boundary thus involving minimum tree felling and also allowing free movement of birds due to high towers heights 45 – 50 Mtrs. The ground clearance for lower-most conductors is 8.84 Meters. The spacing between the phase conductors is (4 Mtrs) as well. A very small space is required for the construction of tower foundations (maximum 20 X 20 Mtrs). The tower foundations are under the ground (3.5 Mtrs) and a small portion of 0.50X0.50 Mtrs are elevated as a plinth.

Although this has been ensured that the incurred forest area should be minimum & unavoidable to the extent possible. To confirm the forest area is minimum & unavoidable, three (03) possible alternate routes from generating to terminating end of the transmission line was worked out and the least impacting route was selected. The route comparison of the 3 routes are given in following section;

The 400 kV D/C Narendra (Karnataka) – Xeldem (Goa) Transmission Line is starting from Narendra village in Dharwad District, Karnataka by tapping the existing 400 kV Narendra line of PGCIL by LILO and terminating at 400/220 kV substation at Xeldem in Goa. The line will be passing through Dharwad, Belgaum and Uttar Kannada District of Karnataka and South Goa District of Goa.

Three alternative route corridors were identified largely by maximizing linear sighting opportunities, such as following existing roadways and power line corridors, negotiation with rivers, railway, road electric power line crossings. All efforts have been made to provide minimum no of angle points.

Power line crossings have been fixed as close as possible to a right angle. Every effort has been made to minimize & avoid forestry.

In Karnataka the total length of the proposed route is 77.641 Km. Out of this only 31.887 Km is forest land and 6.61 Km falls in Dandeli Wild Life Sanctuary and the remaining 39.144 Km is Non Forest Land. In Dandeli Wild Life Sanctuary, there is one 220 kV line and one 110 kV line of KPTCL feeding Goa. The 110 kV line is defunct from border of Goa to Anmod village. Beyond Anmod this 110 kV line is charged and is feeding Anmod Substation so cannot be used. As per the directions of PCCF (WL) and Chief Wild Life Warden Karnataka, proposed route has been aligned such that our 400 kV transmission line will be using the defunct 110 kV corridor thus avoiding new corridor where ever possible.

The total Bee Line Length in Karnataka is 75.642 Km. The line length of Alternate – I (Proposed Line) is 77.64 Km. Alternate – II is 79.1 Km. Alternate – III is 79.855 Km.

Alternate Route I- The length of forest and wild life in alternate – I is 38.497 Km (Forest – 31.887 Km and WL – 6.61 Km).

Alternate Route II- The length of forest and wildlife in alternate – II is 51.5 Km (Forest – 43.40 Km and WL 8.1 Km).

Alternate Route III- The length of forest & wildlife in alternate – III is 50.853 Km (Forest –41.91 Km and WL 8.944 Km).

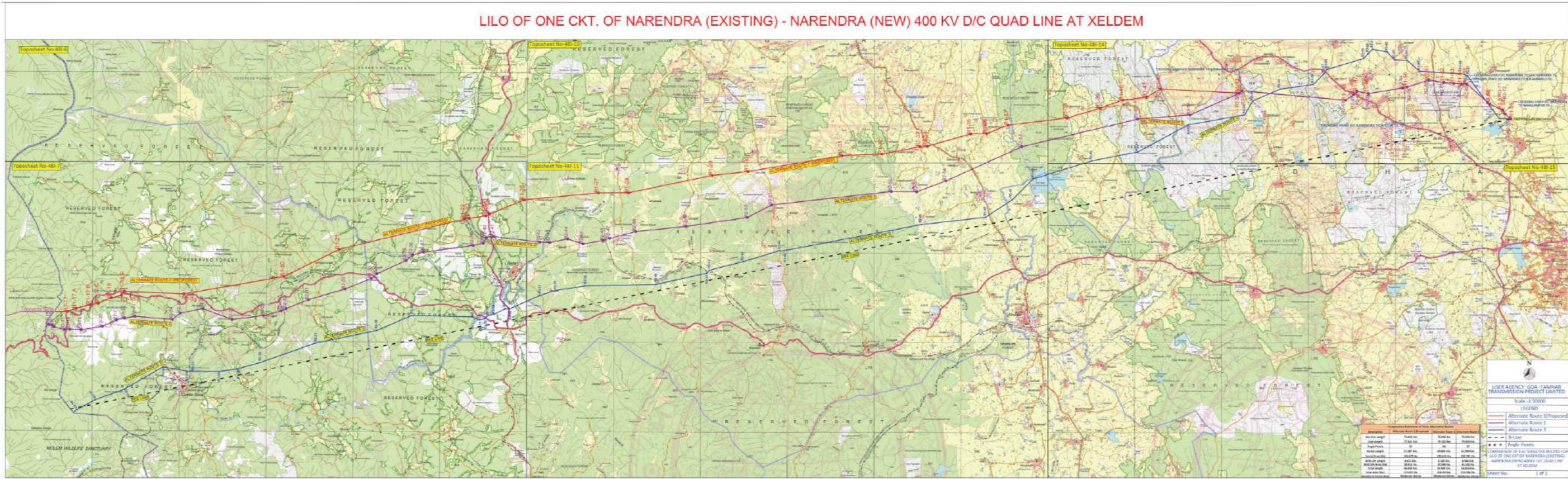
In view of the above facts, it is evident that alternate – I involve the minimum forest and Wild Life Sanctuary land as well non-forest land. (Refer **Table 1.2**)

Table 1.2 Comparative Statement of Three Alternative Routes

Description	Alternate Route 1 (Proposed Route)	Alternate Route 2	Alternate Route 3
Bee Line Length	75.642 Km	75.642 Km	75.642 Km
Line Length	77.64 Km	79.1 Km	79.85 Km
Angle Points	50	62	54
Forest Length	31.887 Km	43.40 Km	41.91 Km
Wildlife Length	6.61 Km	8.1 Km	8.944 Km
Total Forest & WL Length	38.497 Km	51.5 Km	50.853 Km
Forest Area (Ha)	146.679 Ha	199.64 Ha	192.781 Ha
Wildlife & NP Area	30.412 Ha	37.26 Ha	41.142 Ha
Total Forest & WL Area	177.091 Ha	236.9 Ha	233.923Ha
Density of Forest Area	Moderate Dense	High Dense	Moderate Dense

After detailed analysis as per **Table 1.2** above, it is observed that the alternative – I have the least route length and has minimum crossings in terms of rail, road and existing power line. Keeping the above points in consideration, we propose Alternative – I to be taken as final proposed route alignment. The area falling in Karnataka section is presented below (Refer to **Figure 1.1**).

Figure 1.1 Alternate Routes for Xeldem Narendra Line within Karnataka State



1.4 Report Layout

The report is presented in the following format.

Section	Name
Chapter 1 (This Section)	Introduction
Chapter 2	Project Description
Chapter 3	Ecological Baseline
Chapter 4	Impact Assessment
Chapter 5	Mitigation Measures
Chapter 6	Biodiversity Management Plan

2. PROJECT DESCRIPTION

The project is a part of “Additional 400 kV feed to Goa and Additional system for Power Evacuation from Generation Projects Pooled at Rajgarh (Tamnar) Pool”. PFC Consulting Limited (A wholly owned subsidiary of Power Finance Corporation Limited) on behalf of Ministry of Power (GoI) entrusted Goa Tamnar Transmission Project Ltd. to construct the transmission projects in Goa, Karnataka & Chhattisgarh state for “Additional Feed of 400 kV to Goa State”.

The project component for this transmission line project is presented in **Table 2.1** below

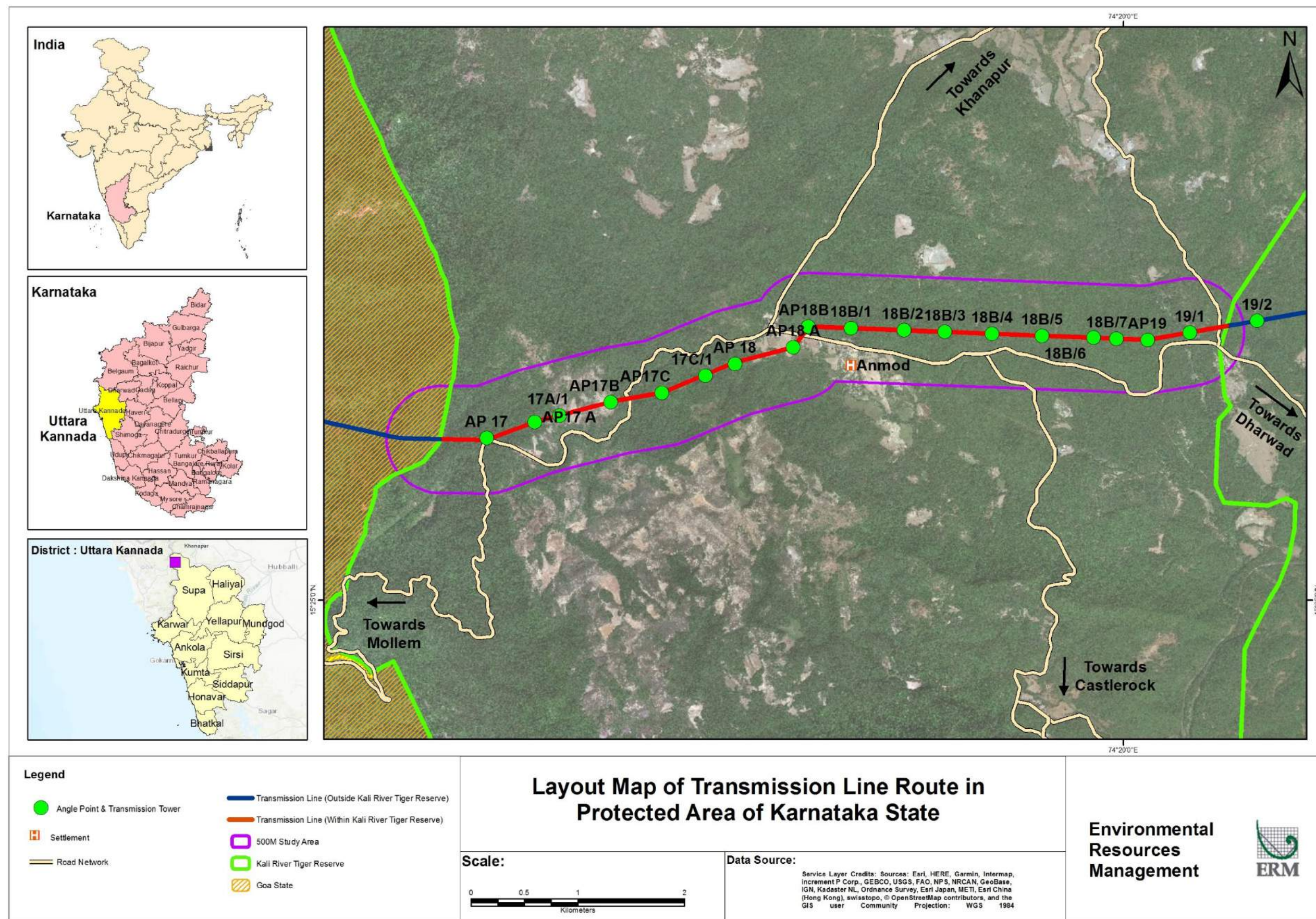
Table 2.1 Transmission Line Project Components

Sn	Transmission System for “Additional 400kV feed to Goa”
1.	LILO of one ckt. of Narendra (existing) – Narendra (New) 400kV D/c quad line at Xeldem
2.	Xeldem – Mapusa 400kV D/c (quad) line
3.	<p>Establishment of 2x500MVA, 400/220kV substation at Xeldem</p> <p><u>400kV</u></p> <ul style="list-style-type: none"> ■ ICTs : 2x500MVA, 400/220kV ■ ICT bays: 2 nos. ■ Line bays: 4 nos. (2 nos. for Xeldem – Mapusa (Goa State) 400kV D/c (quad) line & 2 nos. for LILO of one ckt of Narendra (existing) – Narendra (New) (Karnataka State) 400kV D/c quad line at Xeldem) ■ Bus Reactor: 1x125MVAR ■ Bus Reactor Bay: 1 no ■ Space for 2x500MVA, 400/220kV ICTs (future) ■ Space for ICT bays (future): 2 nos. ■ Space for Line bays along with Line Reactors (future): 4 nos. ■ 1x63MVAR switchable line reactor along with 500 Ohms NGR and its auxiliaries (for Narendra (existing) – Xeldem 400kV line formed after LILO of one ckt of Narendra (existing) – Narendra (New) 400kV D/c quad line at Xeldem) ■ 1x80MVAR switchable line reactor along with 500 Ohms NGR and its auxiliaries (for Narendra (New) –Xeldem 400kV (quad) line formed after LILO of one ckt of Narendra (existing) – Narendra (New) 400kV D/c quad line at Xeldem) <p><u>220kV</u></p> <ul style="list-style-type: none"> ■ 220kV inter-connection with Xeldem (existing) substation ■ ICT bays: 2 nos. ■ Line bays: 6 nos. ■ Space for ICT bays (future): 2 nos. ■ Space for Line bays (future): 6 nos.

2.1 Transmission Line Route in Karnataka State Protected Area

The Transmission line route passes through the Dandeli Wildlife Sanctuary (DWS). It intercepts DWS in two sections. At first, it enters the DWS from Goa Karnataka Border and then secondly it enters ahead of Anmod village to Kali River Crossing. The location map of the transmission line in the protected area of Karnataka State is provided in **Figure 2.1** and route overlaid over the forest map in **Figure 2.2**, **Figure 2.3** and **Figure 2.4**.

Figure 2.1 Layout Map of Transmission Line route in Protected Area of Karnataka State



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Figure 2.3 Transmission Line route overlaid over Forest Map (Anmod)

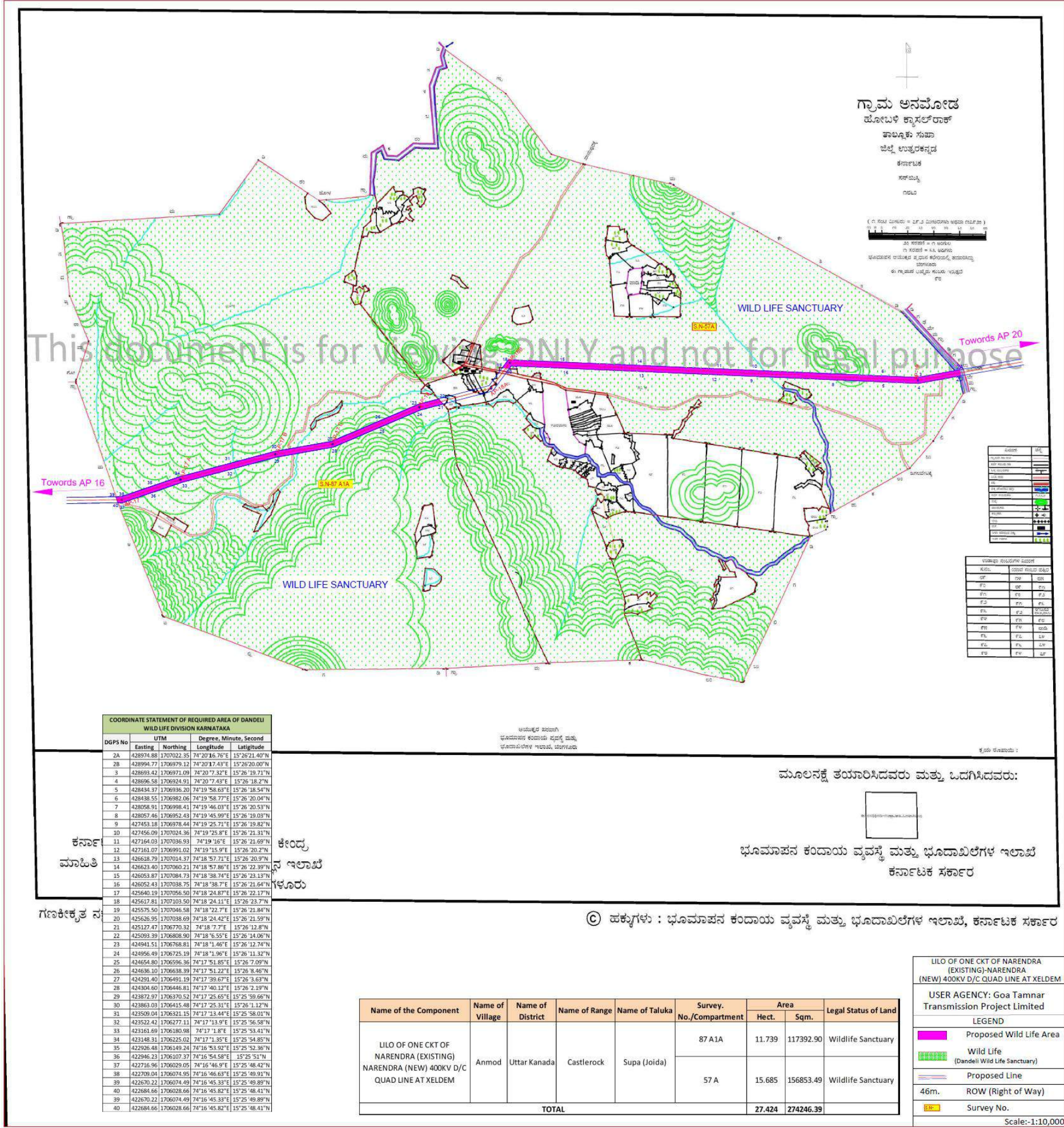
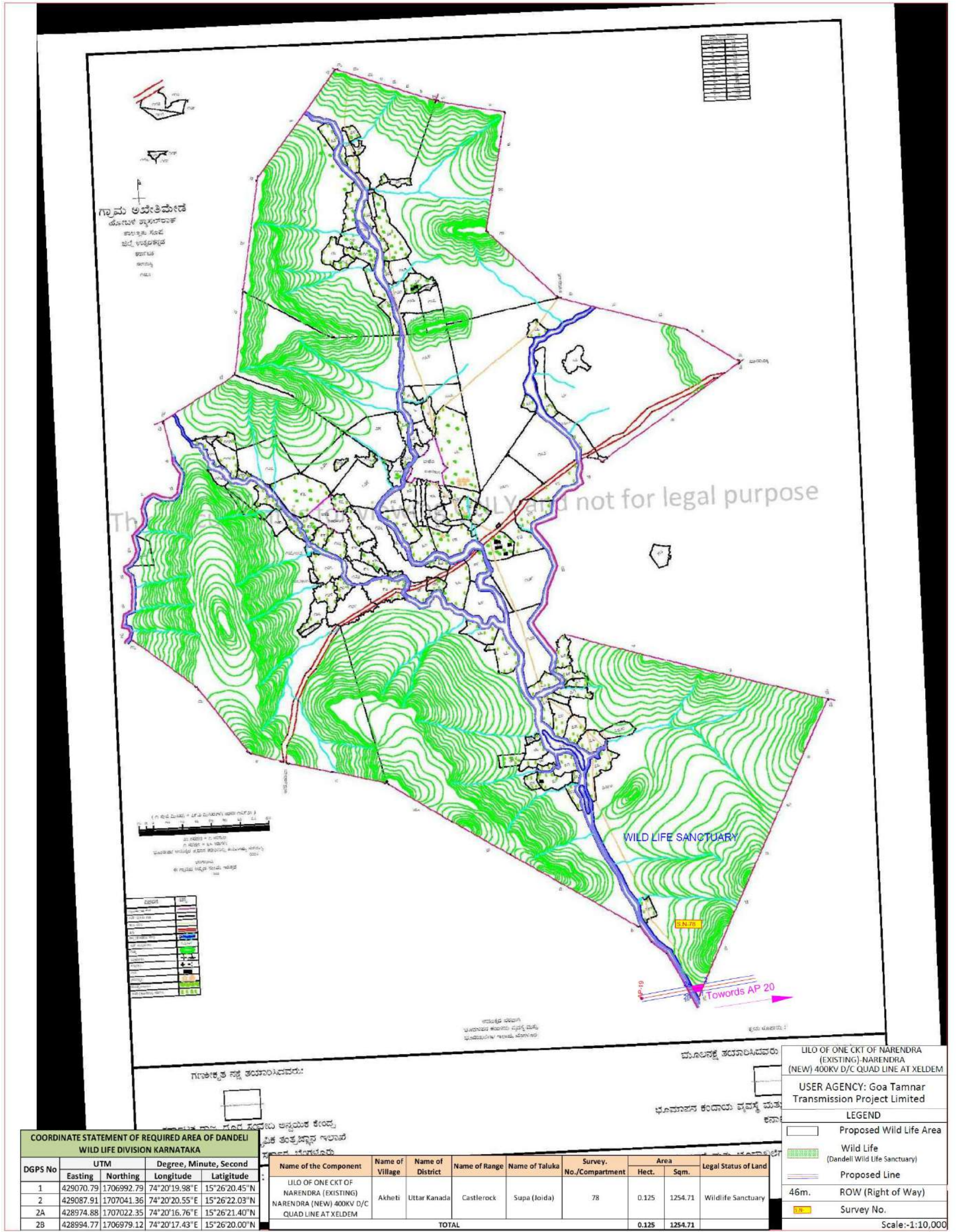


Figure 2.4 Transmission Line route overlaid over Forest Map (Akheti)



The total length of the Transmission Line within in DWS, is falls in three (03) Surveys numbers/Forest compartments. The details are given in below in **Table 2.2.**

Table 2.2Coordinate Statement of required area of Wildlife Division, Karnataka

DGPS No.	UTM		Degree, Minute Second		Wildlife Division	Village Name	Compartment/ Survey No.	Area (Ha.)	Legal Status of Land					
	Easting	Northing	Longitude	Latitude										
1	429015.57	1706982.99	74°20'19.98" E	15°26'20.45"N	Dandeli	Akheti	78	0.125	Reserved Forest					
2	429007.33	1707028.24	74°20'20.55" E	15°26'22.03" N										
2A	428974.88	1707022.35	74°20'16.76" E	15°26'21.40" N										
2B	428994.77	1706979.12	74°20'17.42" E	15°26'20.00" N										
3	428693.42	1706971.09	74°20'7.32" E	15°26'19.71" N	Dandeli	Anmod	87A1A	11.739	Reserved Forest					
4	428696.58	1706924.91	74°20'7.43" E	15°26'18.2" N										
5	428434.37	1706936.20	74°19'58.63" E	15°26'18.54" N										
6	428438.55	1706982.06	74°19'58.77" E	15°26'20.04" N										
7	428058.91	1706998.41	74°19'46.03" E	15°26'20.53" N										
8	428057.46	1706952.43	74°19'45.99" E	15°26'19.03" N										
9	427453.18	1706978.44	74°19'25.71" E	15°26'19.82" N										
10	427456.09	1707024.36	74°19'2.58" E	15°26'21.31" N										
11	427164.03	1707036.93	74°19'16" E	15°26'21.69" N										
12	427161.07	1706991.02	74°19'15.9" E	15°26'20.2" N										
13	426618.79	1707014.37	74°20'57.71" E	15°26'20.9" N										
14	426623.40	1707060.21	74°18'57.86" E	15°26'22.39" N										
15	426053.87	1707084.73	74°18'38.74" E	15°26'23.13" N										
16	426052.43	1707038.75	74°18'38.7" E	15°26'21.64" N										
17	425640.19	1707056.50	74°18'24.87" E	15°26'22.17" N										
18	425617.81	1707103.50	74°18'24.11" E	15°26'23.7" N										
19	425575.50	1707046.58	74°18'22.7" E	15°26'21.84" N										
20	425626.95	1707038.69	74°18'24.42" E	15°26'21.59" N										
21	425127.47	1706770.32	74°18'7.7" E	15°26'12.8" N						Dandeli	Anmod	57A	15.685	Reserved Forest
22	425093.39	1706808.90	74°18'6.55" E	15°26'14.06" N										
23	424941.51	1706768.81	74°18'1.46" E	15°26'12.74" N										
24	424956.49	1706725.19	74°18'1.96" E	15°26'11.32" N										
25	424654.80	1706596.36	74°17'51.85" E	15°26'7.09" N										
26	424636.10	1706638.39	74°17'51.22" E	15°26'8.46" N										
27	424291.40	1706491.19	74°17'39.67" E	15°26'3.63" N										
28	424304.60	1706446.81	74°17'40.12" E	15°26'2.19" N										
29	423872.97	1706370.52	74°17'25.65" E	15°25'59.66" N										
30	423863.03	1706415.48	74°17'25.31" E	15°25'1.12" N										
31	423509.04	1706321.15	74°17'13.44" E	15°25'58.01" N										
32	423522.42	1706277.11	74°17'13.9" E	15°25'56.58" N										
33	423161.69	1706180.98	74°17'1.8" E	15°25'53.4" N										
34	423148.31	1706225.02	74°17'1.35" E	15°25'54.85" N										
35	422926.48	1706149.24	74°16'53.92" E	15°25'52.36" N										
36	422946.23	1706107.37	74°16'54.58" E	15°25'51" N										
37	422716.96	1706029.05	74°16'46.9" E	15°25'48.42" N										
38	422709.04	1706074.95	74°16'46.63" E	15°25'49.91" N										
39	422670.22	1706074.49	74°16'45.33" E	15°25'49.89" N	Dandeli	Atle	2	2.863	Reserved Forest					
40	422684.66	1706028.66	74°16'45.33" E	15°25'48.41" N										
41	422343.62	1706024.54	74°16'34.33" E	15°25'48.23" N										
42	422342.72	1706070.53	74°16'34.33" E	15°25'49.73" N										
43	422073.76	1706067.29	74°16'25.33" E	15°25'49.6" N										
44	422036.58	1706020.84	74°16'24.33" E	15°25'48.08" N										
Total							30.412							

2.2 Tower Details

Tower detailed for the transmission line is presented in **Table 2.3**. A total of 18 transmission towers are planned to be erected for the entire stretch within Dandeli Wildlife Sanctuary (DWS).

Table 2.3 Tower Details

Tower Parameter	Tower Details
Type of the Towers	WZ-1 DA,DB,DC,DD WZ-2 DA,DB,DC,DD
The total height of the tower above the ground level	46.40 m
The average distance between the Towers	400 m
Total no. of towers installed within the Sanctuary area	08 angle & 10 suspension
Foundation area for each tower	20 X 20 m
Elevated Plinth area	0.50X0.50 m
Type of basement	Concrete (RCC/PCC)
Depth	3.5 m
Mode of pit digging for basement construction	Drilling & Manual excavation

Tower design diagrams are presented in **Annex A**, and foundation design diagrams are presented in **Annex B**.

2.3 Conductor Details

The horizontal distance between two conductors varies from 11 m. The lowest conductor from the ground will be providing a ground clearance of 8.84 m + additional 6 m for elephant corridor. the conductor arrangement is present in .

Table 2.4.

Table 2.4 Conductor Details

Conductor Details	
The distance between the two conductors	
Phase to Phase	11 m
Mid Span Clearance	9 m
Ground Clearance	8.84 m+ 6 m

2.4 Siting Criteria for Transmission Line

The siting criteria¹ for transmission line sector is mentioned below:

- The alignment of the transmission line should be most economical from the point of view of construction and maintenance.
- The alignment of the transmission line selected should be the shortest route possible.
- Routing of the 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, the route should be aligned in such a way that cutting of trees is minimum.

(¹) These criteria conform to the "Guidelines for linear infrastructure intrusions in natural areas: roads and power lines, 2011, MoEF, GOI".

- The route should have minimum crossings of major rivers, railway lines, national/state highways, overhead EHV power line, and communication lines.
- The number of angle points shall be kept at a minimum.
- Marshy and low lying areas, river beds and earth slip zones shall be avoided to minimize risk to the foundations.
- It would be preferable to utilize the ground level for the alignment.
- The crossing of power lines shall be minimum. In case it is required, a gap of a minimum distance of 300 m between power lines to avoid induction problems on the lower voltage lines.
- The crossing of communication line shall be minimized and if crossings do occur they shall be cross preferably at right angles. Proximity and parallelism with telecom lines shall be eliminated to avoid the danger of induction to them.
- Areas subjected to flooding such as ditches (nullahs) shall be avoided.
- Restricted areas such as civil and military airfield shall be avoided. Care shall also be taken to avoid aircraft landing approaches.
- All alignment should be easily accessible both in dry and rainy seasons to enable maintenance throughout the year.
- Certain areas such as quarry sites, tea, tobacco plantations, and saffron and rice fields and gardens & nurseries which will result in problems of the right of way during construction and maintenance of towers, should be avoided.
- Angle points should be selected such that shifting of the point within 100 m radius is possible at the time of construction of the transmission line.
- The line routing should avoid large habitations, densely populated areas, forest, animal/bird sanctuaries, reserve coal belt areas, oil pipeline/underground inflammable pipelines etc. to the extent possible.
- The areas requiring special foundations and those prone to flooding should be avoided.

2.5 Construction Activities and Methods

2.5.1 Installation of 400 kV steel tower foundations

The foundations will be excavated manually using manual or mechanized tools and plants and concrete will be mixed manually by hand mixing at the same location.

The standard foundation practice is to have four individual footings for each tower leg. The tower foundation area will be set out and pegged prior to foundation excavation. All such removals are restored upon completion of foundation works. Excavations are set out specifically for the type of tower and the type of foundation required for each specific site.

When each leg is excavated the formation levels (depths) are checked by the onsite engineer. A Prop technique is used to set and hold the tower stubs in position while the concrete is being poured and cured.

After the concrete is poured the remaining part of the foundation, the shear block or neck, is shuttered. Once the shuttering is complete more concrete may be poured and the foundation completed. The tower foundations are backfilled one leg at a time usually with the material already excavated. The backfill is placed and compacted in layers.

Figure 2.5 Photograph setting template being prepared for final concreting



Foundation size

The average foundation size for each tower leg used on the 400kV transmission system is 5.3m x 5.3m x 3.5m for single circuit tower, 5.1m x 5.1m x 3.5m for double circuit angle

Working area

The average working area for construction of a 400 kV tower will be limited to the approved right of way.

Construction equipment to be used for foundation

- 4x4 vehicle upto last approach point of available roads
- Concrete Vibrator
- Timber or other Shuttering boxes
- Hand tools for manual excavation
- Transit van upto last approach point of available roads
- Chains and another small tools
- Concrete Mixer (200Kgs)

Duration of foundation work

- Tower foundation work 10-12 days
- Crew size 18-20 workers

2.5.2 Erection of Tower Body

The most common and effective method of constructing a transmission line of this nature is a “derrick pole”. The methodologies are outlined below.

Derrick Pole Methodology

The tower can be erected using a Derrick / gin pole and tractor. The derrick pole is a very simple and straight forward way to build the tower where small sections of steel are lifted into place using the derrick and a winch. As illustrated the derrick consists of a solid steel pole which is held in position using guy ropes anchored to the ground.

Figure 2.6 Model visual: Derrick pole at the tower base



Construction equipment to be used for tower erection.

- 4x4 vehicle upto last approach point of available roads
- Winch machine
- Derrick pole
- Transit van upto last approach point of available roads
- Chains and other small tools

Duration of tower erection works

The average duration of tower building works is as follows:

- Each Tower erection: 6-8 days
- Crew size: 25 workers

2.5.3 Stringing of Conductor

- Stringing of conductor is done using Mechanised method and power winch.
- Conductor is pulled through pilot wire/ steel wire rope of adequate size.

- The entire operation is done aurally without allowing the conductor to touch the ground.
- For special cases the use of Unmanned Aerial Vehicle (UAV) is now been implemented to safely expedite the process.

Figure 2.7 Conductor Stringing



Once the conductor has been pulled into position, one end of the straight is terminated on the appropriate tension fittings and insulator assemblies. The free end of the straight is then placed in temporary clamps called “come-along” which take the conductor tension. The conductor is then cut from the puller-tensioner and the conductor is sagged using a chain hoist.

Construction equipment to be used during stringing of conductor and earth wire

- 4x4 vehicles upto last approach point of available roads
- Drum stands X 2 upto last approach point of available roads
- Drum carriers X 2 upto last approach point of available roads
- Aerial sieve
- Conductor drums upto last approach point of available roads
- Compressor & head
- Transit vans upto last approach point of available roads
- Chains and other small tools

- Winch machine

Duration of stringing works

The average duration of stringing works is typically 1 week per straight. This figure is approximately the same for all straights regardless of length as the most time-consuming aspect is the movement and setup of stringing equipment. Stringing crews are typically quite large and could have as many as 65 workers.

2.6 Construction Period

The proposed construction is scheduled to start from February 2021 and likely to be completed by April 2022 (Refer **Table 2.5**) in Dandeli Wildlife Sanctuary

Table 2.5 Proposed Construction Period

SN.	Area of Construction	Tentative Period (month and year)
1	The total period for the construction of the project	Feb'21 to April'22
2	Construction along the Dandeli Wildlife Sanctuary	Feb '21 to Nov'21

2.7 Employment

A total of 324 manpower is expected to be deployed for the goa section of the transmission line passing through Dandeli Wildlife Sanctuary. This includes 26 skilled manpower, 48 semi-skilled manpower and 250 unskilled manpower. (Refer to **Table 2.7**)

Table 2.6 Employment Generation

Source of Manpower	Skilled	Semi-skilled	Unskilled	Total
On Roll Company	8	0	0	8
On roll of EPC contractor	8	8	0	16
Involvement of locals- non-technical people	10	40	250	300
Total	26	48	250	324

2.8 Operation and Maintenance

Activities for routine patrols, inspections, or scheduled maintenance, are planned in advance. However, there will be an occasional need for emergency response in cases where safety and property are threatened, to prevent imminent damage to the transmission line and ancillary facilities, or to restore service in the event of an outage. Routine, corrective, and emergency response activities will be conducted in accordance with this O&M typical schedules.

Routine Maintenance (Preventative Maintenance)

Routine maintenance activities are conducted on a regular basis and have been carried out historically to identify and repair any deficiencies. These activities do not damage vegetation or soil and do not adversely impact sensitive resources including known national and state listed species, waters, and cultural resources. Personnel is generally present in any one area for less than one day. The following are examples of routine maintenance activities:

- Routine air patrols to inspect for structural and conductor defects, conductor clearance problems and hazardous trees.

- Routine ground patrols to inspect structural and conductor components. Such inspections generally require either an All-Terrain Vehicle (ATV) or pickup and possibly additional support vehicles traveling on access and service roads and may rely on either direct line-of-sight or binoculars. In some cases, the inspector may walk the ROW. Follow-up maintenance is scheduled depending on the severity of the problem either as soon as possible or as part of routine scheduled maintenance.
- Climbing surveys may be necessary to inspect hardware or make repairs. Personnel generally accesses these structures by a pickup, ATV, or on foot.
- Structure or conductor maintenance is typically done manually. The maintenance vehicle may be located on or off a road, and no-to-minimal grading is necessary to create a safe work area.
- Cathodic protection surveys to check the integrity and functionality of the anodes and ground beds. These surveys typically require personnel to use an ATV or pickup and make brief stops.
- Routine cyclical vegetation clearing to trim or remove tall shrubs and trees to ensure adequate ground-to-conductor clearances. Vegetation clearing cycles vary from 3 to 5 years or as needed (dependent upon the vegetation present). Personnel generally access the area by a pickup, ATV, or on foot; use chainsaws to clear the vegetation, and typically spend less than half a day in any one specific area. In some cases, vegetation may be cleared using mechanical means.
- Removal of individual trees or snags (hazard trees) that pose a risk of falling into conductors or structures and causing outages or fires. Personnel generally accesses hazard trees by truck, ATV, or by foot from an access or service road, and cut them with a chainsaw or similar tool. Any felled trees or snags are left in place as sources of large woody debris or as previously directed by the land management agency. Felled green trees are limbed to reduce fire hazard.

Corrective maintenance

Corrective maintenance activities are relatively large-scale efforts that occur infrequently, may result in more extensive vegetation clearing or earth movement, and may include rehabilitation seeding and associated activities. Personnel is generally present in any one location or area for a prolonged time, generally more than one day. The following are examples of corrective maintenance:

- Non-cyclical vegetation clearing to remove saplings or larger trees in the ROW.
- Structure or conductor maintenance in which earth must be moved, such as the creation of a landing pad for construction or maintenance equipment.
- Structure (e.g., cross-arm, insulator, structure) replacement.
- Follow-up restoration activities, such as seeding, noxious weed control, and erosion control.
- Conductor repair or replacement, which requires the use of several types of trucks and equipment and grading to create a safe work area to hang and pull the conductor into place.

Emergency Situations

Emergency situations are those conditions that may result in imminent or direct threats to public safety or threaten' ability to provide reliable transmission service to its customers. Emergency situations may include:

- Failure of conductor splices.
- Damage to structures or conductors from wildfire, high winds, thunderstorm, or other weather-related conditions.
- Line or system outages or fire hazards caused by trees falling into conductors.

- Breaking or imminent failure of cross-arms or insulators, which could, or does, cause conductor failure.
- Damage to structures or conductors from vandalism.

In the case of an emergency where life or substantial property is at risk or there is a potential or actual interruption in service, the Company will promptly respond to the emergency and conduct any and all activities, including emergency repair requiring heavy equipment access to the structures or other ancillary facilities, needed to remedy the emergency and will implement feasible and practicable Environmental Protection Measures (EPMs).

3. ECOLOGICAL BASELINE

3.1 Physiographic Unit

The project route passes through a portion of the Western Ghats, a range of mountains 1,600 km long extending from north of Mumbai to Cape of Comorin (Kanyakumari), which is identified as one of the 'hotspots' of biological diversity and endemism in the world.^{1 2} The Ghats extend in the north-south direction and exhibit a rise in altitude.

3.2 Climate

The study area is situated in the tropics and has profound orographic influence. The climate is humid throughout the year, with humidity level ranging from 75% to 95% in the monsoon. The main feature of the climate is the south-west monsoon, which occurs between June and September. The average rainfall is 2500 mm to 3000 mm in the Western Ghats, although the downpour can be considerably high (over 4000 mm). In addition, there are pre-monsoon (May) and post-monsoon (October) showers as a result of the north-east monsoon. Study area receives rain from the south-west monsoon, thereby experiencing a dry period lasting from November to May [November to February (winter) and March to May (summer)]. There is a slight variation in temperature through the seasons. May is the relatively warmest month and the mean daily temperature is around 30°C and maximum temperature rises to 36°C. January is the coolest with a mean daily temperature of about 25°C. The average temperature ranges between 21°C and 30°C.³

During the survey, the weather was sunny with at least two incidents of a thunderstorm and heavy rains in evening and night.

3.3 The Study Area

The proposed transmission line passes through the Dandeli Wildlife Sanctuary as presented in **Figure 2.1 of Chapter 2**. The entire stretch of transmission line route is a greenfield area. The core and buffer areas are demarcated as following.

Core Area: The transmission line route, the tower locations (with activity areas of 10 m radius) and the Right of Way (23 m on each side from median of the line route) is considered as Core area for biodiversity assessments.

(¹) Myer, N. (1990): The biodiversity challenge: Expanded hot spots analysis. *Environmentalist*. 10: 243-256.

(²) Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A. B and Kent, J. (2000): Biodiversity hotspots for conservation priorities. *Nature*. 403: 853-858.

(³) Joshi, V. C and Janarthnam, M. K. (2004): The diversity of life forms type, habitat preference and phenology of the endemics in the Goa region of Western Ghats, India. *Journal of Biogeography*. 31: 1227-1237.

Buffer Area: Buffer areas are considered 500 m radius areas from the transmission tower locations and the transmission route.

Kali Tiger Reserve, earlier known as Dandeli-Anshi Tiger Reserve, is located in the central portion of Uttara Kannada district of Karnataka state. It is sandwiched between Haliyal and Karwar forest divisions, and covers parts of Haliyal, Karwar and Joida taluks. The Tiger Reserve comprises two important protected areas of the region viz., Dandeli Wildlife Sanctuary (475.018 Km²) and Anshi National Park (339.866 Km²). These two protected areas are contiguous to each other and form a single tract of protected area located in the biologically sensitive Western Ghats. These two protected areas were administratively unified under Dandeli-Anshi Tiger Reserve (DATR) in the year 2007. The tiger reserve is headed by a Conservator of Forests. There are two sub-divisions, namely, Dandeli and Anshi wildlife sub-divisions, and consist of six ranges, namely, Kulgi, Phansoli, Gund, Anshi, Kumbharwada and Castlerock wildlife ranges. There are 31 sections and 84 beats in the Tiger Reserve. Forests of the Tiger Reserve are primarily moist deciduous and semi-evergreen, with excellent patches of evergreen forests in the western most parts as well as in deep valleys. Animals found in the Tiger Reserve include Tiger, Leopard, Elephant, Bison, Wild dog, Sambar, Spotted deer, Sloth bear, Wild boar, Hanuman langur, Bonnet macaque, varieties of reptiles and birds, etc.

Kali Tiger Reserve is part of the larger landscape namely Malenad-Mysore Tiger Landscape, Western Ghats, India. The Malenad-Mysore Tiger landscape (MMTL) in the state of Karnataka, India is the most productive habitat for large carnivores in the entire Western Ghats region of Southwestern India. This landscape forms the south-central part of the Western Ghats, extending over 22,400 km² of moist-evergreen, moist-deciduous and the dry-deciduous forest types in Karnataka. The forest matrix includes 14 legally designated wildlife protected areas that cover over 5,500 km² of prime tiger habitat. The rest of the landscape comprises of “multiple-use forests” that surround, abut or connect these protected areas providing a permeable matrix through which large carnivores can potentially disperse or perhaps even persist as non-breeding individuals.

The Transmission line route in Karnataka falls within the Castlerock wildlife range of the sub division Dandeli.

3.4 Study Duration

The ERM team comprising of three members undertook a 5-day reconnaissance survey of the transmission line route from 19th September to 24th September 2018. The reconnaissance survey targeted identification of habitats and approach to the transmission line route. Based on the reconnaissance survey, the plan was developed to undertake a detailed survey. Interactions with the proponent were also undertaken on the different alternatives of the transmission line routes. The detailed 7-day ecological survey was commissioned from 2nd October to 9th October 2018. The survey team has ERM team member and external species experts from various groups of flora and fauna to establish the ecological baseline of the study area.

The study area was revisited during 2nd and 3rd November 2020, to ensure the findings of the 2018 study still holds valid (Refer **Figure 3.1**) and there is no major change in the habitat conditions impacting the baseline. During this site visit it was observed that the road next to Transmission line stretch passing close to the Kali River Bridge was under construction however, no construction activities were undergoing.

Figure 3.1 Current State of Disturbances (Nov. 2020)



Considering, the entire transmission line stretch under Karnataka Wildlife area falling within DWS was not disturbed due to any other major activity; there is a less likelihood of the baseline data collected during the November 2018 being changed/alterd.

3.5 Survey Team

The survey team had following members for the enumerating flora and fauna of the transmission line corridor. The team composition is given in **Table 3.1**

Table 3.1 Ecological Survey Team

Name of the Expert	Area of Specialization
ERM Team	
Dr. Rahul Srivastava (Senior Consultant)	Avifauna and Mammal Expert
Mr. Saumabha Bhattacharya (Consultant)	Avifauna Expert
Dr. Omesh Bajpai (Consultant)	Plant Taxonomist
Mr. Suhas Fuladi (Assistant Consultant)	Mammal Expert
Ms. Kritika Gautam (Assistant Consultant)	Ecology Expert
External Expert	
Mr. Nilim Kumar Khaire (Herpetological Society of India, Pune)	Herpetofauna Expert (Snakes)
Dr. Varad B Giri (Herpetological Society of India, Pune)	Herpetofauna Expert (Amphibians and Reptiles)
Dr. Mandar N Datar (Agharkar Research Institute, Pune)	Plant Taxonomist
Mr. Vijay Patil (Herpetological Society of India, Pune)	Field Support & Data Collection
Mr. Aamatya Sharma (Herpetological Society of India, Pune)	Field Support (Data and Photography)

3.6 The scope of Work for Study

The Study was undertaken to achieve the following scope of work,

- Establish a preliminary baseline of terrestrial floral and faunal species within the study area (Length ~ 7.5 km in DWS in Karnataka (approx.) with 46 m width) and immediate vicinity based on primary survey along with a review of secondary literature.'
- Assess the status of major habitats/forests and associated floral species along the proposed transmission line passing through the WLS/Elephant Reserve;
- Identify wildlife/Tiger/Elephant reserve corridors of flagship species get impacted by the proposed project associated activities;
- Identify & evaluate the likely impacts of the proposed transmission line during construction and operational phase on the habitat and wildlife species found in the area;
- Suggest mitigation measures and Biodiversity management plan to minimize the likely impact on the protected area, its habitat values and overall ecology of the wildlife/Tiger/Elephant reserve corridors.

The approach and methodology to confirm the above scope of work is discussed hereunder

3.7 Approach and Methodology

3.7.1 Approach

Following stepwise approach was followed in order to achieve the conformity with the scope of work for baseline data collection:

Step 1: Reconnaissance Survey- A reconnaissance survey to understand the complexity of terrain, habitats available, an approach for various locations en route to transmission line corridor and potential areas for species enumeration.

Step 2: Secondary Data Collection- Available secondary data through published research papers, books and periodicals and Ph.D. thesis from the area was reviewed and enlisted to confirm the presence of species. Secondary data was also collected on the historical surveys in the area. Management plan of the protected area was also reviewed. Consultation with the locals and forest officials were also made.

Step 3: Primary Data Collection- Primary surveys were undertaken to understand the actual baseline and analyze the impacts of the proposed project on the ecological baseline.

Step 4: Biodiversity Impact Assessment- Assessment of the impact of the various construction and operation activities on the ecological baseline.

Step 5: Biodiversity Management Plan- Preparation of Management plan for mitigation of major impacts of construction and operation activities

3.7.2 The methodology of Primary Data Collection

Primary data collection methods for flora and fauna species are discussed hereunder

Floral Assessment

Floral assessment was focused on

- Enumeration of Trees, Shrubs, Herbs, climbers, and orchids likely to encounter on the transmission line route and its immediate vicinity;
- Undertake phytosociology along the transmission line corridor to calculate frequency, density and abundance for plant species along with the IVI and calculation of species richness and species diversity;
- The enumerated list of floral species will be compared to Indian Red Data Book and species listed in the IUCN Red data list to confirm their conservation status.
- Following will be emphasized;
 - Species with conservational significance (Indian Red Data Book)
 - Endemic flora species
 - Species with high commercial value

The detailed methodology for data collection for each floral groups (Habit) are presented hereunder

Trees: Quantitative data were collected using standard quadrature methods of sample plot size 10 m x 10 m for trees in various habitat types along the transmission line route and immediate vicinity.

Shrubs: Quantitative data were collected using standard quadrature methods of sample plot size 10 m x 10 m for shrubs in various habitat types along the transmission line route and immediate vicinity.

Annals (Herbs, Grasses, Pteridophytes, etc.): Quantitative data were collected on plateaus associated with transmission line using standard quadrature methods of sample plot size 1 m x 1 m for herbs, grasses.

Climbers: Quantitative data were collected using standard quadrature methods of sample plot size 10 m x 10 m for large climbers (lianas) in various habitat types along the transmission line route and immediate vicinity.

Details of the quadrates is presented in Refer **Table 3.2** and **Figure 3.1** and **Figure 3.2**

Table 3.2 Details of Floral Survey Quadrates

S.N.	Quadrat Size	Number of Quadrates		
		Core Zone	Buffer Zone	Study Area
1.	Trees, shrubs and lianas	5	5	10
2.	Annuals (Herbs, Grasses, Pteridophytes, etc.) and climbers	Nil	Nil	Nil

Faunal Assessment

- Faunal Assessment was focused on Enumeration of Herpetofaunal (Amphibians and Reptiles), Avifauna (Resident and Migratory) and Mammals likely to encounter on the transmission line route and its immediate vicinity;
- Assessment of various faunal habitats;
- The enumerated list of faunal species will be compared to the Indian Wildlife Protection Act, 1972 schedules and species listed in the IUCN Red data list v.2018.1 to confirm their conservation status.
- Following will be emphasized;
 - Species with conservational significance (Sch. I of IWPA, 1972, IUCN v2018.1 red-listed species)
 - Endemic faunal species
 - Species with listed with CITES Appendix I & II

The detailed methodology for data collection for each faunal groups are presented hereunder,

Four Transects were laid to enumerate

Herpetofauna: In view of the activity pattern of herpetofauna, diurnal and nocturnal surveys were carried out in the study area. Amphibians and Reptiles are known to inhabit various habitats and remain among leaf litter or under rocks and thus special efforts were taken to locate and study them using the following methods:

- **Direct Search Method:** This method involves searching thoroughly the known habitats of amphibians and reptiles. Intensive searching was carried out in most of the habitats by removing stones, logs, among leaf litter and on trees. This is not a time-constrained method so considerable and roughly equal amount of time was spent in most of the habitats.
- **Searching streams:** This method was utilized to study amphibians and certain reptiles which are closely associated with aquatic habitats. The surveys were conducted mostly during the night. A few streams coming in or close to the Transmission Line route were surveyed.
- **Opportunistic records:** The local nature enthusiasts are photographing amphibians and reptiles and posting these images on social networking sites. A few of them send these images for identification to us. This network of local contacts was used to understand the herpetofauna diversity in the study area. The identifications of images taken by locals were confirmed by detailed observations.
- **Systematic Analysis:** In the study area except for a few frogs and lizards, there is less ambiguity in the taxonomy of most of the known amphibians and reptiles. A through taxonomic examination was carried out for most of the herpetofauna encountered during field surveys. The identification was based on recent and historical publications.

Avifauna: In view of the activity of the Avifaunal species early morning and evening surveys were undertaken for enumerating species presence along the transmission line route and buffer area. Day surveys were undertaken to enumerate the soaring birds. Following methods were implied

- Total or flock/block count method: Sridharan 1989¹, Bhupathy 1991², Thompson 2002³ were adopted to assess the status of aquatic birds in dam /water bodies and point count method in the riparian forest along stream/river side (Gregory et al. 2002)⁴ of the project area. Birds in the riparian forests were recorded and enumerated within 50 m radius as part of point count.
- Point Count (Hutto et al. 1986⁵, Bibby et al. 1992⁶, Rosentod et al. 2002⁷, Salim and Rahul 2002⁸) and area search (Dieni and Jones 2002⁹) techniques were applied to assess the status of terrestrial birds. Point counts in the forest and allied habitats were made within 50 m radius, while in agriculture that includes fallow lands, and scrub/grassland/ barren area habitats, birds were recorded within 100 m radius.
- Additional effort was made to locate/identify the presence of any breeding/nesting sites / roosting sites of avifauna.
- Species identification was confirmed using the field guides for the avifaunal species

Mammals

Mammalian fauna was assessed at each sampling locations in different habitats through recording both direct and indirect evidence.

- Status and distribution of different mammalian fauna were quantified using direct count covering all the terrestrial habitats of the block area adopting road count (Burnham et al. 1980¹⁰, Sale and Berkmuller 1988¹¹, Rodgers 1991¹²). These survey routes were the area between two sample points and the roads that traverse across different habitats and land uses.
- In addition indirect evidences (pellets, dungs, droppings, scats and other tracks and signs), were searched within circular (25m radius) plots at each sampling location, which provide relative

¹ Sridharan, U. 1989. Comparative ecology of resident ducks in Keoladeo National Park, Bharatpur. Ph.D. Dissertation, University of Bombay, Bombay.

² Bhupathy, S. 1991. Blotch structure in individual identification of the Indian Python (*Python molurus molurus* Linn.) and its possible usage in population estimation. *Journal of Bombay Natural History Society* 87: 399–404. 85

³ Thompson, W.L. 2002. Towards reliable bird surveys: accounting for individuals present but not detected. *The Auk*. 119:18-25.

⁴ Gregory, R. D., Gibbons, D. W. and Donald, P. F. 2002. Bird census and survey techniques. Pp:17-56. In: *Bird Ecology and Conservation: A Handbook of Techniques*. (Eds.) W. J. Sutherland, I. Newton and R. E. Green. Oxford University Press, Oxford. 386 p.

⁵ Hutto, R.L., S.M. Pletsechel and P. Hendrick. 1986. A fixed radius point count method for non breeding season use. *The Auk*. 103: 593-602.

⁶ Bibby, C.J., N.D., Burgerss and D.A. Hill. 1992. *Bird Census techniques*, Academic Press, London.

⁷ Rosentod, S.S., Anderson, B.R., Giesenck. N, Leukerig, T., and Carter, M.F. 2002. Land bird counting techniques: Current practises and an alternative. *The Auk* 119(1):46-53

⁸ Salim, J. and Rahul, K. 2002. Field methods for bird surveys. Bombay Natural History Society; Department of Wildlife Sciences, Aligarh Muslim University, Aligarh, and world Pheasant association, South Asia Regional Office (SARO), New Delhi, India. 61 p.

⁹ Dieni, J.S. and Jones, S.L. 2002. A field test of the area search method for measuring breeding birds population. *J. Field Ornithology*, 73: 253-257.

¹⁰ Burnham, K.P., D.R. Andreson., and J.L. Laake. 1980. Estimation of density from line transect sampling of biological population. *Wildl. Mongr. No. 72*. The Wildlife Society, Washington D.C. 202p

¹¹ Sale, J.B. and K. Berkmuller, 1988. *Manual of Wildlife Techniques for India*. FAO, United Nation's India Establishment of Wildlife Institute of India Dehra Dun.

¹² Rodgers, W.A. 1991. *Technique for Wildlife Census in India, A field Manual*. Technical Manual. TM2. Wildlife Institute of India, Dehra Dun. India.81pp.

abundance of presence of mammalian fauna (Thompson et al. 1989¹, Rodgers 1991, Henke and Knowlton 1995², Allen et al. 1996³).

- Further presence of different faunal species was also ascertained and substantiated by interviewing the local people with the pictures of the mammals from the field guides that could probably occur in the area and discussion with local experts.

Field Survey pictorial representation is provided in **Figure 3.2**

¹ Thommpson, I.D., Davidson, I.J., O' Donnell, S. and Brazeau, F. 1989. Use of track transect to measure the relative occurrence of some arboreal mammals in uncut forest and regeneration stands. Canadian Journal of Zoology. 67: 1816-1823.

² Henke, S.E. and knowlton, F.F. 1995. Techniques for estimating Coyote abundance. Pp; 71-78. In: Proceedings of the symposium: Coyotes in the southwest. Parks and wildlife Department: Austin, Texas.

³ Allen, L., Engeman, R. and Krupa, H. 1996 Evaluation of three relative abundance indices for assessing dingo population. Wildlife Research. 23 197-206.

Figure 3.2 Ecological Baseline Field Surveys



Flora and Fauna Survey near Tower Location AP 19



Survey Team



Quadrat Survey around Tower Location AP 18A



Field Activities near Tower Location AP18 B/2



Quadrat Survey for Flora



Quadrat Survey for Flora



Transect Survey for Fauna



Transect Survey for Fauna

3.8 Floral Assessment

3.8.1 Vegetation Profile in Study Area

The vegetation¹ of the study area is a mosaic of tropical semi-evergreen and tropical moist deciduous forests. The forest patch adjacent to Kali river has introduction of some exotic elements like *Acacia auriculiformis* planted as a part of forest enrichment programme. The brief account of these vegetation types is given below. (Refer **Figure 3.3**) and quadrature details (Refer **Table 3.3**) and on location map (Refer **Figure 3.4**)

Tropical semi-evergreen forests(West tropical semi-evergreen forests)

This type of forest is intermediate between tropical Evergreen and Moist deciduous types as it has a mixture of both the evergreen and deciduous trees. Some part of area belongs to this category. In this type also a three layer stratification of the trees are met with. The upper stratum is mainly composed of trees such as *Aglaia elaeagnoidea*, *Aphanamixis polystachya*, *Artabotrys zeylanicus*, *Artocarpus gomezianus* subsp. *zeylanicus*, *Bischofia javanica*, *Beilschmiedia roxburghiana*, *Bombax ceiba*, *Bombax insigne*, *Carallia brachiata*, *Celtis timorensis*, *Chukrasia tabularis*, *Dillenia pentagyna*, *Diospyros buxifolia*, *Diospyros candolleana*, *Diospyros crumenata*, *Diospyros oocarpa*, *Dimocarpus longan*, *Flacourtia montana*, *Grewia umbellifera*, *Holigarna arnottiana*, *Holigarna grahamii*, *Hopea ponga*, *Hydnocarpus pentandra*, *Macaranga peltata*, *Mastixia arborea*, *Melicope lunu-ankenda*, *Mimusops elengi*, *Persea macrantha*, *Pittosporum dasycaulon*, *Polyalthia fragrans*, *Pterocarpus marsupium*, *Pterospermum diversifolium*, *Pterospermum xylocarpum*, *Scolopia crenata*, *Spondias pinnata*, *Sterculia guttata*, *Symplocos racemosa*, *Terminalia bellirica*, *Tetrameles nudiflora*, *Toona ciliata*, *Trichilia connaroides*, *Vitex altissima* and *Xylia xylocarpa*.

The middle storey is characterised by taxa like *Acronychia pedunculata*, *Actinodaphne tadulingami*, *Aglaia lawii*, *Atalantia racemosa*, *Bridelia retusa*, *Diospyros montana*, *Diospyros. paniculata*, *Drypetes venusta*, *Ehretia indica*, *Ficus callosa*, *Flacourtia montana*, *Grewia serrulata*, *G. tiliifolia*, *Harpullia arborea*, *Heterophragma quadrilocularis*, *Holoptelea integrifolia*, *Hydnocarpus pentandra*, *Lepisanthes tetraphylla*, *Mallotus ferrugineus*, *Margaritaria indica*, *Nothopegia castaneaefolia*, *Olea dioica*, *Oroxylum indicum*, *Pajanelia longifolia*, *Psydrax umbellata*, *Pterospermum xylocarpum*, *Schleichera oleosa* and *Syzygium hemisphericum*.

The species in the lower stratum are *Agrostistachys indica*, *Antidesma menasu*, *Aporosa lindleyana*, *Buchnanania cochinchinensis*, *Butea monosperma*, *Callicarpa tomentosa*, *Chionanthus malabarica*, *Cinnamomum verum*, *Clausena anisata*, *Firminia colorata*, *Ixora brachiata*, *Lanea coromandelica*, *Maesa indica*, *Mallotus philippensis*, *Pittosporum dasycaulon*, *Sapindus laurifolius*, *Saraca asoca*, *Symplocos cochinchinensis* subsp. *laurina*, *Tabernaemontana alternifolia* and *Terminalia chebula*.

The undergrowth is composed of species like *Spodiopogon rhizophorus*, *Stemonurus tetrandrus*, *Strobilanthes ciliata*, *S. ixiocephala*, *S. lupulina*, *Synedrella nodiflora*, *Tephrosia coccinea*, *Turraea villosa*, *Urena lobata* and *Zingiber neesatum*.

The growth of lianas, twiners and scandent shrubs in this forest type is very characteristic and typical, they are especially present in the outskirts of forest. Some of these species are, *Ampelocissus indica*, *Anamirta cocculus*, *Ancistrocladus heyneanus*, *Anodendron paniculatum*, *Artabotrys zeylanicus*, *Beaumontia jerdoniana*, *Caesalpinia spicata*, *Capparis moonii*, *Capparis rheedei*, *Cayratia tenuifolia*, *Celastrus paniculatus* subsp. *aggregatus*, *Cissus adnata*, *Cissus discolor*, *Connarus monocarpus*,

¹ Datar, M. N., & Lakshminarasimhan, P. (2013). *Flora of Bhagwan Mahavir (Molem) National Park and Adjoinings*, Goa. Botanical Survey of India

Dalbergia horrida, *Dalbergia rubiginosa*, *Desmos lawii*, *Elaeagnus conferta*, *Flemingia strobilifera*, *Genianthus laurifolius*, *Grewia heterotricha*, *Grewia umbellifera*, *Gouania microcarpa*, *Hibiscus hispidissimus*, *Hippocratea grahamii*, *Hippocratea ovata*, *Ichnocarpus frutescens*, *Kametia caryophyllata*, *Mucuna monosperma*, *Mussaenda belilla*, *Olax imbricata*, *Paramignya monophylla*, *Salacia beddomei*, *Salacia gambleana*, *Scutia myrtina*, *Tetrastigma gamblei*, *Thunbergia mysorensis*, *Uvaria narum* and *Ziziphus oenoplia*.

Tropical moist deciduous forests (Southern moist mixed deciduous forests and secondary moist mixed deciduous forests)

This type of forest has a mixed composition with a few evergreen trees as well. During the wet season, because of thick foliage, the canopy looks similar to that of semi-evergreen forests and is therefore scarcely distinguishable. However, during the dry season the moist deciduous forests reveal their identity as the trees shed leaves. The leafless period varies from few weeks to five months depending on the species. Among the trees, *Bombax ceiba*, *Bombax insigne*, *Hymenodictyon obovatum* and *Lagerstroemia microcarpa* have leafless period up to five months. *Terminalia paniculata* have a leafless period of less than two weeks.

The South Indian moist deciduous forests particularly those bearing Teak are variously classified as moist, very moist and slightly moist teak forests. The other two types are the southern moist mixed deciduous forests and secondary moist mixed deciduous forests. The last two types are considered together here, as there is little difference in the floristic composition between the two. The main difference is the degree of degradation.

The upper stratum is composed of trees such as *Albizia amara*, *Albizia lebbeck*, *Albizia odoratissima*, *Anogeissus latifolia*, *Bambusa bambos*, *Bauhinia foveolata*, *Bombax ceiba*, *Bombax insigne*, *Callicarpa tomentosa*, *Careya arborea*, *Cassia fistula*, *Chukrasia tabularis*, *Dalbergia latifolia*, *Dillenia pentagyna*, *Gmelina arborea*, *Grewia tiliifolia*, *Haldina cordifolia*, *Hymenodictyon orixense*, *Kydia calycina*, *Lagerstroemia microcarpa*, *Lannea coromandelica*, *Melia dubia*, *Miliusa tomentosa*, *Pterocarpus marsupium*, *Radermachera xylocarpa*, *Spondias pinnata*, *Stereospermum colais*, *Strychnos nux-vomica*, *Tectona grandis*, *Terminalia bellirica*, *Terminalia elliptica*, *Terminalia paniculata*, *Tetrameles nudiflora* and *Xylia xylocarpa*.

The middle stratum is composed mainly of *Bauhinia malabarica*, *Bauhinia racemosa*, *Cassia fistula*, *Careya arborea*, *Erinocarpus nimmonii*, *Ficus ampelos*, *Garuga pinnata*, *Macaranga peltata*, *Madhuca longifolia* var. *latifolia*, *Miliusa tomentosa*, *Olea dioica*, *Phyllanthus emblica*, *Sapindus laurifolius*, *Spondias pinnata*, *Sterculia guttata*, *Stebulus asper*, *Strychnos nux-vomica*, *Trema orientalis*, *Trewia nudiflora*, *Wrightia arborea* and *Zanthoxylum rhetsa*.

Figure 3.3 Vegetation Types in the Study Area

Tropical moist deciduous forests (Southern moist mixed deciduous forests and secondary moist mixed deciduous forests)



Flora around Tower Location AP 17A



Flora around Tower Location AP-17

Tropical semi-evergreen forests (West tropical semi-evergreen forests)



Flora Survey around Tower Location AP 19



Transmission Line route crossing Kali River

Open Grassland at Top of Plateau

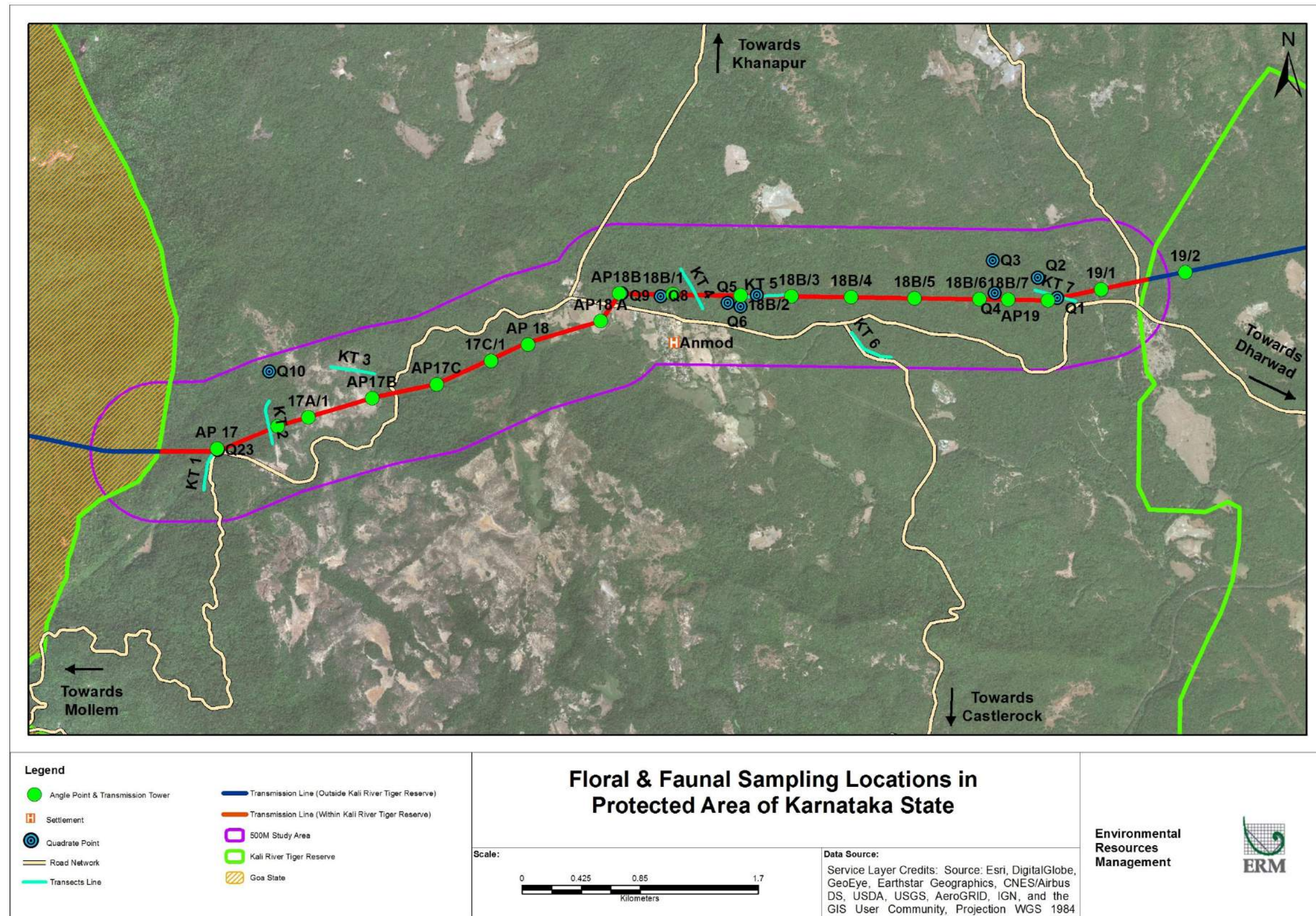


Following quadrates (Refer **Table 3.3**) were laid in the core and buffer zone of the Transmission line corridor. The quadrates location is shown in **Figure 3.4**.

Table 3.3 Details of the Quadrate Surveyed and its Distribution

Quadrates in Core Zone			Quadrates in Buffer Zone		
Q23:	43 P 422718.36 m E; 1706041.17 m N	Tropical semi- evergreen forests	Q2:	43 P 428629.47 m E 1707111.61 m N	Tropical semi- evergreen forests
Q9:	43 P 425644.29 m E 1707081.98 m N	Tropical moist deciduous forests	Q3:	43 P 428309.07 m E 1707243.02 m N	Tropical semi- evergreen forests
Q8:	43 P 425921.23 m E 1707054.10 m N	Tropical moist deciduous forests	Q4:	43 P 428315.43 m E 1707008.93 m N	Tropical semi- evergreen forests
Q7:	43 P 426611.72 m E 1707041.94 m N	Tropical moist deciduous forests	Q5:	43 P 426399.88 m E 1706994.72 m N	Tropical semi- evergreen forests
Q1:	43 P 428765.00 m E 1706962.00 m N	Tropical moist deciduous forests	Q6:	43 P 426494.64 m E 1706965.10 m N	Tropical semi- evergreen forests
			Q10	43P 423101.86 m E 1706592.20 m N	Tropical semi- evergreen forests

Figure 3.4 Floral and Faunal Survey locations



3.8.2 Taxonomic Status-Species Richness

In Karnataka, sampling was done in two types of vegetation (Forest) encountered during the survey i.e., Tropical semi-evergreen forests and Tropical moist deciduous forests. The diversity in core zone is represented by 26 families 29 genera and 30 species.

In buffer zone forest was surveyed yielding 26 families 31 genera and 33 species. (Refer **Table 3.4**)

Table 3.4 Taxonomic Status of Flora along the Proposed Transmission line route

Taxa	Core Zone	CT	Buffer Zone	BT	SAT
	FT(Forests)		FT(Forests)		
Family	26	26	26	26	32
Genus	29	29	31	31	46
Species	30	30	33	33	49

Notes: FT- Tropical semi-evergreen forests and Tropical moist deciduous forests

3.8.3 Status of Growth Forms

Various growth forms studied are discussed hereunder

- **Tree:** A woody, perennial plant, having a single trunk (bole) with multiple branches.
- **Shrub:** A woody, perennial plant, generally smaller than a tree, and with several stems arising from the ground level.
- **Herb:** A non-woody plant other than grasses.
- **Grass:** Plant belonging to the grass families Poaceae, Cyperaceae and Juncaceae.
- **Pteridophyte:** The vascular plant (with xylem and phloem) that disperses spores
- **Climber:** Plant, which climb up trees and other tall objects.

Study area is represented by thirty three (33) trees species; six (6) species of shrubs and ten (10) species of lianas/climbers as mentioned in **Table 3.5** below

Table 3.5 Status of Floral Growth forms along with the Proposed Transmission Line Route

Growth forms	Core Zone	CT	Buffer Zone	BT	SAT
	FT (Forest)		FT (Forests)		
Tree	23	23	21	21	33
Shrub	4	4	4	4	6
Herb	0	0	0	0	0
Grass	0	0	0	0	0
Climber	3	3	8	8	10
Total Species	30	30	33	33	49

Note1: FT- Tropical semi-evergreen forests and Tropical moist deciduous forests CT-Core Zone Total, BT-Buffer Zone Total, SAT-Study Area Total

Note2: Lianas are treated here under shrubs and climbers based on their habit.

3.8.1 Status of Tree species

A total of 49 trees and liana species were recorded from study area. Based on IVI values *Syzygium cumini* and *Olea dioica* were found to be dominant amongst trees, while amongst lianas *Calamus pseudotenuis* and *Gnetum ula* were dominant. In this forest patch *Acacia auriculiformis*, an introduced

exotic species which is planted by forest department for filling the clearings is also of the dominant species. The details are presented below in **Table 3.6**.

Table 3.6 Important Value Index (IVI) and Rank Order of Tree Species and Lianas in Study Area

S. N.	Tree Species	RF (%)	RDN (%)	RA (%)	IVI	RO
Core Zone						
1	<i>Acacia auriculiformis</i> Benth.	2.78	8.08	11.57	22.42	3
2	<i>Atalantia racemosa</i> Wight	2.78	1.01	1.45	5.23	9
3	<i>Bridelia retusa</i> (L.) A. Juss.	2.78	1.01	1.45	5.23	9
4	<i>Calamus pseudotenuis</i> Becc.	5.56	30.30	21.69	57.55	1
5	<i>Capparis rheedei</i> DC.	2.78	1.01	1.45	5.23	9
6	<i>Careya arborea</i> Roxb.	2.78	1.01	1.45	5.23	9
7	<i>Carissa inermis</i> Vahl	2.78	1.01	1.45	5.23	9
8	<i>Casearia ovata</i> (Lam.) Willd.	2.78	1.01	1.45	5.23	9
9	<i>Catunaregam spinosa</i> (Thunb.) Tirveng.	2.78	4.04	5.78	12.60	5
10	<i>Cinnamomum verum</i> J. Presl	2.78	2.02	2.89	7.69	8
11	<i>Colebrookea oppositifolia</i> Sm.	2.78	2.02	2.89	7.69	8
12	<i>Diospyros paniculata</i> Dalzell	2.78	1.01	1.45	5.23	9
13	<i>Euonymus indicus</i> B. Heyne ex Wall.	2.78	1.01	1.45	5.23	9
14	<i>Ficus hispida</i> L.	2.78	1.01	1.45	5.23	9
15	<i>Ficus racemosa</i> L.	2.78	1.01	1.45	5.23	9
16	<i>Glochidion hoheneckeri</i> (Mull. - Arg.) Bedd.	2.78	1.01	1.45	5.23	9
17	<i>Grewia nervosa</i> (Lour.) Panigrahi	2.78	1.01	1.45	5.23	9
18	<i>Lagerstroemia microcarpa</i> Wight	2.78	1.01	1.45	5.23	9
19	<i>Leea indica</i> (Burm. f.) Merr.	2.78	1.01	1.45	5.23	9
20	<i>Lepisanthes tetraphylla</i> (Vahl) Radlk.	2.78	1.01	1.45	5.23	9
21	<i>Mallotus philippensis</i> (Lam.) Mull. Arg.	2.78	2.02	2.89	7.69	8
22	<i>Mangifera indica</i> L.	2.78	2.02	2.89	7.69	8
23	<i>Memecylon umbellatum</i> Burm. f.	8.33	16.16	7.71	32.21	2
24	<i>Nothapodytes nimmoniana</i> (J. Graham) Mabb.	2.78	3.03	4.34	10.15	7
25	<i>Olea dioica</i> Roxb.	8.33	4.04	1.93	14.30	4
26	<i>Salacia oblonga</i> Wall. ex Wight & Arn.	2.78	1.01	1.45	5.23	9
27	<i>Symplocos racemosa</i> Roxb.	5.56	3.03	2.17	10.75	6
28	<i>Syzygium cumini</i> (L.) Skeels	2.78	3.03	4.34	10.15	7
29	<i>Tabernaemontana heyneana</i> Wall.	2.78	2.02	2.89	7.69	8
30	<i>Terminalia elliptica</i> Willd.	2.78	2.02	2.89	7.69	8
Buffer zone		RF (%)	RDN (%)	RA (%)	IVI	RO
1	<i>Calamus pseudotenuis</i> Becc.	7.02	24.82	13.56	45.40	1

S. N.	Tree Species	RF (%)	RDN (%)	RA (%)	IVI	RO
2	<i>Memecylon umbellatum</i> Burm. f.	8.77	13.14	5.74	27.65	2
3	<i>Gnetum ula</i> Brongn.	3.51	8.76	9.57	21.84	3
4	<i>Syzygium cumini</i> (L.) Skeels	7.02	6.57	3.59	17.18	4
5	<i>Leea indica</i> (Burm. f.) Merr.	3.51	4.38	4.79	12.67	5
6	<i>Olea dioica</i> Roxb.	5.26	3.65	2.66	11.57	6
7	<i>Symplocos racemosa</i> Roxb.	5.26	3.65	2.66	11.57	6
8	<i>Moullava spicata</i> (Dalzell) Nicolson	3.51	3.65	3.99	11.15	7
9	<i>Allophylus cobbe</i> (L.) Raeusch.	3.51	3.65	3.99	11.15	7
10	<i>Scutia myrtina</i> (Burm. f.) Kurz	1.75	2.92	6.38	11.06	8
11	<i>Diploclisia glaucescens</i> (Blume) Diels	5.26	2.19	1.60	9.05	9
12	<i>Diospyros paniculata</i> Dalzell	3.51	2.19	2.39	8.09	10
13	<i>Nothapodytes nimmoniana</i> (J. Graham) Mabb.	3.51	2.19	2.39	8.09	10
14	<i>Terminalia elliptica</i> Willd.	3.51	1.46	1.60	6.56	11
15	<i>Holigarna grahamii</i> (Wight) Kurz	3.51	1.46	1.60	6.56	11
16	<i>Glycosmis pentaphylla</i> (Retz.) DC.	1.75	1.46	3.19	6.40	12
17	<i>Cinnamomum verum</i> J. Presl	1.75	1.46	3.19	6.40	12
18	<i>Callicarpa tomentosa</i> (L.) L.	1.75	1.46	3.19	6.40	12
19	<i>Casearia ovata</i> (Lam.) Willd.	1.75	0.73	1.60	4.08	13
20	<i>Canarium strictum</i> Roxb.	1.75	0.73	1.60	4.08	13
21	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	1.75	0.73	1.60	4.08	13
22	<i>Diospyros neilgerrensis</i> (Wight) Kosterm.	1.75	0.73	1.60	4.08	13
23	<i>Ixora brachiata</i> Roxb.	1.75	0.73	1.60	4.08	13
24	<i>Eleocarpus serratus</i> L.	1.75	0.73	1.60	4.08	13
25	<i>Mangifera indica</i> L.	1.75	0.73	1.60	4.08	13
26	<i>Lagerstroemia microcarpa</i> Wight	1.75	0.73	1.60	4.08	13
27	<i>Dimocarpus longan</i> Lour.	1.75	0.73	1.60	4.08	13
28	<i>Mallotus philippensis</i> (Lam.) Mull. Arg.	1.75	0.73	1.60	4.08	13
29	<i>Pittosporum dasycaulon</i> Miq.	1.75	0.73	1.60	4.08	13
30	<i>Macaranga peltata</i> (Roxb.) Mull. Arg.	1.75	0.73	1.60	4.08	13
31	<i>Oxyceros rugulosus</i> (Thw) Tirveng.	1.75	0.73	1.60	4.08	13
32	<i>Jasminum malabaricum</i> Wight	1.75	0.73	1.60	4.08	13
33	<i>Capparis moonii</i> Wight	1.75	0.73	1.60	4.08	13
Study Area		C-IVI	B-IVI	TOTAL		
1	<i>Acacia auriculiformis</i> Benth.	22.42		22.42		
2	<i>Allophylus cobbe</i> (L.) Raeusch.		11.15	11.15		
3	<i>Atalantia racemosa</i> Wight	5.23		5.23		
4	<i>Bridelia retusa</i> (L.) A. Juss.	5.23		5.23		

S. N.	Tree Species	RF (%)	RDN (%)	RA (%)	IVI	RO
5	<i>Calamus pseudotenuis</i> Becc.	57.55	45.40	102.94		
6	<i>Callicarpa tomentosa</i> (L.) L.		6.40	6.40		
7	<i>Canarium strictum</i> Roxb.		4.08	4.08		
8	<i>Capparis moonii</i> Wight		4.08	4.08		
9	<i>Capparis rheedei</i> DC.	5.23		5.23		
10	<i>Careya arborea</i> Roxb.	5.23		5.23		
11	<i>Carissa inermis</i> Vahl	5.23		5.23		
12	<i>Casearia ovata</i> (Lam.) Willd.	5.23	4.08	9.31		
13	<i>Catunaregam spinosa</i> (Thunb.) Tirveng.	12.60		12.60		
14	<i>Cinnamomum verum</i> J. Presl	7.69	6.40	14.09		
15	<i>Colebrookea oppositifolia</i> Sm.	7.69		7.69		
16	<i>Dimocarpus longan</i> Lour.		4.08	4.08		
17	<i>Diospyros neilgerrensis</i> (Wight) Kosterm.		4.08	4.08		
18	<i>Diospyros paniculata</i> Dalzell	5.23	8.09	13.33		
19	<i>Diploclisia glaucescens</i> (Blume) Diels		9.05	9.05		
20	<i>Eleocarpus serratus</i> L.		4.08	4.08		
21	<i>Euonymus indicus</i> B. Heyne ex Wall.	5.23		5.23		
22	<i>Ficus hispida</i> L.	5.23		5.23		
23	<i>Ficus racemosa</i> L.	5.23		5.23		
24	<i>Glochidion hohenackeri</i> (Mull. - Arg.) Bedd.	5.23		5.23		
25	<i>Glycosmis pentaphylla</i> (Retz.) DC.		6.40	6.40		
26	<i>Gnetum ula</i> Brongn.		21.84	21.84		
27	<i>Grewia nervosa</i> (Lour.) Panigrahi	5.23		5.23		
28	<i>Holigarna grahamii</i> (Wight) Kurz		6.56	6.56		
29	<i>Ixora brachiata</i> Roxb.		4.08	4.08		
30	<i>Jasminum malabaricum</i> Wight		4.08	4.08		
31	<i>Lagerstroemia microcarpa</i> Wight	5.23	4.08	9.31		
32	<i>Leea indica</i> (Burm. f.) Merr.	5.23	12.67	17.91		
33	<i>Lepisanthes tetraphylla</i> (Vahl) Radlk.	5.23		5.23		
34	<i>Macaranga peltata</i> (Roxb.) Mull. Arg.		4.08	4.08		
35	<i>Mallotus philippensis</i> (Lam.) Mull. Arg.	7.69	4.08	11.77		
36	<i>Mangifera indica</i> L.	7.69	4.08	11.77		
37	<i>Memecylon umbellatum</i> Burm. f.	32.21	27.65	59.86		
38	<i>Moullava spicata</i> (Dalzell) Nicolson		11.15	11.15		
39	<i>Nothapodytes nimmoniana</i> (J. Graham) Mabb.	10.15	8.09	18.24		
40	<i>Olea dioica</i> Roxb.	14.30	11.57	25.87		
41	<i>Oxyceros rugulosus</i> (Thw) Tirveng.		4.08	4.08		

S. N.	Tree Species	RF (%)	RDN (%)	RA (%)	IVI	RO
42	<i>Pittosporum dasycaulon</i> Miq.		4.08	4.08		
43	<i>Salacia oblonga</i> Wall. ex Wight & Arn.	5.23		5.23		
44	<i>Scutia myrtina</i> (Burm. f.) Kurz		11.06	11.06		
45	<i>Symplocos racemosa</i> Roxb.	10.75	11.57	22.33		
46	<i>Syzygium cumini</i> (L.) Skeels	10.15	17.18	27.32		
47	<i>Tabernaemontana heyneana</i> Wall.	7.69		7.69		
48	<i>Terminalia bellirica</i> (Gaertn.) Roxb.		4.08	4.08		
49	<i>Terminalia elliptica</i> Willd.	7.69	6.56	14.25		

Notes: RF- Relative Frequency, RDN- Relative Density, RDO- Relative Dominance, C-IVI- Core Important Value Index, B-IVI- Buffer Important Value Index, RO- Rank Order (based on the relative frequency of each species, highest being 1 and lowest being 5).

3.8.2 Status of Medicinal Plants

The medicinal plants observed within transmission line route are detailed in **Table 3.7** and represented in **Figure 3.5**

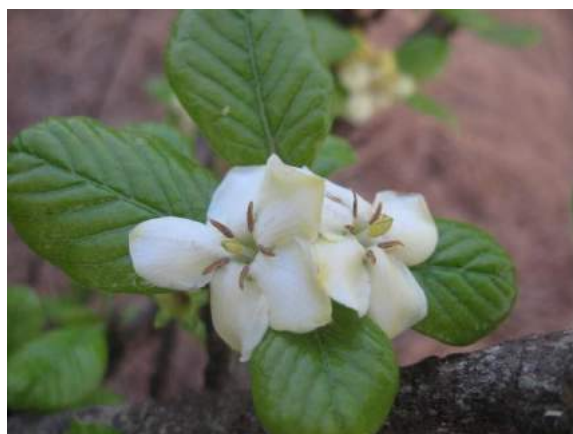
Table 3.7 Medicinal Plants recorded from Transmission Line Route

S.N.	Species	Habit	CZ	BZ	Medicinal use
1	<i>Atalantia racemosa</i> Wight	Tree	@		Healing properties
2	<i>Canarium strictum</i> Roxb.	Tree		@	Inflammation
3	<i>Catunaregam spinosa</i> (Thunb.) Tirveng.	Shrub	@		Diarrhoea and dysentery
4	<i>Ficus racemosa</i> L.	Tree	@		Anti-diarrheal
5	<i>Jasminum malabaricum</i> Wight	Lianas		@	Treatment of Cataract
6	<i>Moullava spicata</i> (Dalzell) Nicolson	Liana		@	Pneumonia, skin diseases
7	<i>Nothapodytes nimmoniana</i> (J. Graham) Mabb.	Tree	@	@	Anticancer
8	<i>Symplocos racemosa</i> Roxb.	Tree	@	@	Bleeding
9	<i>Tabernaemontana heyneana</i> Wall.	Tree	@		Antibacterial
10	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Tree	@		In triphala
		Total	7	5	

Source: Datar and Lakshminarasimhan, 2013

Notes: CZ- Core Zone, BZ- Buffer Zone, CS- Common Species, @-Presence

Figure 3.5 Medicinal Plants recorded from Transmission Line Route



Catunaregam spinos



Terminalia bellirica



Moullava spicata

3.8.3 Status of Threatened Plants

In study area two (02) tree species were found to be threatened . The species are listed in **Table 3.8** and represented in **Figure 3.6**.

Table 3.8 Threatened Species

S. N.	Name of species	Habit	Zones (Core Zone/ Buffer Zone)	IUCN,v2018.1
1	<i>Diospyros paniculata</i> Dalzell	Tree	CZ, BZ	VU
2	<i>Holigarna grahamii</i> (Wight) Kurz	Tree	BZ	LC

Notes: CZ– Core Zone, BZ- Buffer Zone, Source-Secondary Data

Source: Nayar, T. S., Garden, J. N. T. B., Research Institute, Beegam, A. R., & Sibi, M. (2014). Flowering plants of the Western Ghats, India. Jawaharlal Nehru Tropical Botanic Garden and Research Institute.

Figure 3.6 Threatened Species



Holigarna grahamii

3.8.4 Status of Endemic Species

A total of five (5) endemic plants were reported of which four (04) are trees and one (1) is shrub. The endemic species are listed in **Table 3.9**.

Table 3.9 Endemic Species

S. N.	Name of species	Family	Habit	Zones
				(CZ, BZ)
1	<i>Capparis rheedei</i> DC.	Capparaceae	S	CZ
2	<i>Diospyros neilgerrensis</i> (Wight) Kosterm.	Ebenaceae	T	BZ
3	<i>Diospyros paniculata</i> Dalzell	Ebenaceae	T	CZ,BZ
4	<i>Euonymus indicus</i> B. Heyne ex Wall.	Celastraceae	T	CZ
5	<i>Glochidion hohenackeri</i> (Mull.- Arg.) Bedd.	Euphorbiaceae	T	CZ

3.8.5 Overall Species Richness

The study area is represented by 49 species 46 genera and 32 families while associated 76 species belong to 72 genera and 41 family. Overall diversity comprises of 76 species 72 genera and 41 families. The details are presented in **Table 3.10**.

Table 3.10 Overall Species Richness of Flora along the transmission line route

Parameters	Study Area List	SS	Overall
Family	32	41	41
Genus	46	72	72
Species	49	76	76

Notes: SS-taxa which were documented as associated species. Study area list contains taxa documented in quadrats.

3.8.6 Species Diversity and Species Evenness

The species diversity is represented by Shannon Weiner Diversity Index¹ and Simpson Diversity Index² along with Species evenness from the data collected from the study area. The species diversity and species evenness are presented in **Table 3.11**.

Table 3.11 Species Diversity and Species Evenness

Species	Core Zone	Buffer Zone
Shannon Weiner Index of Diversity (H')	2.652	2.826
Simpson Index of Diversity	0.760	0.770
Species Evenness	0.780	0.808

3.8.7 Overall Species list

The overall species list is presented as hereunder;

Table 3.12 Overall List of Flora (Botanical name, Family, Local name, Locality, Local name, Growth form, Vegetation/Forest type) along the Proposed Transmission line

S.N.	Species name	Family	Habitat	Habit	Threatened status
1	<i>Acacia auriculiformis</i> Benth.	Leguminosae	Forest	Tree	
2	<i>Aglaia lawii</i> (Wight) C. J. Saldanha ex Ramamoorthy	Meliaceae	Forest	Tree	
3	<i>Allophylus cobbe</i> (L.) Raeusch.	Sapindaceae	Forest	Tree	
4	<i>Ancistrocladus heyneanus</i> Wall. ex J. Graham	Ancistrocladaceae	Forest	Shrub	Endemic
5	<i>Atalantia racemosa</i> Wight	Rutaceae	Forest	Tree	
6	<i>Bridelia retusa</i> (L.) A. Juss.	Euphorbiaceae	Forest	Tree	
7	<i>Calamus pseudotenius</i> Becc.	Arecaceae	Forest	Liana	
8	<i>Callicarpa tomentosa</i> (L.) L.	Lamiaceae	Forest	Tree	
9	<i>Calophyllum calaba</i> L.	Clusiaceae	Forest	Tree	Endemic
10	<i>Canarium strictum</i> Roxb.	Burseraceae	Forest	Tree	
11	<i>Capparis moonii</i> Wight	Capparaceae	Forest	Liana	

¹ Shannon, C. E. (1948) A mathematical theory of communication. The Bell System Technical Journal, 27, 379–423 and 623–656.

² Simpson, E. H. (1949). "Measurement of diversity". Nature. 163: 688.

S.N.	Species name	Family	Habitat	Habit	Threatened status
12	<i>Capparis rheedei</i> DC.	Capparaceae	Forest	Shrub	Endemic
13	<i>Careya arborea</i> Roxb.	Lecythidaceae	Forest	Tree	
14	<i>Carissa inermis</i> Vahl	Apocynaceae	Forest	Liana	
15	<i>Casearia ovata</i> (Lam.) Willd.	Flacourtiaceae	Forest	Tree	
16	<i>Cassia fistula</i> L.	Leguminosae	Forest	Tree	
17	<i>Catunaregam spinosa</i> (Thunb.) Tirveng.	Rubiaceae	Forest	Tree	
18	<i>Cinnamomum verum</i> J. Presl	Lauraceae	Forest	Tree	
19	<i>Cissus javana</i> DC.	Vitaceae	Forest	Climber	
20	<i>Clerodendrum infortunatum</i> L.	Lamiaceae	Forest	Shrub	
21	<i>Colebrookea oppositifolia</i> Sm.	Lamiaceae	Forest	Tree	
22	<i>Connarus monocarpus</i> L.	Connaraceae	Forest	Shrub	
23	<i>Dimocarpus longan</i> Lour.	Sapindaceae	Forest	Tree	
24	<i>Diospyros neilgerrensis</i> (Wight) Kosterm.	Ebenaceae	Forest	Tree	Endemic
25	<i>Diospyros paniculata</i> Dalzell	Ebenaceae	Forest	Tree	Endemic
26	<i>Diploclisia glaucescens</i> (Blume) Diels	Menispermaceae	Forest	Liana	
27	<i>Eleocarpus serratus</i> L.	Eleocarpaceae	Forest	Tree	
28	<i>Euonymus indicus</i> B. Heyne ex Wall.	Celastraceae	Forest	Tree	Endemic
29	<i>Ficus hispida</i> L.	Moraceae	Forest	Tree	
30	<i>Ficus racemosa</i> L.	Moraceae	Forest	Tree	
31	<i>Glochidion hohenackeri</i> (Mull.- Arg.) Bedd.	Euphorbiaceae	Forest	Tree	Endemic
32	<i>Glycosmis pentaphylla</i> (Retz.) DC.	Rutaceae	Forest	Tree	
33	<i>Gnetum ula</i> Brongn.	Gnetaceae	Forest	Liana	
34	<i>Grewia nervosa</i> (Lour.) Panigrahi	Malvaceae	Forest	Tree	
35	<i>Holigarna grahamii</i> (Wight) Kurz	Anacardiaceae	Forest	Tree	Endemic
36	<i>Hopea ponga</i> (Dennst.) Mabb.	Dipterocarpaceae	Forest	Tree	
37	<i>Hymenodictyon obovatum</i> Wall.	Rubiaceae	Forest	Tree	Endemic
38	<i>Ixora brachiata</i> Roxb.	Rubiaceae	Forest	Tree	Endemic
39	<i>Jasminum malabaricum</i> Wight	Oleaceae	Forest	Liana	Endemic
40	<i>Lagerstroemia microcarpa</i> Wight	Lythraceae	Forest	Tree	
41	<i>Leea indica</i> (Burm. f.) Merr.	Leeaceae	Forest	Tree	

S.N.	Species name	Family	Habitat	Habit	Threatened status
42	<i>Lepisanthes tetraphylla</i> (Vahl) Radlk.	Sapindaceae	Forest	Tree	
43	<i>Macaranga peltata</i> (Roxb.) Mull. Arg.	Euphorbiaceae	Forest	Tree	
44	<i>Mallotus philippensis</i> (Lam.) Mull. Arg.	Euphorbiaceae	Forest	Tree	
45	<i>Mallotus resinous</i> (Blanco) Merr. var. <i>stenanthus</i> (Mull. Arg.) Susila & N. P. Balakr.	Euphorbiaceae	Forest	Shrub	Endemic
46	<i>Mammea suriga</i> (Buch.-Ham. ex Roxb.) Kosterm.	Clusiaceae	Forest	Tree	
47	<i>Mangifera indica</i> L.	Anacardiaceae	Forest	Tree	
48	<i>Maytenus rothiana</i> (Walp.) Lobreau-Callen	Celastraceae	Forest	Shrub	
49	<i>Melastoma malabathricum</i> L.	Melastomataceae	Forest	Shrub	
50	<i>Memecylon umbellatum</i> Burm. f.	Melastomataceae	Forest	Tree	
51	<i>Moullava spicata</i> (Dalzell) Nicolson	Leguminosae	Forest	Liana	Endemic
52	<i>Mussaenda laxa</i> (Hook. f.) Hutch. ex Gamble	Rubiaceae	Forest	Shrub	Endemic
53	<i>Naregamia alata</i> Wight & Arn.	Meliaceae	Forest	Shrub	Endemic
54	<i>Nothapodytes nimmoniana</i> (J. Graham) Mabb.	Icacaceae	Forest	Tree	
55	<i>Nothopegia beddomei</i> Gamble	Anacardiaceae	Forest	Tree	Endemic
56	<i>Oberonia brachyphylla</i> Blatt. & McCann	Orchidaceae	Forest	Epiphtic	Endemic
57	<i>Olea dioica</i> Roxb.	Oleaceae	Forest	Tree	
58	<i>Ophiorrhiza rugosa</i> Wall. var. <i>prostrata</i> (D. Don) Deb & D. C. Monda	Rubiaceae	Forest	Herb	
59	<i>Oroxylum indicum</i> (L.) Benth. ex Kurz	Bignoniaceae	Forest	Tree	
60	<i>Oxyceros rugulosus</i> (Thw) Tirveng.	Rubiaceae	Forest	Liana	
61	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	Forest	Tree	
62	<i>Pittosporum dasycaulon</i> Miq.	Pittosporaceae	Forest	Tree	Endemic
63	<i>Porpax reticulata</i> Lindl.	Orchidaceae	Forest	Epiphtic	
64	<i>Pothos scandens</i> L.	Areceae	Forest	Climber	
65	<i>Psydrax umbellata</i> (Wight) Bridson	Rubiaceae	Forest	Tree	
66	<i>Rhynchostylis retusa</i> (L.) Blume	Orchidaceae	Forest	Epiphtic	
67	<i>Salacia oblonga</i> Wall. ex Wight & Arn.	Celastraceae	Forest	Liana	
68	<i>Scutia myrtina</i> (Burm. f.) Kurz	Rhamnaceae	Forest	Liana	
69	<i>Strobilanthes heyneana</i> Nees	Acanthaceae	Forest	Shrub	Endemic

S.N.	Species name	Family	Habitat	Habit	Threatened status
70	<i>Symplocos racemosa</i> Roxb.	Symplocaceae	Forest	Tree	
71	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	Forest	Tree	
72	<i>Tabernaemontana heyneana</i> Wall.	Apocynaceae	Forest	Tree	Endemic
73	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	Forest	Tree	
74	<i>Terminalia elliptica</i> Willd.	Combretaceae	Forest	Tree	
75	<i>Ventilago denticulata</i> Willd.	Rhamnaceae	Forest	Shrub	Endemic
76	<i>Zanthoxylum rhetsa</i> (Roxb.) DC.	Rutaceae	Forest	Tree	

3.9 Faunal Assessment

Faunal Assessments were focused on the faunal groups such as Herpetofauna (Amphibians and Reptiles), Avifauna and Mammals. Details of these groups are discussed in below sections.

The faunal species survey were made along the transects locations mostly around 50 m width on either side. The location of the transects are discussed as below and presented in **Table 3.13** below

Table 3.13 Transects for Faunal Survey

Transect No.	Habitats
KT1	Running along the Panjim Belagavi Road near Tower Location AP17
KT2	Intersecting TL route at Tower Location AP17A all along the forest trail
KT3	Approaching Tower Location AP17B passing through open areas
KT4	Intersecting TL Route near Anmod village between 18B/1 and 18B/2
KT5	Running along the TL Route between 18B/2 and 18B/3
KT6	Running along the Castle rock road
KT7	Intersecting TL route near Tower Location AP19

The location of the transects are provided in **Figure 3.4**.

3.9.1 Herpetofauna

Most of the amphibians and reptiles are generalist and occur in various habitats and a few are habitat specific. There are burrowing, terrestrial, aquatic and arboreal species of amphibians and reptiles. Most of the amphibians and a few reptiles are only active during the monsoon season and a few species are active throughout the year.

The burrowing species mostly occupy habitats with good canopy cover and thus confined to the forests. Although, there are a few exceptions. Most of the burrowing herpetofauna is also active during monsoon season. The terrestrial species are mostly confined to forest floor and are seen among leaf litter, under logs or rocks. These species are considerably sturdy and are seen throughout

the year. Aquatic species are mostly seen close to streams, pools and rivers and solely depend on these water sources for majority of their activities. Due to this specific requirement, they are mostly encountered during monsoon season. Many aquatic amphibians utilize stagnant pools and a few are only seen in the forest streams. The arboreal forms are also mostly seen in the forest habitats. Arboreal reptiles are seen throughout the year but amphibians are mostly seen during rainy season.

Many of the endemic herpetofauna is confined to natural and less disturbed forest habitats. The species which are widely distributed are mostly seen in the disturbed habitats as well. The habitat of the northern extremities of the Western Ghats region of Karnataka is similar like that of Goa. Most of the species reported from this landscape are based on anecdotal observations. This landscape is also poorly studied for amphibians and reptiles. The herpetofaunal species diversity is more or less similar to that of the Western Ghats region of Goa. Presently, the only known species of herpetofauna endemic to this landscape is *Gegeneophis mhadeiensis*, which is known from Chorla and Castle Rock.

Habitats in Transmission Line Route

The habitat in the study area in Karnataka is mostly homogenous and composed of tropical semi-evergreen forest and tropical moist deciduous forest. Although this habitat has similar altitudinal gradient, the terrain is significantly undulating. The habitat is mostly pristine with a few places with *Eucalyptus* plantations, which appear to be open and exposed. Rest of the natural habitat has an understory plantation with thick layer of decaying leaf litter and rotting logs of dead trees. There are a few streams in this area but most of them were dry compared to those in Goa. The forest cover was wet due to intermittent rainfall during the study period and this resulted in the finding of two specimens of burrowing amphibians, caecilians under rocks close the transmission line. This habitat was ideal for forest dwelling species and we observed *Trimeresurus malabaricus* (Malabar pit viper), *Ichthyophis davidi* (Chorla giant striped caecilian) and *Lygosoma guentheri* (Guenther's supple skink).

This habitat appears to have substantial anthropogenic pressure due to its close vicinity of state highway and human habitation.

Status of Amphibians

The diversity of amphibians in Karnataka section is predominantly similar to that of Goa with a few exceptions. As mentioned, due to lack of proper studies, reliable list of amphibians from this landscape is not yet available. Based on personal observations, opportunistic records and present survey a 21 species of amphibians are recorded from this landscape. This list is mainly for the sites covering the study area. During this study, we observed seven species of amphibians and this low number is mainly due to lack of nocturnal surveys. Due to the tiger reserve, we were allowed to conduct the surveys till 6.00 pm and most the amphibians encountered were during the diurnal surveys.

The commonest amphibian in this region was Amboli bush frog *Pseudophilautus amboli*. They were seen among the leaf litter in the forest. Individuals from different age groups were seen. These frogs are active during the breeding season, from June to September, calling from bushes in the forest and rarely seen in post monsoon seasons. These appear to be a remnant individuals of this season. The other common species of amphibian encountered during this study was *Indirana* sp. In view of taxonomic ambiguity in this group, the species level identification was not done. This can only be done with detailed morphological observations and molecular studies.

Only a single subadult individual of *Hoplobatrachus tigerinus* was seen during this study. Three adult individuals of Indian golden backed frogs were also encountered. These were tentatively identified based on their distribution. The individuals were also seen among the leaf litter in the forest.

Two individuals of Chorla giant striped caecilian *Ichthyophis davidi* were observed during this study. These specimens were seen under rock near a temple enroute anti-poaching camp, outside transmission line area. These are burrowing amphibians and only seen during the monsoon season. Both the individuals were hiding under small rocks and the habitat where they observed was noticeably dry. This indicates their tolerance for less humid conditions as well.

All the 21 species enlisted in the **Table 3.15** may not occur along the transmission line but are reported from this landscape. Species observed are presented in **Figure 3.8**.

Table 3.14 Amphibians reported & recorded from the Transmission Line Route

SN	Family	Full taxon	English Name	IWPA	IUCN. V2018.1
1.	Bufonidae	<i>Duttaphrynus melanostictus</i>	Common Indian Toad*	Schedule IV	LC
2.	Bufonidae	<i>Pedostibes tuberculosus</i>	Malabar Tree Toad	Schedule IV	EN
3.	Dicroglossidae	<i>Euphlyctis cyanophlyctus</i>	Five-fingered Frogs	Schedule IV	LC
4.	Dicroglossidae	<i>Minervarya cepfi</i>	CEPF Burrowing Frog*	Schedule IV	NA
5.	Dicroglossidae	<i>Minervarya gomantaki</i>	Goan Cricket Frog	Schedule IV	NA
6.	Dicroglossidae	<i>Minervarya goemchi</i>	Goan Cricket Frog	Schedule IV	NA
7.	Dicroglossidae	<i>Hoplobatrachus tigerinus</i>	Indian Bull Frog*	Schedule IV	LC
8.	Dicroglossidae	<i>Sphaerotheca breviceps</i>	Indian Burrowing Frog	Schedule IV	LC
9.	Microhylidae	<i>Microhyla ornata</i>	Ornate Narrow-mouthed Frog	Schedule IV	LC
10.	Microhylidae	<i>Microhyla rubra</i>	Reddish Narrow-mouthed Frog	Schedule IV	LC
11.	Microhylidae	<i>Uperodon globulosus</i>	Indian Balloon Frog	Schedule IV	LC
12.	Microhylidae	<i>Uperodon marmorata</i>	Marbled Ramanella	Schedule IV	EN
13.	Ranidae	<i>Indosylvirana cf. indica</i>	Indian Golden-backed Frog	Schedule IV	NA
14.	Ranixalidae	<i>Indirana sp.*</i>			
15.	Rhacophoridae	<i>Polypedates maculatus</i>	Common Indian Tree Frog	Schedule IV	LC
16.	Rhacophoridae	<i>Pseudophilautus amboli</i>	Amboli Bush Frog*	Schedule IV	CR
17.	Rhacophoridae	<i>Raorchestes bombayensis</i>	Maharashtra Bush Frog*	Schedule IV	VU
18.	Rhacophoridae	<i>Rhacophorus malabaricus</i>	Malabar Gliding Frog	Schedule IV	LC
19.	Ichthyophiidae	<i>Ichthyophis bombayensis</i>	Bombay Caecilian	Schedule IV	LC
20.	Ichthyophiidae	<i>Ichthyophis davidi</i>	Chorla giant striped	Schedule IV	NA
21.	Indotyphlidae	<i>Gegeneophis danieli</i>	Daniel's Caecilian	Schedule IV	DD

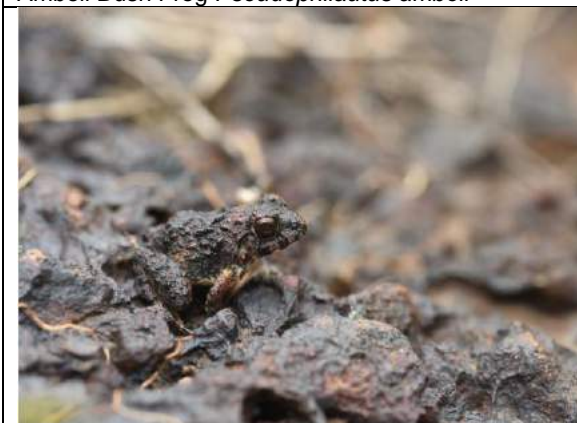
* Species encountered during the survey

LC - Least Concerned, EN - Endangered, CR - Critically Endangered, NA - Not assessed

Figure 3.7 Amphibians recoded from the Study Area



Amboli Bush Frog *Pseudophilautus amboli*



CEPF Burrowing Frog *Minervarya cepfi*



Indian Bull Frog *Hoplobatrachus tigerinus*



Asian Comomn Toad *Duttaphrynus melanostictus*



Netravali Leaping Frog* *Indirana salelkari*



Status of Reptiles

Reptiles are also poikilothermic vertebrates, but they are known to occur in varied habitats. Although there is no seasonality in many reptiles, a few species are active during the monsoon. In view of the rich diversity of flora and availability of good micro-habitats, there is rich diversity of reptiles in the study area.

The reptile diversity is also similar to that of Goa owing to contiguity of the habitat with a list of 60 species known to inhabit this landscape. During this study 11 different species of reptiles were seen.

The commonest reptile was Sahyadri Forest Lizard *Monilesaurus rouxii*. Adults and juveniles of this species were seen on the trees. Two juveniles of Indian garden lizard *Calotes versicolor* were also seen during this study. Two adult specimens of Gunther's supple skink *Lygosoma guentheri* were recorded along with caecilians. These skinks were hidden under rocks. The other skink commonly observed along the transmission line was Bronze grass skink *Eutropis macularia*. In the less disturbed forest three specimens of Beddome's cat skink *Ristella beddomei* were seen in the leaf litter. Many juveniles and a few adults of this species were seen moving among the leaf litter. Three adult individuals of Keeled grass skink *Eutropis carinata* also seen in the study area. The geckos recorded from the study area are Asian house gecko *Hemidactylus frenatus* and Murray's gecko *Hemidactylus murrayi*.

In snakes two specimens of Malabar pit viper *Trimeresurus malabaricus* were encountered. One of them was a juvenile as was resting on a small bush and other was a full-grown female. A single individual of Green vine snake *Ahaetulla nasuta* was also seen.

Table 3.15 Reptiles recorded from the Study Area

Sn	Family	Full taxon	English Name	IWPA,1972	IUCN v2018.1
1.	Geomydidae	<i>Melanochelys trijuga</i>	Indian black turtle	Schedule IV	NT
2.	Trionychidae	<i>Lissemys punctata</i>	Indian flapshell turtle	Schedule I Part II	LC
3.	Agamidae	<i>Monilesaurus rouxii</i>	Sahyadri Forest Lizard*	Schedule IV	LC
4.	Agamidae	<i>Calotes versicolor</i>	Indian Garden Lizard*	Schedule IV	LC
5.	Agamidae	<i>Draco dussumieri</i>	South Indian Flying Lizard	Schedule IV	LC
6.	Gekkonidae	<i>Cnemaspis indraneildasii</i> cf.	Indraneil's Day Gecko	Schedule IV	VU
7.	Gekkonidae	<i>Cyrtodactylus albofasciatus</i>	Boulenger's Indian Gecko	Schedule IV	LC
8.	Gekkonidae	<i>Hemidactylus flaviviridis</i>	Yellow Green House Gecko	Schedule IV	LC
9.	Gekkonidae	<i>Hemidactylus frenatus</i>	Asian House Gecko*	Schedule IV	LC

Sn	Family	Full taxon	English Name	IWPA,1972	IUCN v2018.1
10.	Gekkonidae	<i>Hemidactylus leschenaultii</i>	Bark Gecko	Schedule IV	LC
11.	Gekkonidae	<i>Hemidactylus murrayi</i>	Murray's Gecko*	Schedule IV	LC
12.	Gekkonidae	<i>Hemidactylus prashadi</i>	Prashad's Gecko	Schedule IV	LC
13.	Gekkonidae	<i>Hemidactylus triedrus</i>	Termite Hill Gecko	Schedule IV	LC
14.	Lacertidae	<i>Ophisops beddomei</i>	Beddome's Lacerta	Schedule IV	LC
15.	Mabuyidae	<i>Eutropis carinata</i>	Common Keeled Skink*	Schedule IV	LC
16.	Mabuyidae	<i>Eutropis macularia</i>	Bronze Grass Skink*	Schedule IV	LC
17.	Lygosomidae	<i>Lygosoma guentheri</i>	Günther's Supple Skink*	Schedule IV	LC
18.	Lygosomidae	<i>Lygosoma lineata</i>	Lined Supple Skink	Schedule IV	LC
19.	Ristellidae	<i>Ristella beddomii</i>	Beddome's Cat Skink*	Schedule IV	LC
20.	Varanidae	<i>Varanus bengalensis</i>	Bengal Monitor Lizard	Schedule I Part II	LC
21.	Uropeltidae	<i>Melanophidium khairei</i>	Khaire's Black shieldtail	Schedule IV	NA
22.	Uropeltidae	<i>Uropeltis</i> sp.	Large-scaled shieldtail	Schedule IV	LC
23.	Pythonidae	<i>Python molurus</i>	Indian rock python	Schedule I Part II	VU
24.	Erycidae	<i>Eryx conicus</i>	Common sand boa	Schedule IV	NA
25.	Erycidae	<i>Eryx whitakeri</i>	Whitaker's boa	Schedule IV	NA
26.	Colubridae	<i>Ahaetulla nasuta</i>	Green vine snake*	Schedule IV	LC
27.	Colubridae	<i>Ahaetulla pulverulenta</i>	Brown vine snake	Schedule IV	LC
28.	Colubridae	<i>Chrysopelea ornata</i>	Ornate flying snake	Schedule IV	LC
29.	Colubridae	<i>Dendrelaphis girii</i>	Giri's bronzeback tree snake	Schedule IV	LC
30.	Colubridae	<i>Dendrelaphis tristis</i>	Common bronzeback tree snake	Schedule IV	LC
31.	Colubridae	<i>Argyrogena fasciolata</i>	Banded racer	Schedule IV	LC
32.	Colubridae	<i>Boiga beddomei</i>	Beddome's Cat snake	Schedule IV	LC
33.	Colubridae	<i>Boiga ceylonensis</i>	Ceylon Cat snake	Schedule IV	LC
34.	Colubridae	<i>Boiga forsteri</i>	Forster's Cat snake	Schedule IV	LC
35.	Colubridae	<i>Boiga trigonata</i>	Common Cat snake	Schedule IV	LC
36.	Colubridae	<i>Coelognathus helena monticollaris</i>	Montane trinket snake	Schedule IV	LC
37.	Colubridae	<i>Lycodon</i> cf. <i>aulicus</i>	Common wolf snake	Schedule IV	LC
38.	Colubridae	<i>Lycodon striatus</i>	White-banded wolf snake	Schedule IV	LC
39.	Colubridae	<i>Lycodon travancoricus</i>	Travancore wolf snake	Schedule IV	LC
40.	Colubridae	<i>Oligodon arnensis</i>	Banded kukri snake	Schedule IV	LC
41.	Colubridae	<i>Oligodon taeniolatus</i>	Variegated kukri snake	Schedule IV	LC
42.	Colubridae	<i>Ptyas mucosa</i>	Oriental rat snake*	Schedule II Part II	LC
43.	Colubridae	<i>Rhabdops aquaticus</i>	Aquatic rhabdops	Schedule IV	NA
44.	Colubridae	<i>Sibynophis subpunctatus</i>	Dumeril's black-headed snake	Schedule IV	LC
45.	Colubridae	<i>Amphiesma stolatum</i>	Striped keelback	Schedule IV	LC
46.	Colubridae	<i>Hebius beddomei</i>	Beddome's keelback	Schedule IV	LC

Sn	Family	Full taxon	English Name	IWPA,1972	IUCN v2018.1
47.	Colubridae	<i>Macropisthodon plumbicolor</i>	Green keelback	Schedule IV	LC
48.	Colubridae	<i>Xenochrophis piscator</i>	Checkered keelback	Schedule II Part II	LC
49.	Elapidae	<i>Bungarus caeruleus</i>	Common Indian krait	Schedule IV	LC
50.	Elapidae	<i>Calliophis castoe</i>	Castoe's coral snake	Schedule IV	DD
51.	Elapidae	<i>Calliophis nigrescens</i>	Striped coral snake	Schedule IV	LC
52.	Elapidae	<i>Naja naja</i>	Spectacled cobra	Schedule II Part II	LC
53.	Elapidae	<i>Ophiophagus hannah</i>	King cobra	Schedule II Part II	LC
54.	Viperidae	<i>Hypnale hypnale</i>	Hump-nosed pit viper	Schedule IV	LC
55.	Viperidae	<i>Trimeresurus gramineus</i>	Bamboo pit viper	Schedule IV	LC
56.	Viperidae	<i>Trimeresurus malabaricus</i>	Malabar pit viper*	Schedule IV	LC
57.	Viperidae	<i>Daboia russelii</i>	Russell's viper	Schedule II Part II	LC
58.	Viperidae	<i>Echis carinatus</i>	Indian saw-scaled viper	Schedule IV	LC
59.	Typhlopidae	<i>Grypotyphlops acutus</i>	Beaked Worm snake	Schedule IV	LC
60.	Typhlopidae	<i>Indotyphlops braminus</i>	Brahminy Worm snake	Schedule IV	LC

* Species encountered during the survey

LC - Least Concerned, EN - Endangered, CR - Critically Endangered, NA - Not assessed

Figure 3.8 Reptiles recorded from the Study Area





Sahyadri Forest Lizard *Monilesaurus rouxii*



Malabar pit viper *Trimeresurus malabaricus*



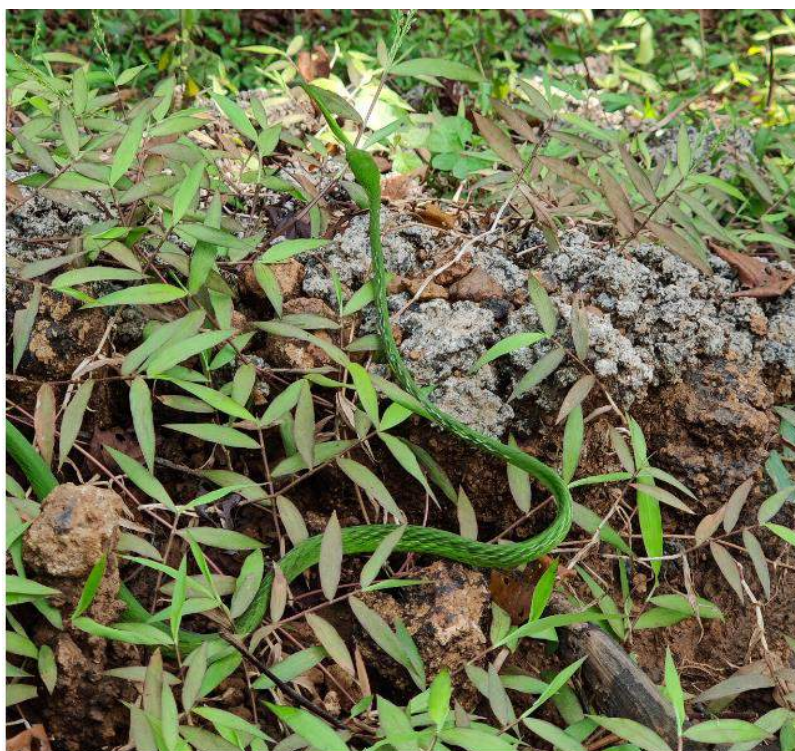
Common wolf snake *Lucodon cf aulicus*



Hump-nosed pit viper *Hypnale hypnale*



South Indian Flying Lizard *Draco dussumieri*



Green vine snake *Ahaetulla nasuta*

Threatened Species

This region is known to inhabit 81 species of amphibians and reptiles of which seven species are in the threatened category of IUCN and remaining are either Least Concerned or Data Deficient. There are a few species which are not yet assessed as they are recently described. These threatened species are listed in **Table 3.16**.

Table 3.16 Threatened Species

Sn	Family	Full taxon	English Name	IUCN v2020.2
1.	Rhacophoridae	<i>Pseudophilautus amboli</i>	Amboli Bush Frog *	CR
2.	Bufonidae	<i>Pedostibes tuberculosus</i>	Malabar Tree Toad	EN
3.	Microhylidae	<i>Uperodon mormorata</i>	Marbled Ramanella	EN
4.	Rhacophoridae	<i>Raorchestes bombayensis</i>	Maharashtra Bush Frog *	VU
5.	Geomydidae	<i>Melanochelys trijuga</i>	Indian black turtle	NT
6.	Gekkonidae	<i>Cnemaspis cf. indraneildasii</i>	Indraneil's Day Gecko	VU
7.	Pythonidae	<i>Python molurus</i>	Indian rock python	VU

Endemic Species

There are endemic amphibians and reptiles in the Western Ghats region of Karnataka but many of these species have a wider range. There are no amphibians and reptiles endemic to the present study area.

3.9.2 Avifauna

Avifaunal surveys were undertaken along the 5 transects within a study area. Point counts were made in 50 m radius plots in the study area.

Species Richness

Total bird species richness, i.e. total number of species recorded from the transects recorded were forty four (44) species.

Pompadour green penguin (*Treron pompadora*), White rumped shama (*Copsychus malabaricus*), red-whiskered bulbul (*Pycnonotus jocosus*), Malabar Pied Hornbill (*Anthracoceros coronatus*) etc. were recorded from the mosaic of grassland and forest habitat at the edge of forest. Species like Malabar Trogon (*Harpactes fasciatus*), Malabar grey Hornbill (*Ocyrceros griseus*), Asian Paradise flycatcher (*Terpsiphone paradise*), Crimson Backed sunbird (*Leptocoma minima*), Malabar woodshrike (*Tephrodornis sylvicola*) etc. were recorded from forested habitat.

Most of the species were recorded during diurnal survey, but Jungle Owlet (*Glaucidium radiatum*) and Sri Lanka frogmouth (*Batrachostomus moniliger*) were recorded during night survey.

Details of all the species recorded during the transect survey is provided in **Table 3.17**.

Table 3.17 Details of Species Recorded from the Study Area

SNo.	Scientific Name	Common Name	Sch. of IWPA, 1972	IUCN (v2020-2)
1	<i>Accipiter trivirgatus</i>	Crested Goshawk	I	LC
2	<i>Acridotheres tristis</i>	Common Myna	IV	LC
3	<i>Aegithina tiphia</i>	Common Iora	IV	LC
4	<i>Alcedo atthis</i>	Common Kingfisher	IV	LC
5	<i>Anthracoceros coronatus</i>	Malabar Pied Hornbill	I	NT
6	<i>Batrachostomus moniliger</i>	Sri Lanka frogmouth	I (part III)	LC
7	<i>Ceyx erillzacus</i>	Oriental dwarf Kingfisher	IV	LC
8	<i>Cinnyris asiaticus</i>	Purple Sunbird	IV	LC
9	<i>Copsychus malabaricus</i>	White rumped shama	IV	LC
10	<i>Copsychus saularis</i>	Oriental Magpie-Robin	IV	LC
11	<i>Dicrurus leucophaeus</i>	Ashy Drongo	IV	LC
12	<i>Dicrurus macrocercus</i>	Black Drongo	IV	LC
13	<i>Dicrurus paradiseus</i>	Greater Racket-tailed drongo	IV	LC
14	<i>Dinopium javanense</i>	Common Flame-backed Woodpecker	IV	LC
15	<i>Elanus caeruleus</i>	Black-winged Kite	I	LC
16	<i>Eudynamys scolopacea</i>	Asian Koel	IV	LC
17	<i>Eumyias thalassinus</i>	Asian Verditer Flycatcher	IV	LC
18	<i>Gallus sonneratti</i>	Grey Junglefowl	II	LC
19	<i>Glaucidium radiatum</i>	Jungle Owlet	IV	LC
20	<i>Halcyon pileata</i>	Black-capped Kingfisher	IV	LC
21	<i>Haliastur indus</i>	Brahminy Kite	I	LC
22	<i>Harpactes fasciatus</i>	Malabar Trogon	IV	LC
23	<i>Hierococcyx varius</i>	Common Hawk Cuckoo	IV	LC
24	<i>Leptocoma minima</i>	Crimson Backed sunbird	IV	LC
25	<i>Leptocoma zeylonica</i>	Purple rumped sunbird	IV	LC
26	<i>Iole indica</i>	Yellow browed bulbul	IV	LC
27	<i>Monticola cinclorhyncha</i>	Blue-capped Rock Thrush	IV	LC
28	<i>Nyctornis athertoni</i>	Blue-bearded Bee-eater	IV	LC

SNo.	Scientific Name	Common Name	Sch. of IWPA, 1972	IUCN (v2020-2)
29	<i>Ocyrceros griseus</i>	Malabar grey Hornbill	IV	LC
30	<i>Oriolus xanthornus</i>	Black-hooded Oriole	IV	LC
31	<i>Ploceus philippinus</i>	Baya Weaver	IV	LC
32	<i>Psilopogon haemacephalus</i>	Coppersmith Barbet	IV	LC
33	<i>Upupa epops</i>	Common Hoopoe	IV	LC
34	<i>Pycnonotus gularis</i>	Flame-throated Bulbul	IV	LC
35	<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul	IV	LC
36	<i>Pycnonotus melanicterus</i>	Black-capped Bulbul	IV	LC
37	<i>Spilornis cheela</i>	Crested Serpent Eagle	I	LC
38	<i>Streptopelia chinensis</i>	Spotted Dove	IV	LC
39	<i>Sturnia pagodarum</i>	Brahminy Starling	IV	LC
40	<i>Surniculus lugubris</i>	Drongo Cuckoo	IV	LC
41	<i>Tephrodornis pondicerianus</i>	Common Woodshrike	IV	LC
42	<i>Tephrodornis sylvicola</i>	Malabar woodshrike	IV	LC
43	<i>Terpsiphone paradisi</i>	Asian Paradise flycatcher	IV	LC
44	<i>Treron pompadora</i>	Pompadour green pegeon	IV	LC

Source – ERM Primary Survey

IUCN Status: LC- Least Concern, NT- Near Threatened

Figure 3.9 Avifauna Recorded During Survey





Common Hoopoe



Purple Sunbird



Black Hooded Oriole



Malabar Woodshrike



Magpie Robin



Red whiskered Bulbul

Overall Species Richness

To overcome the limitations of this particular survey and to have a understanding of the overall species richness of the study area, a cumulative list of all the species found in the study area was prepared based on available bird checklist from Dandeli Wildlife Sanctuary. Based on this secondary information, overall species richness i.e. total number of species that can be found in the study area is Two hundred and thirteen (213) listed in **Table 3.18** below.

Table 3.18 Potential Species List likely to be observed from the Study Area

Sr. No.	Scientific Name	Common Name	IWPA 1972 Schedule	IUCN Status (v. 2020-2)
1	<i>Psittacula eupatria</i>	Alexandrine Parakeet	IV	NT
2	<i>Tachymarptis melba</i>	Alpine Swift	NL	LC
3	<i>Dicrurus leucophaeus</i>	Ashy Drongo	IV	LC
4	<i>Artamus fuscus</i>	Ashy Woodswallow	IV	LC
5	<i>Eremopterix griseus</i>	Ashy-crowned Sparrow Lark	IV	LC
6	<i>Muscicapa dauurica</i>	Asian Brown Flycatcher	IV	LC
7	<i>Irena puella</i>	Asian Fairy-bluebird	IV	LC
8	<i>Nettapus coromandelianus</i>	Asian Pygmy Goose	IV	LC
9	<i>Eumyias thalassinus</i>	Asian Verditer Flycatcher	IV	LC
10	<i>Cacomantis sonneratii</i>	Banded Bay Cuckoo	IV	LC
11	<i>Hirundo rustica</i>	Barn Swallow	NL	LC
12	<i>Hemipus picatus</i>	Bar-winged Flycatcher-shrike	IV	LC
13	<i>Ploceus philippinus</i>	Baya Weaver	IV	LC
14	<i>Hypsipetes leucocephalus</i>	Black Bulbul	IV	LC
15	<i>Dicrurus macrocercus</i>	Black Drongo	IV	LC
16	<i>Ictinaetus malaiensis</i>	Black Eagle	I	LC
17	<i>Milvus migrans</i>	Black Kite	I	LC

Sr. No.	Scientific Name	Common Name	IWPA 1972 Schedule	IUCN Status (v. 2020-2)
18	<i>Ciconia nigra</i>	Black Stork	IV	LC
19	<i>Sterna acuticauda</i>	Black-bellied Tern	IV	EN
20	<i>Halcyon pileata</i>	Black-capped Kingfisher	IV	LC
21	<i>Pycnonotus melanicterus</i>	Black-capped Bulbul	IV	LC
22	<i>Lalage melanoptera</i>	Black-headed Cuckooshrike	IV	LC
23	<i>Threskiornis melanocephalus</i>	Black-headed Ibis	IV	NT
24	<i>Oriolus xanthornus</i>	Black-hooded Oriole	IV	LC
25	<i>Machlolophus xanthogenys</i>	Black-lored Tit	IV	LC
26	<i>Hypothymis azurea</i>	Black-naped Monarch	IV	LC
27	<i>Dinopium benghalense</i>	Black-rumped Woodpecker	IV	LC
28	<i>Elanus caeruleus</i>	Black-winged Kite	I	LC
29	<i>Himantopus himantopus</i>	Black-winged Stilt	IV	LC
30	<i>Monticola solitarius</i>	Blue Rock Thrush	IV	LC
31	<i>Nyctornis athertoni</i>	Blue-bearded Bee-eater	IV	LC
32	<i>Monticola cinclorhyncha</i>	Blue-capped Rock Thrush	IV	LC
33	<i>Merops philippinus</i>	Blue-tailed Bee-eater	IV	LC
34	<i>Acrocephalus dumetorum</i>	Blyth's Reed Warbler	IV	LC
35	<i>Hieraaetus pennatus</i>	Booted Eagle	I	LC
36	<i>Haliastur indus</i>	Brahminy Kite	I	LC
37	<i>Sturnia pagodarum</i>	Brahminy Starling	IV	LC
38	<i>Dicrurus aeneus</i>	Bronzed Drongo	IV	LC
39	<i>Metopidius indicus</i>	Bronze-winged Jacana	IV	LC

Sr. No.	Scientific Name	Common Name	IWPA 1972 Schedule	IUCN Status (v. 2020-2)
40	<i>Lanius cristatus</i>	Brown Shrike	IV	LC
41	<i>Hirundapus giganteus</i>	Brown-backed Needletail	NL	LC
42	<i>Dendrocopos moluccensis</i>	Brown-capped Woodpecker	IV	LC
43	<i>Alcippe poioicephala</i>	Brown-cheeked Fulvetta	IV	LC
44	<i>Psilopogon zeylanicus</i>	Brown-headed Barbet	IV	LC
45	<i>Bubulcus ibis</i>	Cattle Egret	IV	LC
46	<i>Nisaetus cirrhatus</i>	Changeable Hawk Eagle	I	LC
47	<i>Sitta castanea</i>	Indian Nuthatch	IV	LC
48	<i>Merops leschenaulti</i>	Chestnut-headed Bee-eater	IV	LC
49	<i>Gymnoris xanthocollis</i>	Chestnut-shouldered Bush Sparrow	IV	LC
50	<i>Sturnia malabarica</i>	Chestnut-tailed Starling	IV	LC
51	<i>Parus cinereus</i>	Cinereous Tit	IV	LC
52	<i>Otus bakkamoena</i>	Indian Scops Owl	IV	LC
53	<i>Sarkidiornis melanotos</i>	Comb Duck	IV	LC
54	<i>Fulica atra</i>	Common Coot	IV	LC
55	<i>Dinopium javanense</i>	Common Flame-backed Woodpecker	IV	LC
56	<i>Hierococcyx varius</i>	Common Hawk Cuckoo	IV	LC
57	<i>Aegithina tiphia</i>	Common Iora	IV	LC
58	<i>Falco tinnunculus</i>	Common Kestrel	IV	LC
59	<i>Alcedo atthis</i>	Common Kingfisher	IV	LC
60	<i>Eudynamys scolopaceus</i>	Common Koel	IV	LC
61	<i>Gallinula chloropus</i>	Common Moorhen	IV	LC

Sr. No.	Scientific Name	Common Name	IWPA 1972 Schedule	IUCN Status (v. 2020-2)
62	<i>Acridotheres tristis</i>	Common Myna	IV	LC
63	<i>Erythrura erythrura</i>	Common Rosefinch	IV	LC
64	<i>Actitis hypoleucos</i>	Common Sandpiper	IV	LC
65	<i>Orthotomus sutorius</i>	Common Tailorbird	IV	LC
66	<i>Tephrodornis pondicerianus</i>	Common Woodshrike	IV	LC
67	<i>Psilopogon haemacephalus</i>	Coppersmith Barbet	IV	LC
68	<i>Accipiter trivirgatus</i>	Crested Goshawk	I	LC
69	<i>Spilornis cheela</i>	Crested Serpent Eagle	I	LC
70	<i>Hemiprocne coronata</i>	Crested Treeswift	IV	LC
71	<i>Leptocoma minima</i> Endemic	Crimson-backed Sunbird	IV	LC
72	<i>Rhopocichla atriceps</i>	Dark-fronted Babbler	IV	LC
73	<i>Ptyonoprogne concolor</i>	Dusky Crag Martin	IV	LC
74	<i>Neophron percnopterus</i>	Egyptian Vulture	IV	EN
75	<i>Chalcophaps indica</i>	Emerald Dove	IV	LC
76	<i>Ptyonoprogne rupestris</i>	Eurasian Crag Martin	IV	LC
77	<i>Falco subbuteo</i>	Eurasian Hobby	IV	LC
78	<i>Dendronanthus indicus</i>	Forest Wagtail	IV	LC
79	<i>Spatula querquedula</i>	Garganey	IV	LC
80	<i>Chloropsis aurifrons</i>	Golden-fronted Leafbird	IV	LC
81	<i>Phalacrocorax carbo</i>	Great Cormorant	IV	LC
82	<i>Ardea alba</i>	Great Egret	IV	LC
83	<i>Lanius excubitor</i>	Great Grey Shrike	NL	LC

Sr. No.	Scientific Name	Common Name	IWPA 1972 Schedule	IUCN Status (v. 2020-2)
84	<i>Buceros bicornis</i>	Great Hornbill	IV	LC
85	<i>Centropus sinensis</i>	Greater Coucal	IV	LC
86	<i>Chrysocolaptes lucidus</i>	Greater Flame-backed Woodpecker	IV	LC
87	<i>Rostratula benghalensis</i>	Greater Painted-snipe	IV	LC
88	<i>Dicrurus paradiseus</i>	Greater Racket-tailed Drongo	IV	LC
89	<i>Merops orientalis</i>	Green Bee-eater	IV	LC
90	<i>Seicercus trochiloides</i>	Greenish Leaf Warbler	IV	LC
91	<i>Ardea cinerea</i>	Grey Heron	IV	LC
92	<i>Gallus sonneratii</i>	Grey Junglefowl	IV	LC
93	<i>Caprimulgus indicus</i>	Grey Nightjar	IV	LC
94	<i>Motacilla cinerea</i>	Grey Wagtail	IV	LC
95	<i>Cacomantis passerinus</i>	Grey-bellied Cuckoo	IV	LC
96	<i>Prinia hodgsonii</i>	Grey-breasted Prinia	IV	LC
97	<i>Ichthyophaga ichhyaetus</i>	Grey-headed Fish Eagle	I	NT
98	<i>Dicrurus hottentottus</i>	Hair-crested Drongo	IV	LC
99	<i>Hemicircus canente</i>	Heart-spotted Woodpecker	IV	LC
100	<i>Gracula religiosa</i>	Hill Myna	IV	LC
101	<i>Passer domesticus</i>	House Sparrow	IV	LC
102	<i>Turdus simillimus</i>	Indian Blackbird	IV	LC
103	<i>Phalacrocorax fuscicollis</i>	Indian Cormorant	IV	LC
104	<i>Cuculus micropterus</i>	Indian Cuckoo	IV	LC
105	<i>Oriolus kundoo</i>	Indian Golden Oriole	IV	LC

Sr. No.	Scientific Name	Common Name	IWPA 1972 Schedule	IUCN Status (v. 2020-2)
106	<i>Ocyrceros birostris</i>	Indian Grey Hornbill	I	LC
107	<i>Terpsiphone paradisi</i>	Indian Paradise-flycatcher	IV	LC
108	<i>Pavo cristatus</i>	Indian Peafowl	I	LC
109	<i>Pitta brachyura</i>	Indian Pitta	IV	LC
110	<i>Ardeola grayii</i>	Indian Pond Heron	IV	LC
111	<i>Saxicoloides fulicatus</i>	Indian Robin	IV	LC
112	<i>Coracias benghalensis</i>	Indian Roller	IV	LC
113	<i>Pomatorhinus horsfieldii</i>	Indian Scimitar Babbler	IV	LC
114	<i>Euodice malabarica</i>	Indian Silverbill	IV	LC
115	<i>Aerodramus unicolor</i>	Indian Swiftlet	IV	LC
116	<i>Ardea intermedia</i>	Intermediate Egret	IV	LC
117	<i>Chloropsis jerdoni</i>	Jerdon's Leafbird	IV	LC
118	<i>Turdoides striata</i>	Jungle Babbler	IV	LC
119	<i>Glaucidium radiatum</i>	Jungle Owlet	IV	LC
120	<i>Prinia sylvatica</i>	Jungle Prinia	IV	LC
121	<i>Coracina javensis</i>	Large Cuckooshrike	IV	LC
122	<i>Tephrodornis virgatus</i>	Large Woodshrike	IV	LC
123	<i>Corvus macrorhynchos</i>	Large-billed Crow	IV	LC
124	<i>Leptoptilos javanicus</i>	Lesser Adjutant	IV	VU
125	<i>Dendrocygna javanica</i>	Lesser Whistling Duck	IV	LC
126	<i>Picus chlorolophus</i>	Lesser Yellow-naped Woodpecker	IV	LC
127	<i>Microcarbo niger</i>	Little Cormorant	IV	LC

Sr. No.	Scientific Name	Common Name	IWPA 1972 Schedule	IUCN Status (v. 2020-2)
128	<i>Egretta garzetta</i>	Little Egret	IV	LC
129	<i>Tachybaptus ruficollis</i>	Little Grebe	IV	LC
130	<i>Arachnothera longirostra</i>	Little Spiderhunter	IV	LC
131	<i>Apus affinis</i>	Little Swift	IV	LC
132	<i>Lanius schach</i>	Long-tailed Shrike	NL	LC
133	<i>Psilopogon malabaricus</i>	Malabar Barbet	IV	LC
134	<i>Ocyrceros griseus</i>	Malabar Grey Hornbill	IV	LC
135	<i>Galerida malabarica</i>	Malabar Lark	IV	LC
136	<i>Psittacula columboides</i>	Malabar Parakeet	IV	LC
137	<i>Anthraceroceros coronatus</i>	Malabar Pied Hornbill	IV	NT
138	<i>Harpactes fasciatus</i>	Malabar Trogon	IV	LC
139	<i>Myophonus horsfieldii</i>	Malabar Whistling Thrush	IV	LC
140	<i>Nisaetus nipalensis</i>	Mountain Hawk Eagle	I	LC
141	<i>Ducula badia</i>	Mountain Imperial Pigeon	IV	LC
142	<i>Delichon urbicum</i>	Northern House Martin	IV	LC
143	<i>Jynx torquilla</i>	Northern Wryneck	IV	LC
144	<i>Anthus hodgsoni</i>	Olive-backed Pipit	IV	LC
145	<i>Geokichla citrina</i>	Orange-headed Thrush	IV	LC
146	<i>Anhinga melanogaster</i>	Oriental Darter	IV	NT
147	<i>Pernis ptilorhynchus</i>	Oriental Honey Buzzard	I	LC
148	<i>Copsychus saularis</i>	Oriental Magpie Robin	IV	LC
149	<i>Alauda gulgula</i>	Oriental Sky Lark	IV	LC

Sr. No.	Scientific Name	Common Name	IWPA 1972 Schedule	IUCN Status (v. 2020-2)
150	<i>Streptopelia orientalis</i>	Oriental Turtle Dove	IV	LC
151	<i>Zosterops palpebrosus</i>	Oriental White-eye	NL	LC
152	<i>Anthus rufulus</i>	Paddyfield Pipit	IV	LC
153	<i>Dicaeum erythrorhynchos</i>	Pale-billed Flowerpecker	IV	LC
154	<i>Falco peregrinus</i>	Peregrine Falcon	IV	LC
155	<i>Saxicola caprata</i>	Pied Bush Chat	IV	LC
156	<i>Ceryle rudis</i>	Pied Kingfisher	IV	LC
157	<i>Dicaeum concolor</i>	Plain Flowerpecker	IV	LC
158	<i>Psittacula cyanocephala</i>	Plum-headed Parakeet	IV	LC
159	<i>Treron pompadora</i>	Pompadour Green Pigeon	IV	LC
160	<i>Pellorneum ruficeps</i>	Puff-throated Babbler	IV	LC
161	<i>Ardea purpurea</i>	Purple Heron	IV	LC
162	<i>Cinnyris asiaticus</i>	Purple Sunbird	IV	LC
163	<i>Leptocoma zeylonica</i>	Purple-rumped Sunbird	IV	LC
164	<i>Galloperdix spadicea</i>	Red Spurfowl	IV	LC
165	<i>Ficedula parva</i>	Red-breasted Flycatcher	IV	LC
166	<i>Cecropis daurica</i>	Red-rumped Swallow	IV	LC
167	<i>Pycnonotus cafer</i>	Red-vented Bulbul	IV	LC
168	<i>Vanellus indicus</i>	Red-wattled Lapwing	IV	LC
169	<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul	IV	LC
170	<i>Sterna aurantia</i>	River Tern	IV	NT
171	<i>Columba livia</i>	Rock Dove	IV	LC

Sr. No.	Scientific Name	Common Name	IWPA 1972 Schedule	IUCN Status (v. 2020-2)
172	<i>Psittacula krameri</i>	Rose-ringed Parakeet	IV	LC
173	<i>Dendrocitta vagabunda</i>	Rufous Treepie	IV	LC
174	<i>Micropternus brachyurus</i>	Rufous Woodpecker	IV	LC
175	<i>Lonchura punctulata</i>	Scaly-breasted Munia	IV	LC
176	<i>Pericrocotus flammeus</i>	Scarlet Minivet	IV	LC
177	<i>Accipiter badius</i>	Shikra	I	LC
178	<i>Pericrocotus cinnamomeus</i>	Small Minivet	IV	LC
179	<i>Picumnus innominatus</i>	Speckled Piculet	IV	LC
180	<i>Bubo nipalensis</i>	Spot-bellied Eagle Owl	IV	LC
181	<i>Athene brama</i>	Spotted Owlet	IV	LC
182	<i>Streptopelia chinensis</i>	Spotted-necked Dove	IV	LC
183	<i>Pelargopsis capensis</i>	Stork-billed Kingfisher	IV	LC
184	<i>Butorides striata</i>	Striated Heron	IV	LC
185	<i>Aquila rapax</i>	Tawny Eagle	I	VU
186	<i>Dumetia hypertyra</i>	Tawny-bellied Babbler	IV	LC
187	<i>Dicaeum agile</i>	Thick-billed Flowerpecker	IV	LC
188	<i>Cyornis tickelliae</i>	Tickell's Blue Flycatcher	IV	LC
189	<i>Sitta frontalis</i>	Velvet-fronted Nuthatch	IV	LC
190	<i>Loriculus vernalis</i>	Vernal Hanging Parrot	IV	LC
191	<i>Seicercus occipitalis</i>	Western Crowned Leaf Warbler	IV	LC
192	<i>Circus aeruginosus</i>	Western Marsh Harrier	I	LC
193	<i>Dicrurus caerulescens</i>	White-bellied Drongo	IV	LC

Sr. No.	Scientific Name	Common Name	IWPA 1972 Schedule	IUCN Status (v. 2020-2)
194	<i>Dryocopus javensis</i>	White-bellied Woodpecker	IV	LC
195	<i>Amauornis phoenicurus</i>	White-breasted Waterhen	IV	LC
196	<i>Pycnonotus luteolus</i>	White-browed Bulbul	IV	LC
197	<i>Rhipidura aureola</i>	White-browed Fantail	IV	LC
198	<i>Motacilla maderaspatensis</i>	White-browed Wagtail	IV	LC
199	<i>Psilopogon viridis</i> Endemic	White-cheeked Barbet	NL	LC
200	<i>Lonchura striata</i>	White-rumped Munia	IV	LC
201	<i>Kittacincla malabarica</i>	White-rumped Shama	IV	LC
202	<i>Zoonavena sylvatica</i>	White-rumped Spinetailed Swift	IV	LC
203	<i>Gyps bengalensis</i>	White-rumped Vulture	I	CR
204	<i>Rhipidura albicollis</i>	White-throated Fantail	IV	LC
205	<i>Halcyon smyrnensis</i>	White-throated Kingfisher	IV	LC
206	<i>Hirundo smithii</i>	Wire-tailed Swallow	NL	LC
207	<i>Ciconia episcopus</i>	Asian Woollyneck	IV	VU
208	<i>Acritillas indica</i>	Yellow-browed Bulbul	IV	LC
209	<i>Abornis inornatus</i>	Yellow-browed Warbler	IV	LC
210	<i>Dendrocopos mahrattensis</i>	Yellow-crowned Woodpecker	IV	LC
211	<i>Treron phoenicopterus</i>	Yellow-legged Green Pigeon	IV	LC
212	<i>Vanellus malabaricus</i>	Yellow-wattled Lapwing	IV	LC
213	<i>Cisticola juncidis</i>	Zitting Cisticola	IV	LC

IUCN Status: LC- Least Concern, NT- Near Threatened, VU- Vulnerable

Endemism

A total of sixteen (16) species are endemic to Western Ghats. Details of endemic species recorded and reported from the study are provided below in **Table 3.19**.

Table 3.19 Endemic Avian Species of the Study Area

S.No.	Scientific name	Common name	Recorded during Primary survey	Schedule of WPA, 1972	IUCN status (v2018-1)
1.	<i>Columba ephinstonii</i>	Nilgiri wood pigeon	No	IV	VU
2.	<i>Psittacula columboides</i>	Blue winged Parakeet	No	IV	LC
3.	<i>Collocalia unicolor</i>	Indian edible nest swiftlet	No	I	LC
4.	<i>Harpactes fasciatus</i>	Malabar Trogon	Yes	IV	LC
5.	<i>Ocyrceros griseus</i>	Malabar grey Hornbill	Yes	IV	LC
6.	<i>Anlhracoceros coronatus</i>	Malabar Pied Hornbill	Yes	I	NT
7.	<i>A1egalaima virdis</i>	White checked Barbet	Yes	IV	LC
8.	<i>Tephrodornis sylvicola</i>	Malabar woodshrike	Yes	IV	LC
9.	<i>Pycnonotus priocephalus</i>	Grey-headed Bulbul	No	IV	NT
10.	<i>Iole indica</i>	Yellow browed bulbul	Yes	IV	LC
11.	<i>Pycnonotus gularis</i>	flame-throated bulbul	Yes	IV	LC
12.	<i>Garrulax delesserti</i>	Wynaad Laughingthrush	No	IV	LC
13.	<i>Rhopociclrila alriceps</i>	Dark Fronted babbler	No	IV	LC
14.	<i>Turdoides subrufus</i>	Indian rufous babbler	No	IV	LC
15.	<i>Leptocoma minima</i>	Crimson Backed sunbird	Yes	IV	LC
16.	<i>Batrachostomus moniliger</i>	Sri Lanka frogmouth	Yes	I	LC

3.9.3 Mammals

Species Richness

A total of 36 species of mammals are reported in the Anshi Dandeli Tiger Conservation Plan for the larger landscape. Out of which 29 species of mammals are reported from the Dandeli Wildlife Sanctuary. The transmission line section falling within the Karnataka section of the study area may support 20 species of this list as detailed in the **Table 3.20**. The species recorded through direct sighting include Gaur (*Bos gaurus*), Grey Mongoose (*Herpestes edwardsii*), Bonnet Macaque (*Macaca radiata*), Indian Giant Squirrel (*Ratifa indica*), Hanuman Langur (*Semnopithecus entellus*). While the signs such as pellet of Sambar (*Rusa unicolor*), quills of Indian Porcupine (*Hystrix indica*), and resting places of Wild Pig (*Sus scrofa*) were also recorded during transects. Species such as Malabar Giant Squirrel (*Ratifa indica*) and Bonnet Macaque (*Macaca radiata*) were the species sighted most frequently across the study area.

Table 3.20 Details of Sightings in Transmission Line Corridor

S.No.	Common Name	Scientific Name	IUCN	IWPA,1972	Observed /reported from the Study Area
1	Bonnet Macaque	<i>Macaca radiata</i>	VU	II	Y
2	Hanuman Langur	<i>Semnopithecus entellus</i>	LC	II	Y
3	Grey Slender Loris	<i>Loris lydekkerianus</i>	EN	I	N-Less likely
4	Tiger	<i>Panthera tigris</i>	EN	I	Y-Occasional
5	Leopard	<i>Panthera pardus</i>	VU	I	Y-Occasional
6	Jungle Cat	<i>Felis chaus</i>	LC	II	Y
7	Small Indian Civet	<i>Viverricula indica</i>	LC	II	Y
8	Common Palm Civet	<i>Paradoxurus hermaphroditus</i>	LC	II	Y
9	Common Mongoose	<i>Herpestes edwardsi</i>	LC	IV	Y
10	Striped necked Mongoose	<i>Herpestes vitticollis</i>	LC	IV	Y
11	Striped Hyena	<i>Hyaena hyaena</i>	NT	III	N-Less likely
12	Jackal	<i>Canis aureus</i>	LC	II	Y
13	Dhole	<i>Cuon alpinus</i>	EN	II	N-Less likely
14	Sloth Bear	<i>Melursus ursinus</i>	VU	I	Y-Occasional
15	Common Otter	<i>Lutra lutra</i>	NT	I	N-Less likely
16	Indian Elephant	<i>Elephas maximus indicus</i>	EN	I	N-Less likely
17	Gaur	<i>Bos gaurus</i>	VU	I	Y
18	Sambar	<i>Rusa unicolor</i>	VU	III	Y
19	Chital	<i>Axis axis</i>	LC	III	Y
20	Muntjac	<i>Muntiacus muntjak</i>	LC	III	Y
21	Indian spotted chevrotain	<i>Moschiola indica</i>	LC	I	Y-Occasional
22	Wild Pig	<i>Sus scrofa</i>	LC	III	Y
23	Indian Hare	<i>Lepus nigricollis</i>	LC	IV	Y
24	Indian crested Porcupine	<i>Hystrix indica</i>	LC	IV	Y
25	Indian giant squirrel	<i>Ratufa indica</i>	LC	I	Y
26	Indian giant flying squirrel	<i>Petaurista philippensis</i>	LC	II	Y
27	Indian Flying Fox	<i>Pteropus medius</i>	LC	V	Y
28	Short nosed Fruit Bat	<i>Cynopterus brachyotis</i>	LC	V	Y
29	Indian Pangolin	<i>Manis crassicaudata</i>	EN	I	N-Less likely

Figure 3.10 Mammal Species recorded in Transmission Line Corridor



Indian Giant Squirrel



Bonnet Macaque



Carcass of Indian Chevrotain (Fawn)

Threatened Species

Out of 29 species listed from the Dandeli Wildlife Sanctuary 10 species are protected under Schedule I of Wildlife (Protection) Act 1972 and are of conservation significance. There is an occasional occurrence of the species such as Tiger (*Panthera tigris*) IUCN EN listed and Leopard (*Panthera pardus*) IUCN VU listed species in the study area. As the entire landscape has a contiguous forest which becomes the part of their home range and the study area is a small part of the larger landscape. Tiger and Leopard are the top predators of the Study area. Based on the 2020 Tiger Census, Anshi Dandeli Tiger Reserve has 4 Tigers as observed from camera trapping results.

Gaur (*Bos gaurus*) IUCN VU, and Sloth Bear (*Melursus ursinus*) IUCN VU, Mouse Deer (*Moschiola indica*) are occasional visitor to the study area. However, species such as Indian Elephant (*Elephas maximus indicus*) EN, Common Otter (*Lutra lutra*) NT and Grey Slender Loris (*Loris lydekkerianus*) IUCN EN which are reported from the Dandeli Wildlife Sanctuary are less likely to be present in the

Study Area; based on the presence of indirect evidences and consultation with the Forest Guards and local villagers who collect the fuel wood from these forest areas.

4. IMPACT ASSESSMENT

4.1 Impacts on Biodiversity

The impacts on biodiversity of the proposed transmission line corridor passing through Dandeli Wildlife Sanctuary/Kali Tiger Reserve has been categorized into the following categories

- Impacts during Construction Phase
- Impacts during Operation Phase

Unlike other linear projects such as road infrastructure, rail infrastructure, pipeline laying, canal laying etc. the impacts of biodiversity are much lower in scale. Most of the impacts are confined to the activities such as tower foundation tower erection and stringing. The ground disturbances if any, are likely to be regenerated on the ground. The operation phase will have limited impacts *w.r.t.* vegetation clearance below the line is to maintain the desired ground clearance as per the established electrical safety norms.

4.2 Impacts during Construction Stage

Following impacts are envisaged during the construction stage on the biodiversity of the Transmission Line route

- Impacts during route survey and planning
- Impacts during vegetation clearance on approach roads
- Impacts during vegetation clearance on Tower locations
- Impacts during man and material transportation on each of the tower location
- Impacts during storage of construction material
- Impacts during construction activities
- Impacts during stringing of conductor

4.3 Impacts during Operation Stage

Following impacts are envisaged during the Operation Phase

- Mortality due to Electrocution and Collision of Avifaunal species
- Mortality due to Electrocution and Collision of arboreal mammalian species

4.4 Impact Assessment Criteria

ERM Impact Assessment Standards defines the sensitivity of ecological receptors by determining the significance of effects on species and habitats separately. The significance tables for species and habitats are given in **Table 4.1** and **Table 4.2**.

Table 4.1 Habitat Impact Assessment Criteria

Habitat Sensitivity/ Value		Magnitude of Effect on Baseline Habitats			
		Negligible	Small	Medium	Large
		The effect is within the normal range of variation	Affects only a small area of habitat, such that there is no loss of viability/ function of the habitat	Affects part of the habitat but does not threaten the long-term viability/ function of the habitat	Affects the entire habitat, or a significant portion of it, and the long-term viability/ function of the habitat is threatened.
Negligible	Habitats with negligible interest for biodiversity.	Not significant	Not significant	Not significant	Not significant
Low	Habitats with no, or only a local designation/recognition, habitats of significance for species listed as of Least Concern (LC) on IUCN Red List of Threatened Species, habitats which are common and widespread within the region, or with low conservation interest based on expert opinion.	Not significant	Not significant	Minor	Moderate
Medium	Habitats within nationally designated or recognised areas, habitats of significant importance to globally Vulnerable (VU), Near Threatened (NT), or Data Deficient (DD) species, habitats of significant importance for nationally restricted range species, habitats supporting nationally significant concentrations of migratory species and / or congregation species, and low value habitats used by species of medium value.	Not significant	Minor	Moderate	Major
High	Habitats within internationally designated or recognised areas; habitats of significant importance to globally Critically Endangered (CR) or Endangered (EN) species, habitats of significant importance to endemic and/or globally restricted-range species, habitats supporting globally significant concentrations of migratory species and / or congregation species, highly threatened and/or unique ecosystems, areas associated with key evolutionary species, and low or medium value habitats used by high value species.	Not significant	Moderate	Major	Critical

Table 4.2 Species impact assessment criteria

Habitat Sensitivity/ Value		Magnitude of Effect on Baseline Species			
		Negligible	Small	Medium	Large
		Effect is within the normal range of variation for the population of the species	Effect does not cause a substantial change in the population of the species or other species dependent on it	Effect causes a substantial change in abundance and/or reduction in the distribution of a population over one, or more generations, but does not threaten the long term viability/ function of that population dependent on it.	Affects entire population, or a significant part of it causing a substantial decline in abundance and/or change in and recovery of the population (or another dependent on it) is not possible either at all, or within several generations due to natural recruitment (reproduction, immigration from unaffected areas).
Negligible	Species with no specific value or importance attached to them.	Not significant	Not significant	Not significant	Not significant
Low	Species and sub-species of Least Concern (LC) on the IUCN Red List, or not meeting criteria for medium or high value.	Not significant	Not significant	Minor	Moderate
Medium	Species on IUCN Red List as Vulnerable (VU), Near Threatened (NT), or Data Deficient (DD), species protected under national legislation, nationally restricted range species, nationally important numbers of migratory, or congregatory species, species not meeting criteria for high value, and species vital to the survival of a medium value species.	Not significant	Minor	Moderate	Major
High	Species on IUCN Red List as Critically Endangered (CR), or Endangered (EN). Species having a globally restricted range (ie plants endemic to a site, or found globally at fewer than 10 sites, fauna having a distribution range (or globally breeding range for bird species) less than 50,000 km ²), internationally important numbers of migratory, or congregatory species, key evolutionary species, and species vital to the survival of a high value species.	Not significant	Moderate	Major	Critical

4.5 Impact Assessment

4.5.1 Impacts during Construction Phase

Context

The context for impacts of various activities are provided as per **Table 4.3**.

Table 4.3 Context of various impacts during the construction phase

Impacts during the construction phase	Context
Impacts during Route Survey and Planning	Route survey and planning involves surveying the transmission line route and identifying transmission tower location. The survey identifies the probable approach route to tower locations, feasibility for tower erection, soil testing etc. This will involve vegetation clearance en route and at tower locations
Impacts during vegetation clearance on approach roads	Approach roads will be required to reach at the tower locations, most of the construction material will be carried on foot using existing trails. Existing Forest roads will be utilized to the extent possible in case it is required for movement of construction material in bulk.
Impacts during vegetation clearance at Tower locations	The tower erection area will need to be cleared for construction activities. An area of 10 m radius within the RoW area will be required to be cleared at each of the tower locations and leveled.
Impacts during man and material transportation on each of the tower location	The transportation of construction workers and construction material at the tower location will be required during the construction phase. While workers transportation facility will be provided till the nearest road end, material transportation will be made through tractor and trolley till the place it is feasible with a minimum requirement of vegetation clearance and leveling, it will be further transported on head load by workers to the construction site. Locations which involve larger vegetation clearance, alternate arrangements such as material transportation through ropeways will be explored.
Impacts during storage of construction material	The civil work for foundation and erection of each transmission tower will require the storage of tower components and foundation materials at tower location. No construction material storage yard will be located within the wild life area. Temporary storage at the tower location during the erection however, cannot be ruled out.
Impacts during construction activities	Foundation and Erection of transmission tower will involve deployment of manpower, excavation of foundation, civil works. This will create a temporary habitat disturbance.
Impacts during stringing of conductor	Once the transmission tower erection is completed, conductor stringing will be undertaken. During the stringing, all tall trees and branches will be lopped and pruned where minimum ground clearance to conductor will be maintained.

Receptors

The receptors in the transmission line route are 30 species of floral species, 21 species of amphibians, 60 species of reptiles, 44 species of avifauna and 29 species of mammals which are observed during the study. The species of the conservational significance include floral species two (02) species are listed as threatened as per IUCN Red list v1.2018, ten (10) species of medicinal importance having commercial value and five (05) endemic species from the Western Ghats region.

The tree enumeration survey was undertaken for the transmission line route RoW of 46 m wildlife area in Dandeli Wildlife Sanctuary. A tree enumeration list is presented in **Table 4.4**.

Table 4.4 Tree Enumeration List from the Transmission Line route

S.N.	Scientific Name	Family	IUCN Status	Local Name	(0-30) cm	(31-60) cm	(61-90) cm	(91-120) cm	(121-150)cm	(>150) cm
1	<i>Ficus racemosa</i>	Moraceae		Aala	0	0	2	0	0	0
2	<i>Acacia auriculiformis</i>	Fabaceae		Acasia	20	139	69	10	1	0
3	<i>Misc. Species</i>			Alm	0	0	0	1	1	2
4	Other			Amberi	29	181	65	38	21	11
5	Other			Andmurugal u	0	1	0	0	0	0
6	Misc. Species			Anjan	0	7	11	15	7	2
7	Misc. Species			Anjani	53	927	509	274	124	64
8	<i>Caryota urens</i>	Arecaceae		Bagani	0	0	0	1	0	0
9	<i>Mimusops elengi</i>	Sapotaceae		Bakula	3	20	13	9	4	1
10	Misc. Species			Bananta	0	0	0	1	0	2
11	Misc. Species			Bedas	2	53	27	10	4	3
12	Misc. Species			Bedri	0	0	0	0	0	1
13	Misc. Species			Beer	2	26	0	0	0	0
14	Other			Belesarale	10	54	33	27	14	9
15	Other			Bilibasari	0	1	1	0	1	3
16	Misc. Species			Chandado	7	153	53	14	3	1
17	Misc. Species			Char	0	0	3	1	0	0
18	<i>Cinnamomum zeylanicum</i>	Lauraceae		Dalchini	24	312	86	25	8	0

S.N.	Scientific Name	Family	IUCN Status	Local Name	(0-30) cm	(31-60) cm	(61-90) cm	(91-120) cm	(121-150)cm	(>150) cm
19	<i>Grewia tiliifolia</i>	Malvaceae		Daman	1	27	13	2	0	0
20	Misc. Species			Denda	1	2	2	0	0	0
21	Other			Dhardar	7	28	9	4	7	2
22	Other			Durnata	0	9	1	0	0	1
23	Other			Ebonia	0	27	4	2	0	2
24	Other			Elm	0	0	0	3	0	0
25	Other			Gorabale	2	19	4	0	1	0
26	Misc. Species			Gulmaavu	0	67	71	123	52	27
27	Other			Haiga	0	38	45	12	9	3
28	Other			Holagera	4	89	53	36	15	20
29	<i>Pongamia pinnata</i>	Fabaceae		Honge	0	0	0	1	0	1
30	Other			Jangali	289	1878	484	199	74	54
31	Other			Kade	0	1	0	0	0	0
32	Other			Kakd	0	3	0	0	0	0
33	<i>Cassia fistula</i>	Fabaceae		Kakke	0	1	0	0	0	0
34	Other			Kalagonda	62	554	210	59	18	17
35	Other			Kalam	0	2	2	3	0	0
36	Other			Karambal	5	116	104	22	7	8
37	Other			Kare	19	106	21	5	3	4
38	<i>Murraya koenigii</i>	Rutaceae		Karibevu	1	6	0	0	0	0

S.N.	Scientific Name	Family	IUCN Status	Local Name	(0-30) cm	(31-60) cm	(61-90) cm	(91-120) cm	(121-150)cm	(>150) cm
39	<i>Murraya koenigii</i>	Rutaceae		Karibevu	1	6	0	0	0	0
40	Other			Karimara	8	118	55	8	5	0
41	Other			Kat	0	1	1	3	3	2
42	Other			Katekavach	0	59	16	3	0	0
43	<i>Mallotus philippinensis</i>	Euphorbiaceae		Keshari	0	2	1	1	0	0
44	<i>Terminalia paniculata</i>	Combretaceae		Kundal	4	280	260	68	18	8
45	<i>Garcinia indica</i>	Clusiaceae	Vulnerable	Kokam	2	35	7	0	0	0
46	Other			Kundo	0	2	0	0	0	0
47	Other			Kunjan	4	17	2	0	0	0
48	Other			Kusum	0	0	1	0	0	0
49	Other			Lavaki	21	252	146	92	31	20
50	<i>Terminalia tomentosa</i>	Combretaceae		Matti	11	286	302	141	50	23
51	<i>Mangifera indica</i>	Anacardiaceae		Mavu	3	30	19	10	3	17
52	Other			Masse	1	33	9	1	1	1
53	Other			Nagarkoda	9	97	8	4	0	0
54	<i>Lagerstroemia lanceolata</i>	Lythraceae		Nandi	5	105	89	51	16	30
55	Other			Navladi	0	0	0	1	0	2
56	<i>Emblia officinalis</i>	Phyllanthaceae		Nelli	2	24	3	0	0	0
57	<i>Syzygium cumini</i>	Myrtaceae		Nerale	10	235	249	152	60	41
58	Other			Nagarkudkuda	1	0	0	0	0	0

S.N.	Scientific Name	Family	IUCN Status	Local Name	(0-30) cm	(31-60) cm	(61-90) cm	(91-120) cm	(121-150)cm	(>150) cm
59	Other			Nurkau	0	15	2	0	0	0
60	Other			Olamb	0	1	0	1	0	0
61	Other			Pansi	0	1	1	4	1	0
62	<i>Myristica magnifica</i>	Myristica	Endangered	Rampatri	1	59	31	29	11	10
63	Other			Ramta	1	8	0	0	0	0
64	Other			Salaki	62	1052	181	9	4	1
65	<i>Alstonia scholaris</i>	Apocynaceae		Saton	0	0	1	0	0	1
66	<i>Albizia lebbeck</i>	Fabaceae		Sirs	0	1	0	0	0	0
67	<i>Dalbergia latifolia</i>	Fabaceae	Vulnerable	Sissam	0	9	6	2	0	0
68	Other			Sowar	2	33	8	1	1	0
69	Other			Sukini	42	1258	359	59	5	2
70	<i>Calophyllum inophyllum</i>	Clusiaceae		Surahonne	0	16	7	7	3	6
71	Other			Surgi	0	16	7	2	2	0
72	<i>Terminalia bellirica</i>	Combretaceae		Tare	0	6	18	13	11	12
73	Other			Uppage	0	10	0	1	1	0
74	Other			Vel	3	36	4	0	0	0
				Total	734	8950	3688	1560	600	414
				Sub Total (No of Trees)	15946					

Based on the survey a total of 15946 individuals of various tree species are enumerated within the RoW of 46 m for a 440 kV transmission line. However, based on the consultation with Sterlite's personnel only 35% of the RoW will be required to be disturbed largely at the tower location and stringing to maintain the required mandatory ground clearance.

Faunal species comprising of twenty-one (21) species of amphibians, sixty (60) species of reptiles, forty four (44) species of avifauna and twenty nine (29) species of mammals are reported from the area.

Of the above-listed species we have IUCN listed threatened species such as in amphibians; Amboli Bush Frog *Pseudophilautus amboli* IUCN CR v2020.2, Malabar Tree Toad *Pedostibes tuberculosus*, and Marbled Ramanella *Uperodon marmorata* IUCN EN v2020.2 and Maharashtra Bush Frog *Raorchestes bombayensis* listed as IUCN VU v2020.2.

In reptiles, Indraneil's Day Gecko (*Cnemaspis cf. indraneildasi*) and Indian rock python (*Python molurus*) listed as IUCN VU v2020.2 are observed from the study area.

There is a significant presence of Sch. I species of Indian Wildlife Protection Act, 1972 in each faunal group (Refer **Section 3.9**)

In avifauna, species such as White-rumped Vulture (*Gyps bengalensis*) IUCN listed CR species, Black-bellied Tern (*Sterna acuticauda*) and Egyptian Vulture (*Neophron percnopterus*) IUCN listed EN species, Lesser Adjutant (*Leptoptilos javanicus*), Tawny Eagle (*Aquila rapax*), Asian Woollyneck (*Ciconia episcopus*) IUCN listed VU species are reported from the study area. A total of 213 species of avifauna are reported from the Dandeli Wildlife Sanctuary.

In mammals, a total of 29 species were reported from the study area. Species such as Tiger (*Panthera tigris*), Dhole (*Cuon alpinus*), Indian Elephant (*Elephas maximus indicus*), Indian Pangolin (*Manis crassicaudata*) are listed as IUCN EN v.2020.2, while species such as Bonnet Macaque (*Macaca radiata*), Sloth Bear (*Melursus ursinus*), Gaur (*Bos gaurus*), Common Leopard (*Panthera pardus*), Sloth Bear (*Melursus ursinus*) and Sambar (*Rusa unicolor*) are listed as IUCN VU v2020.2. These species are reported from the Anshi Dandeli Tiger Reserve and can be potentially impacted due to the transmission line development.

Impact Significance

Vegetation clearance along the access road and transmission tower locations for the various construction activities as described in **Table 4.3** will lead to habitat loss, habitat disturbance to faunal species. It will also lead to loss of natural vegetation which will lead to reduced vegetal cover, shrinkage in natural forest cover, loss of nesting and foraging for avifaunal species, arboreal amphibians, reptiles and movement pattern of mammal species in the study area.

The excavation, leveling and removal of vegetation will also result in soil erosion which will be washed and drained with the occurrence of rains will runoff to the natural streams and change the stream characteristics, impacting the aquatic habitat associated amphibians and reptile and mammalian species.

The study area falls within the Dandeli Wildlife Sanctuary/Kali Tiger Reserve with the presence of a significant number of Sch. I species along with the presence of IUCN listed CR, EN and VU species, therefore the resource sensitivity is **High** for habitats and species. The impact will be limited to the activity areas, approach roads and transmission line RoW activity areas as described above and will not cause a significant change in the population of these species and therefore the impact magnitude has been deemed as **Medium**. The construction period suggested is of 6 months hence, the impact duration suggested as **Short term** and likely to be reduced in subsequent years due to high re-generation rate. (Refer **Table 4.4**). The net impact hence assessed as **Major**.

Residual Impacts

Removal of vegetation, development of approach roads and construction activities can have a direct and indirect impact on the local ecology. The impact is limited to the construction phase of the Project, following which the vegetation can recover, however, recovery as back to original stage will require significant duration of undisturbed state. The significance of the residual impacts is **Minor** for habitats and species. (Refer **Table 4.5**)

Table 4.5 Impact significance of Overall Construction Activities

Impact	During Construction Phase				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Limited to tower location, approach roads, stringing and immediate surroundings mostly within RoW				
Frequency	Construction phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Agricultural lands)	Low		Medium		High
Resource Sensitivity (Species)	Low		Medium		
Impact Significance	Not Significant	Minor		Moderate	Major
	The significance of impact is considered Major for habitat and species.				
Residual Impact Significance					
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Not Significant	Minor		Moderate	Major
	The significance of impact is considered Moderate for habitats and species.				

4.5.2 Impacts during operation Phase

Context

The context for impacts of various activities during operation phase are provided as per **Table 4.3**

Table 4.6 Context of various impacts during the operation phase

Impacts during the operation phase	Context
Impacts due to electrocution and collision of avifaunal species with conductor	Mortality by Electrocution: Electrocution may happen if the avifaunal species sitting on the conductor and touching two-phase
	Mortality by collision Mortality by collision may happen if the avifauna flying near the conductor did not spot the conductor and collides with it in

Impacts during the operation phase	Context
	full force, leading to physical injury (Like broken wings etc) resulting into death.
Disturbance to vegetation during maintenance of required ground clearance	Preventive and Corrective Maintenance of the transmission line and for maintenance of the mandatory vertical clearance between vegetation and the lowest point of conductor sag. This will involve lopping and pruning of existing tree species leading to loss of nesting and perching sites
Electrocution of Arboreal mammals	The arboreal mammals in the study area may face changes in the movement within traditional corridors and mortality due to electrocution while moving from one canopy to another canopy with transmission line as the barrier in between.

Receptors

The avifaunal species observed and reportedly present within the study area and in the larger landscape of the wildlife sanctuary such as Black Stork (*Ciconia nigra*), Asian Woollyneck (*Ciconia episcopus*), Malabar Grey Hornbill (*Ocyrceros griseus*)* Western Ghats endemic, Indian grey hornbill (*Ocyrceros birostris*), Malabar Pied Hornbill (*Anhracoceros coronatus*), Great Pied Hornbill (*Buceros bicornis*) have larger wingspan and face risk of electrocution while perching on the conductor and mortality due to collision while flying into conductor and getting injured.

Raptor species listed as Sch.I of the Indian Wildlife Protection Act, 1972 such as, Oriental Honey Buzzard (*Pernis ptilorhyncus*), Black winged Kite (*Elanus careleus*), Crested Goshawk (*Accipiter trivirgatus*), Shikra (*Accipiter badius*), Black Eagle (*Icrillaellts malyanensis*), Tawny Eagle (*Aquila rapax*) from the study area and larger landscape have a perching behavior on the transmission line and nesting in transmission line tower. These are also under potential risk of mortality due to electrocution and collision with conductors.

Arboreal (Tree Dwelling) mammals such as Slender Loris (*Loris lydekkerianus*) Indian Giant Flying Squirrel (*Petaurista philippensis*), Indian/Malabar Giant Squirrel (*Ratufa indica*), Bonnet Macaque (*Macaca radiata*), Hanuman /Black-faced Langur (*Semnopithecus entellus*) may face a barrier in movement due to the transmission line.

Aerial mammalian species such as Fulvous Fruit Bat (*Rousettus leschenaultia*), Lesser False Vampire (*Megaderma spasma*), Indian Pipistrelle (*Pipistrellus coromandra*), Indian Pygmy Bat (*Pipistrellus tenuis*) and Lesser Dog-faced Fruit Bat (*Cynopterus brachyotis*) are also likely to get impacted due to collision with transmission line conductor.

Few IUCN listed species such as Tiger (*Panthera tigris*), Dhole (*Cuon alpinus*), Indian Elephant (*Elephas maximus indicus*), Indian Pangolin (*Manis crassicaudata*) are listed as IUCN EN v.2020.2, while species such as Bonnet Macaque (*Macaca radiata*), Sloth Bear (*Melursus ursinus*), Gaur (*Bos gaurus*), Common Leopard (*Panthera pardus*), Sloth Bear (*Melursus ursinus*) and Sambar (*Rusa unicolor*) are listed as IUCN VU v2020.2 may be impacted due to habitat disturbance due to routine and corrective maintenance.

Impact Significance

There is a potential of impacts on IUCN listed EN and VU species, Schedule I species of Indian Wildlife Protection Act, 1972 and endemic species from the Western Ghats. The study area falls within the Dandeli Wildlife Sanctuary/Kali Tiger Reserve with the presence of significant number of Sch. I species, IUCN listed CR, EN and VU species, the resource sensitivity as **High** for habitats and species. The impacts described above will not cause a significant change in the population of these species as sufficient habitat is present in the study area and the larger landscape. The impact duration is **Long term** as the impacts will be applicable for entire project cycle. Hence the impact

magnitude is deemed as **medium** as effect may causes a substantial change in abundance and/or reduction in distribution of a population over one, or more generations, but does not threatened the long term viability/ function of that population dependent on it. Overall impact assessed for the operational phase as **Major** for habitat and species.

Residual Impacts

The residual impacts for the operational phase impacts are deemed as **Moderate** as the implementation of mitigation measures suggested will lower the impact magnitude from **medium** to **small**. (Refer **Table 4.6**)

Table 4.7 Impact significance of Operational Activities

Impact	During Operation Phase				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	Routine and Corrective Maintenance				
Frequency	Operation phase				
Likelihood	Likely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity (Agricultural lands)	Low		Medium		High
Resource Sensitivity (Species)	Low		Medium		
Impact Significance	Not Significant	Minor		Moderate	Major
	Significance of impact is considered Major for habitat and species.				
Residual Impact Significance					
Residual Impact Magnitude	Positive	Negligible	Small	Medium	Large
Residual Impact Significance	Not Significant	Minor		Moderate	Major
	Significance of impact is considered Moderate for habitats and species.				

5. MITIGATION MEASURES

5.1 INTRODUCTION

“Mitigation Measures,” refer to the actions that can be implemented to minimize the magnitude of the project related detrimental impacts on different physical, biological and social environments of the project area. Mitigation can carry on along three possible courses of actions, either by changing actions (1) at source, (2) on path (3) or at the receiving end.

Based on the present study it is very clear that the prevailing physical environmental conditions of the project location and associated project activities predicted to impact upon some biological attributes of the project area which are at local, shorter period mainly during construction phase and magnitude of low to moderate levels in many cases.

Overall impact statement identified impacts in construction and operation phase. The impact summary from the previous chapter is provided in **Table 5.1**.

Table 5.1 Impact Summary

Impact Description	Impact Nature	Impact Significance	
		Without Mitigation	Residual (With Mitigation)
Construction Phase	Negative	Major	Moderate
Operation Phase	Negative	Major	Moderate

The mitigation measures for the construction phase and operation phase as discussed hereunder;

5.2 Construction Phase Mitigation Measures

The proposed transmission line project is estimated to acquire a total of 30.412 ha. area of Dandeli Wildlife Sanctuary which would impact as a loss of forest habitat, change in species composition and change in abundance of faunal groups of the overall project area.

The Transmission line (Refer **Figure 2.1**) route falls in the Tropical semi-evergreen forests (West tropical semi-evergreen forests) habitat and Tropical moist deciduous forests (Southern moist mixed deciduous forests and secondary moist mixed deciduous forests) forest area. The tower locations are in the dense to very dense forest area.

Mitigation measures suggested in the construction phase are discussed below;

- Habitat disturbances to be kept at minimum by using existing trails for transportation of man, material and machinery;
- Any vegetation clearance required should be limited to the minimum area required for such passages;
- Alternate mode of transportation such as Rope-ways should be considered were ever feasible to the maximum extent;
- Tree enumeration for clearance has been already undertaken. During the vegetation removal, a trained botanist will be required in order to seek guidance to avoid, restore and replant species of conservation significance such as IUCN listed threatened species, endemic species and medicinal plants as per **section 3.8**;
- Construction activity, man and material movement should be limited to the day time and early morning, late evening and night activity should be completely avoided to allow the unrestricted wildlife movement;
- No night stay at the construction site should be planned, proper planning of day work (within the daylight hours) should be done;

- Movement within the wildlife area should be entirely regulated, each work force party/gang should be trained in do's and don't's and how to deal in a situation of wildlife encounter before entering the wildlife area,
- Tree felling should be in compliance of all the statutory requirements, tree felling in the nesting season of endemic avifaunal species (Refer **Table 3.19**) should carefully examine the active nest on trees before felling, relocation of active nest should be undertaken with the help of State Forest Department and/or wildlife NGO;
- Hunting, trapping and poaching by the employed work force should be completely banned and no poaching tolerance strategy should be covered under contractual obligations;
- Vehicle speed while travelling to the activity area should be regulated and minimized as required;
- The vegetation clearance along the RoW of the transmission line will create a canopy break for the arboreal mammals (Tree dwelling) construction of **canopy bridges** at key locations (where such canopy breaks are very evident) are suggested.
- Proper housekeeping of the construction areas should be followed during and after construction phase is completed.
- Independent monitoring agency (preferably a local wildlife NGO) should be appointed to oversee and guide the mitigation measure implementation during the construction phase and should periodically update the higher official of Sterlite.

5.3 Mitigation for Operational Phase

Operational Phase impacts will be associated to the routine and corrective maintenance, potential risk of electrocution and collision for avifaunal species and electrocution for arboreal mammalian species. In the routine maintenance, in order to require the mandatory vertical clearance pruning and lopping of trees may be required within the RoW.

Mitigation measures suggested in the operation phase are discussed below;

- Any routine and corrective maintenance schedule planned should be undertaken only after pre-informing the forest department;
- Sterlite should make an arrangement for dedicated personal from forest department, trained in dealing situations of wildlife encounters, movement, rescue and rehabilitation (preferably reptiles and mammals) while under taking such routine visits ;
- Pre nest search before commencing any pruning and lopping to be undertaken;
- Suggesting artificial nest boxes along the transmission line route to mitigate the loss of nesting sites along the transmission line route;
- Periodic review of condition of canopy bridges and undertake required maintenance;
- Installation of bird diverters on the conductor and perch rejecters on transmission tower along the transmission line corridor should be undertaken along the wildlife stretch;
- In addition to the above, artificial nesting platform for raptor species to be built along the transmission line at a distance of 200 m;
- Structures to climb transmission towers should have a restriction guards (to avoid access to for arboreal species (Maccaques, Langurs, Loris, Giant Squirrels etc.)
- Rapid carcass search along the transmission line corridor for possible victims of collision and electrocution should be undertaken once in 6 months

The suggested mitigation structures are depicted in **Figure 5.1**.

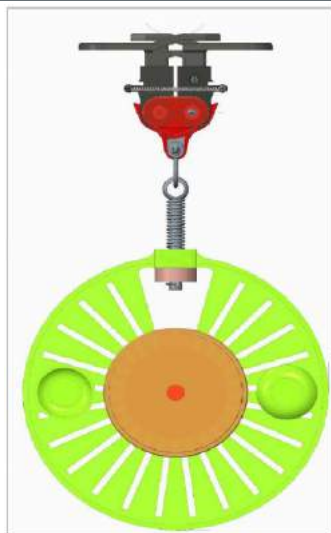
Figure 5.1 Mitigation Structures for Transmission Line



Artificial nesting platforms reduce electrical hazards and enhance habitat for breeding and roosting



Canopy bridge construction for arboreal mammals movement in canopy break area



Power line Bird Diverters



High temperature Power line Markers

6. BIODIVERSITY MANAGEMENT PLAN

6.1 Introduction

Where biodiversity values of importance to conservation are associated with a project site or its area of influence, the preparation of a Biodiversity Management Plan (BMP) provides a useful means to focus a project's mitigation and management strategy. The development of a BMP for transmission line project is a requirement for regulatory clearances as it documents the process, actions, responsibilities and budget allocation. It also gives the opportunities to investigate the effectiveness of the mitigation measures suggested and provides as chance to revisit them and make timely changes to update/upgrade the mitigation actions for better management of biodiversity.

6.2 Biodiversity Management Plan

The biodiversity management plan has been devised on the following aspects;

- Ecological Sensitivities along the transmission line corridor;
- Species of conservational significance along the transmission line corridor;
- Impacts during the construction and operation phase;
- Proposed mitigation measures;
- Parameters to be monitored;
- Measurement and frequency;
- Institutional responsibility;
- Implementation schedule

6.2.1 Ecological Sensitivity

The ecological sensitivities along the transmission line are;

Habitats: The transmission line passes through the protected area, “**Dandeli Wildlife Sanctuary/Kali Tiger Reserve**”. This sanctuary contains pristine vegetation classified as Tropical semi-evergreen forests (West tropical semi-evergreen forests) and Tropical moist deciduous forests (Southern moist mixed deciduous forests and secondary moist mixed deciduous forests).

Species of Conservational Significance: The species of conservational significance (IUCN listed Critically Endangered, Endangered and Vulnerable species, Indian Wildlife Protection Act, 1972 listed Schedule I species observed and reported from the transmission line corridor are listed in **Table 6.1**.

The threatened species observed in the transmission line corridor and the buffer area are given as per **Table 6.1**;

Table 6.1 Threatened Species

Common Name	Scientific Name	IUCN v.2020.2	IWPA,1972	Observed /Reported
Plants				
Tree	<i>Diospyros paniculata</i> Dalzell	VU		Observed
Tree	<i>Holigarna grahamii</i> (Wight) Kurz.	LC		Observed
	<i>Dalbergia latifolia</i> Roxb.	VU		Tree Enumeration
Tree	<i>Myristica magnifica</i>	EN		Tree Enumeration

Common Name	Scientific Name	IUCN v.2020.2	IWPA,1972	Observed /Reported
Tree	<i>Garcinia indica</i>	VU		Tree Enumeration
Amphibian				
Malabar Tree Toad	<i>Pedostibes tuberculosus</i>	EN	IV	Observed
Marbled Ramanella	<i>Uperodon mormorata</i>	EN	IV	Reported
Amboli Bush Frog	<i>Pseudophilautus amboli</i>	CR	IV	Observed
Maharashtra Bush Frog	<i>Raorchestes bombayensis</i>	VU	IV	Observed
Reptiles				
Indian flapshell turtle	<i>Lissemys punctata</i>	LC	I	Reported
Indraneil's Day Gecko	<i>Cnemaspis cf. indraneildasii</i>	VU	IV	Observed
Bengal Monitor Lizard	<i>Varanus bengalensis</i>	LC	I	Reported
Indian rock python	<i>Python molurus</i>	VU	I	Observed
Avifauna				
Wooly-necked stork	<i>Ciconia episcopus</i>	VU	IV	Reported
Oriental Honey Buzzard	<i>Penlis ptilorhynchus</i>	LC	I (part III)	Reported
Black shouldered Kite	<i>Elanus careleus</i>	LC	I (part III)	Reported
Crested Serpent eagle	<i>Spilornis cheela</i>	LC	I (part III)	Reported
Crested Goshawk	<i>Accipiter trivirgatus</i>	LC	I (part III)	Reported
Shikra	<i>Accipiter badius</i>	LC	I (part III)	Reported
Black Eagle	<i>Icrillaellts malyanensis</i>	LC	I (part III)	Reported
Tawny Eagle	<i>Aquila rapax</i>	LC	I (part III)	Reported
Malabar Pied Hornbill	<i>Anlhracoceros coronatus</i>	NT	I (part III)	Observed
Great pied Hornbill	<i>Buceros bicornis</i>	NT	I (part III)	Reported
Sri Lanka frogmouth	<i>Batrachostomus moniliger</i>	LC	I (part III)	Observed
Mammals				
Bonnet Macaque	<i>Macaca radiata</i>	VU	II	
Grey Slender Loris	<i>Loris lydekkerianus</i>	EN	I	
Tiger	<i>Panthera tigris</i>	EN	I	
Leopard	<i>Panthera pardus</i>	VU	I	
Dhole	<i>Cuon alpinus</i>	EN	II	
Sloth Bear	<i>Melursus ursinus</i>	VU	I	
Common Otter	<i>Lutra lutra</i>	NT	I	
Indian Elephant	<i>Elephas maximus indicus</i>	EN	I	
Gaur	<i>Bos gaurus</i>	VU	I	
Sambar	<i>Rusa unicolor</i>	VU	III	
Indian spotted chevrotain	<i>Moschiola indica</i>	LC	I	
Indian giant squirrel	<i>Ratufa indica</i>	LC	I	
Short nosed Fruit Bat	<i>Cynopterus brachyotis</i>	LC	V	

The plan is described in **Table 6.2** below

Table 6.2 Biodiversity Management Plan

Activity	Impact	Target species groups	Phase (Construction/ Operation)	Proposed mitigation measures	Parameters to be monitored	Measurement and frequency	Institutional responsibility
Route Survey and Planning	Habitat disturbance due to clearance of bushes while new	Faunal groups (Herpetofauna, Avifauna and Mammals)	Construction Phase	<ul style="list-style-type: none"> Habitat disturbances to be kept at minimum by using existing trails for transportation of man, material and machinery; Any vegetation clearance required should be limited to the minimum area required for such passages; Alternate mode of transportation such as Rope-ways should be considered were ever feasible to the maximum extent 	Physical demarcation of the Right of Way before any vegetation clearance	Visual inspection on monthly basis during the construction phase	Third Party Inspection report to GTTPL
Impacts during vegetation clearance on approach roads and RoW	Habitat Loss and habitat disturbance, loss of nesting sites	Flora and Faunal groups	Construction Phase	<ul style="list-style-type: none"> Tree cutting for the approach roads and RoW should be undertaken where only it is absolutely necessary, Tree enumeration for clearance should be undertaken in presence to trained botanist/forest department in order to seek guidance to avoid, restore and replant species of conservation significance such as IUCN listed threatened species, endemic species and medicinal plants as per section 3.8; Tree felling should be in compliance of all the statutory requirements; tree felling in the nesting season (March to September) should carefully examine the active nest on trees before felling; relocation of active nest should be undertaken with the help of State Forest Department and/or wildlife NGO; Cleared wood material removal should be undertaken as per guidance of the state forest department; The ground dwelling fauna in the area should be approached carefully and removed from the direct path by trained experts, no direct attendance of the wildlife encounters 	Physical demarcation of the vegetation in approach roads before clearance	Visual inspection on weekly basis during the construction phase	Third Party Inspection report to GTTPL, GTTPL to prepare a clearance schedule based on tree enumeration survey
Impacts during vegetation	Habitat loss and Habitat disturbance	Floral and faunal groups	Construction phase	<ul style="list-style-type: none"> The tower location need 10 m radius working area for tower erection for which vegetation clearance 	Third party verification during	Visual inspection on weekly basis	Third Party Inspection

Activity	Impact	Target species groups	Phase (Construction/ Operation)	Proposed mitigation measures	Parameters to be monitored	Measurement and frequency	Institutional responsibility
clearance on Tower locations				<p>will be required. The clearance should be confined within the designated area</p> <ul style="list-style-type: none"> ■ The various components of tower will be stored in the tower locations resulting in additional areas for clearance. The site manager will ensure that minimum area disturbance is made during tower erection; ■ No night stays should be made inside the Sanctuary area. Entire day activities should be planned in a way, early morning, night and late evening time should be avoided. ■ No blasting with the sanctuary area should be made for excavation of rocks for foundation, alternative less disruptive methods should be identified; ■ The cleared vegetation should be removed from the construction area. A designated place for the storage of the cleared wood as per direction of forest department should be made; ■ No wildlife should be harmed by the work force in the forest and sanctuary area. 	construction period	during the construction phase	report to GTTPL
Impacts during man and material transportation on each of the tower location	Habitat disturbances	Fauna group	Construction phase	<ul style="list-style-type: none"> ■ Material movement will be through trucks till the road end and further on tractor trolley to the end possible. In case the last location is not approachable then material will be transported either on foot by labourers or through rope way likely to be erected for transportation which required minimum disturbances; ■ Man movement will be on foot, damage to flora and fauna should be avoided to maximum extent, ■ Contractual obligations should clearly define zero tolerance to hunting, trapping and poaching. 	Material movement at each tower location	Visual inspection on weekly basis during the construction phase	Third Party Inspection report to GTTPL
Impacts during stringing of conductor	Habitat disturbances	Fauna group	Construction phase	<ul style="list-style-type: none"> ■ Stringing on conductor will involve vegetation clearance, as any obstruction during stringing will be chopped, lopped and pruned as per requirement. Before undertaking such activity, it is 	Stringing the towers	Visual inspection during stringing	Third Party Inspection report to GTTPL

Activity	Impact	Target species groups	Phase (Construction/ Operation)	Proposed mitigation measures	Parameters to be monitored	Measurement and frequency	Institutional responsibility
				<p>to be ensured that the remaing tree left will grow further;</p> <ul style="list-style-type: none"> ■ Nesting sites of avifaunal species to be avoided to the extent possible, if not then the nest translocation should be undertaken by trained wildlife personels, pre-identification of nesting site should be under taken; 			
Risk of mortality due to electrocution and collision	mortality in Species of conservational significance	Avifauna and Arboreal mammals	Operation Phase	<ul style="list-style-type: none"> ■ Any routine and corrective maintenance schedule planned should be undertaken only after pre informing the forest department; ■ GTTPL should make an arrangement for dedicated personal from forest department, trained in dealing situations of wildlife encounters, movement, rescue and rehabilitation (preferably reptiles and mammalsians) while under taking such routine visits ; ■ Structures to climb transmission towers should have a restriction guards (to avoid access to for arboreal species (Macques, Langurs, Loris, Giant Squirrels etc.) ■ Rapid carcass search along the transmission line corridor for possible victims of collision and electrocution ■ Installation of canopy bridges in the canopy break areas for zero hinderance movement of arboreal mammals. Periodic review of condition of canopy bridges and undertake required maintenance; ■ Installation of bird diverters on the conductor and perch rejecters on transmission tower along the transmission line corridor; ■ In addition to the above artificial nesting platform for raptor species to be built along the transmission line at a distance of 200 m; 	Species mortality and effectiveness to mitigation measures	Quarterly during first two years of energization and then six monthly during next two years	External Consultant and GTTPL
Vegetation removal for maintaining mandatory electrical	Habitat loss and habitat disturbances	Floral and faunal groups	Operation Phase	<ul style="list-style-type: none"> ■ Pre nest search before commencing any pruning and lopping to be undertaken; 	Nesting frequency of avifaunal species	Quarterly during first two years of energization and then six	External Consultant and GTTPL

Activity	Impact	Target species groups	Phase (Construction/ Operation)	Proposed mitigation measures	Parameters to be monitored	Measurement and frequency	Institutional responsibility
safety vegetation clearance				■ Suggesting artificial nest boxes along the transmission line route to mitigate the loss of nesting sites along the transmission line route.		monthly during next two years	

6.3 Cost of the Biodiversity Management Plan

The cost for the implementation of the conservation plan is provided in **Table 6.3** below. There costs are indicative and will be updated in consultation of the state forest and wildlife department.

Table 6.3 Cost of Implementation of BMP

Sn.	Activity	Budget in Rupees
A.	Project Specific Cost	
1.	Bird diverters along the transmission line	Rs. 25 .0 Lakhs
	Sub Total A	
B	Management Actions through Agencies	
1.	Professional and administrative support from Forest Department for vegetation clearance, monitoring and implementation, and overall guidance	Rs. 30 Lakhs
2.	Biodiversity Monitoring during construction and operation phase	Rs.10.0 Lakhs
3.	Creation of Nest boxes, nesting platforms and canopy bridges	Rs. 10.0 Lakhs
	Total	Rs. 75.0 Lakhs

APPENDIX A TOWER DESIGN DETAILS

To,

Mr. Rajiv Ranjan,
M/s Larsen & Toubro Ltd.
Power Transmission & Distribution,
Mount Poonamallee Road, Manapakkam,
P.B. No. 979, Chennai -600089

Ref No: SPGVL/GTTPL/ENGG/L&T/22
Dated: 10th August'2018

PROJECT: 765 kV, 400 kV & 220 kV Transmission lines associated with Goa Tamnar Transmission Project Limited

LOA No: SPGVL/17-18/LOA/009 Dated: 29-12-2017.

Subject: Issuance of Final Approved Tower Spotting data for 400kV D/C Quad AAAC Moose T/L (WZ-1 & WZ-2) including additional family of Towers.

Dear Sir,

This is with reference to 400kV D/C Quad AAAC Moose T/L (WZ-1 & WZ-2) for GTTPL Project. We are hereby releasing the below mentioned approved documents for your reference and use in same: -

Sr.No	Description	Document No.	Rev. No.
Tower Spotting Data for WZ-1			
1.	400kV D/C Quad AAAC Moose T/L	DS-1003	1
Tower Spotting Data for WZ-2			
1.	400kV D/C Quad AAAC Moose T/L	DS-1008	1

Approval conveyed herein neither relieve M/s L&T of his contractual obligation & his responsibilities for correctness of dimension, materials of construction, weights, designed details, assembly fits, performance particulars & conformity of the supplies with the Indian statutory laws as may be applicable, nor does it limit the SPGVL rights under the contract.

Regards

for 
Dr. Deepak Lakhapati
Chief Design Officer

Encl: As Above

Copy to:

1. Mr. Amitanshu along with Encl



Project : **400 KV D/C TRANSMISSION LINE**

Line : **Xeldam- Narendra 400 KV D/C Transmission Line with Quad AAAC Moose Conductor (WZ-1)**

Wind Zone : **I (33 m/s)**

Owner : **Sterlite Power Grid Ventures Limited**

Description : **TOWER SPOTTING DATA (Upto +9M)**

STERLITE POWER GRID VENTURES LTD
RELEASED FOR CONSTRUCTION
CONTROLLED COPY

Approved Vide Ref. Letter No. SPGVL/GTTP/L

ENGG/L&T/22 Date 10/08/2018
Engineering Deptt.
the above does not relieve the contractor from their contractual obligations

Document no.	Date	Rev no.	Remarks if any	Desn by	STATUS
DS-1003	10-08-2018	01	Additional Tower Families Included	AM	

TOWER SPOTTING DATA FOR XELDAM- NAREDA 400 KV D/C TRANSMISSION LINE (WZ-1) (QUAD AAAC MOOSE CONDUCTOR)																				4
Sr. No.	DESCRIPTION	DA (0-2 DEGREE)	DBN (0-8 DEGREE)	DB (0-15 DEGREE)	DC (15-30 DEGREE)	DDN (30-45 DEGREE)	DD (30-60 DEGREE)	DE (0-15 DEGREE)												
1	MAX ANGLE OF DEVIATION	2	8	15	30	45	60	15												
2	VERTICAL LOAD LIMITATION ON WEIGHT SPAN	DOWNWARDS ONLY	DOWNWARD	UPWARD	DOWNWARD	UPWARD	DOWNWARD	UPWARD	DOWNWARD	UPWARD	DOWNWARD	UPWARD	DOWNWARD	UPWARD	DOWNWARD	UPWARD	DOWNWARD	UPWARD	DOWNWARD	
2.1	GROUNDWIRE EFFECT	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
	(I) ON BOTH SPAN (M)	600	200	600	-200	600	-200	600	-200	600	-200	600	-200	600	-200	600	-200	600	-200	
	(II) ONE SPAN (M)	360	100	360	-100	360	-100	360	-100	360	-100	360	-100	360	-100	360	-100	360	-100	
2.2	CONDUCTOR EFFECT																			
	(I) ON BOTH SPAN (M)	600	200	600	-200	600	-200	600	-200	600	-200	600	-200	600	-200	600	-200	600	-200	
	(II) ONE SPAN (M)	360	100	360	-100	360	-100	360	-100	360	-100	360	-100	360	-100	360	-100	360	-100	
3	WEIGHTS																			
3.1	GROUNDWIRE EFFECT																			
	(I) ON BOTH SPAN (KG)	290	97	290	-97	290	-97	290	-97	290	-97	290	-97	290	-97	290	-97	290	-97	
	(II) ONE SPAN (KG)	174	49	174	-49	174	-49	174	-49	174	-49	174	-49	174	-49	174	-49	174	-49	
3.2	CONDUCTOR EFFECT																			
	(I) ON BOTH SPAN (KG)	1000	334	1000	-334	1000	-334	1000	-334	1000	-334	1000	-334	1000	-334	1000	-334	1000	-334	
	(II) ONE SPAN (KG)	600	167	600	-167	600	-167	600	-167	600	-167	600	-167	600	-167	600	-167	600	-167	
4	PERMISSIBLE SUM OF ADJACENT SPANS IN M FOR VARIOUS DEVIATION ANGLES. PERMISSIBLE ONE SPAN FOR VARIOUS DEVIATION ANGLES SHOULD NOT EXCEED 60% OF THE VALUE SHOWN FOR THE SUM OF ADJACENT SPANS SUBJECTED TO AVAILABILITY OF GROUND CLEARANCES.	EVN ANGLE	SPAN	DEVN ANGLE	SPAN	DEVN ANGLE	SPAN	DEVN ANGLE	SPAN	DEVN ANGLE	SPAN	DEVN ANGLE	SPAN	DEVN ANGLE	SPAN	DEVN ANGLE	SPAN	DEVN ANGLE	SPAN	
		2	800	8	800	15	800	30	800	45	800	60	800	75	800	90	800	105	800	
		1	850	7	861	14	860	29	860	44	857	59	853	74	849	89	845	104	841	
		0	900	6	922	13	921	28	920	43	914	58	906	73	899	88	891	103	884	
				5	984	12	982	27	979	42	971	57	959	72	947	87	935	102	923	
				4	1044	11	1042	26	1039	41	1028	56	1012	71	1000	86	984	101	968	
				3	1105	10	1104	25	1098	40	1084	55	1064	70	1044	85	1019	100	994	
				2	1166	9	1164	24	1158	39	1141	54	1118	69	1094	84	1064	99	1034	
				1	1227	8	1225	23	1216	38	1198	53	1171	68	1141	83	1104	98	1064	
				0	1288	7	1285	22	1276	37	1254	52	1224	67	1184	82	1144	97	1104	
						6	1347	21	1335	36	1311	51	1278	66	1234	81	1184	96	1144	
						5	1407	20	1393	35	1367	50	1330	65	1284	80	1234	95	1184	
						4	1469	19	1453	34	1425	49	1384	64	1334	79	1284	94	1234	
						3	1529	18	1512	33	1482	48	1438	63	1384	78	1334	93	1284	
						2	1590	17	1572	32	1540	47	1493	62	1438	77	1384	92	1334	
						I & below		16	1631	31	1598	46	1548	61	1493	76	1443	91	1384	
						15	1691	30	1656	45 & below	1603									
5	DESIGN LOAD TENSION																			
5.1	OPGW - (32C AND Full Wind)																			
	OPGW - (32C AND 75% of Full Wind)																			
	OPGW - (32C AND 36% of Full Wind)																			
5.2	CONDUCTOR - (32C AND Full Wind)																			
	CONDUCTOR - (32C AND 75% of Full Wind)																			
	CONDUCTOR - (32C AND 36% of Full Wind)																			
6	BROKEN WIRE CONDITION (BROKEN ON THE SAME SIDE ON THE SAME SPAN)																			
		GW/ANY ONE CONDUCTOR	GW+ANY ONE CONDUCTOR OR ANY TWO CONDUCTORS															GW+ANY TWO CONDUCTORS OR ALL THREE CONDUCTORS		

PROJECT DETAILS : 400 KV D/C TRANS. LINE WITH QUAD AAAC MOOSE CONDUCTOR (WZ-1)
OWNER: STERLITE POWER GRID VENTURES LIMITED - NEW DELHI

SAG TENSION CALCULATIONS

Ruling span: (L)	400.00 m	
Design Wind Pressure: (Pd) :	346.00 N/Sq.mt	
	35.30 kg/Sq.mt	
Gust response factor (for wire) : Gc:	2.22	2.30
Final wind pressure (for wire) :	79.00 kg/Sq.mt	98.00 kg/Sq.mt
	2.52 kg/m	1.18 kg/m
Final wind pressure (for Insulator) :	106.00 kg/Sq.mt	

Particulars

	<u>Conductor</u>	<u>Earth-wire</u>
Code :	AAAC Moose	OPGW (24F)
Area, (A) :	6.040 sq.cm	0.7737 sq.cm
Unit Wt :	1.666 kg/m	0.483 kg/m
Diameter : (D)	3.195 cms	1.200 cms
Tensile strength: (T)	17130.00 kgs	8410.00 kgs
Elast. Mod : (E)	.5508E+06 kg/sq.cm	.1417E+07 kg/sq.cm
Expsn. Coef : (α)	.2300E-04 /Deg.Cnt	.1380E-04 /Deg.Cnt

BASIC EQUATION OF SAG TENSION CALCULATIONS :-
 $FA^2 [F - (K - \infty * T * E)] = Z$

STARTING CASE - (CASE : 1)

TEMP	32	0
WIND	0	0
K CAL BY FOS OR SAG	FOS	SAG
FOS OR SAG REQ.	4.55	6.399

		<u>Conductor</u>			<u>Earth-wire</u>		
Loading Conditions		sag (m)	Ult. Tension	% OF UTS	sag (m)	Ult. Tension	% OF UTS
0 - Dgr.	No - Wind	7.110	4686.07	27.36 %	6.399	1509.52	17.95 %
0 - Dgr.	36% - Wind	-	5034.25	29.39 %	-	1747.99	20.78 %
32 - Dgr.	No - Wind	8.841	3768.60	22.00 %	7.462	1294.54	15.39 %
32 - Dgr.	75% - Wind	-	5023.37	29.32 %	-	2044.76	24.31 %
32 - Dgr.	Full - Wind	-	5693.07	33.23 %	-	2373.67	28.22 %
53 - Dgr.	No - Wind	-	-		8.178	1181.29	14.05 %
85 - Dgr.	No - Wind	11.621	2867.16	16.74 %	-	-	

TOWER SPOTTING DATA FOR XELDAM- NAREDA 400 KV D/C TRANSMISSION LINE (WZ-1)
(QUAD AAAC MOOSE CONDUCTOR)

(I) GENERAL DETAILS:

Normal Span (M) = **400**

Design Wind Span (M) =

Type of Condition	DA	DBN	DB	DC	DDN	DD	DE
NC	400	400	400	400	400	400	260
BWC	240	240	240	240	240	240	156

(II) TOWER TYPES:

- a) Tower type "DA" Shall be used as Tangent tower with Double Suspension Insulator String.
- b) Tower type "DBN/DB/DC/DDN/DD" Shall be used as Tension tower with Quad Tension Insulator String.
- c) Tower type "DBN/DB" Shall also be used as Section tower.
- d) Dead End tower shall have provision of 0 to 15 Degree deviation on line side as well as slack side.
- e) **Suitable Pilot String Shall be Used for Tower type "DC". DC Tower shall not use as section tower.**

(III) ELECTRICAL CLEARANCES FOR RAILWAY CROSSING

- a) Crossing should be done with DDN/DD type tower with Quad tension insulator string with limiting span as 300m.
- b) The crossing shall normally be at right angle to the railway track.

Minimum Clearance between lowest point of 400 KV line conductor & Rail level shall be as below.

- | | | |
|---|----------|---|
| (1) For Existing Power Line Crossings :- | 17.90 m | |
| (2) For New Power Line Crossings or Alteration to Existing Power Line Crossing in Electrified Sections :- | 18.26 m | (Clearance at OHE structures in mm) |
| | 15.434 m | (Clearance at Mid OHE span in mm) |
| (3) For Power Line Crossings in Non-Electrified Sections :- | 14.46 m | (Line is not anticipated to be electrified) |
| | 18.26 m | (Line to be electrified in future) |
| (4) For Highest Traction Conductor & Lowest crossing conductor :- | 5.49 m | |

However, approval of Railway Crossing from railway authority has to be obtained in each case.

(IV) MINIMUM CLERANCE FOR POWER LINE CROSSING WHEN CROSSING EACH OTHER

For System 400 KV

For 11KV to 66 KV	5.49 m
For 110KV to 132 KV	5.49 m
For 220 KV	5.49 m
For 400 KV	5.49 m
For 765 KV	7.94 m
For 1200 KV	10.44 m
For 500 KV HVDC	6.79 m
For 800 KV HVDC	9.04 m

(V) TELECOMMUNICATION LINE CROSSING

The angle of crossing shall be as near to 90 deg as possible. However deviation to the extent of 30 deg may be permitted under exceptional difficult situation.

For 400 KV	4.48 m
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(VI) SECTION TOWER

The No. of consecutive spans between the section points shall not exceed 15 or 5kms in plain terrain & 10 spans or 3kms in hilly terrain. A section point shall comprise of tension point with DBN/DB type tower.

(VII) Minimum ground clearance required = 8840 mm.

(VIII) For all national highways crossings, tension towers is to be used and crossing span is not to exceed 250 m

(IX) Way leave clearance: 26 m from the cl of tower on either side of tower.

(X) Maximum span of adjacent spans for various angle of deviation are subjected to the condition that minimum specified live metal clearances and minimum ground clearances are available.

(XI) suspension towers shall be spotted such that vertical load of individual spans shall be acting downwards only. no uplift is permitted in suspension towers.

(XII) tower type "DC" shall be used for transposition with 0 deg. deviation with modification of cross arms.

(XIII) Intermediate spans in a section shall be as near as possible to the normal span.

(XIV) For Body & Leg Extensions Arrangement - Refer attached Annexure - I

Body Extensions : - -3MBE, +0M BE, +3M BE & +6M BE

Leg Extensions : - -3.0M LE, -1.5M LE, +0.0M LE, +1.5M LE, +3.0M LE

These positive and negative extensions shall be used to achieve required ground clearance.

Maximum allowable difference in two legs at one tower is 4.5m.

(XV) Normal tower consists of Basic Body + (+0M B.E.) + (+0M L.E.).

(XVI) Height of bottom conductor from ground level for tower combination Basic Body + (+0M B.E.) + (+0M L.E.) is 20.900m.

Max. Individual Span Calculation

L = Normal Span (m) 400

V = System voltage in kVs 400

S = Max. Sag (including Sag error) (m) 11.621

$$L_{\max} = L \sqrt{\frac{K}{S}}$$

K = Max. Sag factor corresponding to Max. Individual span & is given by the equation written Below

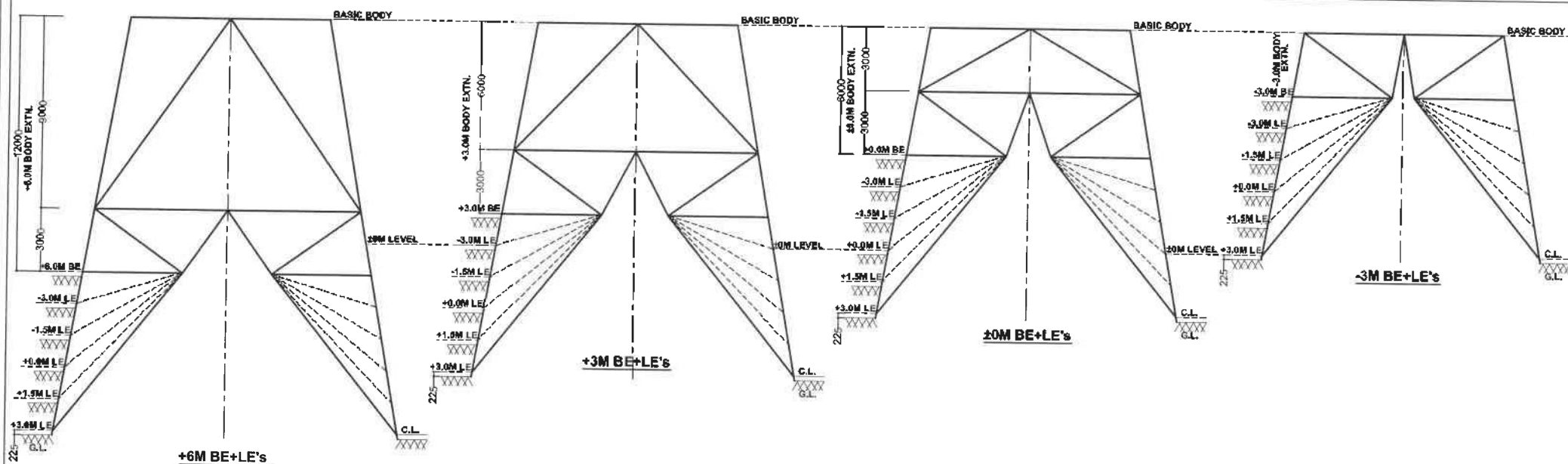
$$VS = 0.75 \sqrt{K + SI} + \frac{V}{150}$$

VS = Vertical Separation

SI = Suspension insulator Assembly Length

TOWER	VS	SI	K	L_{\max} (m)	Span limit for permissible sum of adjacent span (m) ($L_{\max} \times 2$)
DA	8.45	4.8	54.661	868.0	1736.0
DBN	8.00	0	50.568	834.0	1668.0
DB	8.00	0	50.568	834.0	1668.0
DC	8.20	0	54.432	866.0	1732.0
DDN	8.35	0	57.423	889.0	1778.0
DD	8.35	0	57.423	889.0	1778.0

ANNEXURE - 1



Notes:-

1. Body Extensions: -3M BE, -+0M BE, +3M BE & 6M BE.
2. Leg Extensions: -3.0M LE, -1.5M LE, +0.0M LE, +1.5M LE, +3.0M LE.
3. These positive and negative extensions shall be used to achieve required ground clearance.
4. Maximum allowable difference in two legs at one tower is 4.5m.
5. Normal tower consists of Basic Body + (+0M B.E.) + (+0M L.E.).
6. Height of bottom conductor from ground level for tower combination Basic Body + (+0M B.E.) + (+0M L.E.) is 20.900m.

GENERAL ARRANGEMENT FOR UNIVERSAL BODY & LEG EXTENSION COMBINATION



Project : **400 KV D/C TRANSMISSION LINE**

Line : **Xeldam- Mapusha 400 KV D/C Transmission Line with Quad AAAC Moose Conductor (WZ-2)**

Wind Zone : **II (39 m/s)**

Owner : **Sterlite Power Grid Ventures Limited**

Description : **TOWER SPOTTING DATA (Upto +9M)**

STERLITE POWER GRID VENTURES LTD
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Approved Vide Ref. Letter No. SPG.VL/GTTP/L
ENG6/L4T/22 Date: 10/08/2018
Engineering Deptt.
the above does not relieve the contractor from their
contractual obligations

Document no.	Date	Rev no.	Remarks if any	Desn by	STATUS
DS-1008	10-08-2018	01	Additional Tower Families Included	AM	

Xeldam- Mapusha 400 KV D/C Transmission Line with Quad AAAC Moose Conductor (WZ-2)**OWNER: STERLITE POWER GRID VENTURES LIMITED - NEW DELHI****SAG TENSION CALCULATIONS**

Ruling span: (L)	400.00 m	
Design Wind Pressure: (Pd) :	483.00 N/Sq.mt	
	49.20 kg/Sq.mt	
Gust response factor (for wire) : Gc:	2.22	2.30
Final wind pressure (for wire) :	110.00 kg/Sq.mt	136.00 kg/Sq.mt
	3.51 kg/m	1.49 kg/m
Final wind pressure (for Insulator) :	148.00 kg/Sq.mt	

Particulars**Conductor****Earth-wire**

Code :	AAAC Moose	7/3.66
Area, (A) :	6.040 sq.cm	0.7365 sq.cm
Unit Wt :	1.666 kg/m	0.583 kg/m
Diameter : (D)	3.195 cms	1.098 cms
Tensile strength: (T)	17130.00 kgs	6973.00 kgs
Elast. Mod : (E)	.5508E+06 kg/sq.cm	.1936E+07 kg/sq.cm
Expsn. Coef : (α)	.2300E-04 /Deg.Cnt	.1150E-04 /Deg.Cnt

BASIC EQUATION OF SAG TENSION CALCULATIONS :-

$$FA^2 [F - (K - \alpha \cdot T \cdot E)] = Z$$

STARTING CASE - (CASE : 1)

TEMP	32	0
WIND	0	0
K CAL BY FOS OR SAG	FOS	SAG
FOS OR SAG REQ.	4.55	6.399

		<u>Conductor</u>			<u>Earth-wire</u>		
Loading Conditions		sag (m)	Ult. Tension	% OF UTS	sag (m)	Ult. Tension	% OF UTS
0 - Dgr.	No - Wind	7.110	4686.07	27.36 %	6.399	1822.05	26.13 %
0 - Dgr.	36% - Wind	-	5316.60	31.04 %	-	2146.42	30.78 %
32 - Dgr.	No - Wind	8.841	3768.60	22.00 %	7.312	1594.66	22.87 %
32 - Dgr.	75% - Wind	-	5814.00	33.94 %	-	2587.54	37.11 %
32 - Dgr.	Full - Wind	-	6765.07	39.49 %	-	3013.72	43.22 %
53 - Dgr.	No - Wind	-	-		7.923	1471.62	21.10 %
85 - Dgr.	No - Wind	11.621	2867.16	16.74 %	-	-	

Xeldam- Mapusha 400 KV D/C Transmission Line with Quad AAAC Moose Conductor (WZ-2)**OWNER: STERLITE POWER GRID VENTURES LIMITED - NEW DELHI****SAG TENSION CALCULATIONS**

Ruling span: (L)	400.00 m	
Design Wind Pressure: (Pd) :	483.00 N/Sq.mt	
	49.20 kg/Sq.mt	
Gust response factor (for wire) : Gc:	2.22	2.30
Final wind pressure (for wire) :	110.00 kg/Sq.mt	136.00 kg/Sq.mt
	3.51 kg/m	1.66 kg/m
Final wind pressure (for Insulator) :	148.00 kg/Sq.mt	

Particulars**Conductor****Earth-wire**

Code :	AAAC Moose	OPGW (24F)
Area, (A) :	6.040 sq.cm	0.7565 sq.cm
Unit Wt :	1.666 kg/m	0.483 kg/m
Diameter : (D)	3.195 cms	1.220 cms
Tensile strength: (T)	17130.00 kgs	9032.00 kgs
Elast. Mod : (E)	.5508E+06 kg/sq.cm	.1417E+07 kg/sq.cm
Expsn. Coef : (α)	.2300E-04 /Deg.Cnt	.1380E-04 /Deg.Cnt

BASIC EQUATION OF SAG TENSION CALCULATIONS :-

$$F \wedge 2 [F - (K - \infty * T * E)] = Z$$

STARTING CASE - (CASE : 1)

TEMP	32	0
WIND	0	0
K CAL BY FOS OR SAG	FOS	SAG
FOS OR SAG REQ.	4.55	6.399

Conductor**Earth-wire**

Loading Conditions		sag (m)	Ult. Tension	% OF UTS	sag (m)	Ult. Tension	% OF UTS
0 - Dgr.	No - Wind	7.110	4686.07	27.36 %	6.399	1509.52	16.71 %
0 - Dgr.	36% - Wind	-	5316.60	31.04 %	-	1920.80	21.27 %
32 - Dgr.	No - Wind	8.841	3768.60	22.00 %	7.451	1296.43	14.35 %
32 - Dgr.	75% - Wind	-	5814.00	33.94 %	-	2441.18	27.03 %
32 - Dgr.	Full - Wind	-	6765.07	39.49 %	-	2879.04	31.88 %
53 - Dgr.	No - Wind	-	-		8.161	1183.71	13.11 %
85 - Dgr.	No - Wind	11.621	2867.16	16.74 %	-	-	

TOWER SPOTTING DATA FOR XELDAM- MAPUSHA 400 KV D/C TRANSMISSION LINE (WZ-2) (QUAD AAAC MOOSE CONDUCTOR)

(I) GENERAL DETAILS:

Normal Span (M) = **400**

Design Wind Span (M) =

Type of Condition	DA	DBN	DB	DC	DDN	DD	DE
NC	400	400	400	400	400	400	260
BWC	240	240	240	240	240	240	156

(II) TOWER TYPES:

- a) Tower type "DA" Shall be used as Tangent tower with Double Suspension Insulator String.
- b) Tower type "DBN/DB/DC/DDN/DD" Shall be used as Tension tower with Quad Tension Insulator String.
- c) Tower type "DBN/DB" Shall also be used as Section tower.
- d) Dead End tower shall have provision of 0 to 15 Degree deviation on line side as well as slack side.

(III) ELECTRICAL CLEANCES FOR RAILWAY CROSSING

- a) Crossing should be done with DDN/DD type tower with Quad tension insulator string with limiting span as 300m.
- b) The crossing shall normally be at right angle to the railway track.

Minimum Clearance between lowest point of 400 KV line conductor & Rail level shall be as below.

(1) For Existing Power Line Crossings :-	17.90 m	
(2) For New Power Line Crossings or Alteration to Existing Power Line Crossing in Electrified Sections :-	18.26 m 15.434 m	(Clearance at OHE structures in mm) (Clearance at Mid OHE span in mm)
(3) For Power Line Crossings in Non-Electrified Sections :-	14.46 m 18.26 m	(Line is not anticipated to be electrified) (Line to be electrified in future)
(4) For Highest Traction Conductor & Lowest crossing conductor :-	5.49 m	

However, approval of Railway Crossing from railway authority has to be obtained in each case.

(IV) MINIMUM CLERANCE FOR POWER LINE CROSSING WHEN CROSSING EACH OTHER

For System 400 KV

For 11KV to 66 KV	5.49 m
For 110KV to 132 KV	5.49 m
For 220 KV	5.49 m
For 400 KV	5.49 m
For 765 KV	7.94 m
For 1200 KV	10.44 m
For 500 KV HVDC	6.79 m
For 800 KV HVDC	9.04 m

(V) TELECOMMUNICATION LINE CROSSING

The angle of crossing shall be as near to 90 deg as possible. However deviation to the extent of 30 deg may be permitted under exceptional difficult situation.

For 400 KV	4.48 m
------------	--------

(VI) SECTION TOWER

The No. of consecutive spans between the section points shall not exceed 15 or 5kms in plain terrain & 10 spans or 3kms in hilly terrain. A section point shall comprise of tension point with DBN/DB type tower.

(VII) Minimum ground clearance required = 8840 mm.

(VIII) For all national highways crossings, tension towers is to be used and crossing span is not to exceed 250 m

(IX) Way leave clearance: 26 m from the cl of tower on either side of tower.

(X) Maximum span of adjacent spans for various angle of deviation are subjected to the condition that minimum specified live metal clearances and minimum around clearances are available.

(XI) suspension towers shall be spotted such that vertical load of individual spans shall be acting downwards only, no uplift is permitted in suspension towers.

(XII) tower type "DC" shall be used for transposition with 0 deg. deviation with modification of cross arms.

(XIII) Intermediate spans in a section shall be as near as possible to the normal span.

Max. Individual Span Calculation

L = Normal Span (m) 400

V = System voltage in kVs 400

S = Max. Sag (including Sag error) (m) 11.621

$$L_{max} = L \sqrt{\frac{K}{S}}$$

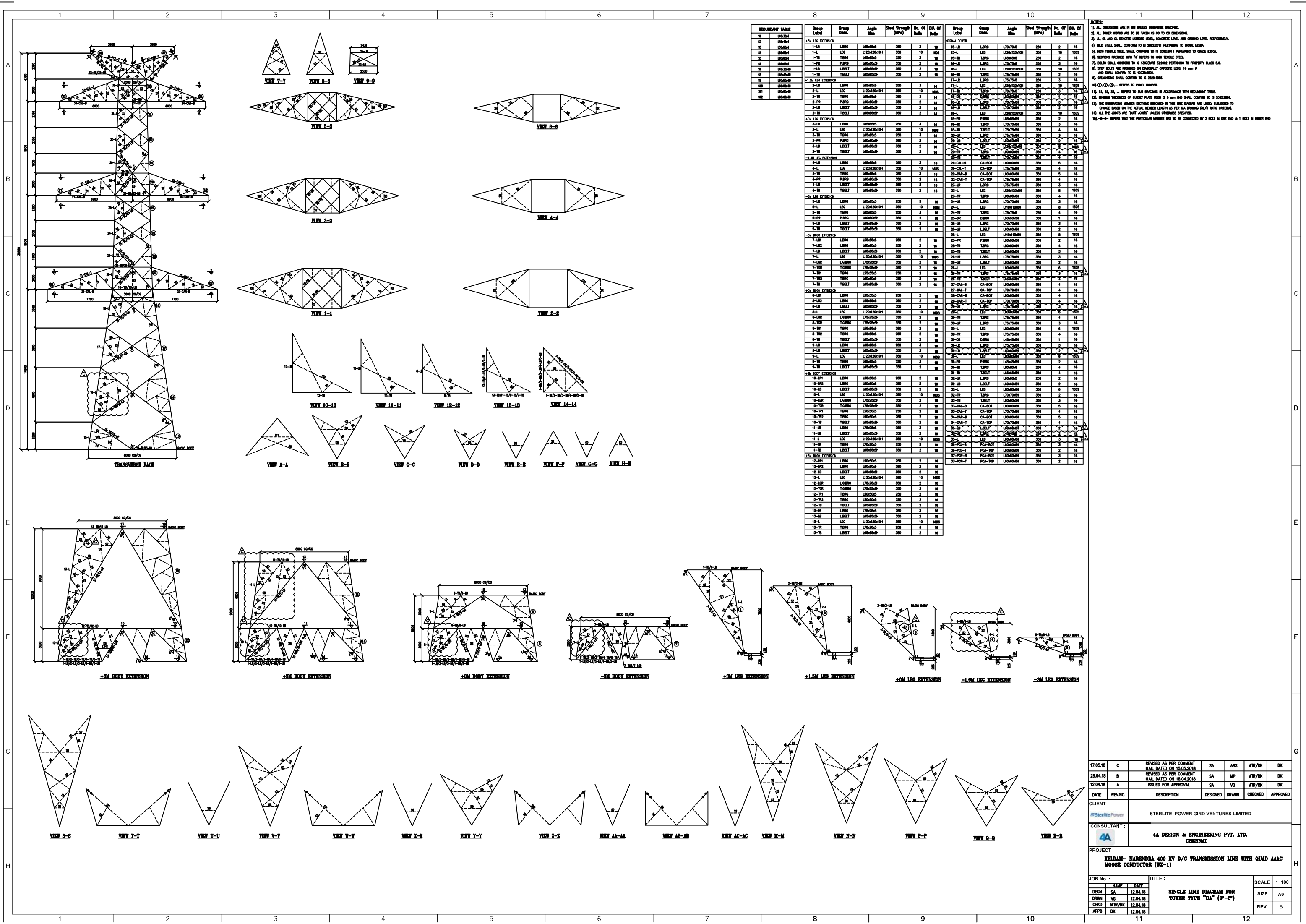
K = Max. Sag factor corresponding to Max.
Individual span & is given by the equation written Below

$$VS = 0.75 \sqrt{K + SI} + \frac{V}{150}$$

VS = Vertical Separation

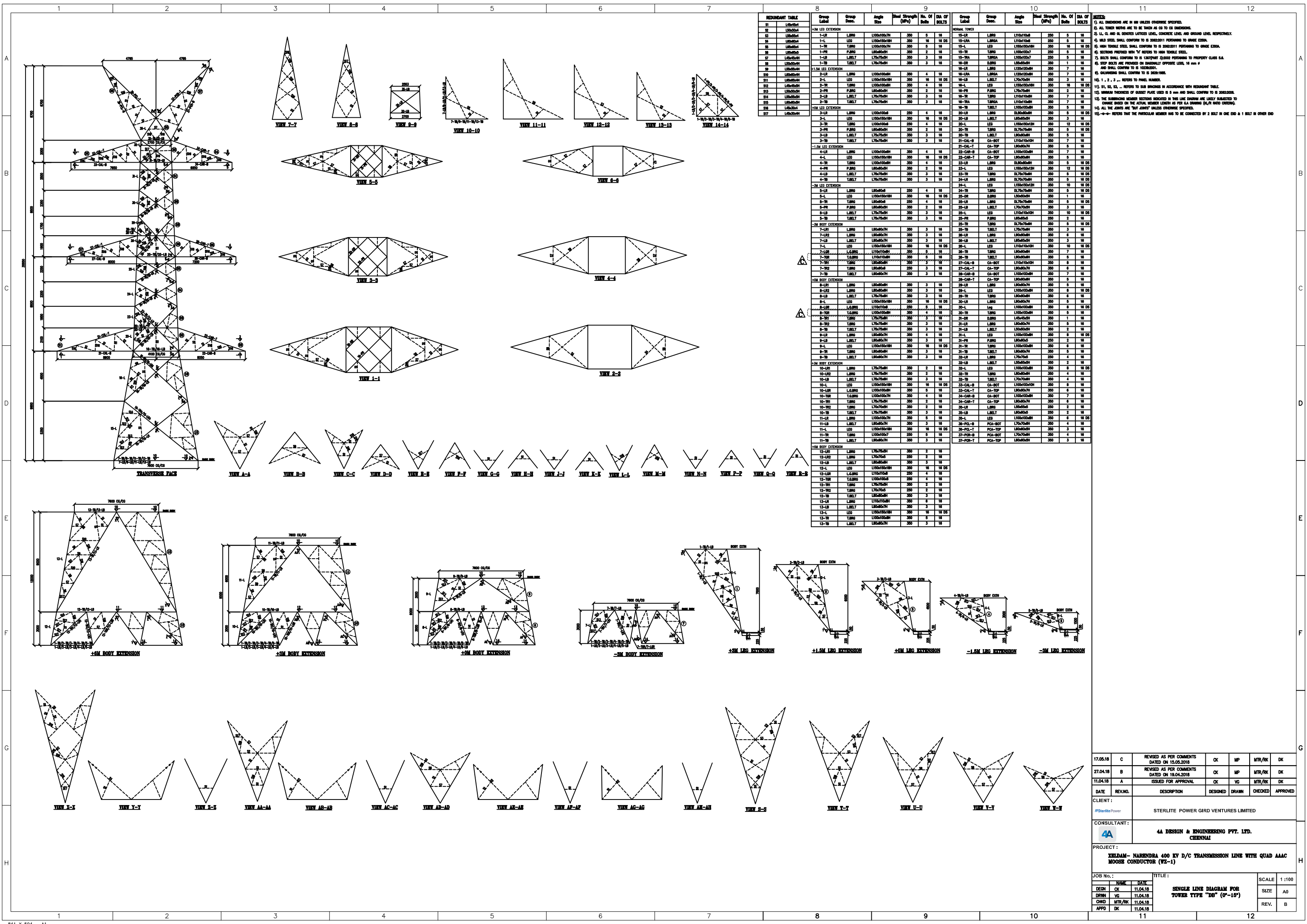
SI = Suspension insulator Assembly Length

TOWER	VS	SI	K	L_{max} (m)	Span limit for permissible sum of adjacent span (m) ($L_{max} \times 2$)
DA	8.45	4.8	54.661	868.0	1736.0
DB	8.00	0	50.568	834.0	1668.0
DC	8.20	0	54.432	866.0	1732.0
DD	8.35	0	57.423	889.0	1778.0



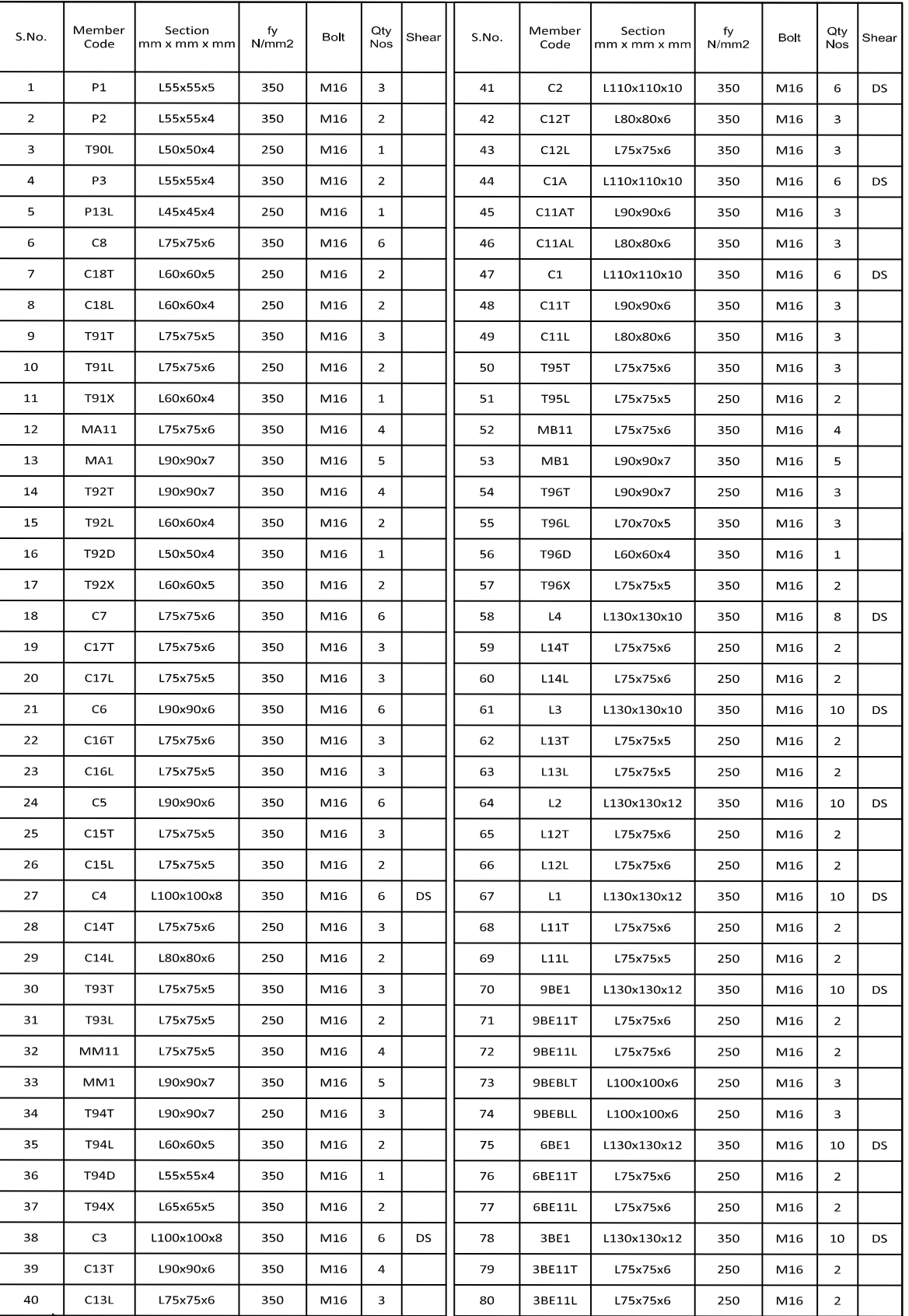
NOTES:
1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. ALL TOWER MEMBERS ARE TO BE TAKEN AS CD TO CD DIMENSIONS.
3. LL, CL AND GL DENOTES LATICES LEVEL, CONCRETE LEVEL AND GROUND LEVEL RESPECTIVELY.
4. MID STEEL SHALL CONFORM TO IS 2002:2011 PERFORMING TO GRADE E250A.
5. HIGH TENSILE STEEL SHALL CONFORM TO IS 2002:2011 PERFORMING TO GRADE E250A.
6. SECTIONS PREPARED WITH 'H' REFERS TO HIGH TENSILE STEEL.
7. BOLTS SHALL CONFORM TO IS 1507:1970 3.2002 PERFORMING TO PROPERTY CLASS 8.8.
8. STEP BOLTS ARE PROVIDED ON DIAGONALLY OPPOSITE LEGS, 10 mm P AND SHALL CONFORM TO IS 1028:2001.
9. GALVANIZING SHALL CONFORM TO IS 2028:1985.
10. (1), (2), (3) ... REFERS TO PANEL NUMBER.
11. S1, S2, S3, ... REFERS TO SUB DIMENSIONS IN ACCORDANCE WITH REDUNDANT TABLE.
12. MINIMUM THICKNESS OF GUSSET PLATE USED IS 8 mm AND SHALL CONFORM TO IS 2002:2011.
13. THE SURROUNDING MEMBER SECTIONS INDICATED IN THIS LINE DRAWING ARE LOCALLY SUBJECTED TO CHANGE BASED ON THE ACTUAL MEMBER LENGTH AS PER G.A DRAWING (D/LR/ RAO DATED).
14. ALL THE JOINTS ARE "BUTT JOINTS" UNLESS OTHERWISE SPECIFIED.
15. - - - - - REFERS THAT THE PARTICULAR MEMBER HAS TO BE CONNECTED BY 2 BOLT IN ONE END & 1 BOLT IN OTHER END

17.05.18	C	REVISED AS PER COMMENT MAIL DATED ON 15.05.2018	SA	ABS	MTR/RK	OK
25.04.18	B	REVISED AS PER COMMENT MAIL DATED ON 18.04.2018	SA	MP	MTR/RK	OK
12.04.18	A	ISSUED FOR APPROVAL	SA	VG	MTR/RK	OK
DATE	REV.NO.	DESCRIPTION	DESIGNED	DRAWN	CHECKED	APPROVED
CLIENT :			STERLITE POWER GRID VENTURES LIMITED			
CONSULTANT :			4A DESIGN & ENGINEERING PVT. LTD. CHENNAI			
PROJECT :			YELDAM- NARENDRA 400 KV D/C TRANSMISSION LINE WITH QUAD AAC MOOSE CONDUCTOR (WZ-1)			
JOB No. :			TITLE :			SCALE : 1:100
DESN	SA	12.04.18	SINGLE LINE DIAGRAM FOR TOWER TYPE "DA" (0°-0°)			SIZE : A0
CHKD	VG	12.04.18				REV. : B
MTR/RK	VG	12.04.18				
APPD	DK	12.04.18				



- NOTES:
1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
 2. ALL TOWER PARTS ARE TO BE TAKEN AS SHOWN IN THIS DRAWING.
 3. LL, CL AND GL DENOTES LATITUDE LEVEL, CONCRETE LEVEL AND GROUND LEVEL RESPECTIVELY.
 4. HIGH TENSILE STEEL SHALL CONFORM TO IS 2002:2011 PERTAINING TO GRADE EX20A.
 5. SECTIONS PREFRILLED WITH 'V' REFERS TO HIGH TENSILE STEEL.
 6. BOLTS SHALL CONFORM TO IS 1302:2011 GRADE 8.8 PER IS 4026:2011 INTO CHANNEL.
 7. STOP BOLTS ARE PROVIDED ON EXTERNALLY EXPOSED ENDS, 10 mm ϕ AND SHALL CONFORM TO IS 1302:2011.
 8. GALVANIZING SHALL CONFORM TO IS 2002:1985.
 9. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

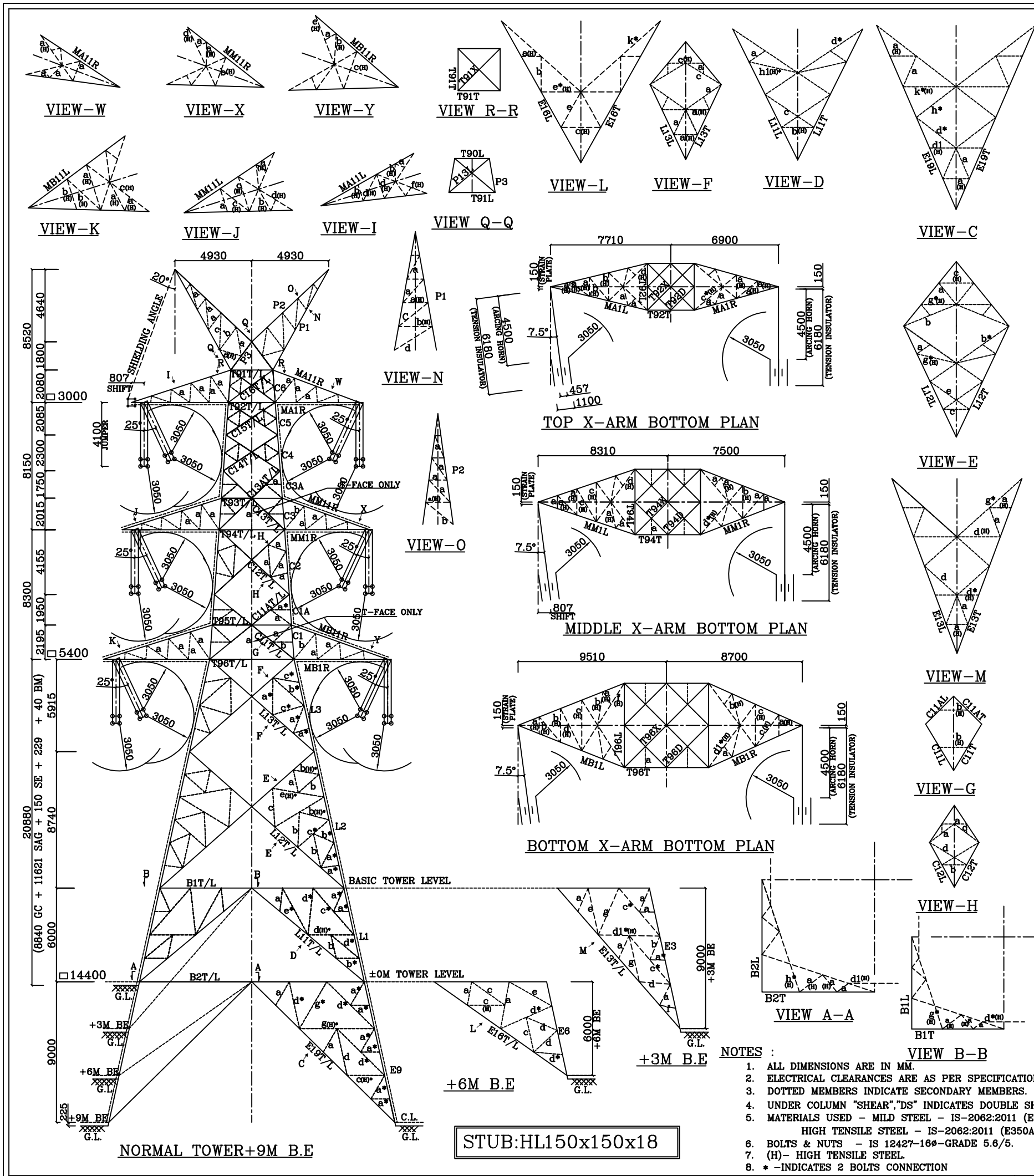
17.05.18	C	REVISED AS PER COMMENTS DATED ON 15.05.2018	CK	MP	MTR/RK	DK
27.04.18	B	REVISED AS PER COMMENTS DATED ON 18.04.2018	CK	MP	MTR/RK	DK
11.04.18	A	ISSUED FOR APPROVAL	CK	VG	MTR/RK	DK
DATE	REVNO.	DESCRIPTION	DESIGNED	DRAWN	CHECKED	APPROVED
CLIENT:						
STERILITE POWER GRID VENTURES LIMITED						
CONSULTANT:						
4A DESIGN & ENGINEERING PVT. LTD. CHENNAI						
PROJECT:						
XELDAM- NARENDRA 400 KV D/C TRANSMISSION LINE WITH QUAD AAC MOOSE CONDUCTOR (WZ-1)						
JOB No.:						
DESN	CK	DATE	11.04.18	TITLE:		
DRWN	VG	DATE	11.04.18	SINGLE LINE DIAGRAM FOR TOWER TYPE "DB" (0°-18°)		
CHKD	MTR/RK	DATE	11.04.18	SCALE: 1:100		
APPD	DK	DATE	11.04.18	SIZE: A0		
				REV: B		



REV. No.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED
PROJECT : 400KV D/C TRANSMISSION LINE					
CLIENT : SPGVL					
CONTRACTOR : SPGVL					
DESIGNER : TRUCON ASSOCIATES, NAGPUR					
DRAWN	RAHUL		LINE DIAGRAM FOR 400KV D/C TANGENT TOWER TYPE - "DA"		
CHECKED	MMK				
APPROVED					
DATE : 31/12/16		DRAWING NO : C243/SGPVL/400KVDC/DA		SHEET. NO. : 1/1	REV. : 0

NOTES :

1. ALL DIMENSIONS ARE IN MM.
2. ELECTRICAL CLEARANCES ARE AS PER SPECIFICATION.
3. DOTTED MEMBERS INDICATE SECONDARY MEMBERS.
4. UNDER COLUMN "SHEAR","DS" INDICATES DOUBLE SHEAR.
5. MATERIALS USED - MILD STEEL - IS-2062:2011 (E250A).
HIGH TENSILE STEEL - IS-2062:2011 (E350A).
6. BOLTS & NUTS - IS 12427-16 ϕ -GRADE 5.6/5.
7. (H)- HIGH TENSILE STEEL.

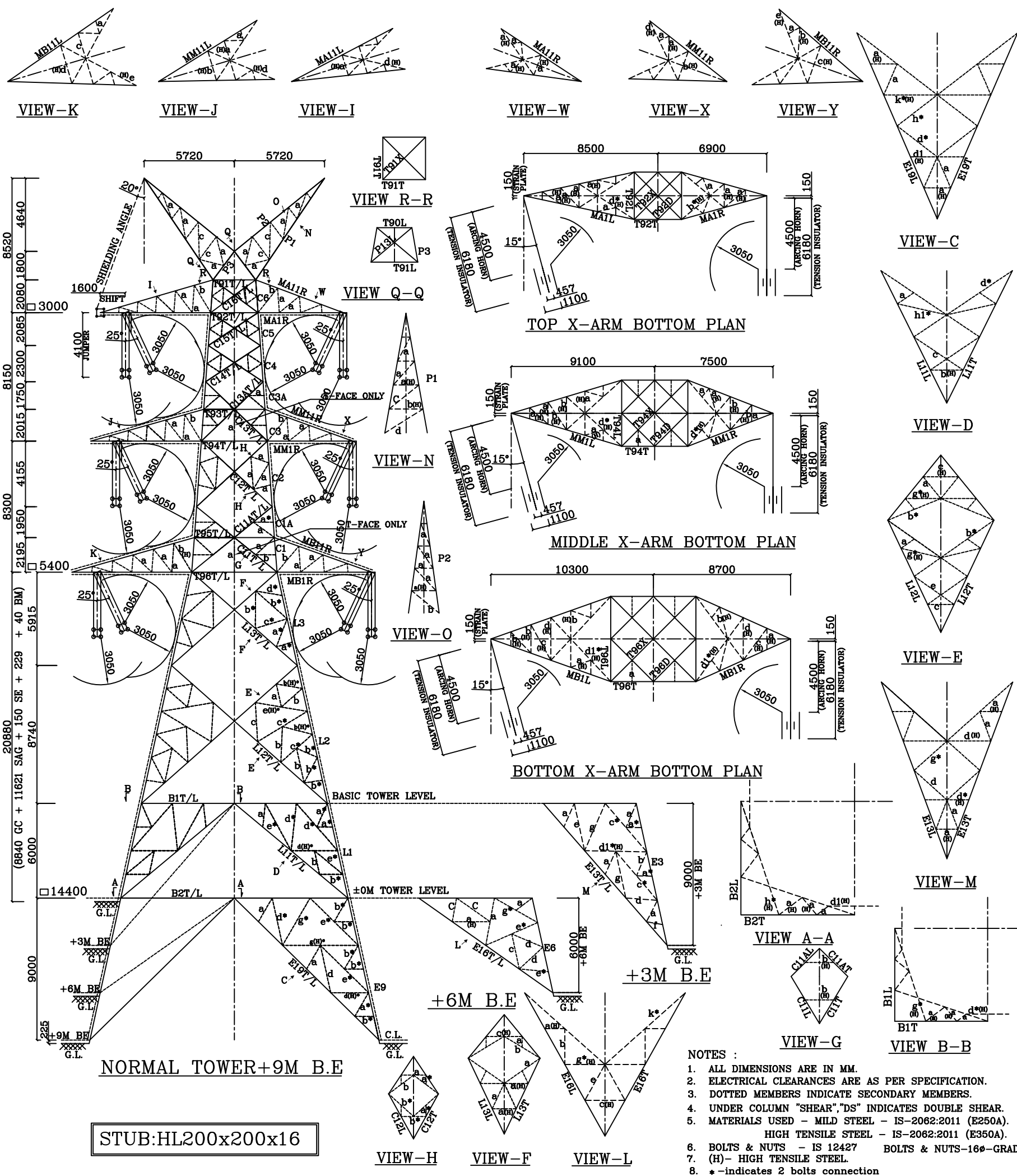


S.No.	Member Code	Section mm x mm x mm	fy N/mm2	Bolt	Qty Nos	Shear
1	P1	L65x65x5	250	M16	2	DS
2	P2	L60x60x5	250	M16	2	
3	T90L	L60x60x4	250	M16	2	
4	P3	L65x65x5	350	M16	2	
5	P13L	L60x60x4	250	M16	2	
6	C6	L100x100x8	350	M16	3	DS
7	C16T	L75x75x5	250	M16	3	
8	C16L	L60x60x5	250	M16	2	
9	T91T	L90x90x6	350	M16	4	
10	T91L	L75x75x5	250	M16	2	
11	T91X	L60x60x5	350	M16	2	
12	MA11L	L100x100x7	350	M16	6	
13	MA1L	L120x120x10	350	M16	9	
14	MA11R	L90x90x7	350	M16	6	
15	MA1R	L110x110x8	350	M16	9	
16	T92T	L100x100x8	350	M16	6	
17	T92L	L75x75x6	350	M16	3	
18	T92D	L60x60x5	250	M16	2	
19	T92X	L75x75x5	350	M16	3	
20	C5	L100x100x8	350	M16	6	DS
21	C15T	L100x100x8	350	M16	6	
22	C15L	L100x100x7	350	M16	6	
23	C4	L100x100x8	350	M16	6	DS
24	C14T	L100x100x7	350	M16	5	
25	C14L	L100x100x7	350	M16	5	
26	C3A	L110x110x8	350	M16	8	DS
27	C13AT	L110x110x8	350	M16	6	
28	C13AL	L110x110x8	350	M16	6	
29	C3	L110x110x8	350	M16	8	DS
30	C13T	L110x110x8	350	M16	6	
31	C13L	L110x110x8	350	M16	6	
32	T93T	L80x80x6	350	M16	5	
33	T93L	L75x75x6	250	M16	2	
34	MM11L	L100x100x7	350	M16	6	
35	MM1L	L110x110x10	350	M16	8	
36	MM11R	L90x90x7	350	M16	6	
10	MM1R	L100x100x8	350	M16	8	
38	T94T	L110x110x8	350	M16	5	
39	T94L	L75x75x6	250	M16	2	
40	T94D	L65x65x5	250	M16	2	
41	T94X	L80x80x6	250	M16	2	

REDUNDANT MEMBERS			
UN-NOTED	SECTION	ANGLE	BOLTS
a	L 45X30X4	160-1	
a	L 45X45X4	160-1	
b	L 50X50X4	160-1	
c	L 55X55X4	160-1	
d	L 60X60X4	160-1	
d1	L 60X60X5	160-1	
e	L 65X65X4	160-1	
f	L 65X65X5	160-1	
g	L 70X70X5	160-1	
h	L 75X75X5	160-1	
h1	L 75X75X6	160-1	
k	L 80X80X6	160-1	
m	L 90X90X6	160-1	
n	L 100X100X7	160-1	

S.No.	Member Code	Section mm x mm x mm	fy N/mm2	Bolt	Qty Nos	Shear
42	C2	L130x130x10	350	M16	10	DS
43	C12T	L120x120x10	350	M16	8	
44	C12L	L120x120x10	350	M16	8	
45	C1A	L150x150x12	350	M16	12	DS
46	C11AT	L120x120x8	350	M16	7	
47	C11AL	L120x120x8	350	M16	7	
48	C1	L150x150x12	350	M16	12	DS
49	C11T	L110x110x8	350	M16	7	
50	C11L	L120x120x8	350	M16	7	
51	T95T	L90x90x7	250	M16	5	
52	T95L	L90x90x6	250	M16	2	
53	MB11L	L100x100x7	350	M16	6	
54	MB1L	L110x110x8	350	M16	7	
55	MB11R	L90x90x7	350	M16	6	
56	MB1R	L100x100x8	350	M16	7	
57	T96T	L120x120x8	350	M16	7	
58	T96L	L110x110x8	250	M16	4	
59	T96D	L75x75x5	250	M16	2	
60	T96X	L90x90x6	250	M16	2	
61	L3	L150x150x16	350	M16	16	DS
62	L13T	L110x110x8	350	M16	6	
63	L13L	L120x120x8	350	M16	6	
64	L2	L150x150x18	350	M16	16	DS
65	L12T	L100x100x7	250	M16	4	
66	L12L	L110x110x8	250	M16	5	
67	L1	L150x150x18	350	M16	16	DS
68	L11T	L100x100x7	250	M16	4	
69	L11L	L100x100x7	250	M16	4	
70	B1T	L100x100x8	250	M16	5	
71	B1L	L100x100x8	250	M16	5	
72	E9	L150x150x18	350	M16	16	DS
73	E19T	L100x100x7	250	M16	4	
74	E19L	L100x100x7	250	M16	4	
75	B2T	L110x110x8	250	M16	5	
76	B2L	L110x110x8	250	M16	5	
79	E6	L150x150x18	350	M16	16	DS
77	E16T	L100x100x7	250	M16	4	
78	E16L	L100x100x7	250	M16	4	
79	E3	L150x150x18	350	M16	16	DS
80	E13T	L100x100x7	250	M16	4	
81	E13L	L100x100x7	250	M16	4	

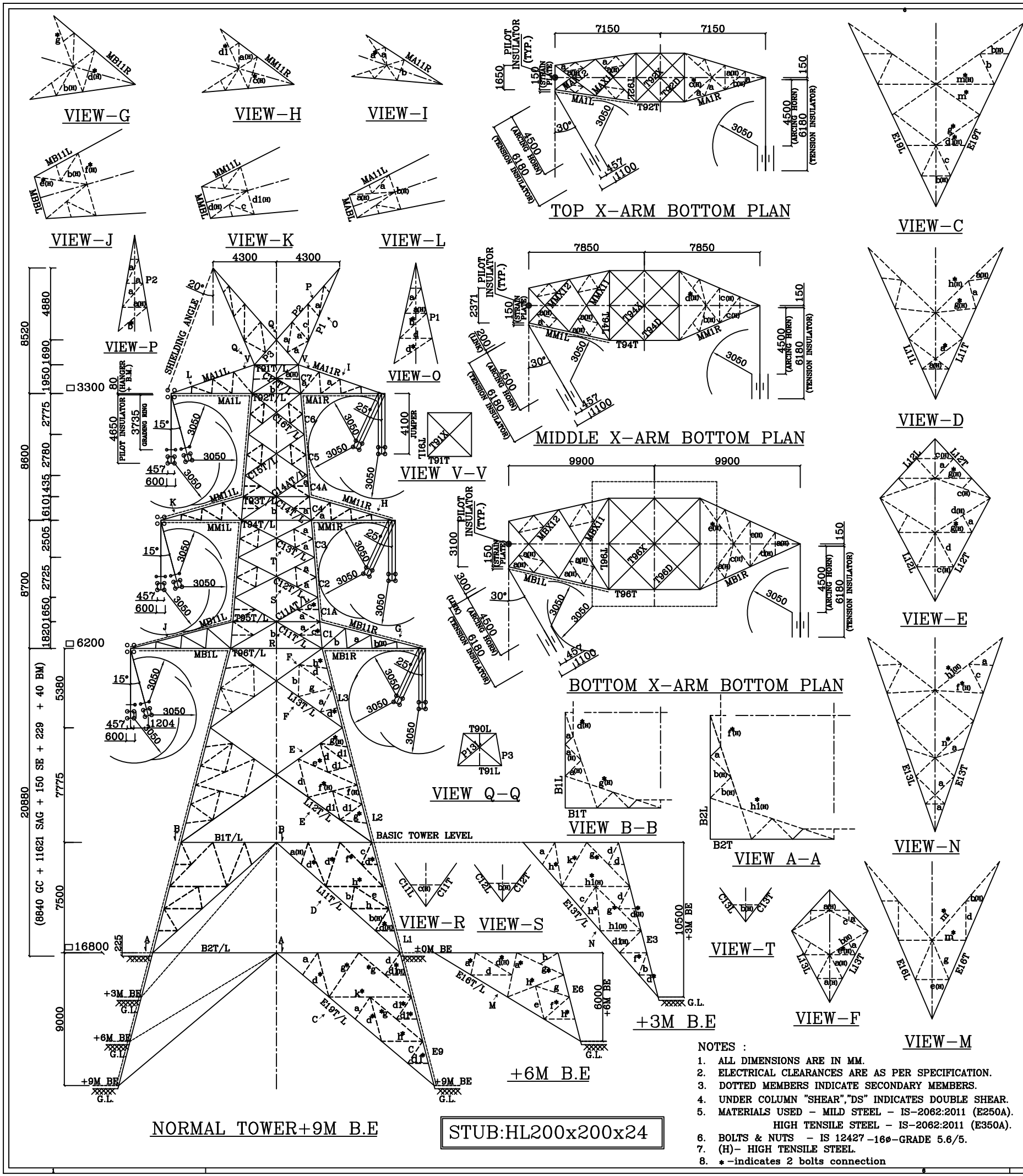
01	1/3/2017	Revised	RAHUL	MKM	
REV. No.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED
PROJECT : 400KV DC TRANSMISSION LINE					
CLIENT : SPGVL					
CONTRACTOR : SPGVL					
DESIGNER : TRUCON ASSOCIATES, NAGPUR					
DRAWN	RAHUL		LINE DIAGRAM FOR 400KV D/C ANGLE TOWER TYPE "DB"		
CHECKED	MKM				
APPROVED					
DATE : 11/02/17	DRAWING NO : C243/SGPVL/400KVDC/DB	SHEET. NO. : 1/1		REV. :01	



S.No.	Member Code	Section mm x mm x mm	fy N/mm2	Bolt	Qty Nos	Shear
1	P1	L70x70x5	250	M16	2	DS
2	P2	L60x60x5	250	M16	2	
3	T90L	L60x60x4	250	M16	2	
4	P3	L70x70x5	350	M16	2	
5	P13L	L60x60x5	250	M16	2	
6	C6	L90x90x6	350	M16	4	DS
7	C16T	L80x80x6	250	M16	3	
8	C16L	L65x65x5	250	M16	2	
9	T91T	L90x90x6	350	M16	4	
10	T91L	L70x70x5	250	M16	2	
11	T91X	L60x60x5	250	M16	2	
12	MA11L	L100x100x8	350	M16	7	
13	MA1L	L120x120x10	350	M16	10	
14	MA11R	L90x90x7	350	M16	7	
15	MA1R	L110x110x8	350	M16	8	
16	T92T	L110x110x8	350	M16	5	
17	T92L	L75x75x6	350	M16	3	
18	T92D	L65x65x5	250	M16	2	
19	T92X	L80x80x6	350	M16	2	
20	C5	L110x110x8	350	M16	6	DS
21	C15T	L110x110x8	350	M16	7	
22	C15L	L100x100x8	350	M16	6	
23	C4	L110x110x8	350	M16	6	DS
24	C14T	L100x100x8	350	M16	7	
25	C14L	L100x100x8	350	M16	6	
26	C3A	L110x110x10	350	M16	6	DS
27	C13AT	L120x120x8	350	M16	6	
28	C13AL	L110x110x8	350	M16	6	
29	C3	L110x110x10	350	M16	6	DS
30	C13T	L120x120x8	350	M16	6	
31	C13L	L110x110x8	350	M16	6	
32	T93T	L90x90x6	350	M16	6	
33	T93L	L75x75x6	250	M16	2	
34	MM11L	L100x100x7	350	M16	7	
35	MM1L	L110x110x10	350	M16	9	
36	MM11R	L90x90x7	350	M16	7	
37	MM1R	L100x100x8	350	M16	8	
38	T94T	L100x100x8	350	M16	6	
39	T94L	L75x75x6	250	M16	2	
40	T94D	L65x65x5	250	M16	2	
41	T94X	L90x90x6	250	M16	2	
42	C2	L150x150x12	350	M16	10	DS

5.6/5.	REDUNDANT MEMBERS		
	SYMBOL ANGLE SECTION BOLTS		
	UN-NOTED	L 45X30X4	16ø-1
	a	L 45X45X4	16ø-1
	b	L 50X50X4	16ø-1
	c	L 55X55X4	16ø-1
	d	L 60X60X4	16ø-1
	d1	L 60X60X5	16ø-1
	e	L 65X65X4	16ø-1
	f	L 65X65X5	16ø-1
	g	L 70X70X5	16ø-1
	h	L 75X75X5	16ø-1
	h1	L 75X75X6	16ø-1
	k	L 80X80X6	16ø-1
	m	L 90X90X6	16ø-1
n	L 100X100X7	16ø-1	

01	28/02/2017	Revised			RAHUL	MKM	
REV. No.	DATE	DESCRIPTION			DRAWN	CHECKED	APPROVED
PROJECT : 400KV DC TRANSMISSION LINE							
CLIENT : SPGVL							
CONTRACTOR : SPGVL							
DESIGNER : TRUCON ASSOCIATES, NAGPUR							
DRAWN		RAHUL		LINE DIAGRAM FOR 400KV DC MEDIUM ANGLE TOWER TYPE "DC"			
CHECKED		MKM					
APPROVED							
DATE : 08/02/17		DRAWING NO : C243/SGPVL/400KVDC/DC			SHEET. NO. : 1/1 REV. :00		



S.No.	Member Code	Section mm x mm x mm	fy N/mm2	Bolt	Qty Nos	Shear	S.No.	Member Code	Section mm x mm x mm	fy N/mm2	Bolt	Qty Nos	Shear
48	C3	L150x150x12	350	M16	12	DS	1	P1	L75x75x5	350	M16	2	DS
49	C13T	L130x130x12	350	M16	9		2	P2	L70x70x5	350	M16	2	
50	C13L	L120x120x10	250	M16	8		3	T90L	L50x50x4	350	M16	1	
51	C2	L200x200x15	350	M16	16	DS	4	P3	L55x55x5	350	M16	2	
52	C12T	L130x130x10	350	M16	9		5	P13L	L55x55x5	250	M16	1	
53	C12L	L120x120x10	250	M16	7		6	C7	L120x120x10	350	M16	6	DS
54	C1A	L200x200x15	350	M16	16	DS	7	C17T	L80x80x6	250	M16	3	
55	C11AT	L130x130x10	350	M16	8		8	C17L	L75x75x5	250	M16	2	
56	C11AL	L120x120x10	350	M16	7		9	T91T	L65x65x4	350	M16	3	
57	C1	L200x200x15	350	M16	16	DS	10	T91L	L70x70x5	250	M16	2	
58	C11T	L130x130x10	350	M16	8		11	T91X	L65x65x4	350	M16	2	
59	C11L	L120x120x10	350	M16	7		12	MA11R	L80x80x6	350	M16	4	
60	T95T	L90x90x6	350	M16	4		13	MA1R	L110x110x10	350	M16	8	
61	T95L	L100x100x7	250	M16	3		14	MA11L	L80x80x6	350	M16	4	
62	MB11R	L90x90x7	350	M16	6		15	MA1L	L130x130x10	350	M16	10	
63	MB1R	L110x110x8	350	M16	6		16	MABL	BL65x65x5	350	M16	5	
64	MB11L	L90x90x7	350	M16	6		17	MAX11	L90x90x7	250	M16	3	
65	MB1L	L120x120x10	350	M16	8		18	MAX12	L100x100x8	250	M16	4	
66	MBBL	BL65x65x5	350	M16	4		19	T92T	L110x110x10	350	M16	7	
67	MBX11	L100x100x7	250	M16	3		20	T92L	L75x75x6	250	M16	3	
68	MBX12	L100x100x8	250	M16	3		21	T92D	L55x55x4	350	M16	1	
69	T96T	L150x150x12	250	M16	9		22	T92X	L75x75x6	250	M16	2	
70	T96L	L130x130x12	250	M16	6		23	C6	L120x120x10	350	M16	6	DS
71	T96D	L65x65x5	350	M16	1		24	C16T	L120x120x8	350	M16	8	
72	T96X	L100x100x8	250	M16	2		25	C16L	L100x100x7	350	M16	5	
73	L3	L200x200x22	330	M24	10	DS	26	C5	L120x120x10	350	M16	6	DS
74	L13T	L120x120x10	250	M16	8		27	C15T	L110x110x8	350	M16	6	
75	L13L	L110x110x10	250	M16	7		28	C15L	L100x100x7	350	M16	5	
76	L2	L200x200x22	330	M24	10	DS	29	C4A	L150x150x12	350	M16	12	DS
77	L12T	L120x120x8	350	M16	5		30	C14AT	L100x100x8	350	M16	5	
78	L12L	L120x120x8	250	M16	5		31	C14AL	L100x100x7	250	M16	4	
79	L1	L200x200x24	330	M24	10	DS	32	C4	L150x150x12	350	M16	12	DS
80	L11T	L110x110x8	250	M16	5		33	C14T	L100x100x8	350	M16	5	
81	L11L	L100x100x8	250	M16	5		34	C14L	L100x100x7	250	M16	4	
82	B1T	L110x110x8	350	M16	5		35	T93T	L80x80x6	350	M16	4	
83	B1L	L110x110x8	350	M16	5		36	T93L	L90x90x6	250	M16	3	
84	E9	L200x200x24	330	M24	10	DS	37	MM11R	L90x90x7	350	M16	5	
85	E19T	L110x110x8	250	M16	5		38	MM1R	L110x110x8	350	M16	7	
86	E19L	L110x110x8	250	M16	5		39	MM11L	L90x90x7	350	M16	5	
87	B2T	L110x110x10	350	M16	5		40	MM1L	L120x120x10	350	M16	9	
88	B2L	L110x110x10	350	M16	5		41	MMBL	BL65x65x5	350	M16	4	
89	E6	L200x200x24	330	M24	10	DS	42	MMX11	L100x100x7	250	M16	3	
90	E16T	L110x110x8	250	M16	5		43	MMX12	L100x100x7	250	M16	4	
91	E16L	L110x110x8	250	M16	5		44	T94T	L110x110x8	250	M16	5	
92	E3	L200x200x24	330	M24	10	DS	45	T94L	L80x80x6	250	M16	3	
93	E13T	L110x110x8	250	M16	5		46	T94D	L65x65x4	350	M16	2	
94	E13L	L110x110x8	250	M16	5		47	T94X	L90x90x6	250	M16	2	

REDUNDANT MEMBERS

UN-NOTED	SECTION	ANGLE
a	L 45X30X4	160-1
b	L 45X45X4	160-1
c	L 50X50X4	160-1
d	L 55X55X4	160-1
e	L 60X60X4	160-1
f	L 60X60X5	160-1
g	L 65X65X4	160-1
h	L 65X65X5	160-1
i	L 70X70X5	160-1
j	L 75X75X5	160-1
k	L 75X75X6	160-1
l	L 80X80X6	160-1
m	L 80X90X6	160-1
n	L 100X100X6	160-1

02	27/12/2016	AS PER COMMENTS	RAHUL		
01	20/12/2016	AS PER COMMENTS	RAHUL		
REV. No.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED

PROJECT : 400KV D/C TRANSMISSION LINE

CLIENT : SPGVL

CONTRACTOR : SPGVL

DESIGNER : TRUCON ASSOCIATES, NAGPUR

DRAWN

CHECKED

APPROVED

RAHUL

MMK

DATE : 22/11/16

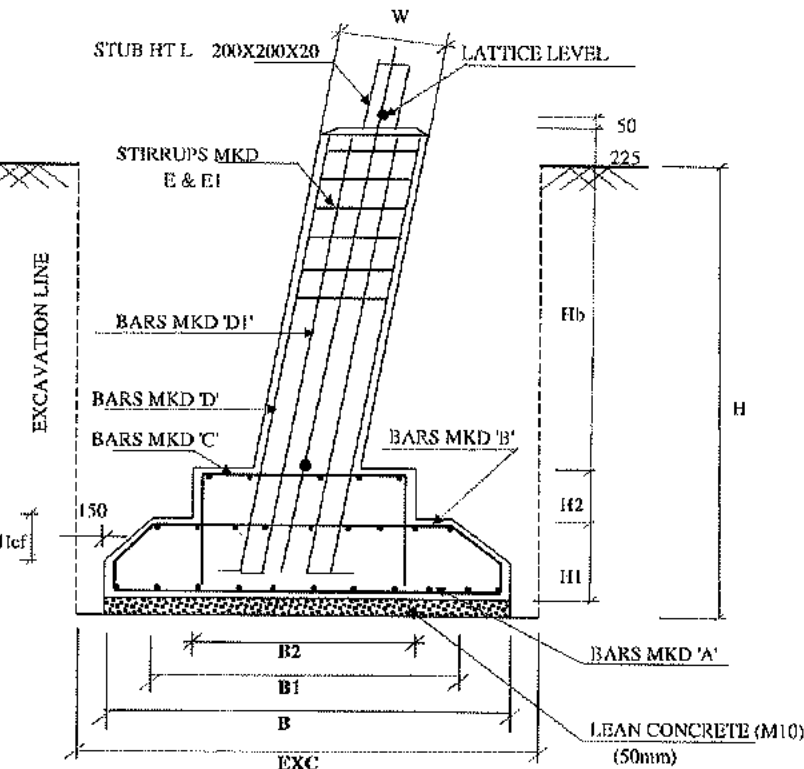
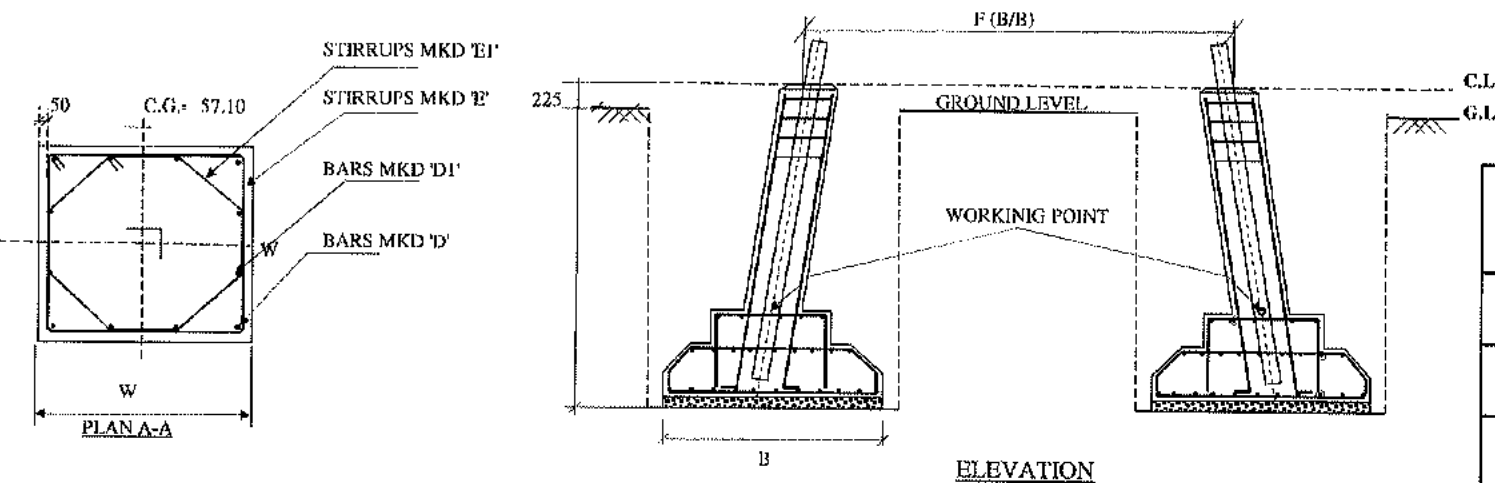
DRAWING NO : C243/SGPVL/400KVDC/DA

SHEET. NO. : 1/1

REV. :02

LINE DIAGRAM FOR 400KV D/C
ANGLE /DEAD END TOWER TYPE -"DD"

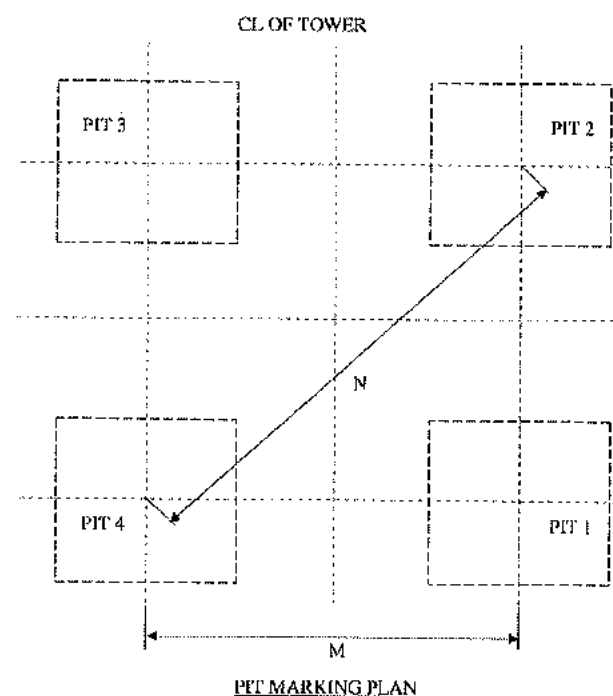
APPENDIX B FOUNDATION DESIGN DETAILS



FOUNDATION ELEVATION (CROSS SECTION)

VERTICAL SLOPE	
TAN B =	0.241965602
2 TAN B =	0.483931204
FACE =	1.028857304
DEV =	1.05692701
IN FACE SLOPE	
TAN B =	0.235178971
SEC B =	1.027282409

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL:	FULLY SUBMERGED
UNIT WEIGHT (Kg/m ³):	940
LIMIT BEARING CAPACITY (Kg/m ²):	12500
ANGLE OF REPOSE:	15
WATER TABLE (m):	0m BELOW G.L.
FOUNDATION DEPTH (m):	3.5



REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
7530	7230	3500	700	6630	2000	400	300	300	2750

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	7130	PAD REINFORCEMENT	20	72	7130	2.46	1265.44	5061.76
B	6530 50 354 354 50	PAD REINFORCEMENT	16	76	7337	1.58	879.72	3518.86
C	1900 560 50 50 560	PAD REINFORCEMENT	16	20	3120	1.58	98.47	393.87
D	3503	CHIMNEY BAR	32	4	4003	6.31	101.04	404.17
D1	500	CHIMNEY BAR	28	8	4003	4.83	154.71	618.88
E	600 600	CHIMNEY SQUARE SPACER	8	13	2592	0.39	13.29	53.18
E1	200 283	CHIMNEY SQUARE SPACER	8	13	2123	0.39	10.89	43.57
TOTAL REINFORCEMENT/TOWER=								10094.3

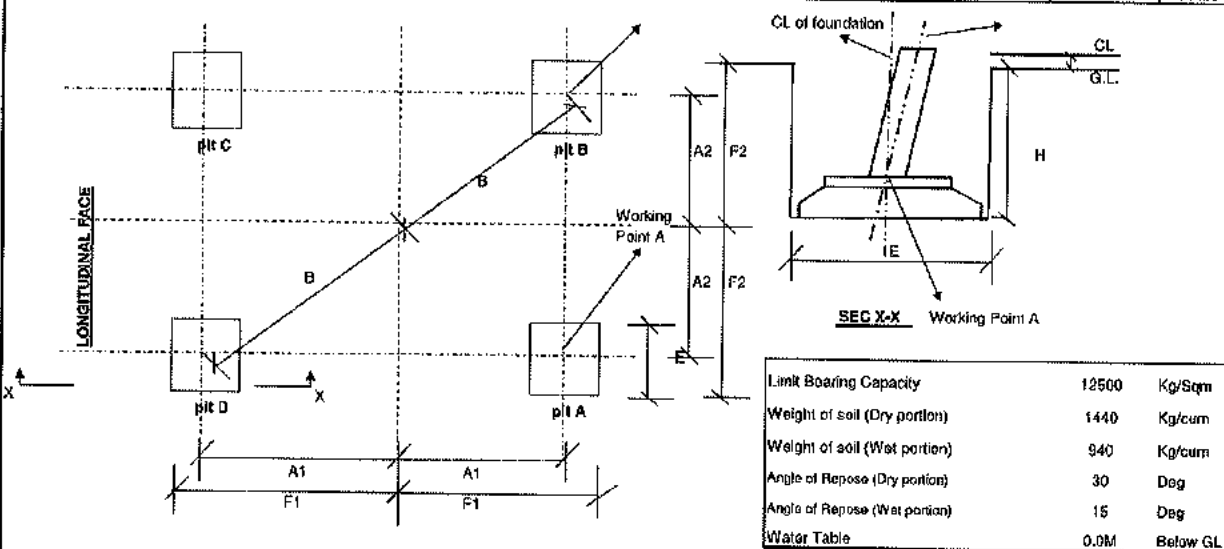
- NOTES:
- DRAWING NOT TO SCALE
 - ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
 - CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
 - REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
 - STUB BELOW GROUND LEVEL = 3300
 - WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
 - FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
 - CLEAR COVER TO REINFORCEMENT IS 50MM
 - STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
 - AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	89.21
CONCRETE (M10) m ³	10.45
TOTAL CONCRETE m ³	99.66
EXCAVATION m ³	793.81
REINFORCEMENT Kg	10094.3

Approved for
Railway
Sterlite Power Grid Ventures
New Delhi
for
proposal

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	21-09-18	FOUNDATION DRAWING FOR TOWER TYPE DD-3/+0/+3/+6M 400KV D/C (WZ-1) FULLY SUBMERGED SOIL (3.5M DEPTH)		
CHKD	AM	21-09-18			
APPD	DL	21-09-18			
DATE	21-09-18	DRAWING NO.	GT/PL/400DC/WZ-1/DD/P-004A	SHEET NO.	1/2 REV 0

Project GOA										400 KV D/C -X-M & X-N (WZ-1) - TT "DD" SOIL TYPE - FS (3.5M DEPTH)										Client: SPQVL			
												PIT DIMENSION TABLE											
400 KV D/C-X-M & X-N- TT "DD"		"F" B/B of Tower at 3MBE(+)-3MLE (TF)		"F" B/B of Tower at 3MBE(+)-3MLE (LF)		Stub Section (HT)		Lattice Level to CL	cg	sec B1	2°Tan B1	sec B2	2°Tan B2										
		12713		12713		200X200X20		50	57.1	1.028857	0.483931204	1.028857	0.4839312										
Tower Detail	Extn from 3MBE(+)-3MLE (mm)	cg-cg dim at CL (TF)	cg-cg dim at CL (LF)	Foundation Base Width	work pt	G.L. TO C.L.	A1	A2	B	E	F1	F2	H										
-3MBE (+) -3M LE	0	12623	12623	7230	2750	225	7031	7031	8944	7530	10796	10796	3500										
-3MBE (+) -1.5M LE	1600	13349	13349	7230	2750	225	7394	7394	10457	7530	11159	11159	3500										
-3MBE (+) +0M LE	3000	14074	14074	7230	2750	225	7757	7757	10970	7530	11522	11522	3500										
-3MBE (+) +1.5M LE	4500	14800	14800	7230	2750	225	8120	8120	11483	7530	11885	11885	3500										
-3MBE (+) +3M LE	6000	15526	15526	7230	2750	225	8483	8483	11997	7530	12248	12248	3500										
+0MBE (+) -3M LE	3000	14074	14074	7230	2750	225	7757	7757	10970	7530	11522	11522	3500										
+0MBE (+) -1.5M LE	4500	14800	14800	7230	2750	225	8120	8120	11483	7530	11885	11885	3500										
+0MBE (+) +0M LE	6000	15526	15526	7230	2750	225	8483	8483	11997	7530	12248	12248	3500										
+0MBE (+) +1.5M LE	7500	16252	16252	7230	2750	225	8846	8846	12510	7530	12611	12611	3500										
+0MBE (+) +3M LE	9000	16978	16978	7230	2750	225	9209	9209	13023	7530	12974	12974	3500										
+3MBE (+) -3M LE	6000	15526	15526	7230	2750	225	8483	8483	11997	7530	12248	12248	3500										
+3MBE (+) -1.5M LE	7500	16252	16252	7230	2750	225	8846	8846	12510	7530	12611	12611	3500										
+3MBE (+) +0M LE	9000	16978	16978	7230	2750	225	9209	9209	13023	7530	12974	12974	3500										
+3MBE (+) +1.5M LE	10500	17704	17704	7230	2750	225	9572	9572	13537	7530	13337	13337	3500										
+3MBE (+) +3M LE	12000	18430	18430	7230	2750	225	9935	9935	14050	7530	13700	13700	3500										
+6MBE (+) -3M LE	9000	16978	16978	7230	2750	225	9209	9209	13023	7530	12974	12974	3500										
+6MBE (+) -1.5M LE	10500	17704	17704	7230	2750	225	9572	9572	13537	7530	13337	13337	3500										
+6MBE (+) +0M LE	12000	18430	18430	7230	2750	225	9935	9935	14050	7530	13700	13700	3500										
+6MBE (+) +1.5M LE	13500	19156	19156	7230	2750	225	10298	10298	14563	7530	14063	14063	3500										
+6MBE (+) +3M LE	15000	19882	19882	7230	2750	225	10661	10661	15076	7530	14426	14426	3500										



NOTE:

- BEFORE START OF THE FOUNDATION ACTIVITY, ALL THE RELEVANT INFORMATION PROVIDED IN THE TECHNICAL NOTES AND FOUNDATION DRAWINGS SHALL BE READ AND UNDERSTOOD. IF ANY ERROR OR CHANGES ARE OBSERVED, SAME SHALL BE INTIMATED TO ENGINEERING TEAM FOR CORRECTIVE ACTION.
- FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.241965802
2 TAN B =	0.483931204
FACE =	1.028857304
DEV =	1.05092701
IN FACE SLOPE	
TAN B =	0.235178971
SEC B =	1.027282409

NOTES:

- DRAWING NOT TO SCALE
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3300 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAR FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.



REV NO.	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	21-09-18	FOUNDATION DRAWING FOR TOWER TYPE DD-3A/0A/3A/6M 400KV D/C (WZ-1) FULLY SUBMERGED SOIL (3.5M DEPTH)		
CHKD	AM	21-09-18			
APPD	DL	21-09-18			
DATE	21-09-18	DRAWING NO.	GTTP/400D/CWZ-1/DDN-001A	SHEET NO.	2/2

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B	H	W	B1	B2	H1	H2	Hef	Hb
4860	3500	700	4260	2000	400	300	300	2750

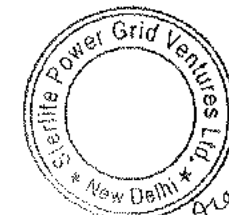
BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	4760	PAD REINFORCEMENT	16	68	4760	1.58	510.68	2042.71
B	4160 50 354 354 50	PAD REINFORCEMENT	16	32	4967	1.58	250.80	1003.18
C	1900 568 50 50 568	PAD REINFORCEMENT	16	18	3136	1.58	89.08	356.32
D	3511	CHIMNEY BAR	32	4	4011	6.31	101.24	404.98
D1	500	CHIMNEY BAR	28	8	4011	4.83	155.02	620.11
E	600 2 600	CHIMNEY SQUARE SPACER	8	13	2592	0.39	13.29	53.18
E1	200 283	CHIMNEY SQUARE SPACER	8	13	2123	0.39	10.89	43.55
TOTAL REINFORCEMENT TOWER=								4524.0

FOUNDATION DESIGN PARAMETERS:	
TYPH OF SOIL :	DRY FISSURED ROCK
UNIT WEIGHT (Kg/m ³):	1700
LIMIT BEARING CAPACITY (Kg/m ²):	62500
ANGLE OF REPOSE :	20
WATER TABLE (m):	BELOW 3.5m FROM G.L.
FOUNDATION DEPTH (m):	3.5

QUANTITIES/STRUCTURE	
CONCRETE (M20) m ³	45.07
CONCRETE (M10) m ³	4.72
TOTAL CONCRETE m ³	49.79
EXCAVATION m ³	293.64
REINFORCEMENT Kg	4524.0

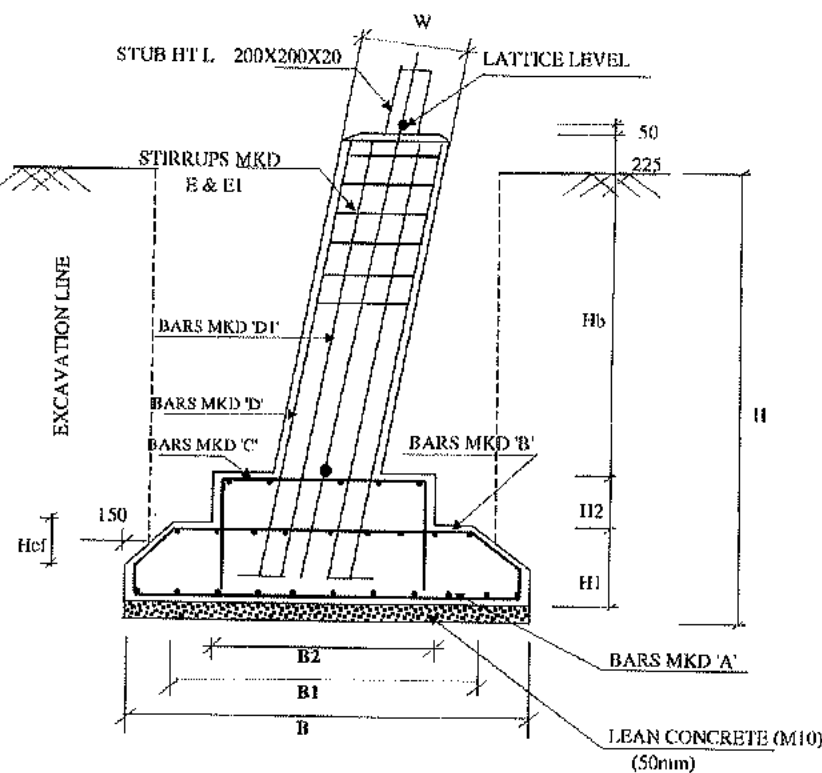
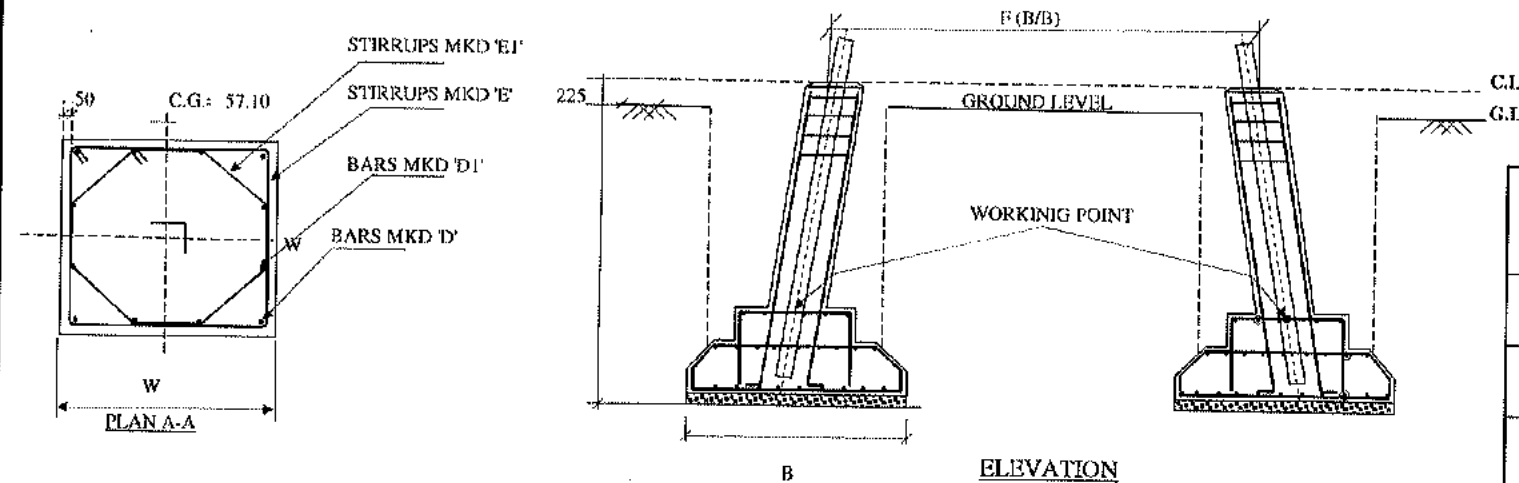
NOTES:

1. DRAWING NOT TO SCALE
2. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
3. CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
4. REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
5. STUB BELOW GROUND LEVEL = 3300
6. WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
7. FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
8. CLEAR COVER TO REINFORCEMENT IS 50MM
9. STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
10. AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.



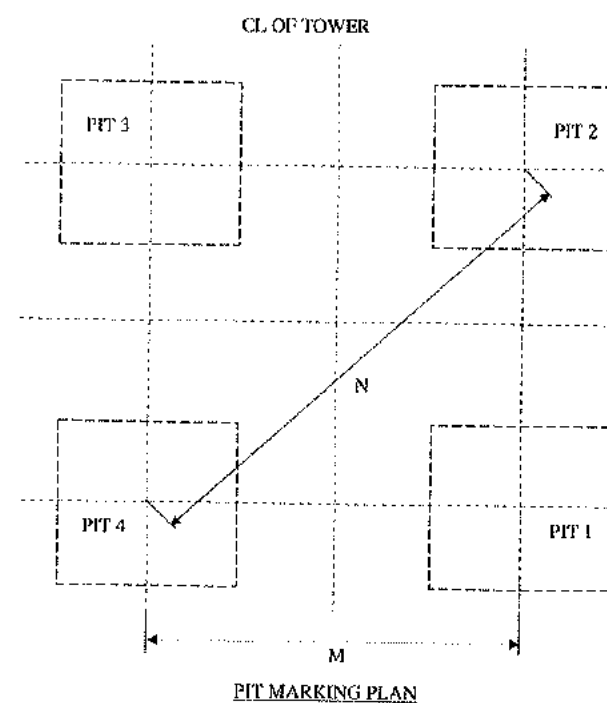
Approved for railway crossing proposal.

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	21-09-18	FOUNDATION DRAWING FOR TOWER TYPE DD-3/40/+3+6M 400KV D/C (WZ-1) DRY FISSURED ROCK SOIL (3.5M DEPTH)		
CHKD	AM	21-09-18			
APPD	DL	21-09-18			
DATE	21-09-18	DRAWING NO.			
		GT/PL/400DC/WZ-1/DD/F-005A	SHEET NO.	1/2	REV 0



FOUNDATION ELEVATION (CROSS SECTION)

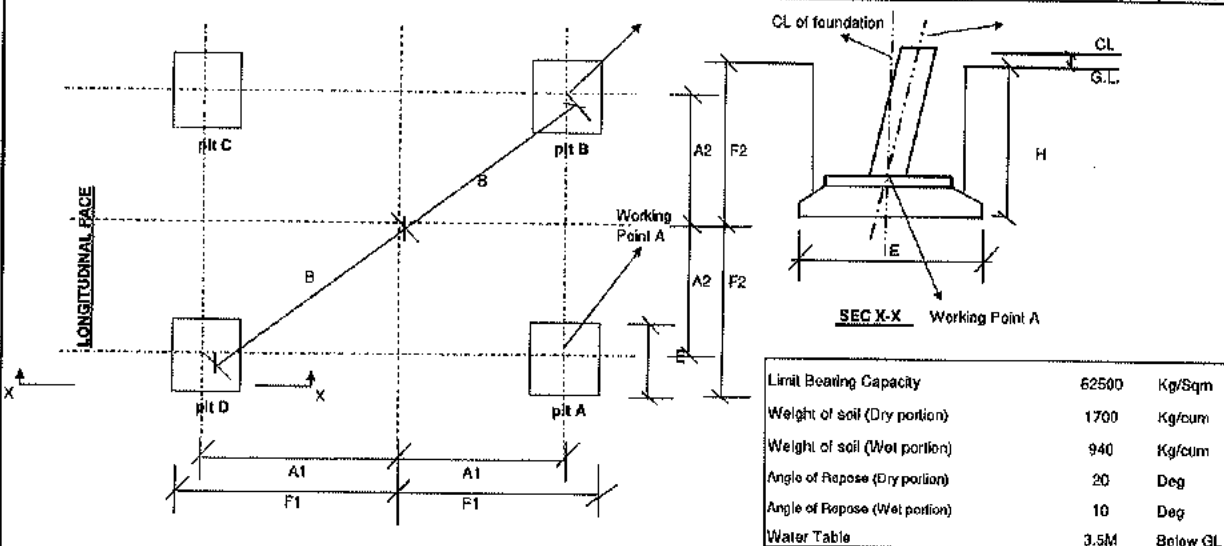
VERTICAL SLOPE	
TAN B =	0.241965602
2 TAN B =	0.483931204
FACE =	1.028857304
DEV =	1.05692701
IN FACE SLOPE	
TAN B =	0.235178971
SEC B =	1.027282409



REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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Project GOA														Client: SPGVL	
400 KV D/C -X-M & X-N (WZ-1) - TT "DD" SOIL TYPE - DFR (3.5M DEPTH) PIT DIMENSION TABLE															
400 KV D/C-X-M & X-N TT "DD"		"F" B/B of Tower at 3MBE(+)-3MLE (TF)		"F" B/B of Tower at 3MBE(+)-3MLE (LF)		Stub Section (HT)		Lattice Level to CL	cg	sec B1	2*Tan B1	sec B2	2*Tan B2		
		12713		12713		200X200X20		50	67.1	1.028857	0.483831204	1.028857	0.4838312		
Tower Detail	Extn from -3MBE(+)- 3MLE (mm)	cg-cg dim at CL (TF)	cg-cg dim at CL (LF)	Foundation Base Width	work pt	G.L. TO C.L.	A1	A2	B	E	F1	F2	H		
-3MBE (+)-3M LE	0	12623	12623	4860	2750	225	7031	7031	8944	4860	9461	9461	3500		
-3MBE (+)-1.5M LE	1500	13349	13349	4860	2750	225	7394	7394	10457	4860	9824	9824	3600		
-3MBE (+)+0M LE	3000	14074	14074	4860	2750	225	7757	7757	10970	4860	10187	10187	3500		
-3MBE (+)+1.5M LE	4500	14800	14800	4860	2750	225	8120	8120	11483	4860	10560	10560	3500		
-3MBE (+)+3M LE	6000	15526	15526	4860	2750	225	8483	8483	11997	4860	10913	10913	3500		
+0MBE (+)-3M LE	3000	14074	14074	4860	2750	225	7757	7757	10970	4860	10187	10187	3500		
+0MBE (+)-1.5M LE	4500	14800	14800	4860	2750	225	8120	8120	11483	4860	10560	10560	3500		
+0MBE (+)+0M LE	6000	15526	15526	4860	2750	225	8483	8483	11997	4860	10913	10913	3500		
+0MBE (+)+1.5M LE	7500	16252	16252	4860	2750	225	8846	8846	12510	4860	11276	11276	3500		
+0MBE (+)+3M LE	9000	16978	16978	4860	2750	225	9209	9209	13023	4860	11639	11639	3500		
+3MBE (+)-3M LE	6000	15526	15526	4860	2750	225	8483	8483	11997	4860	10913	10913	3500		
+3MBE (+)-1.5M LE	7500	16252	16252	4860	2750	225	8846	8846	12510	4860	11276	11276	3500		
+3MBE (+)+0M LE	9000	16978	16978	4860	2750	225	9209	9209	13023	4860	11639	11639	3500		
+3MBE (+)+1.5M LE	10500	17704	17704	4860	2750	225	9572	9572	13537	4860	12002	12002	3500		
+3MBE (+)+3M LE	12000	18430	18430	4860	2750	225	9935	9935	14050	4860	12365	12365	3500		
+6MBE (+)-3M LE	9000	16978	16978	4860	2750	225	9209	9209	13023	4860	11639	11639	3500		
+6MBE (+)-1.5M LE	10500	17704	17704	4860	2750	225	9572	9572	13537	4860	12002	12002	3500		
+6MBE (+)+0M LE	12000	18430	18430	4860	2750	225	9935	9935	14050	4860	12365	12365	3500		
+6MBE (+)+1.5M LE	13500	19156	19156	4860	2750	225	10298	10298	14563	4860	12728	12728	3500		
+6MBE (+)+3M LE	15000	19882	19882	4860	2750	225	10661	10661	15076	4860	13091	13091	3500		



NOTES:

- BEFORE START OF THE FOUNDATION ACTIVITY, ALL THE RELEVANT INFORMATION PROVIDED IN THE TECHNICAL NOTES AND FOUNDATION DRAWINGS SHALL BE READ AND UNDERSTOOD. IF ANY ERROR OR CHANGES ARE OBSERVED, SAME SHALL BE INTIMATED TO ENGINEERING TEAM FOR CORRECTIVE ACTION.
- FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN U =	0.241985602
2 TAN U =	0.483931204
FACE =	1.028857304
DIV =	1.05602701
IN FACE SLOPE	
TAN B =	0.235176971
SEC B =	1.027282109

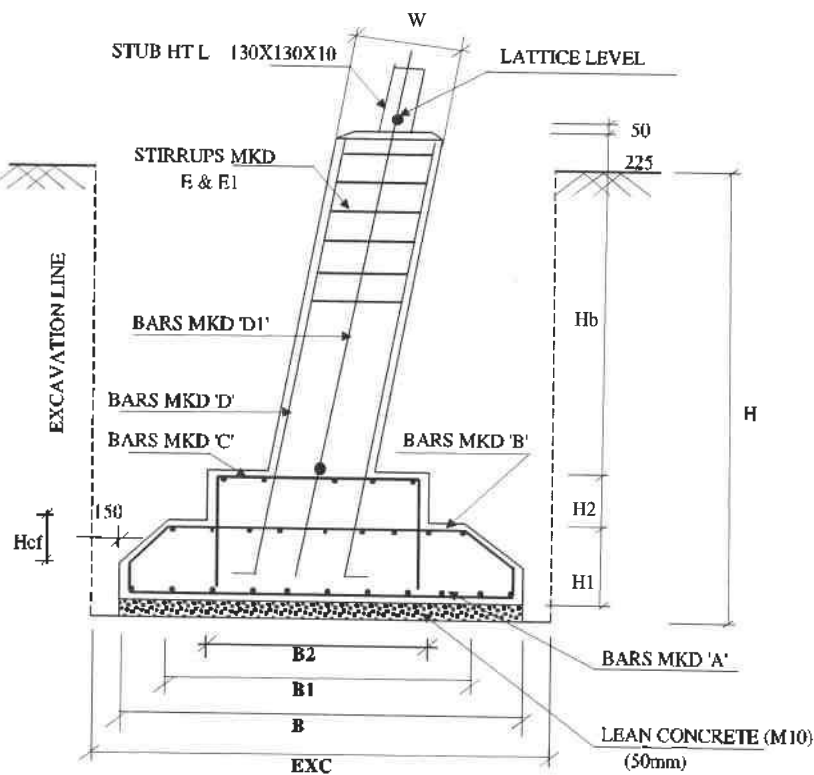
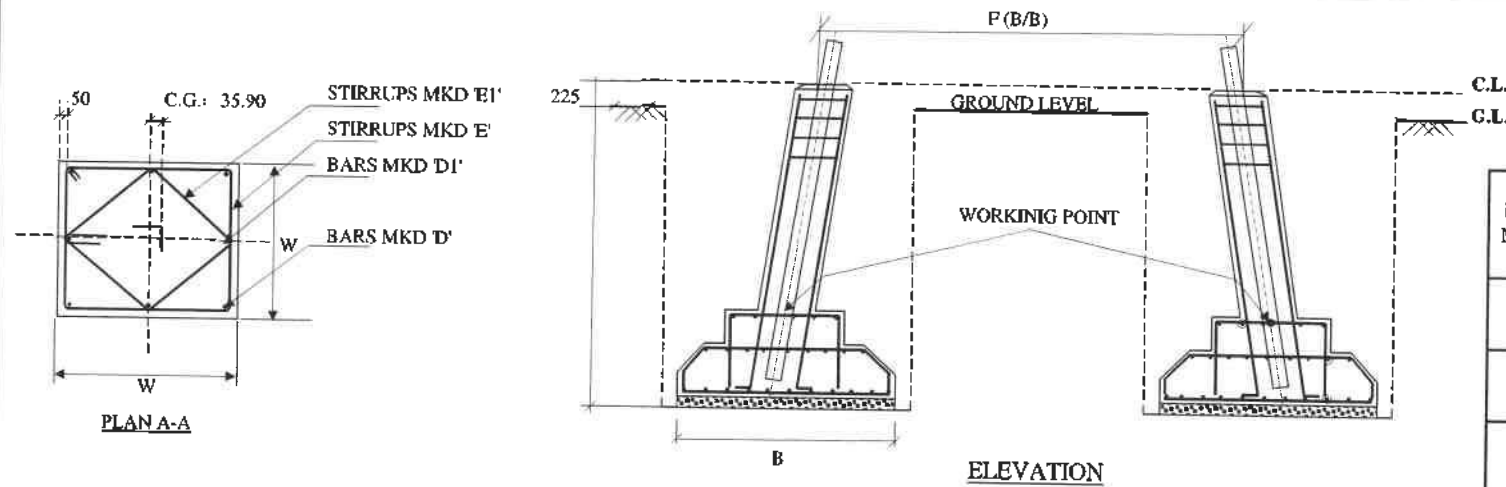
NOTES:

- DRAWING NOT TO SCALE
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3300 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAR FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

Approved for railway crossing proposal

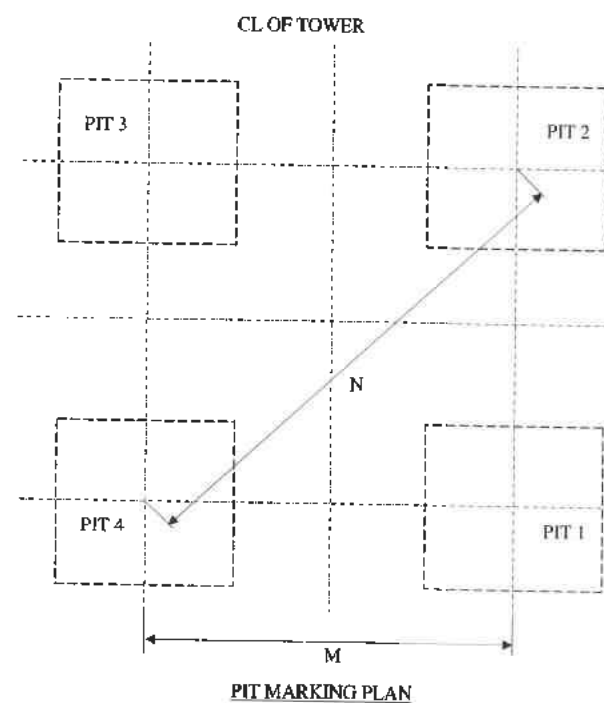
REV NO	DATE	DESCRIPTION	DRAWN	CHECKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	21-09-18	FOUNDATION DRAWING FOR TOWER TYPE DD-3/H/4/3/6M 400KV D/C (WZ-1) DRY FISSURED ROCK SOIL (3.5M DEPTH)		
CHECKD	AM	21-09-18			
APPD	DL	21-09-18			
DATE	21-09-18	DRAWING NO.	GTTH/400KV/WZ-1/DD/F-005A	SHEET NO	2/2

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VERTICAL SLOPE	
TAN B =	0.151724138
2 TAN B =	0.303448276
FACE =	1.011444617
DEV =	1.022761178
IN FACE SLOPE	
TAN B =	0.150003
SEC B =	1.0111885

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	WET
UNIT WEIGHT (Kg/m ³):	1440 / 940
LIMIT BEARING CAPACITY (Kg/m ²):	12500
ANGLE OF REPOSE :	30 / 15
WATER TABLE (m):	1.50 BELOW G.L.
FOUNDATION DEPTH (m):	3.5



REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
3250	2950	3500	420	2650	1410	250	200	150	3000

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	2850	PAD REINFORCEMENT	12	30	2850	0.89	75.93	303.72
B	2550	PAD REINFORCEMENT	10	24	2933	0.62	43.42	173.70
C	1310	PAD REINFORCEMENT	10	18	2062	0.62	22.90	91.61
D	3531	CHIMNEY BAR	20	4	3831	2.46	37.77	151.11
D1	300	CHIMNEY BAR	20	4	3831	2.46	37.77	151.11
E	320	CHIMNEY SQUARE SPACER	8	13	1472	0.39	7.55	30.21
E1	226	CHIMNEY SQUARE SPACER	8	13	1097	0.39	5.62	22.52
TOTAL REINFORCEMENT/ TOWER=								924.0

- NOTES:**
1. DRAWING NOT TO SCALE
 2. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
 3. CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
 4. REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
 5. STUB BELOW GROUND LEVEL = 3300
 6. WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
 7. FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
 8. CLEAR COVER TO REINFORCEMENT IS 50MM
 9. STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
 10. AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	12.06
CONCRETE (M10) m ³	1.74
TOTAL CONCRETE m ³	13.8
EXCAVATION m ³	147.88
REINFORCEMENT Kg	924.0

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BHGG/LBT/23 Date: 13/08/18
Engineering Deptt.
the above does not relieve the contractor from their contractual obligations

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DAL-3/+0/+3/+6M 400KV D/C (WZ-1) WET SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE	03-08-18	DRAWING NO.			
		GTTP/400DC/WZ-1/DAL/F-002	SHEET NO.	1/2	REV 0

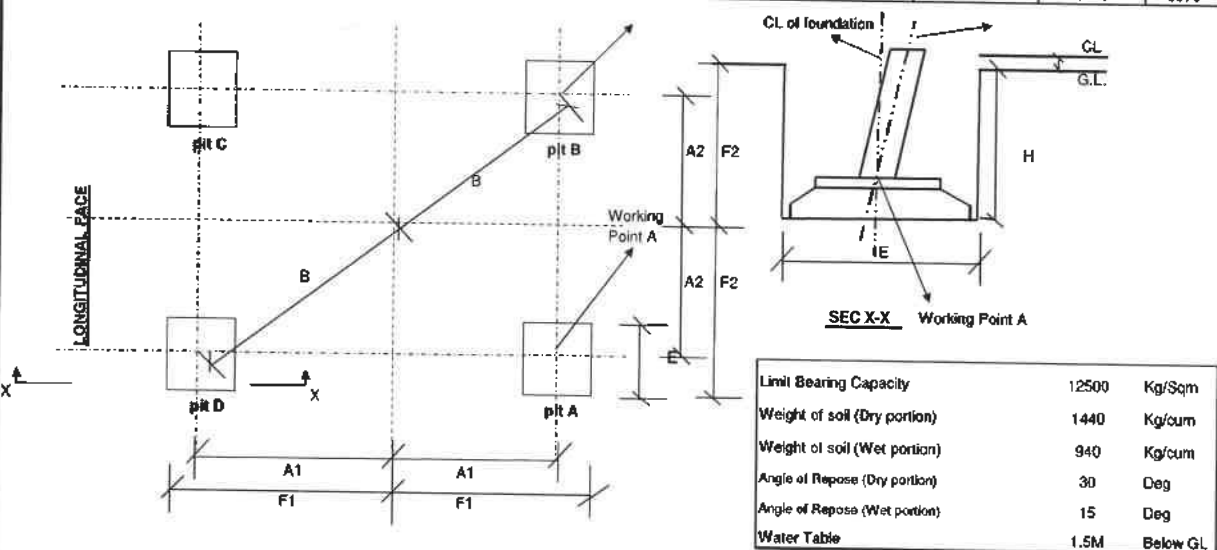
Project
GOA

400 KV D/C -X-M & X-N (WZ-1) - TT "DAL" SOIL TYPE - WET

Client:
SPGVL

PIT DIMENSION TABLE

400 KV D/C-X-M & X-N- TT "DAL"		F " B/B of Tower at 3MBE(+)-3MLE (TF)		F " B/B of Tower at 3MBE(+)-3MLE (LF)		Stub Section (HT)		Latice Level to CL	cg	sec B1	2°Tan B1	sec B2	2°Tan B2
		9432		9432		130X130X10		50	35.9	1.011445	0.303448276	1.011445	0.3034483
Tower Detail	Extn from 3MBE(+)-3MLE (mm)	cg-cg dim at CL (TF)	cg-cg dim at CL (LF)	Foundation Base Width	work pt	G.L TO C.L	A1	A2	B	E	F1	F2	H
-3MBE (+) -3M LE	0	9375	9375	2950	3000	225	5177	5177	7321	3250	6802	6802	3500
-3MBE (+) -1.5M LE	1500	9830	9830	2950	3000	225	5404	5404	7643	3250	7029	7029	3500
-3MBE (+) +0M LE	3000	10285	10285	2950	3000	225	5632	5632	7965	3250	7257	7257	3500
-3MBE (+) +1.5M LE	4500	10741	10741	2950	3000	225	5860	5860	8287	3250	7485	7485	3500
-3MBE (+) +3M LE	6000	11196	11196	2950	3000	225	6087	6087	8609	3250	7712	7712	3500
+0MBE (+) -3M LE	3000	10285	10285	2950	3000	225	5632	5632	7965	3250	7257	7257	3500
+0MBE (+) -1.5M LE	4500	10741	10741	2950	3000	225	5860	5860	8287	3250	7485	7485	3500
+0MBE (+) +0M LE	6000	11196	11196	2950	3000	225	6087	6087	8609	3250	7712	7712	3500
+0MBE (+) +1.5M LE	7500	11651	11651	2950	3000	225	6315	6315	8930	3250	7940	7940	3500
+0MBE (+) +3M LE	9000	12106	12106	2950	3000	225	6542	6542	9252	3250	8167	8167	3500
+3MBE (+) -3M LE	6000	11196	11196	2950	3000	225	6087	6087	8609	3250	7712	7712	3500
+3MBE (+) -1.5M LE	7500	11651	11651	2950	3000	225	6315	6315	8930	3250	7940	7940	3500
+3MBE (+) +0M LE	9000	12106	12106	2950	3000	225	6542	6542	9252	3250	8167	8167	3500
+3MBE (+) +1.5M LE	10500	12561	12561	2950	3000	225	6770	6770	9574	3250	8395	8395	3500
+3MBE (+) +3M LE	12000	13016	13016	2950	3000	225	6998	6998	9896	3250	8623	8623	3500
+6MBE (+) -3M LE	9000	12106	12106	2950	3000	225	6542	6542	9252	3250	8167	8167	3500
+6MBE (+) -1.5M LE	10500	12561	12561	2950	3000	225	6770	6770	9574	3250	8395	8395	3500
+6MBE (+) +0M LE	12000	13016	13016	2950	3000	225	6998	6998	9896	3250	8623	8623	3500
+6MBE (+) +1.5M LE	13500	13472	13472	2950	3000	225	7225	7225	10218	3250	8850	8850	3500
+6MBE (+) +3M LE	15000	13927	13927	2950	3000	225	7453	7453	10540	3250	9078	9078	3500



NOTE:

- BEFORE START OF THE FOUNDATION ACTIVITY, ALL THE RELEVANT INFORMATION PROVIDED IN THE TECHNICAL NOTES AND FOUNDATION DRAWINGS SHALL BE READ AND UNDERSTOOD. IF ANY ERROR OR CHANGES ARE OBSERVED, SAME SHALL BE INTIMATED TO ENGINEERING TEAM FOR CORRECTIVE ACTION.
- FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.151724138
2 TAN B =	0.303448276
FACE =	1.011444617
DEV =	1.022761178
IN FACE SLOPE	
TAN B =	0.150003
SEC B =	1.0111895

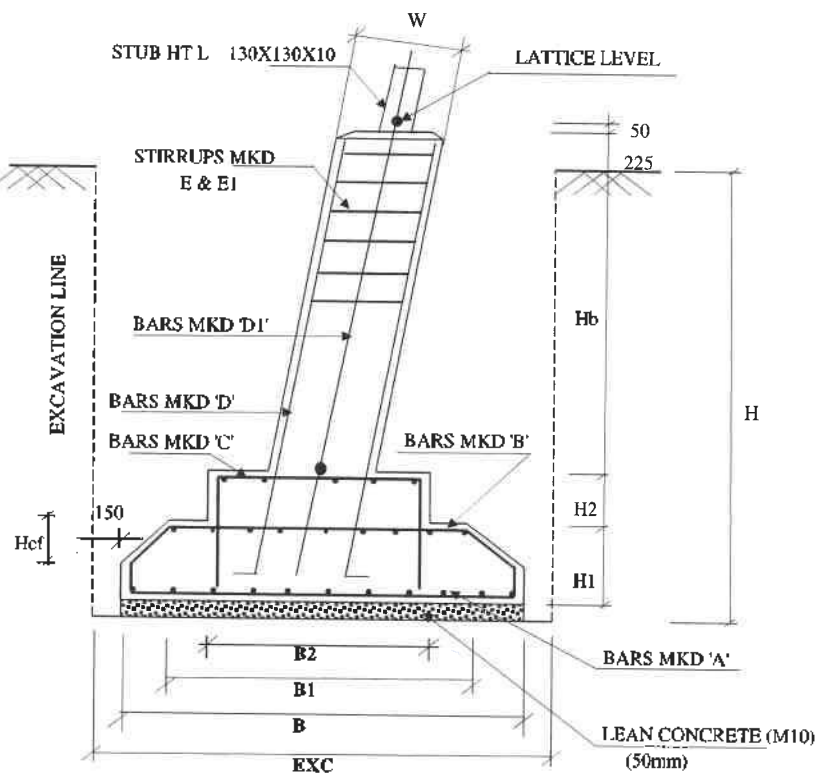
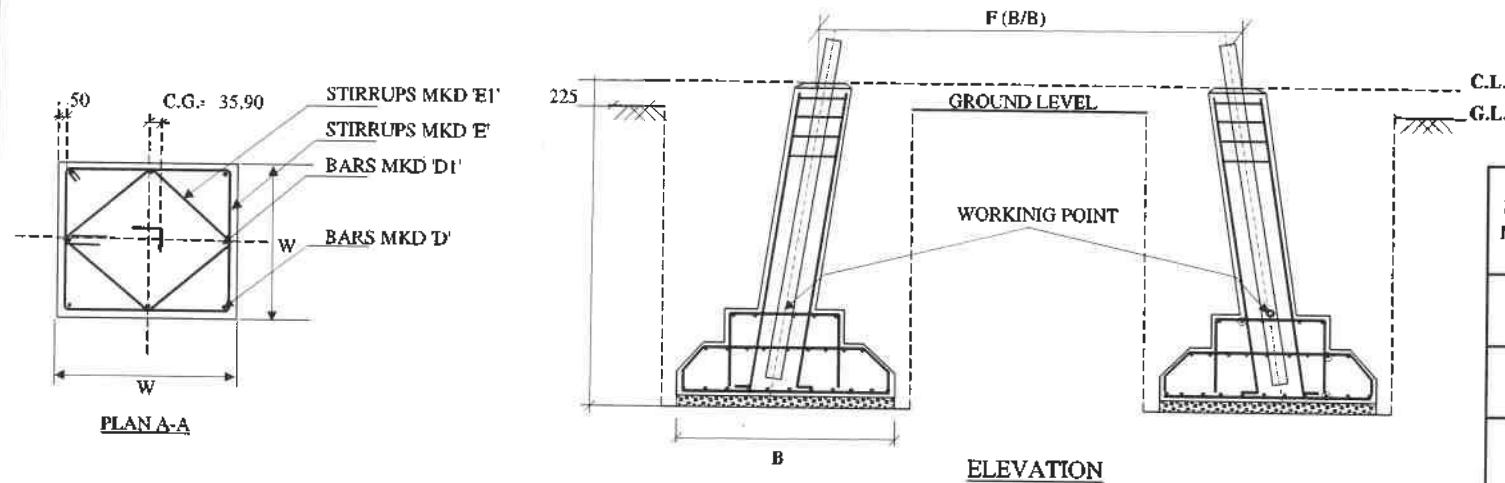
NOTES:

- DRAWING NOT TO SCALE
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3300 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

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REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DAL-3/+0/+3/+6M 400KV D/C (WZ-1) WET SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE	03-08-18	DRAWING NO.			
		GTTP/L400DC/WZ-1/DALF-002	SHEET NO	2/2	REV 0

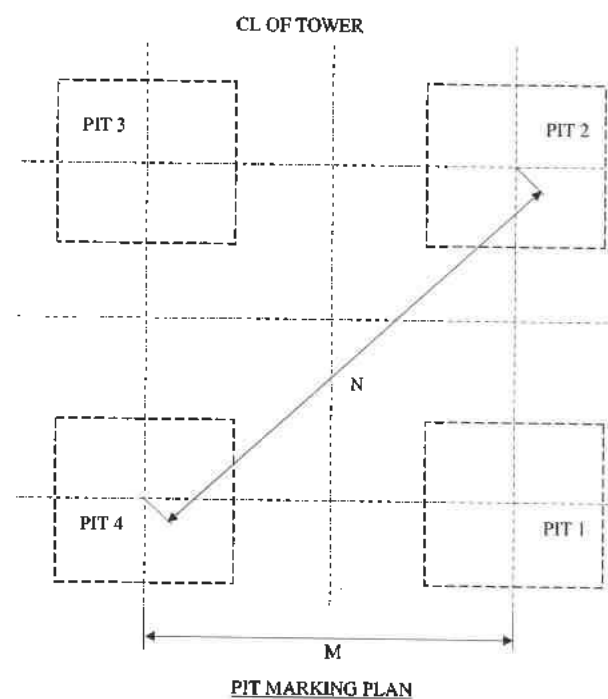
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liable for any damages and consequences in its responsibility.



FOUNDATION ELEVATION (CROSS SECTION)

VERTICAL SLOPE	
TAN B =	0.151724138
2 TAN B =	0.303448276
FACE =	1.011444617
DEV =	1.022761178
IN FACE SLOPE	
TAN B =	0.150003
SEC B =	1.0111885

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL:	DRY
UNIT WEIGHT (Kg/m ³):	1440
LIMIT BEARING CAPACITY (Kg/m ²):	25000
ANGLE OF REPOSE:	30
WATER TABLE (m):	BELOW 3.5m FROM G.L.
FOUNDATION DEPTH (m):	3.5



REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
2450	2150	3500	420	1850	1410	250	200	150	3000

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	2050	PAD REINFORCEMENT	12	24	2050	0.89	43.72	174.87
B	1750 50 141 141 50	PAD REINFORCEMENT	10	14	2133	0.62	18.45	73.80
C	1310 326 50 50 326	PAD REINFORCEMENT	10	18	2062	0.62	22.90	91.61
D	3531	CHIMNEY BAR	20	4	3831	2.46	37.77	151.11
D1	300	CHIMNEY BAR	20	4	3831	2.46	37.77	151.11
E	320 320	CHIMNEY SQUARE SPACER	8	13	1472	0.39	7.55	30.21
E1	226 226	CHIMNEY SQUARE SPACER	8	13	1097	0.39	5.62	22.52
TOTAL REINFORCEMENT/ TOWER=								695.2

NOTES:

1. DRAWING NOT TO SCALE
2. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
3. CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
4. REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
5. STUB BELOW GROUND LEVEL = 3300
6. WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
7. FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
8. CLEAR COVER TO REINFORCEMENT IS 50MM
9. STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
10. AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	8.12
CONCRETE (M10) m ³	0.92
TOTAL CONCRETE m ³	9.04
EXCAVATION m ³	84.04
REINFORCEMENT Kg	695.2

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Engineering Deptt.
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REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT	400KV D/C XELDAM-NARENDRA TRANSMISSION LTD				
CLIENT	STERLITE POWER GRID VENTURES LIMITED				
DESIGNER:	STERLITE POWER GRID VENTURES LIMITED				
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DAL-3/+0/+3/+6M 400KV D/C (WZ-1) DRY SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE	03-08-18	DRAWING NO.	GTTP4/400DC/WZ-1/DAL/F-001	SHEET NO.	1/2 REV 0

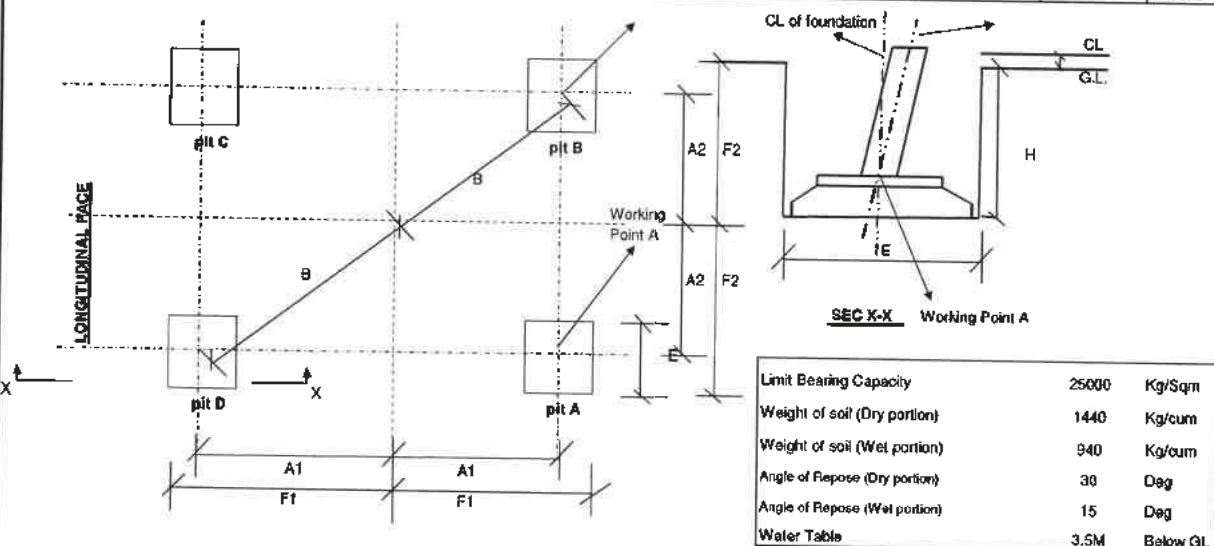
Project
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400 KV D/C -X-M & X-N (WZ-1) - TT "DAL" SOIL TYPE - DRY

PIT DIMENSION TABLE

Client:
SPGVL

400 KV D/C-X-M & X-N- TT "DAL"		" F " B/B of Tower at 3MBE(+)-3MLE (TF)		" F " B/B of Tower at 3MBE(+)-3MLE (LF)		Stub Section (HT)		Lattice Level to CL	cg	sec B1	2* Tan B1	sec B2	2* Tan B2
9432		9432		130X130X10		50	35.9	1.011445	0.303448276	1.011445	0.3034483		
Tower Detail	Extn from -3MBE(+)-3MLE (mm)	cg-cg dim at CL (TF)	cg-cg dim at CL (LF)	Foundation Base Width	work pt	G.L. TO C.L.	A1	A2	B	E	F1	F2	H
-3MBE (+) -3M LE	0	9375	9375	2150	3000	225	5177	5177	7321	2450	6402	6402	3500
-3MBE (+) -1.5M LE	1500	9830	9830	2150	3000	225	5404	5404	7643	2450	6629	6629	3500
-3MBE (+) +0M LE	3000	10285	10285	2150	3000	225	5632	5632	7965	2450	6857	6857	3500
-3MBE (+) +1.5M LE	4500	10741	10741	2150	3000	225	5860	5860	8287	2450	7085	7085	3500
-3MBE (+) +3M LE	6000	11196	11196	2150	3000	225	6087	6087	8609	2450	7312	7312	3500
+0MBE (+) -3M LE	3000	10285	10285	2150	3000	225	5632	5632	7965	2450	6857	6857	3500
+0MBE (+) -1.5M LE	4500	10741	10741	2150	3000	225	5860	5860	8287	2450	7085	7085	3500
+0MBE (+) +0M LE	6000	11196	11196	2150	3000	225	6087	6087	8609	2450	7312	7312	3500
+0MBE (+) +1.5M LE	7500	11651	11651	2150	3000	225	6315	6315	8930	2450	7540	7540	3500
+0MBE (+) +3M LE	9000	12106	12106	2150	3000	225	6542	6542	9252	2450	7767	7767	3500
+3MBE (+) -3M LE	6000	11196	11196	2150	3000	225	6087	6087	8609	2450	7312	7312	3500
+3MBE (+) -1.5M LE	7500	11651	11651	2150	3000	225	6315	6315	8930	2450	7540	7540	3500
+3MBE (+) +0M LE	9000	12106	12106	2150	3000	225	6542	6542	9252	2450	7767	7767	3500
+3MBE (+) +1.5M LE	10500	12561	12561	2150	3000	225	6770	6770	9574	2450	7995	7995	3500
+3MBE (+) +3M LE	12000	13016	13016	2150	3000	225	6998	6998	9896	2450	8223	8223	3500
+6MBE (+) -3M LE	9000	12106	12106	2150	3000	225	6542	6542	9252	2450	7767	7767	3500
+6MBE (+) -1.5M LE	10500	12561	12561	2150	3000	225	6770	6770	9574	2450	7995	7995	3500
+6MBE (+) +0M LE	12000	13016	13016	2150	3000	225	6998	6998	9896	2450	8223	8223	3500
+6MBE (+) +1.5M LE	13500	13472	13472	2150	3000	225	7225	7225	10218	2450	8450	8450	3500
+6MBE (+) +3M LE	15000	13927	13927	2150	3000	225	7453	7453	10540	2450	8678	8678	3500



NOTE:

- BEFORE START OF THE FOUNDATION ACTIVITY, ALL THE RELEVANT INFORMATION PROVIDED IN THE TECHNICAL NOTES AND FOUNDATION DRAWINGS SHALL BE READ AND UNDERSTOOD. IF ANY ERROR OR CHANGES ARE OBSERVED, SAME SHALL BE INTIMATED TO ENGINEERING TEAM FOR CORRECTIVE ACTION.
- FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.151724138
2 TAN B =	0.303448276
FACE =	1.011444817
DEV =	1.022761178
IN FACE SLOPE	
TAN B =	0.150003
SEC B =	1.0111885

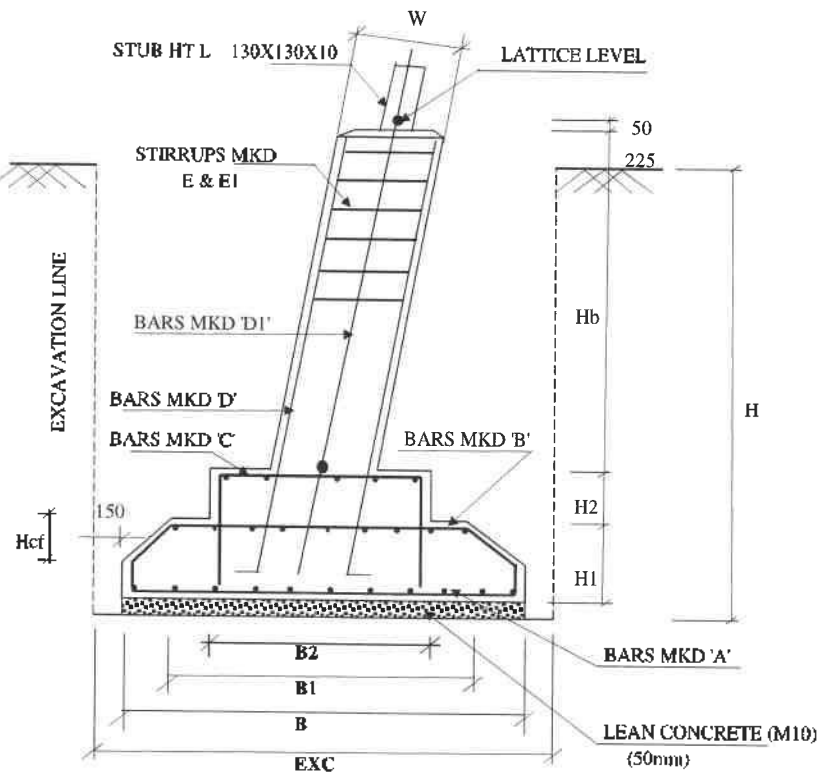
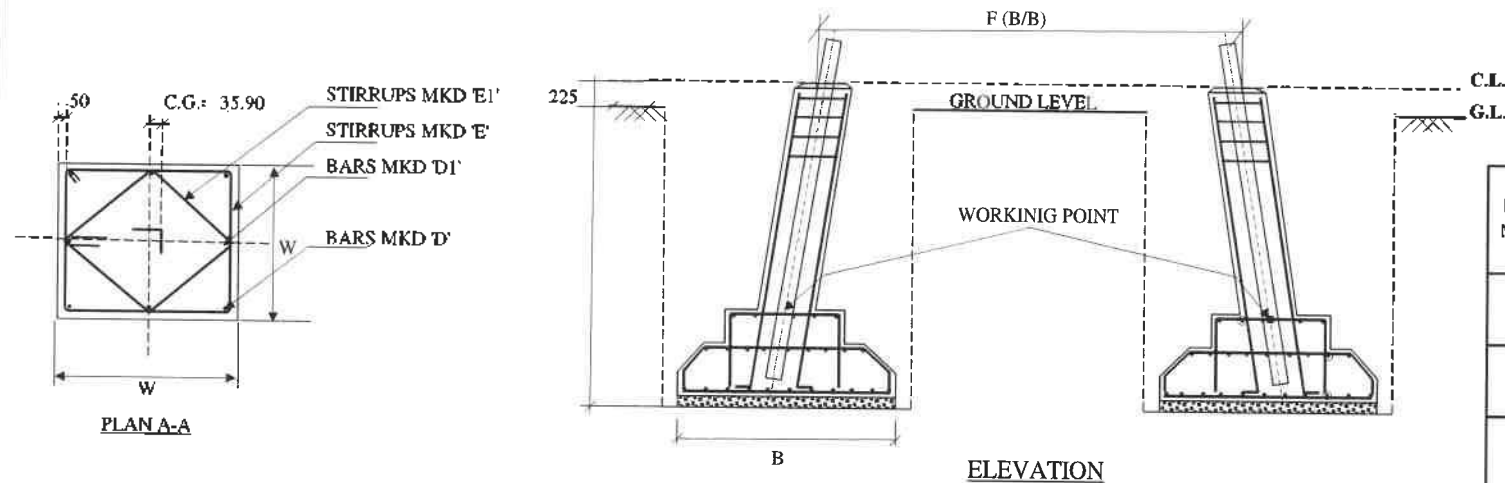
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Engineering Deptt.
the above does not relieve the contractor from their contractual obligations

NOTES:

- DRAWING NOT TO SCALE
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3300 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DAL-3/40+3/40M 400KV D/C (WZ-1) DRY SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE	03-08-18	DRAWING NO.	GTTP/L400DC/WZ-1/DALF-001	SHEET NO.	22
		REV	0		

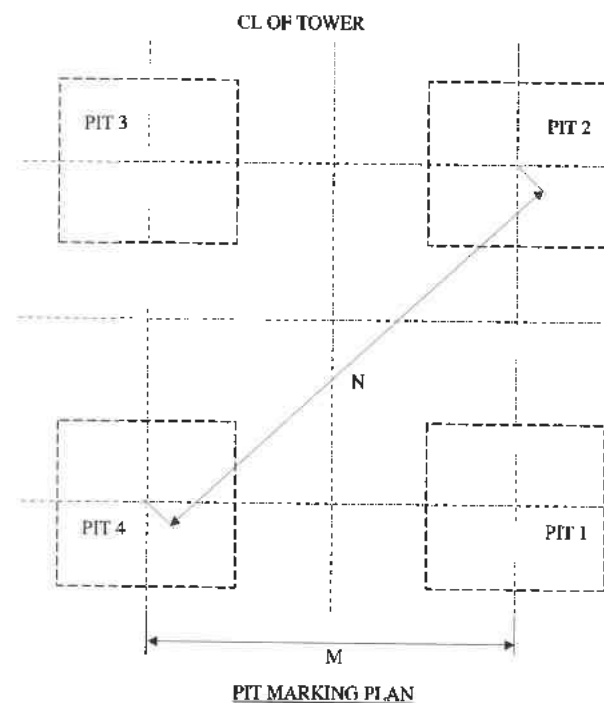
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FOUNDATION ELEVATION (CROSS SECTION)

VERTICAL SLOPE	
TAN B =	0.151724138
2 TAN B =	0.303448276
FACE =	1.011444617
DEV =	1.022761178
IN FACE SLOPE	
TAN B =	0.150003
SEC B =	1.0111885

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	PARTIALLY SUBMERGED
UNIT WEIGHT (Kg/m ³):	1440 / 940
LIMIT BEARING CAPACITY (Kg/m ²):	12500
ANGLE OF REPOSE :	30 / 15
WATER TABLE (m):	0.75 BELOW G.L.
FOUNDATION DEPTH (m):	3.5



PIT MARKING PLAN

EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
3550	3250	3500	420	2950	1410	250	200	150	3000

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	3150	PAD REINFORCEMENT	12	36	3150	0.89	100.69	402.75
B	2850 50 141 141 50	PAD REINFORCEMENT	10	28	3233	0.62	55.83	223.32
C	1310 326 50 50 326	PAD REINFORCEMENT	10	18	2062	0.62	22.90	91.61
D	3531	CHIMNEY BAR	20	4	3831	2.46	37.77	151.11
D1	300	CHIMNEY BAR	20	4	3831	2.46	37.77	151.11
E	320 320	CHIMNEY SQUARE SPACER	8	13	1472	0.39	7.55	30.21
E1	226 226	CHIMNEY SQUARE SPACER	8	13	1097	0.39	5.62	22.52
TOTAL REINFORCEMENT/ TOWER=								1072.6

NOTES:

- 1.DRAWING NOT TO SCALE
- 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
- 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
- 5.STUB BELOW GROUND LEVEL = 3300
- 6.WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- 8.CLEAR COVER TO REINFORCEMENT IS 50MM
- 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

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ENG/6/10/23 Date: 13/08/18
Engineering Deptt.
The above does not relieve the contractor from their contractual obligations.

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DAL-3/+0/+3/+6M 400KV D/C (WZ-1) PARTIALLY SUBMERGED SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE	03-08-18	DRAWING NO.	GTTL/400DC/WZ-1/DAL/F-003	SHEET NO.	1/1 REV 0

REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

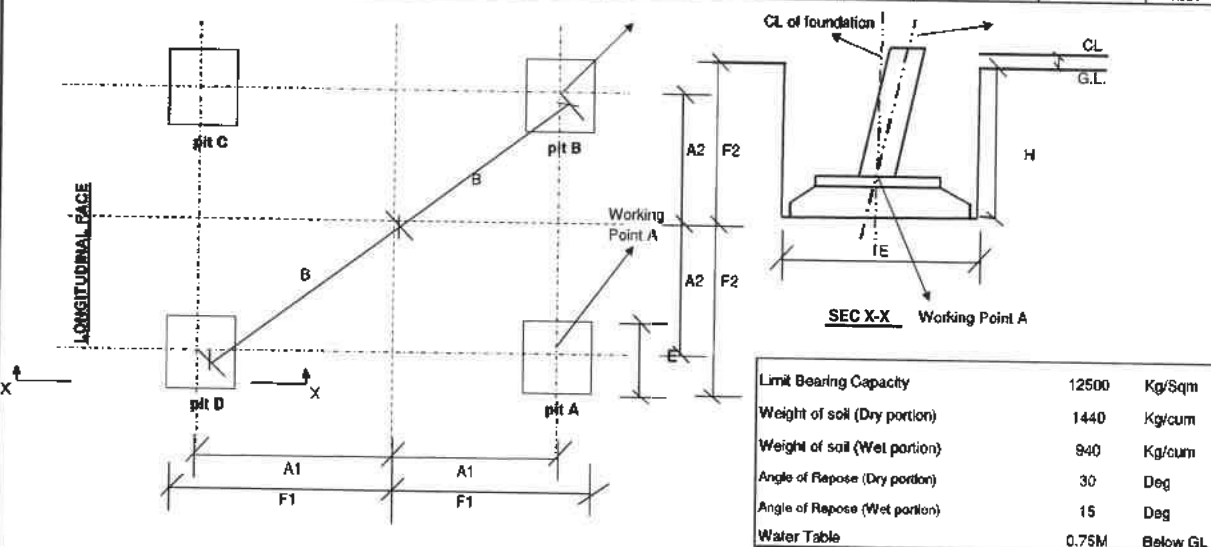
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Project
GOA

400 KV D/C -X-M & X-N (WZ-1) - TT "DAL" SOIL TYPE - PS
PIT DIMENSION TABLE

Client:
SPQVL

400 KV D/C-X-M & X-N- TT "DAL"		"F" B/B of Tower at 3MBE(+)-3MLE (TF)		"F" B/B of Tower at 3MBE(+)-3MLE (LF)		Stub Section (HT)		Lattice Level to CL	cg	sec B1	2"Tan B1	sec B2	2"Tan B2
		9432		9432		130X130X10		50	35.9	1.011445	0.303448276	1.011445	0.3034483
Tower Detail	Extn from 3MBE(+)-3MLE (mm)	cg-cg dim at CL (TF)	cg-cg dim at CL (LF)	Foundation Base Width	work pt	G.L. TO C.L.	A1	A2	B	E	F1	F2	H
-3MBE (+) -3M LE	0	9375	9375	3250	3000	225	5177	5177	7321	3550	6952	6952	3500
-3MBE (+) -1.5M LE	1500	9830	9830	3250	3000	225	5404	5404	7643	3550	7179	7179	3500
-3MBE (+) +0M LE	3000	10285	10285	3250	3000	225	5632	5632	7965	3550	7407	7407	3500
-3MBE (+) +1.5M LE	4500	10741	10741	3250	3000	225	5860	5860	8287	3550	7835	7835	3500
-3MBE (+) +3M LE	6000	11196	11196	3250	3000	225	6087	6087	8609	3550	7862	7862	3500
+0MBE (+) -3M LE	3000	10285	10285	3250	3000	225	5632	5632	7965	3550	7407	7407	3500
+0MBE (+) -1.5M LE	4500	10741	10741	3250	3000	225	5860	5860	8287	3550	7835	7835	3500
+0MBE (+) +0M LE	6000	11196	11196	3250	3000	225	6087	6087	8609	3550	7862	7862	3500
+0MBE (+) +1.5M LE	7500	11651	11651	3250	3000	225	6315	6315	8930	3550	8090	8090	3500
+0MBE (+) +3M LE	9000	12106	12106	3250	3000	225	6542	6542	9252	3550	8317	8317	3500
+3MBE (+) -3M LE	6000	11196	11196	3250	3000	225	6087	6087	8609	3550	7862	7862	3500
+3MBE (+) -1.5M LE	7500	11651	11651	3250	3000	225	6315	6315	8930	3550	8090	8090	3500
+3MBE (+) +0M LE	9000	12106	12106	3250	3000	225	6542	6542	9252	3550	8317	8317	3500
+3MBE (+) +1.5M LE	10500	12561	12561	3250	3000	225	6770	6770	9574	3550	8545	8545	3500
+3MBE (+) +3M LE	12000	13016	13016	3250	3000	225	6998	6998	9896	3550	8773	8773	3500
+6MBE (+) -3M LE	9000	12106	12106	3250	3000	225	6542	6542	9252	3550	8317	8317	3500
+6MBE (+) -1.5M LE	10500	12561	12561	3250	3000	225	6770	6770	9574	3550	8545	8545	3500
+6MBE (+) +0M LE	12000	13016	13016	3250	3000	225	6998	6998	9896	3550	8773	8773	3500
+6MBE (+) +1.5M LE	13500	13472	13472	3250	3000	225	7225	7225	10218	3550	9000	9000	3500
+6MBE (+) +3M LE	15000	13927	13927	3250	3000	225	7453	7453	10540	3550	9228	9228	3500



NOTE:

- BEFORE START OF THE FOUNDATION ACTIVITY, ALL THE RELEVANT INFORMATION PROVIDED IN THE TECHNICAL NOTES AND FOUNDATION DRAWINGS SHALL BE READ AND UNDERSTOOD. IF ANY ERROR OR CHANGES ARE OBSERVED, SAME SHALL BE INTIMATED TO ENGINEERING TEAM FOR CORRECTIVE ACTION.
- FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.151724138
2 TAN B =	0.303448276
FACE =	1.011444617
DEV =	1.022761179
IN FACE SLOPE	
TAN B =	0.150003
SEC B =	1.011585

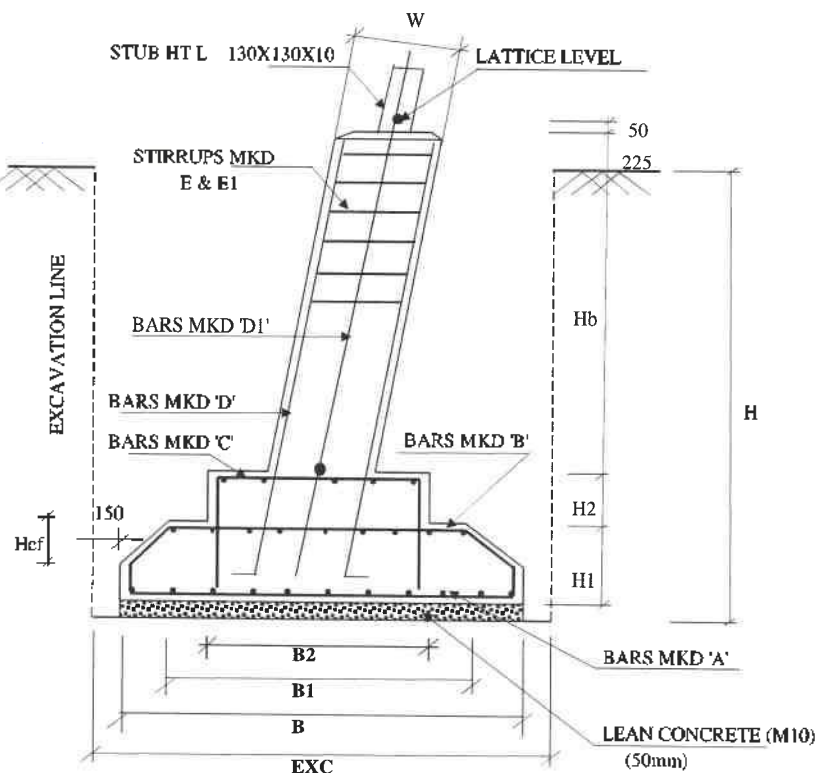
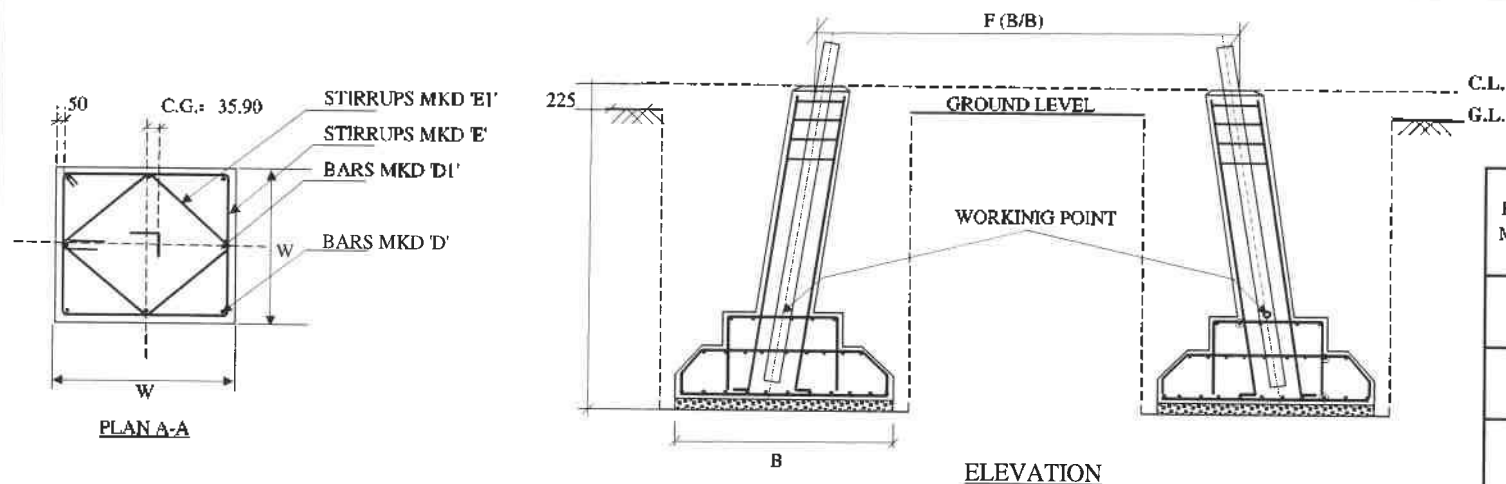
NOTES:

- DRAWING NOT TO SCALE
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3300 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

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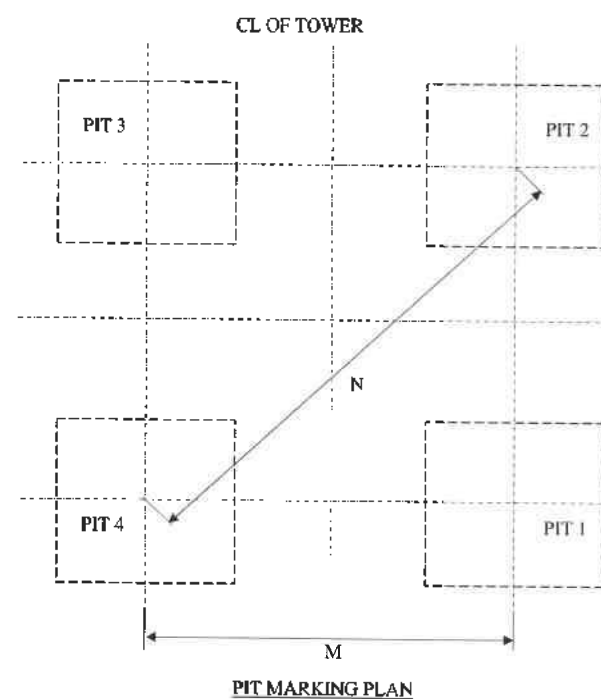
REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DAL-3/40+3/46M 400KV D/C (WZ-1) PARTIALLY SUBMERGED SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE	03-08-18	DRAWING NO.			
		GTTPL/400DC/WZ-1/DALF-003	SHEET NO.	2/2	REV 0

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VERTICAL SLOPE	
TAN B =	0.151724138
2 TAN B =	0.303448276
FACE =	1.011444617
DEV =	1.022761178
IN FACE SLOPE	
TAN B =	0.150003
SEC B =	1.0111885

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	FULLY SUBMERGED
UNIT WEIGHT (Kg/m ³):	940
LIMIT BEARING CAPACITY (Kg/m ²):	12500
ANGLE OF REPOSE :	15
WATER TABLE (m):	0m BELOW G.L.
FOUNDATION DEPTH (m):	3.5



REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
3940	3640	3500	420	3340	1410	250	200	150	3000

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	3540	PAD REINFORCEMENT	12	42	3540	0.89	131.99	527.97
B	3240	PAD REINFORCEMENT	12	26	3623	0.89	83.63	334.54
C	1310	PAD REINFORCEMENT	12	14	2062	0.89	25.65	102.59
D	3531	CHIMNEY BAR	20	4	3831	2.46	37.77	151.11
D1	300	CHIMNEY BAR	20	4	3831	2.46	37.77	151.11
E	320	CHIMNEY SQUARE SPACER	8	13	1472	0.39	7.55	30.21
E1	226	CHIMNEY SQUARE SPACER	8	13	1097	0.39	5.62	22.52
TOTAL REINFORCEMENT/TOWER=								1320.0

NOTES:

- 1.DRAWING NOT TO SCALE
- 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
- 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
- 5.STUB BELOW GROUND LEVEL = 3300
- 6.WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- 8.CLEAR COVER TO REINFORCEMENT IS 50MM
- 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	16.48
CONCRETE (M10) m ³	2.65
TOTAL CONCRETE m ³	19.13
EXCAVATION m ³	217.33
REINFORCEMENT Kg	1320.0

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Engineering Deptt.
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REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT	400KV D/C XELDAM-NARENDRA TRANSMISSION LTD				
CLIENT	STERLITE POWER GRID VENTURES LIMITED				
DESIGNER:	STERLITE POWER GRID VENTURES LIMITED				
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DAL-3/+0/+3/+6M 400KV D/C (WZ-1) FULLY SUBMERGED SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE	03-08-18	DRAWING NO.	GTPL/400DC/WZ-1/DAL/F-004	SHEET NO.	1/2 REV 0

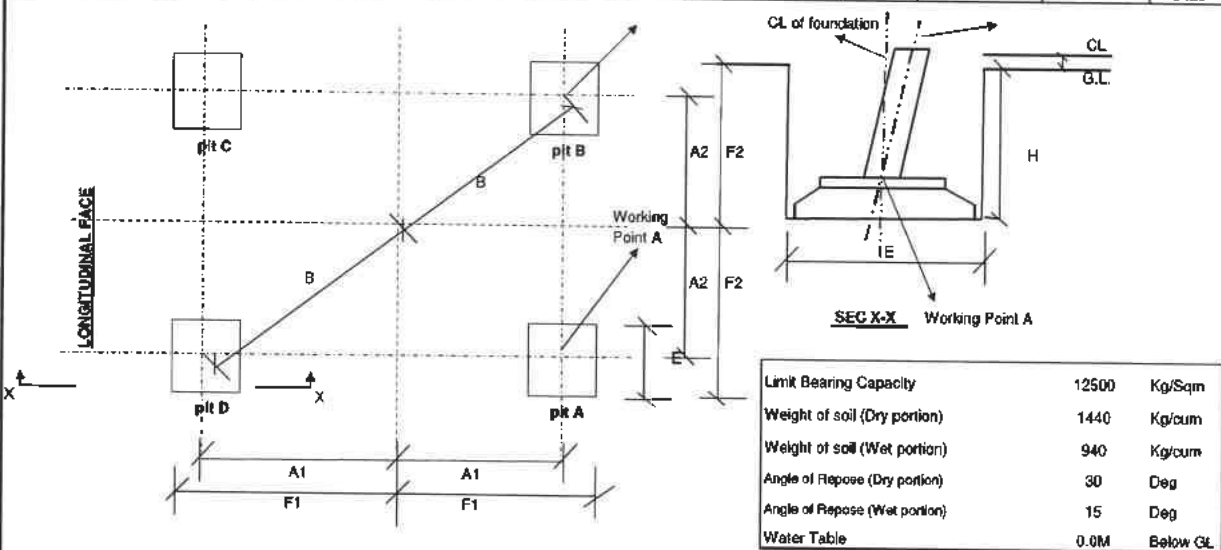
Project
GOA

400 KV D/C -X-M & X-N (WZ-1) - TT "DAL" SOIL TYPE - FS

PIT DIMENSION TABLE

Client:
SPQVL

400 KV D/C-X-M & X-N- TT "DAL"		* F * B/B of Tower at 3MBE(+)-3MLE (TF)		* F * B/B of Tower at 3MBE(+)-3MLE (LF)		Stub Section (HT)		Lattice Level to CL	cg	sec B1	2°Tan B1	sec B2	2°Tan B2
		9432		9432		130X130X10		50	35.9	1.011445	0.303448276	1.011445	0.3034483
Tower Detail	Extn from -3MBE(+)-3MLE (mm)	cg-cg dim at CL (TF)	cg-cg dim at CL (LF)	Foundation Base Width	work pt	G.L. TO C.L.	A1	A2	B	E	F1	F2	H
-3MBE (+) -3M LE	0	9375	9375	3640	3000	225	5177	5177	7321	3940	7147	7147	3500
-3MBE (+) -1.5M LE	1500	9830	9830	3640	3000	225	5404	5404	7643	3940	7374	7374	3500
-3MBE (+) +0M LE	3000	10285	10285	3640	3000	225	5632	5632	7965	3940	7602	7602	3500
-3MBE (+) +1.5M LE	4500	10741	10741	3640	3000	225	5860	5860	8287	3940	7830	7830	3500
-3MBE (+) +3M LE	6000	11196	11196	3640	3000	225	6087	6087	8609	3940	8057	8057	3500
+0MBE (+) -3M LE	3000	10285	10285	3640	3000	225	5632	5632	7965	3940	7602	7602	3500
+0MBE (+) -1.5M LE	4500	10741	10741	3640	3000	225	5860	5860	8287	3940	7830	7830	3500
+0MBE (+) +0M LE	6000	11196	11196	3640	3000	225	6087	6087	8609	3940	8057	8057	3500
+0MBE (+) +1.5M LE	7500	11651	11651	3640	3000	225	6315	6315	8930	3940	8285	8285	3500
+0MBE (+) +3M LE	9000	12106	12106	3640	3000	225	6542	6542	9252	3940	8512	8512	3500
+3MBE (+) -3M LE	6000	11196	11196	3640	3000	225	6087	6087	8609	3940	8057	8057	3500
+3MBE (+) -1.5M LE	7500	11651	11651	3640	3000	225	6315	6315	8930	3940	8285	8285	3500
+3MBE (+) +0M LE	9000	12106	12106	3640	3000	225	6542	6542	9252	3940	8512	8512	3500
+3MBE (+) +1.5M LE	10500	12561	12561	3640	3000	225	6770	6770	9574	3940	8740	8740	3500
+3MBE (+) +3M LE	12000	13016	13016	3640	3000	225	6998	6998	9896	3940	8968	8968	3500
+6MBE (+) -3M LE	9000	12106	12106	3640	3000	225	6542	6542	9252	3940	8512	8512	3500
+6MBE (+) -1.5M LE	10500	12561	12561	3640	3000	225	6770	6770	9574	3940	8740	8740	3500
+6MBE (+) +0M LE	12000	13016	13016	3640	3000	225	6998	6998	9896	3940	8968	8968	3500
+6MBE (+) +1.5M LE	13500	13472	13472	3640	3000	225	7225	7225	10218	3940	9195	9195	3500
+6MBE (+) +3M LE	15000	13927	13927	3640	3000	225	7453	7453	10540	3940	9423	9423	3500



NOTE:

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- FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.151724138
2 TAN B =	0.303448276
FACB =	1.011444617
DEV =	1.022781175
IN FACE SLOPE	
TAN B =	0.150003
SEC B =	1.0111895

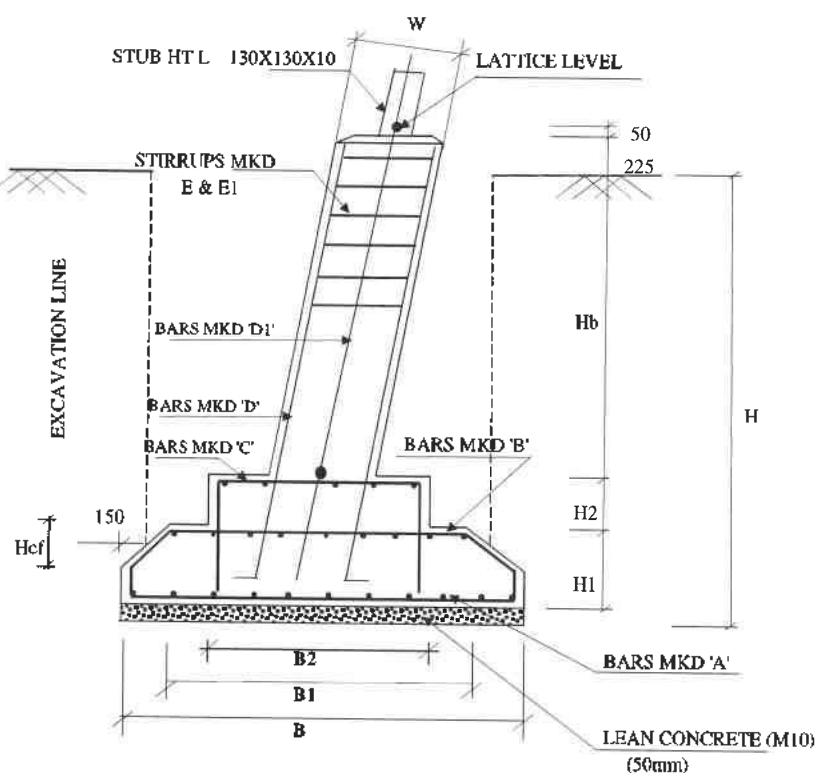
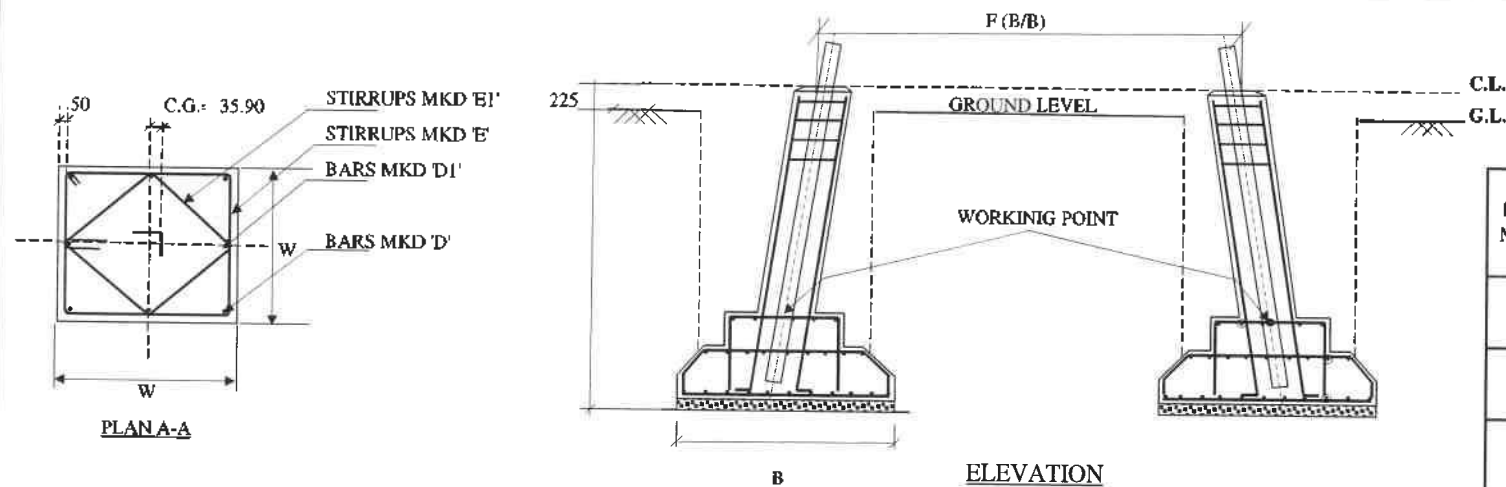
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NOTES:

- DRAWING NOT TO SCALE
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3300 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DAL-3/+0/+3/+6M 400KV D/C (WZ-1) FULLY SUBMERGED SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE	03-08-18	DRAWING NO.	GITPL400DC/WZ-1/DAL/F-004	SHEET NO.	27
		REV			0

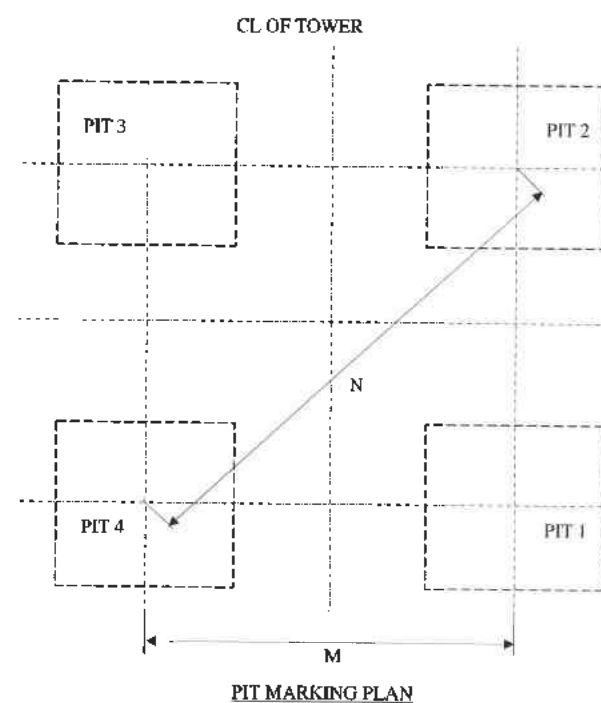
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FOUNDATION ELEVATION (CROSS SECTION)

VERTICAL SLOPE	
TAN B =	0.151724138
2 TAN B =	0.303448276
FACE =	1.011444617
DEV =	1.022761178
IN FACE SLOPE	
TAN B =	0.150003
SEC B =	1.0111885

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	DRY FISSURED ROCK
UNIT WEIGHT (Kg/m ³):	1700
LIMIT BEARING CAPACITY (Kg/m ²):	62500
ANGLE OF REPOSE :	20
WATER TABLE (m) :	BELOW 3.5m FROM G.L.
FOUNDATION DEPTH (m):	3.5



REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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B	H	W	B1	B2	H1	H2	Hcf	Hb
2170	3500	420	1870	1410	250	200	150	3000

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	2070	PAD REINFORCEMENT	10	26	2070	0.62	33.23	132.90
B	1770 50 141 141 50	PAD REINFORCEMENT	10	16	2153	0.62	21.28	85.10
C	1310 330 50 50 330	PAD REINFORCEMENT	10	18	2070	0.62	22.99	91.96
D	3535	CHIMNEY BAR	20	4	3835	2.46	37.81	151.27
D1	300	CHIMNEY BAR	20	4	3835	2.46	37.81	151.27
E	320 320	CHIMNEY SQUARE SPACER	8	13	1472	0.39	7.55	30.21
E1	226 226	CHIMNEY SQUARE SPACER	8	13	1097	0.39	5.62	22.50
TOTAL REINFORCEMENT/ TOWER=								665.2

NOTES:

1. DRAWING NOT TO SCALE
2. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
3. CONCRETE MIX USED M20. LEAN CONCRETE MIX M10.
4. REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFORMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
5. STUB BELOW GROUND LEVEL = 3300
6. WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
7. FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
8. CLEAR COVER TO REINFORCEMENT IS 50MM
9. STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
10. AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	8.2
CONCRETE (M10) m ³	0.94
TOTAL CONCRETE m ³	9.14
EXCAVATION m ³	50.04
REINFORCEMENT Kg	665.2

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REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT	400KV D/C XELDAM-NARENDRA TRANSMISSION LTD				
CLIENT	STERLITE POWER GRID VENTURES LIMITED				
DESIGNER:	STERLITE POWER GRID VENTURES LIMITED				
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DAL-3/+0/+3/+6M 400KV D/C (WZ-1) DRY FISSURED ROCK SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE	03-08-18	DRAWING NO.	GTTP4/400DC/WZ-1/DAL/F-005	SHEET NO.	1/2 REV 0

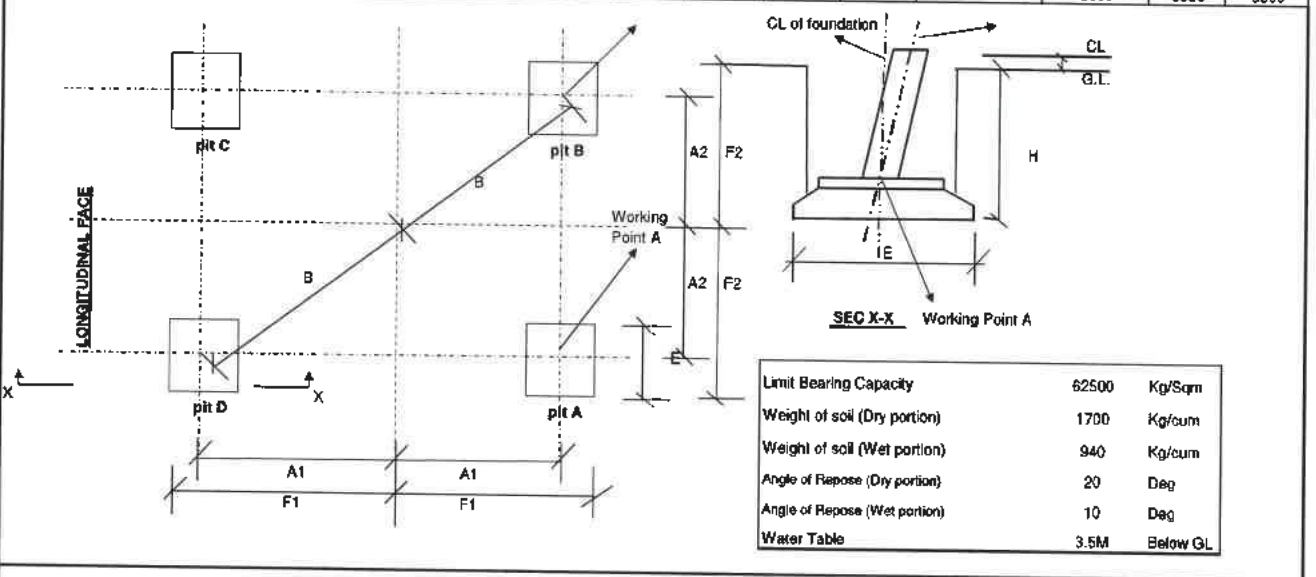
Project
GOA

400 KV D/C -X-M & X-N (WZ-1) - TT "DAL" SOIL TYPE - DFR

PIT DIMENSION TABLE

Client:
SPGVL

400 KV D/C-X-M & X-N- TT "DAL"		* F * B/B of Tower at 3MBE(+)-3MLE (TF)		* F * B/B of Tower at 3MBE(+)-3MLE (LF)		Stub Section (H/T)		Lattice Level to CL	cg	sec B1	2°Tan B1	sec B2	2°Tan B2
		9432		9432		130X130X10		50	35.9	1.011445	0.303448276	1.011445	0.3034483
Tower Detail	Extn from 3MBE(+)-3MLE (mm)	cg-cg dim at CL (TF)	cg-cg dim at CL (LF)	Foundation Base Width	work pl	G.L. TO C.L.	A1	A2	B	E	F1	F2	H
-3MBE (+) -3M LE	0	9375	9375	2170	3000	225	5177	5177	7321	2170	6262	6262	3500
-3MBE (+) -1.5M LE	1500	9830	9830	2170	3000	225	5404	5404	7643	2170	6489	6489	3500
-3MBE (+) +0M LE	3000	10285	10285	2170	3000	225	5632	5632	7965	2170	6717	6717	3500
-3MBE (+) +1.5M LE	4500	10741	10741	2170	3000	225	5860	5860	8287	2170	6945	6945	3500
-3MBE (+) +3M LE	6000	11196	11196	2170	3000	225	6087	6087	8609	2170	7172	7172	3500
+0MBE (+) -3M LE	3000	10285	10285	2170	3000	225	5632	5632	7965	2170	6717	6717	3500
+0MBE (+) -1.5M LE	4500	10741	10741	2170	3000	225	5860	5860	8287	2170	6945	6945	3500
+0MBE (+) +0M LE	6000	11196	11196	2170	3000	225	6087	6087	8609	2170	7172	7172	3500
+0MBE (+) +1.5M LE	7500	11651	11651	2170	3000	225	6315	6315	8930	2170	7400	7400	3500
+0MBE (+) +3M LE	9000	12106	12106	2170	3000	225	6542	6542	9252	2170	7627	7627	3500
+3MBE (+) -3M LE	6000	11196	11196	2170	3000	225	6087	6087	8609	2170	7172	7172	3500
+3MBE (+) -1.5M LE	7500	11651	11651	2170	3000	225	6315	6315	8930	2170	7400	7400	3500
+3MBE (+) +0M LE	9000	12106	12106	2170	3000	225	6542	6542	9252	2170	7627	7627	3500
+3MBE (+) +1.5M LE	10500	12561	12561	2170	3000	225	6770	6770	9574	2170	7855	7855	3500
+3MBE (+) +3M LE	12000	13016	13016	2170	3000	225	6998	6998	9896	2170	8083	8083	3500
+6MBE (+) -3M LE	9000	12106	12106	2170	3000	225	6542	6542	9252	2170	7627	7627	3500
+6MBE (+) -1.5M LE	10500	12561	12561	2170	3000	225	6770	6770	9574	2170	7855	7855	3500
+6MBE (+) +0M LE	12000	13016	13016	2170	3000	225	6998	6998	9896	2170	8083	8083	3500
+6MBE (+) +1.5M LE	13500	13472	13472	2170	3000	225	7225	7225	10218	2170	8310	8310	3500
+6MBE (+) +3M LE	15000	13927	13927	2170	3000	225	7453	7453	10540	2170	8538	8538	3500



NOTE:

- BEFORE START OF THE FOUNDATION ACTIVITY, ALL THE RELEVANT INFORMATION PROVIDED IN THE TECHNICAL NOTES AND FOUNDATION DRAWINGS SHALL BE READ AND UNDERSTOOD. IF ANY ERROR OR CHANGES ARE OBSERVED, SAME SHALL BE INTIMATED TO ENGINEERING TEAM FOR CORRECTIVE ACTION.
- FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.151724138
2 TAN B =	0.303448276
FACE =	1.011444617
DEV =	1.022761178
IN FACE SLOPE	
TAN B =	0.150003
SEC B =	1.0111805

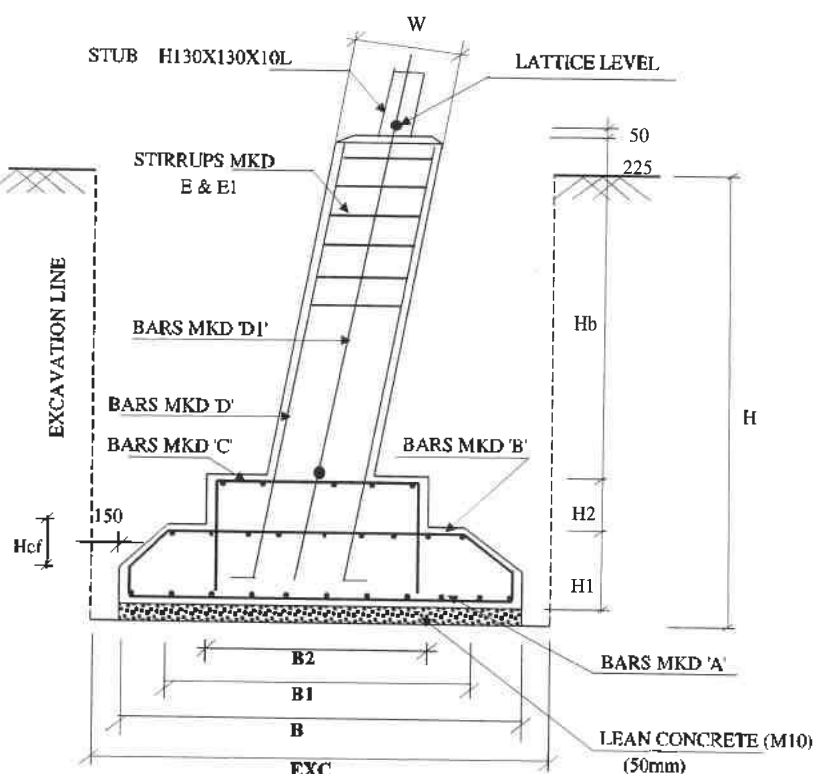
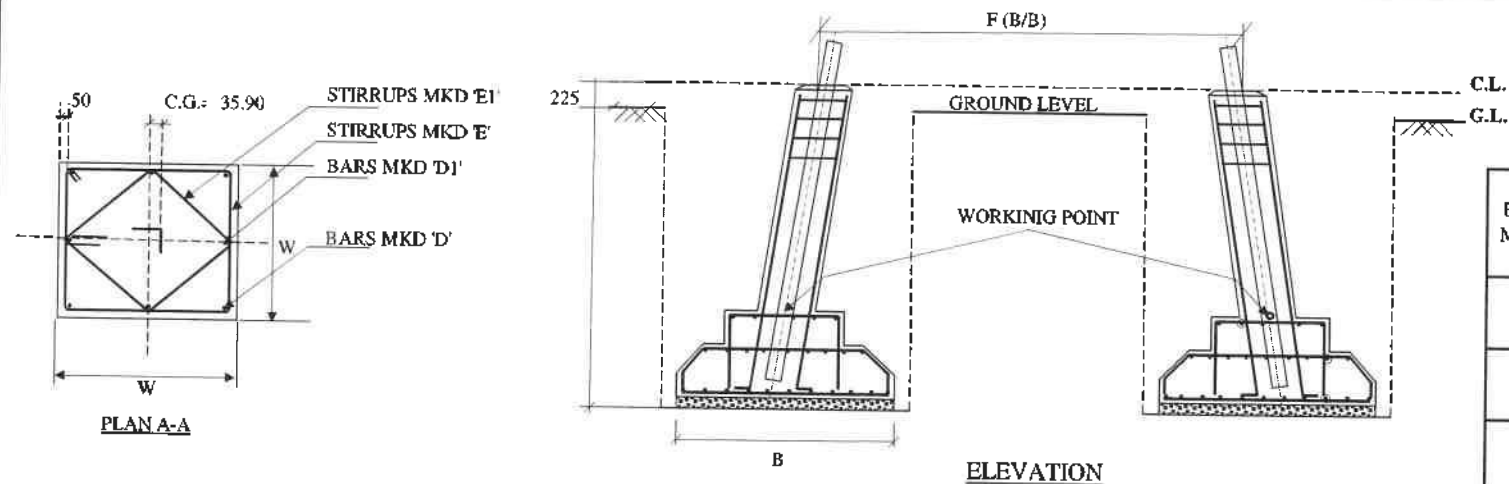
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NOTES:

- DRAWING NOT TO SCALE
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- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3300 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

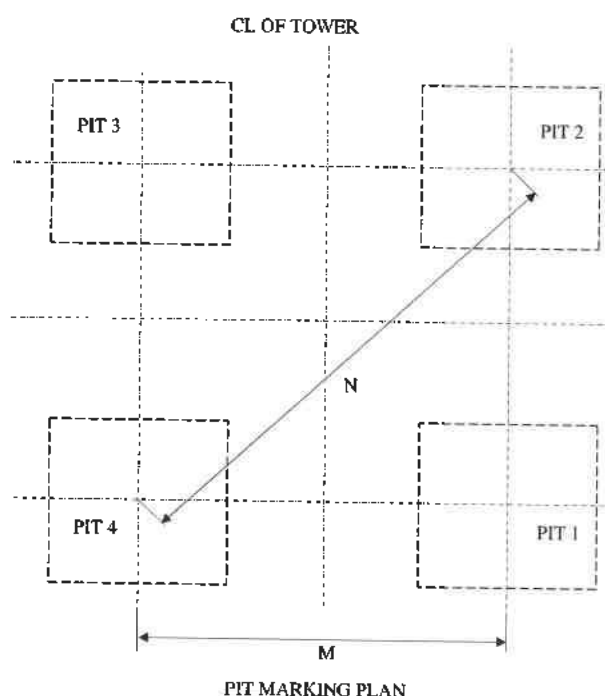
REV. NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DAL-3/+0/+3/+6M 400KV D/C (WZ-1) DRY FISSURED ROCK SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE:	03-08-18	DRAWING NO.	GTPL/400KVWZ-1/DALF-005	SHEET NO.	22
				REV	0

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FOUNDATION ELEVATION (CROSS SECTION)

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	DRY
UNIT WEIGHT (Kg/m ³):	1440
LIMIT BEARING CAPACITY (Kg/m ²):	25000
ANGLE OF REPOSE :	30
WATER TABLE (m):	BELOW 3.5m FROM G.L.
FOUNDATION DEPTH (m):	3.5



EXCAVATION PLAN DETAIL			
STUB = H130X130X10L			
TOWER SLOPE = 9.26		2*TAN α = 0.32620278	
B/B WIDTH AT C.L.(mm) = 11588.3			
CG OF STUB(mm) = 35.9			
CG TO CG WIDTH AT C.L.(mm) = 11517			
TOWER TYPE	F B/B AT C.L.	M (CG TO CG) AT WORKING POINT	N
N = NORMAL TOWER	11588	12569	17775
3M BE = ATTACHED TO NT	12567	13548	19160
6M BE = ATTACHED TO NT	13546	14526	20543
9M BE = ATTACHED TO NT	14524	15505	21928

EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
2400	2100	3500	420	1800	1410	250	200	150	3000

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	2000	PAD REINFORCEMENT	10	26	2000	0.62	32.10	128.41
B	1700 50 141 141 50	PAD REINFORCEMENT	10	14	2083	0.62	18.02	72.08
C	1310 330 50 50 330	PAD REINFORCEMENT	10	18	2070	0.62	22.99	91.96
D	3535	CHIMNEY BAR	20	4	3835	2.46	37.81	151.27
D1	300	CHIMNEY BAR	20	4	3835	2.46	37.81	151.27
E	320 320	CHIMNEY SQUARE SPACER	8	13	1472	0.39	7.55	30.21
E1	226 226	CHIMNEY SQUARE SPACER	8	13	1097	0.39	5.62	22.52
TOTAL REINFORCEMENT/ TOWER=								647.7

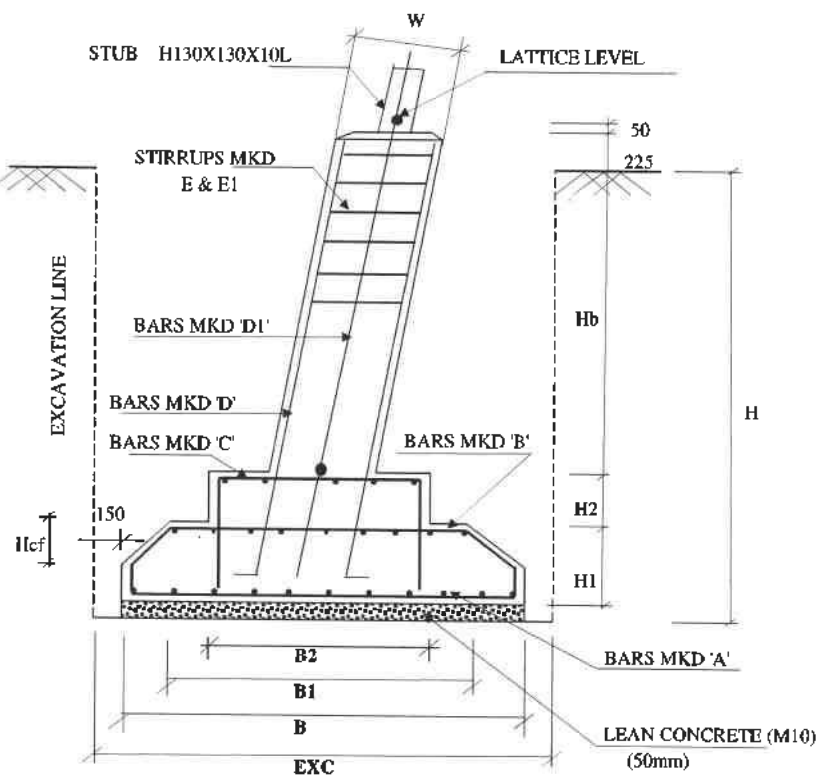
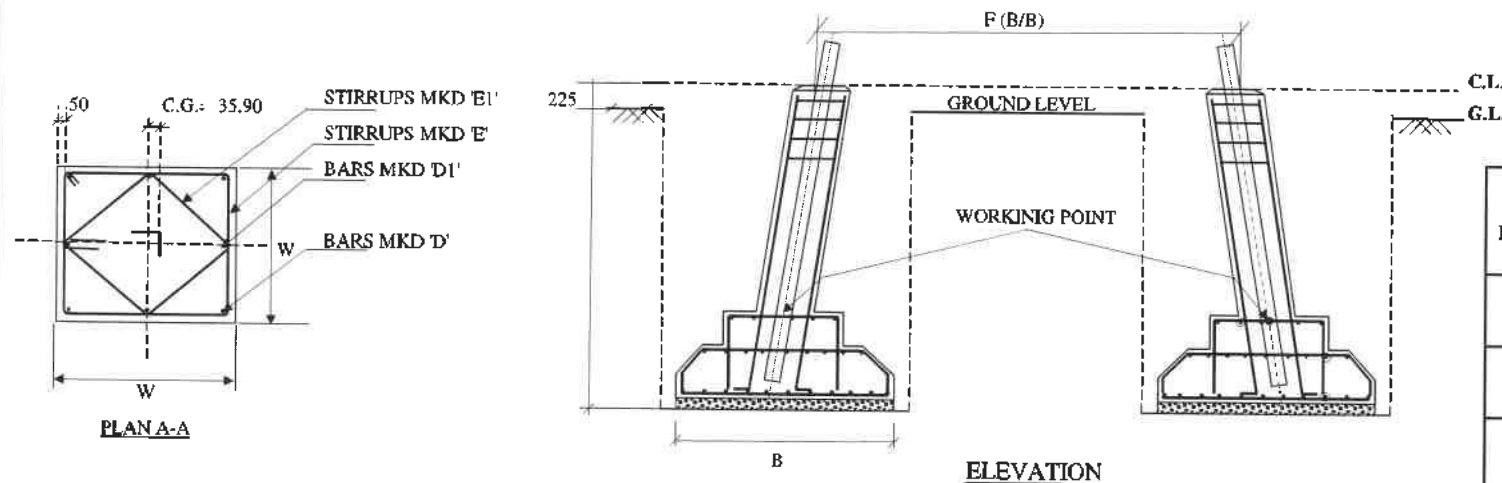
- NOTES:
- 1.DRAWING NOT TO SCALE
 - 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
 - 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
 - 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
 - 5.STUB BELOW GROUND LEVEL = 3300
 - 6.WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
 - 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
 - 8.CLEAR COVER TO REINFORCEMENT IS 50MM
 - 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
 - 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	7.92
CONCRETE (M10) m ³	0.88
TOTAL CONCRETE m ³	8.8
EXCAVATION m ³	80.64
REINFORCEMENT Kg	647.7

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REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM - NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DA+0/+3/+6/+9M 400KV D/C (WZ-1) DRY SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE	03-08-18	DRAWING NO.	KTL400DC/WZ-1/DA/F-001	SHEET NO.	1/1 REV 0

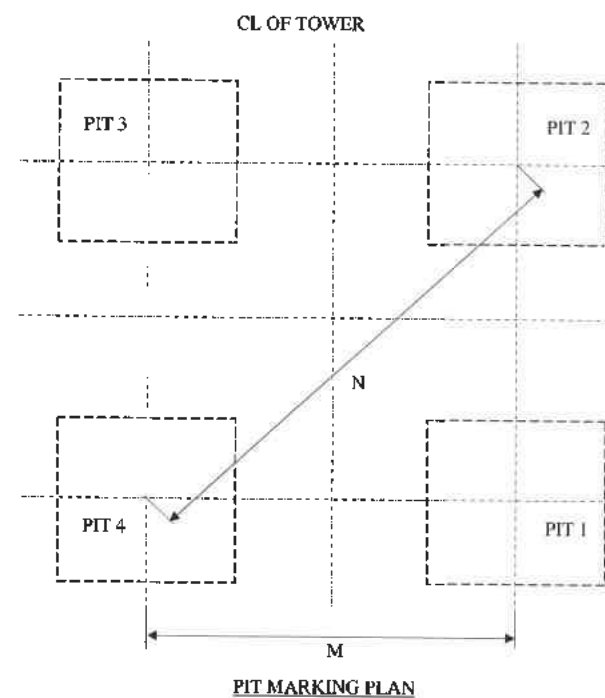
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FOUNDATION ELEVATION (CROSS SECTION)

EXCAVATION PLAN DETAIL			
STUB = H130X130X10L			
TOWER SLOPE = 9.26 2*TAN α = 0.32620278			
B/B WIDTH AT C.L.(mm) = 11588.3			
CG OF STUB(mm) = 35.9			
CG TO CG WIDTH AT C.L.(mm) = 11517			
TOWER TYPE	F B/B AT C.L.	M (CG TO CG) AT WORKING POINT	N
N = NORMAL TOWER	11588	12569	17775
3M BE = ATTACHED TO NT	12567	13548	19160
6M BE = ATTACHED TO NT	13546	14526	20543
9M BE = ATTACHED TO NT	14524	15505	21928

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	WET
UNIT WEIGHT (Kg/m ³):	1440 / 940
LIMIT BEARING CAPACITY (Kg/m ²):	12500
ANGLE OF REPOSE :	30 / 15
WATER TABLE (m) :	1.50 BELOW G.L.
FOUNDATION DEPTH (m):	3.5



EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
3150	2850	3500	420	2550	1410	250	200	150	3000

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	2750	PAD REINFORCEMENT	12	26	2750	0.89	63.51	254.03
B	2450	PAD REINFORCEMENT	10	20	2833	0.62	34.96	139.85
C	1310	PAD REINFORCEMENT	10	18	2062	0.62	22.90	91.61
D	3531	CHIMNEY BAR	20	4	3831	2.46	37.77	151.11
D1	300	CHIMNEY BAR	20	4	3831	2.46	37.77	151.11
E	320	CHIMNEY SQUARE SPACER	8	13	1472	0.39	7.55	30.21
E1	226	CHIMNEY SQUARE SPACER	8	13	1097	0.39	5.62	22.52
TOTAL REINFORCEMENT/ TOWER=								840.4

NOTES:

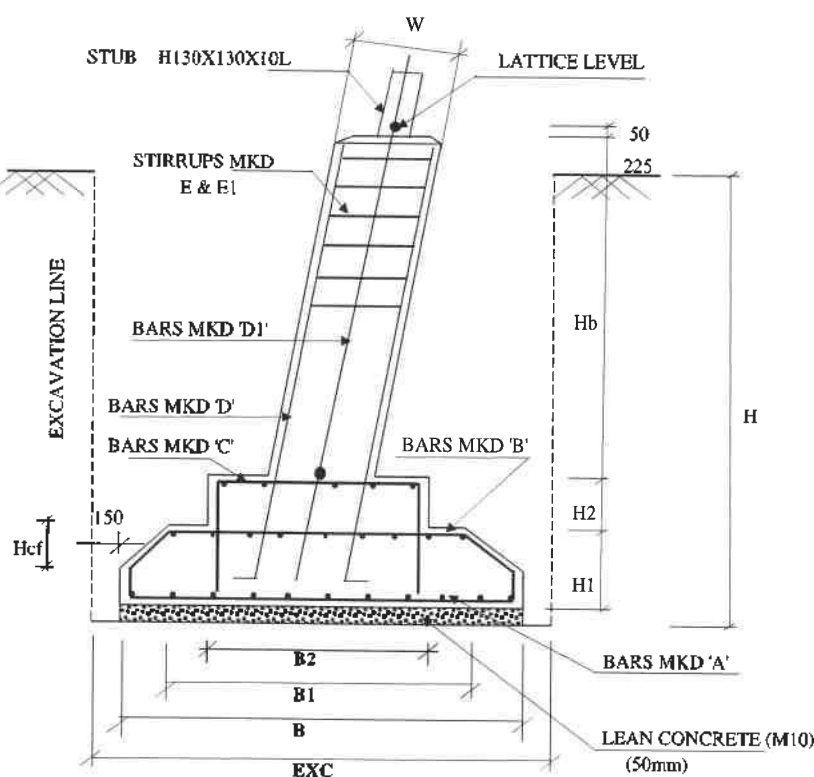
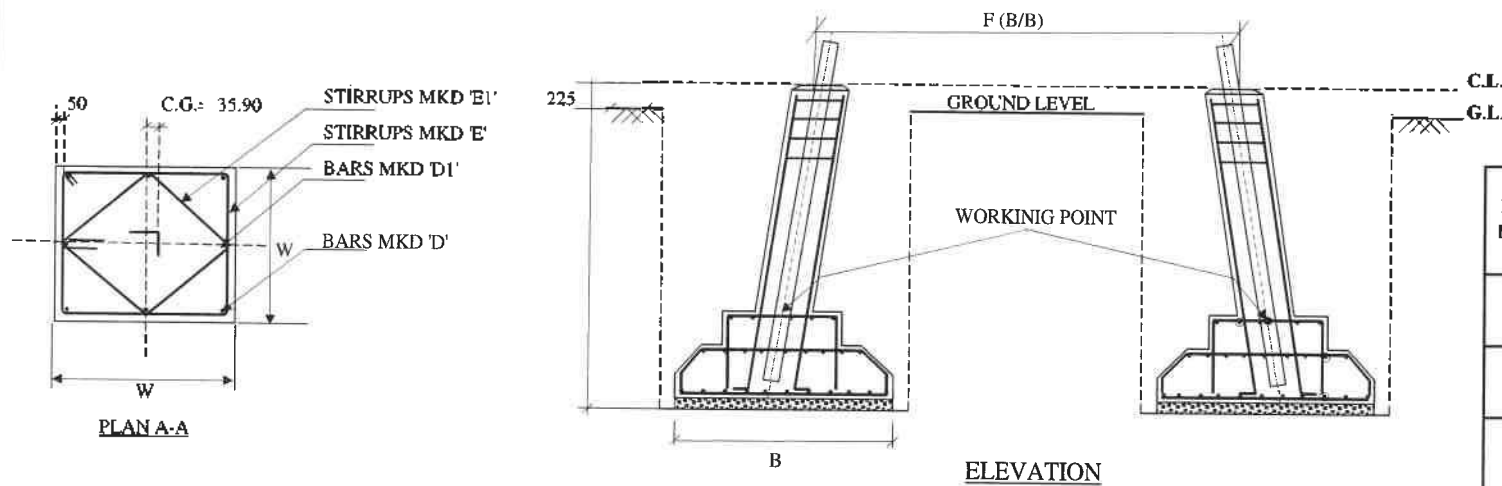
- 1.DRAWING NOT TO SCALE
- 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
- 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
- 5.STUB BELOW GROUND LEVEL = 3300
- 6.WHENEVER NECESSARY TO CLEAR STUB CLEAR FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- 8.CLEAR COVER TO REINFORCEMENT IS 50MM
- 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	11.49
CONCRETE (M10) m ³	1.62
TOTAL CONCRETE m ³	13.11
EXCAVATION m ³	138.92
REINFORCEMENT Kg	841.0

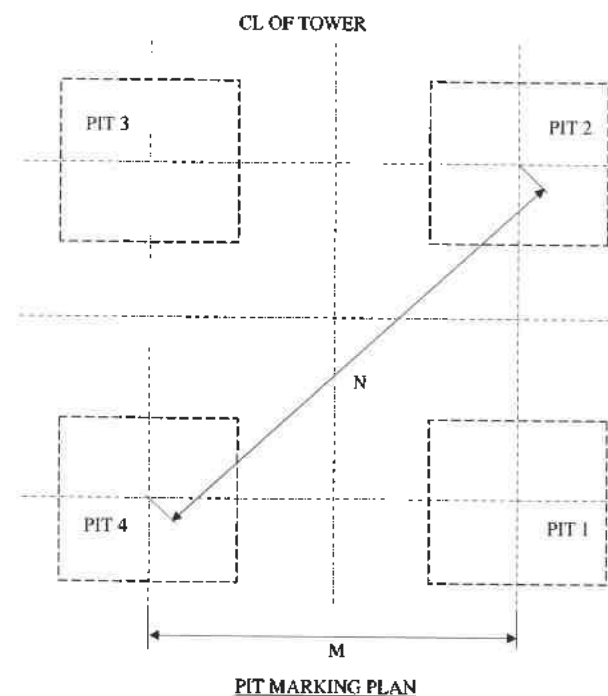
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Engineering Dept.
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REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM - NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DA+0/+3/+6/+9M 400KV D/C (WZ-1) WET SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE	03-08-18	DRAWING NO.	KTL400DC/WZ-1/DA/F-002	SHEET NO.	1/1 REV 0

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FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	PARTIALLY SUBMERGED
UNIT WEIGHT (Kg/m ³):	1440 / 940
LIMIT BEARING CAPACITY (Kg/m ²):	12500
ANGLE OF REPOSE :	30 / 15
WATER TABLE (m) :	0.75 BELOW G.L.
FOUNDATION DEPTH (m):	3.5



EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
3280	2980	3500	420	2680	1410	250	200	150	3000

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	2880	PAD REINFORCEMENT	12	30	2880	0.89	76.73	306.91
B	2580	PAD REINFORCEMENT	10	20	2963	0.62	36.57	146.26
C	1310	PAD REINFORCEMENT	10	18	2062	0.62	22.90	91.61
D	3531	CHIMNEY BAR	20	4	3831	2.46	37.77	151.11
D1	300	CHIMNEY BAR	20	4	3831	2.46	37.77	151.11
E	320	CHIMNEY SQUARE SPACER	8	13	1472	0.39	7.55	30.21
E1	226	CHIMNEY SQUARE SPACER	8	13	1097	0.39	5.62	22.52
TOTAL REINFORCEMENT/ TOWER=								899.7

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	12.23
CONCRETE (M10) m ³	1.78
TOTAL CONCRETE m ³	14.01
EXCAVATION m ³	150.62
REINFORCEMENT Kg	899.7

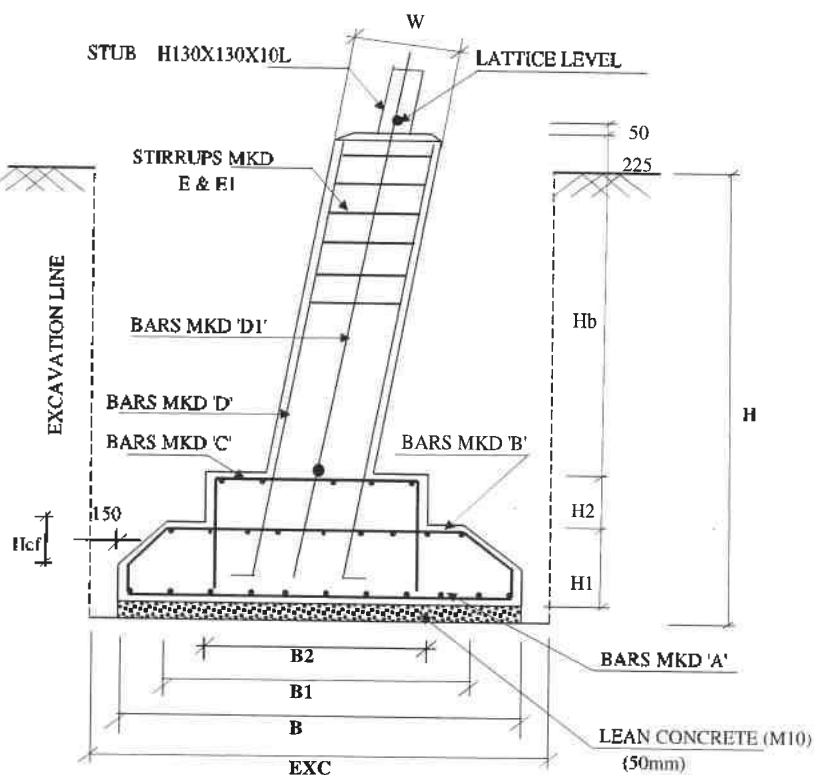
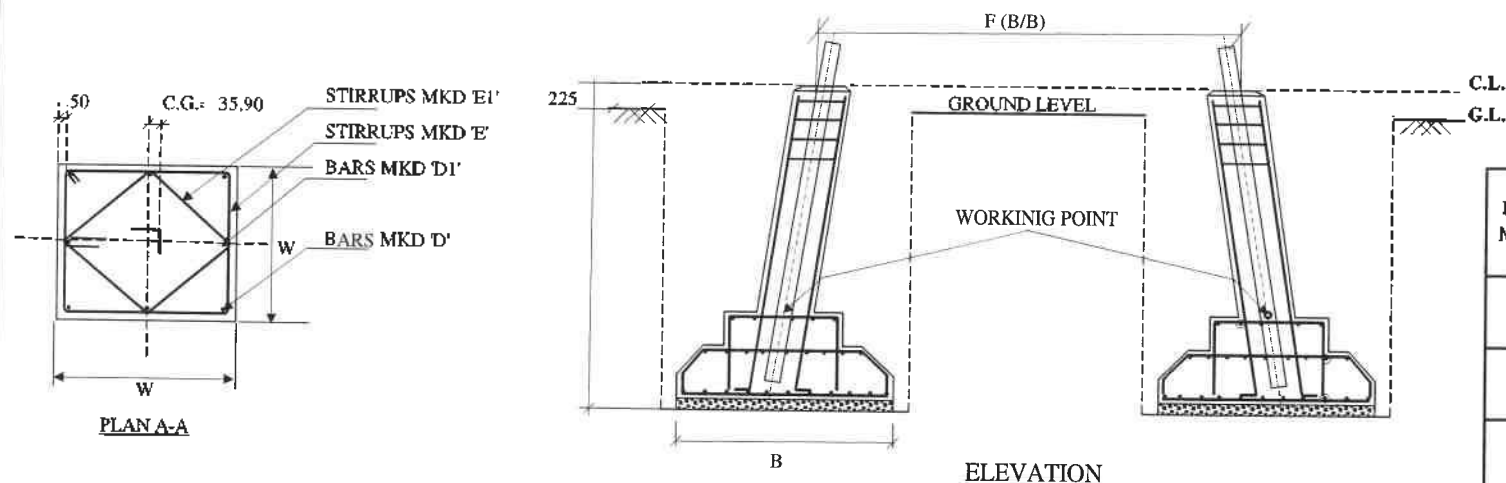
- NOTES:
- 1.DRAWING NOT TO SCALE
 - 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
 - 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
 - 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
 - 5.STUB BELOW GROUND LEVEL = 3300
 - 6.WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
 - 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
 - 8.CLEAR COVER TO REINFORCEMENT IS 50MM
 - 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
 - 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

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ENG/LAT/23 Date: 03/08/18
Engineering Dept.
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EXCAVATION PLAN DETAIL			
STUB = H130X130X10L			
TOWER SLOPE = 9.26 2*TAN α = 0.32620278			
B/B WIDTH AT C.L.(mm) = 11588.3			
CG OF STUB(mm) = 35.9			
CG TO CG WIDTH AT C.L.(mm) = 11517			
TOWER TYPE	F B/B AT C.L	M (CG TO CG) AT WORKING POINT	N
N = NORMAL TOWER	11588	12569	17775
3M BE = ATTACHED TO NT	12567	13548	19160
6M BE = ATTACHED TO NT	13546	14526	20543
9M BE = ATTACHED TO NT	14524	15505	21928

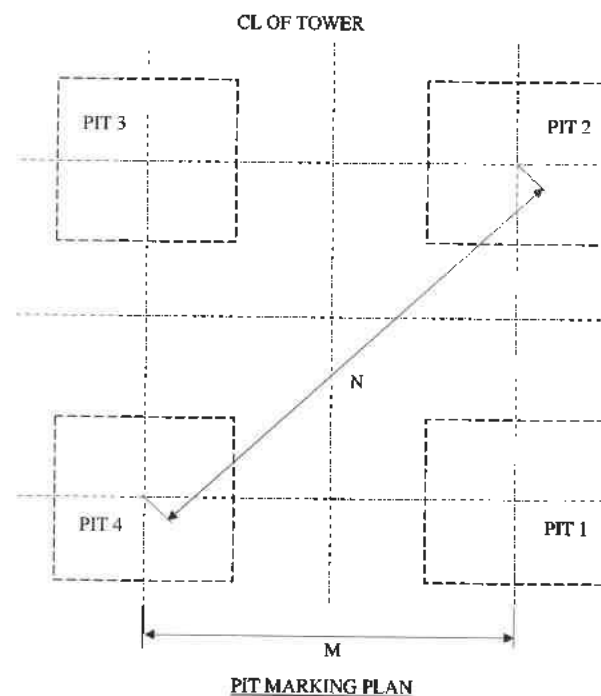
REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT	400KV D/C XELDAM - NARENDRA TRANSMISSION LTD				
CLIENT	STERLITE POWER GRID VENTURES LIMITED				
DESIGNER:	STERLITE POWER GRID VENTURES LIMITED				
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DA+0/+3/+6/+9M 400KV D/C (WZ-1) PARTIALLY SUBMERGED SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE	03-08-18	DRAWING NO.	KTL400DC/WZ-1/DA/F-003	SHEET NO.	1/1 REV 0

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FOUNDATION ELEVATION (CROSS SECTION)

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	FULLY SUBMERGED
UNIT WEIGHT (Kg/m ³):	940
LIMIT BEARING CAPACITY (Kg/m ²):	12500
ANGLE OF REPOSE :	15
WATER TABLE (m):	0m BELOW G.L.
FOUNDATION DEPTH (m):	3.5



EXCAVATION PLAN DETAIL			
STUB = H130X130X10L			
TOWER SLOPE = 9.26		2*TAN α = 0.32620278	
B/B WIDTH AT C.L.(mm) = 11588.3			
CG OF STUB(mm) = 35.9			
CG TO CG WIDTH AT C.L.(mm) = 11517			
TOWER TYPE	F B/B AT C.L.	M (CG TO CG) AT WORKING POINT	N
N = NORMAL TOWER	11588	12569	17775
3M BE = ATTACHED TO NT	12567	13548	19160
6M BE = ATTACHED TO NT	13546	14526	20543
9M BE = ATTACHED TO NT	14524	15505	21928

EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
3650	3350	3500	420	3050	1410	250	200	150	3000

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	3250	PAD REINFORCEMENT	12	32	3250	0.89	92.35	369.38
B	2950	PAD REINFORCEMENT	10	26	3333	0.62	53.45	213.79
C	1310	PAD REINFORCEMENT	10	18	2062	0.62	22.90	91.61
D	3531	CHIMNEY BAR	20	4	3831	2.46	37.77	151.11
D1	300	CHIMNEY BAR	20	4	3831	2.46	37.77	151.11
E	320	CHIMNEY SQUARE SPACER	8	13	1472	0.39	7.55	30.21
E1	226	CHIMNEY SQUARE SPACER	8	13	1097	0.39	5.62	22.52
TOTAL REINFORCEMENT/ TOWER=								1029.7

NOTES:

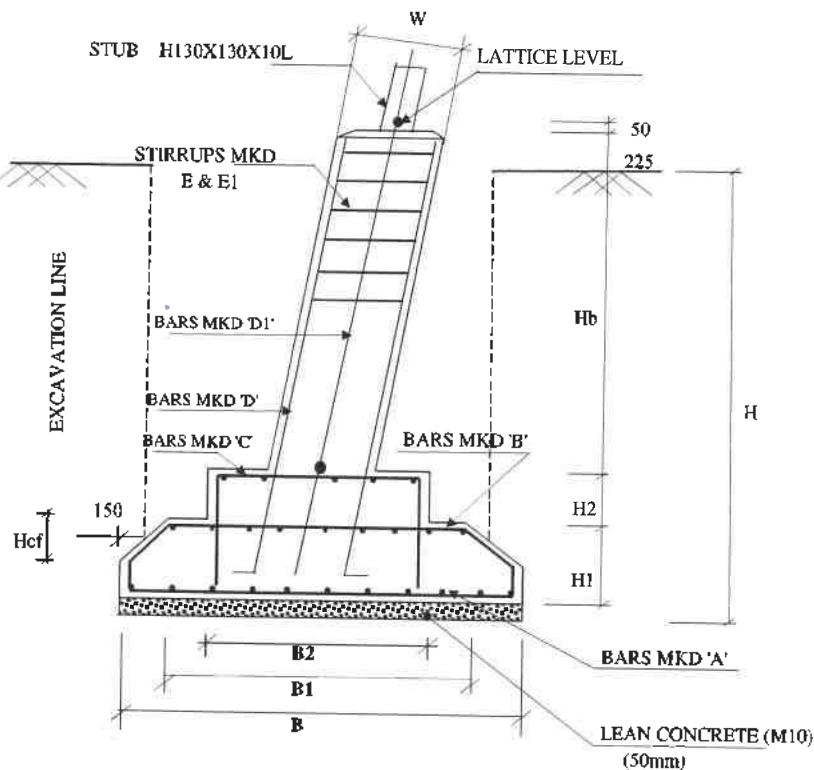
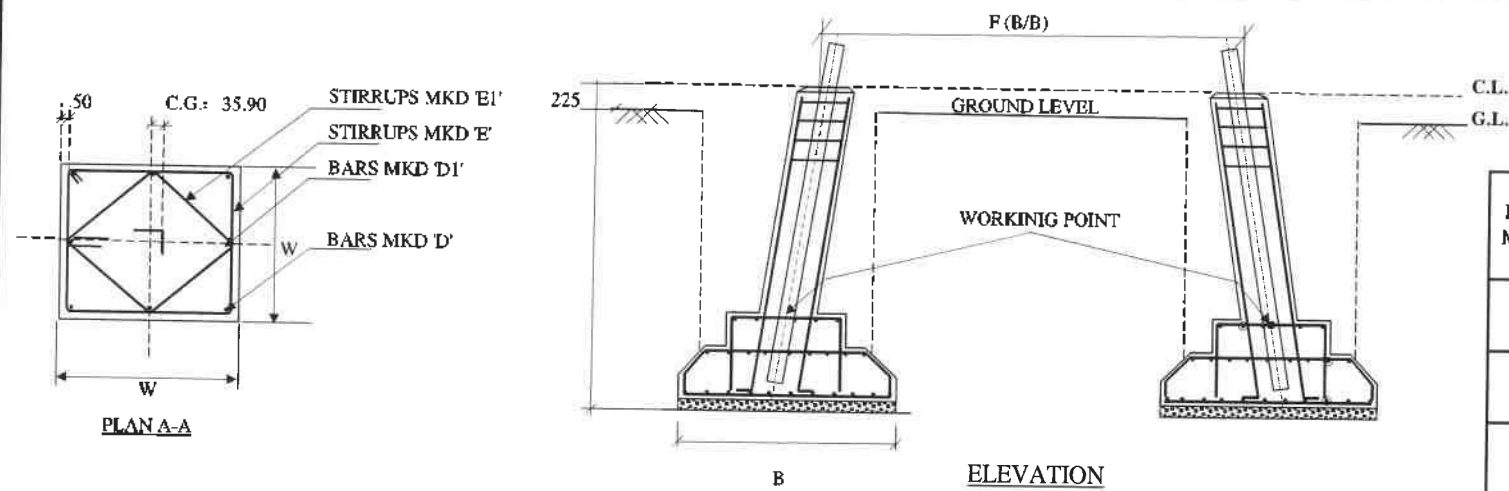
- 1.DRAWING NOT TO SCALE
- 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
- 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
- 5.STUB BELOW GROUND LEVEL = 3300
- 6.WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- 8.CLEAR COVER TO REINFORCEMENT IS 50MM
- 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	14.5
CONCRETE (M10) m ³	2.24
TOTAL CONCRETE m ³	16.74
EXCAVATION m ³	186.52
REINFORCEMENT Kg	1029.7

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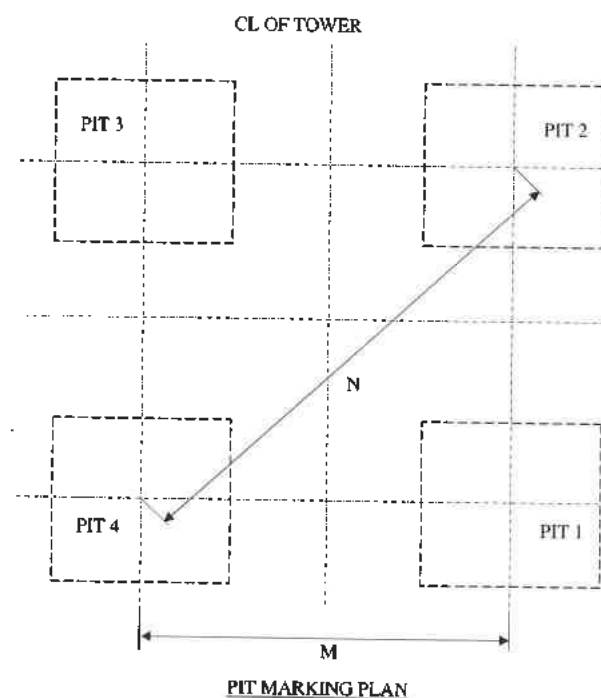
REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM - NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DA+0/+3/+6/+9M 400KV D/C (WZ-1) FULLY SUBMERGED SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE	03-08-18	DRAWING NO.	KTL/400DC/WZ-1/DA/F-004	SHEET NO.	1/1 REV 0

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FOUNDATION ELEVATION (CROSS SECTION)

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	DRY FISSURED ROCK
UNIT WEIGHT (Kg/m ³):	1700
LIMIT BEARING CAPACITY (Kg/m ²):	62500
ANGLE OF REPOSE :	20
WATER TABLE (m) :	BELOW 3.5m FROM G.L.
FOUNDATION DEPTH (m):	3.5



EXCAVATION PLAN DETAIL			
STUB = H130X130X10L			
TOWER SLOPE = 9.26 2*TAN α = 0.32620278			
B/B WIDTH AT C.L. (mm) = 11583.3			
CG OF STUB (mm) = 35.9			
CG TO CG WIDTH AT C.L. (mm) = 11517			
TOWER TYPE	F B/B AT C.L.	M (CG TO CG) AT WORKING POINT	N
N = NORMAL TOWER	11588	12569	17775
3M BE = ATTACHED TO NT	12567	13548	19160
6M BE = ATTACHED TO NT	13546	14526	20543
9M BE = ATTACHED TO NT	14524	15505	21928

B	H	W	B1	B2	H1	H2	Hcf	Hb
2000	3500	420	1700	1410	250	200	150	3000

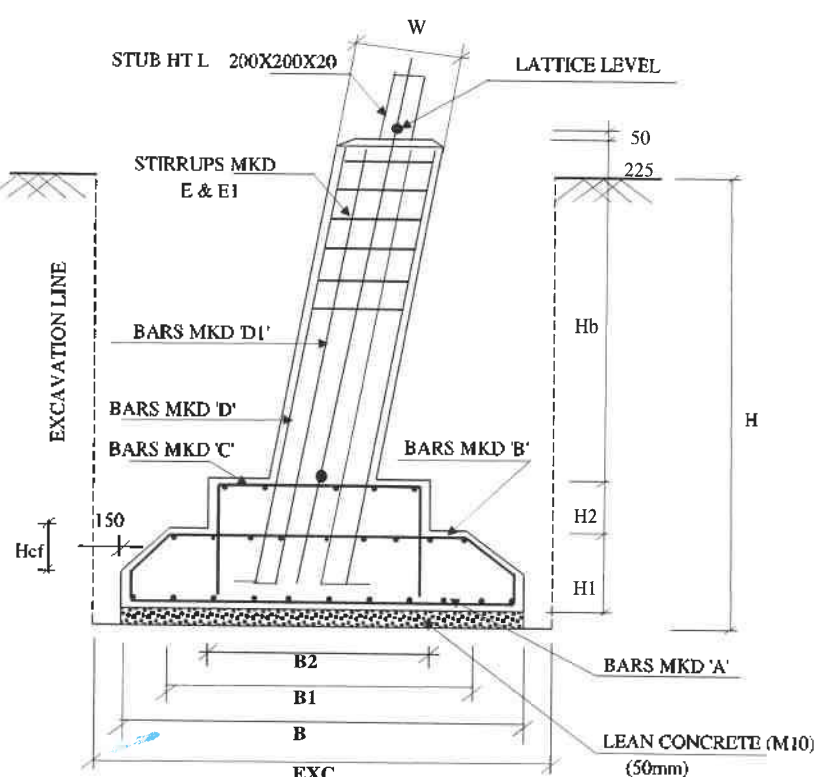
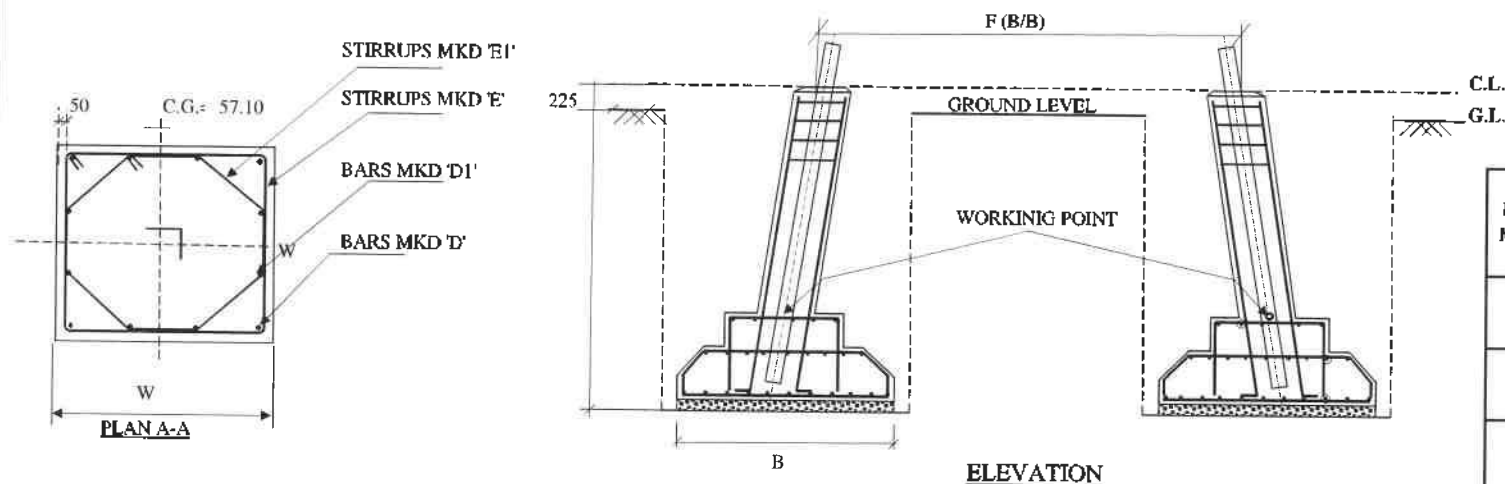
BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	1900	PAD REINFORCEMENT	10	26	1900	0.62	30.50	122.01
B	1600	PAD REINFORCEMENT	10	14	1983	0.62	17.16	68.63
C	1310	PAD REINFORCEMENT	10	18	2070	0.62	22.99	91.96
D	3535	CHIMNEY BAR	20	4	3835	2.46	37.81	151.27
D1	300	CHIMNEY BAR	20	4	3835	2.46	37.81	151.27
E	320	CHIMNEY SQUARE SPACER	8	13	1472	0.39	7.55	30.21
E1	226	CHIMNEY SQUARE SPACER	8	13	1097	0.39	5.62	22.50
TOTAL REINFORCEMENT/ TOWER=								637.8

NOTES:

1. DRAWING NOT TO SCALE
2. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
3. CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
4. REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
5. STUB BELOW GROUND LEVEL = 3300
6. WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
7. FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
8. CLEAR COVER TO REINFORCEMENT IS 50MM
9. STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
10. AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

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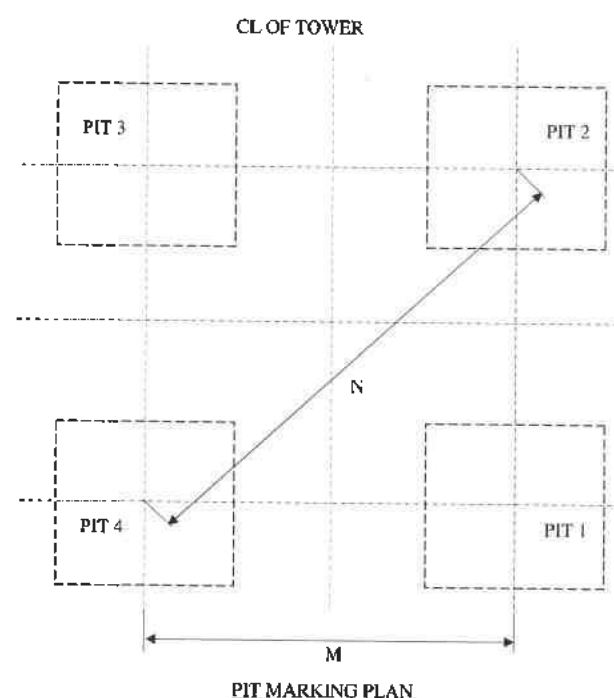
REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM - NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	03-08-18	FOUNDATION DRAWING FOR TOWER TYPE DA+0/+3/+6/+9M 400KV D/C (WZ-1) DRY FISSURED ROCK SOIL (3.5M DEPTH)		
CHKD	AM	03-08-18			
APPD	DL	03-08-18			
DATE	03-08-18	DRAWING NO.	KTL/400DC/WZ-1/DA/F-005	SHEET NO.	I/I REV 0



FOUNDATION ELEVATION (CROSS SECTION)

VERTICAL SLOPE	
TAN B =	0.241965602
2 TAN B =	0.483931204
FACE =	1.028857304
DEV =	1.05692701
IN FACE SLOPE	
TAN B =	0.235178971
SEC B =	1.027282409

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	DRY
UNIT WEIGHT (Kg/m ³):	1440
LIMIT BEARING CAPACITY (Kg/m ²):	25000
ANGLE OF REPOSE :	30
WATER TABLE (m):	BELOW 3.5m FROM G.L.
FOUNDATION DEPTH (m):	4



PIT MARKING PLAN

EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
4400	4100	4000	700	3500	2000	400	300	300	3250

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	4000	PAD REINFORCEMENT	16	50	4000	1.58	315.57	1262.27
B	3400 50 354 354 50	PAD REINFORCEMENT	12	36	4207	0.89	134.45	537.79
C	1900 568 50 50 568	PAD REINFORCEMENT	16	16	3136	1.58	79.18	316.74
D	4011	CHIMNEY BAR	32	4	4511	6.31	113.86	455.46
D1	500	CHIMNEY BAR	32	8	4511	6.31	227.72	910.90
E	600 600	CHIMNEY SQUARE SPACER	8	14	2592	0.39	14.31	57.27
E1	200 283	CHIMNEY SQUARE SPACER	8	14	2123	0.39	11.72	46.92
TOTAL REINFORCEMENT/ TOWER=								3587.3

NOTES:

1. DRAWING NOT TO SCALE
2. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
3. CONCRETE MIX USED M20. LEAN CONCRETE MIX M10.
4. REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
5. STUB BELOW GROUND LEVEL = 3800
6. WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
7. FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
8. CLEAR COVER TO REINFORCEMENT IS 50MM
9. STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
10. AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

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ENG/18/23 Date: 18/08/18
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REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	13-08-18	FOUNDATION DRAWING FOR TOWER TYPE DD-3/+0/+3/+6M 400KV D/C (WZ-1) DRY SOIL (4.0M DEPTH)		
CHKD	AM	13-08-18			
APPD	DL	13-08-18			
DATE	13-08-18	DRAWING NO.	GTTP/400DC/WZ-1/DD/F-001	SHEET NO.	1/2 REV 0

REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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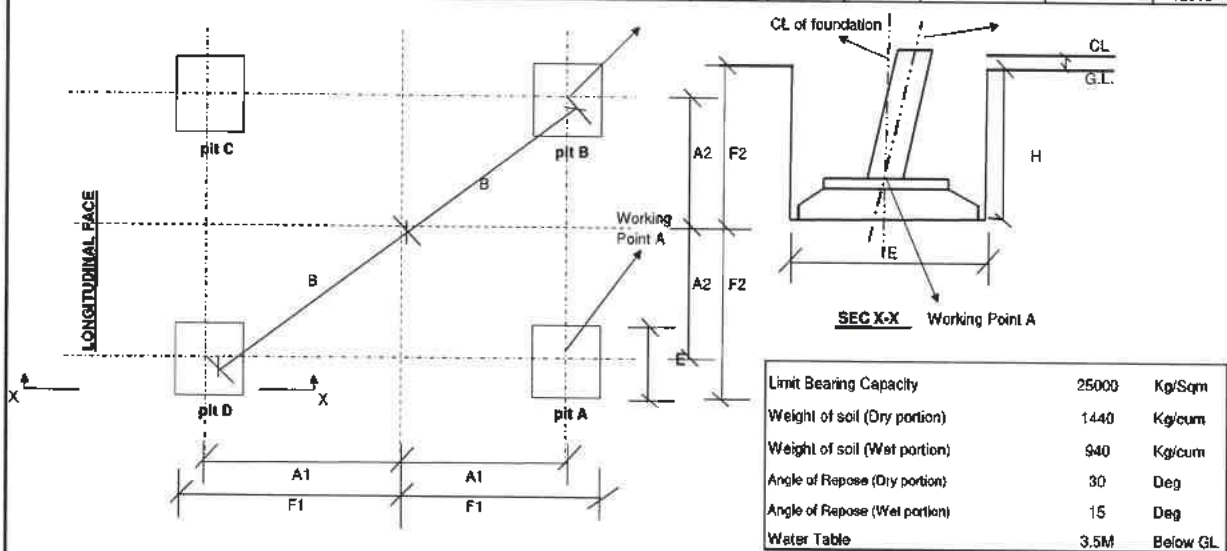
Project
GOA

400 KV D/C -X-M & X-N (WZ-1) - TT "DD" SOIL TYPE - DRY (4.0M DEPTH)

PIT DIMENSION TABLE

Client:
SPQVL

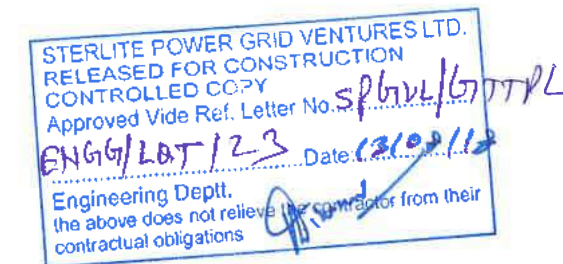
400 KV D/C-X-M & X-N- TT "DD"		* F * B/B of Tower at 3MBE(+)-3MLE (TF)		* F * B/B of Tower at 3MBE(+)-3MLE (LF)		Stub Section (HT)		Lattice Level to CL	cg	sec B1	2°Tan B1	sec B2	2°Tan B2
		12713		12713		200X200X20		50	57.1	1.028857	0.483931204	1.028857	0.4839312
Tower Detail	Extm from -3MBE(+)-3MLE (mm)	cg-cg dim at CL (TF)	cg-cg dim at CL (LF)	Foundation Base Width	work pl	G.L. TO C.L.	A1	A2	B	E	F1	F2	H
-3MBE (+)-3M LE	0	12623	12623	4100	3250	225	7152	7152	10115	4400	9352	9352	4000
-3MBE (+)-1.5M LE	1500	13349	13349	4100	3250	225	7515	7515	10628	4400	9715	9715	4000
-3MBE (+)+0M LE	3000	14074	14074	4100	3250	225	7878	7878	11141	4400	10078	10078	4000
-3MBE (+)+1.5M LE	4500	14800	14800	4100	3250	225	8241	8241	11655	4400	10441	10441	4000
-3MBE (+)+3M LE	6000	15526	15526	4100	3250	225	8604	8604	12168	4400	10804	10804	4000
+0MBE (+)-3M LE	3000	14074	14074	4100	3250	225	7878	7878	11141	4400	10078	10078	4000
+0MBE (+)-1.5M LE	4500	14800	14800	4100	3250	225	8241	8241	11655	4400	10441	10441	4000
+0MBE (+)+0M LE	6000	15526	15526	4100	3250	225	8604	8604	12168	4400	10804	10804	4000
+0MBE (+)+1.5M LE	7500	16252	16252	4100	3250	225	8967	8967	12681	4400	11167	11167	4000
+0MBE (+)+3M LE	9000	16978	16978	4100	3250	225	9330	9330	13194	4400	11530	11530	4000
+3MBE (+)-3M LE	6000	15526	15526	4100	3250	225	8604	8604	12168	4400	10804	10804	4000
+3MBE (+)-1.5M LE	7500	16252	16252	4100	3250	225	8967	8967	12681	4400	11167	11167	4000
+3MBE (+)+0M LE	9000	16978	16978	4100	3250	225	9330	9330	13194	4400	11530	11530	4000
+3MBE (+)+1.5M LE	10500	17704	17704	4100	3250	225	9693	9693	13708	4400	11893	11893	4000
+3MBE (+)+3M LE	12000	18430	18430	4100	3250	225	10056	10056	14221	4400	12256	12256	4000
+6MBE (+)-3M LE	9000	16978	16978	4100	3250	225	9330	9330	13194	4400	11530	11530	4000
+6MBE (+)-1.5M LE	10500	17704	17704	4100	3250	225	9693	9693	13708	4400	11893	11893	4000
+6MBE (+)+0M LE	12000	18430	18430	4100	3250	225	10056	10056	14221	4400	12256	12256	4000
+6MBE (+)+1.5M LE	13500	19156	19156	4100	3250	225	10419	10419	14734	4400	12619	12619	4000
+6MBE (+)+3M LE	15000	19882	19882	4100	3250	225	10782	10782	15248	4400	12982	12982	4000



NOTE:

- BEFORE START OF THE FOUNDATION ACTIVITY, ALL THE RELEVANT INFORMATION PROVIDED IN THE TECHNICAL NOTES AND FOUNDATION DRAWINGS SHALL BE READ AND UNDERSTOOD. IF ANY ERROR OR CHANGES ARE OBSERVED, SAME SHALL BE INTIMATED TO ENGINEERING TEAM FOR CORRECTIVE ACTION.
- FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.241965802
2 TAN B =	0.483931204
FACE =	1.028857304
DEV =	1.05692701
IN FACE SLOPE	
TAN B =	0.235178971
SEC B =	1.027282409

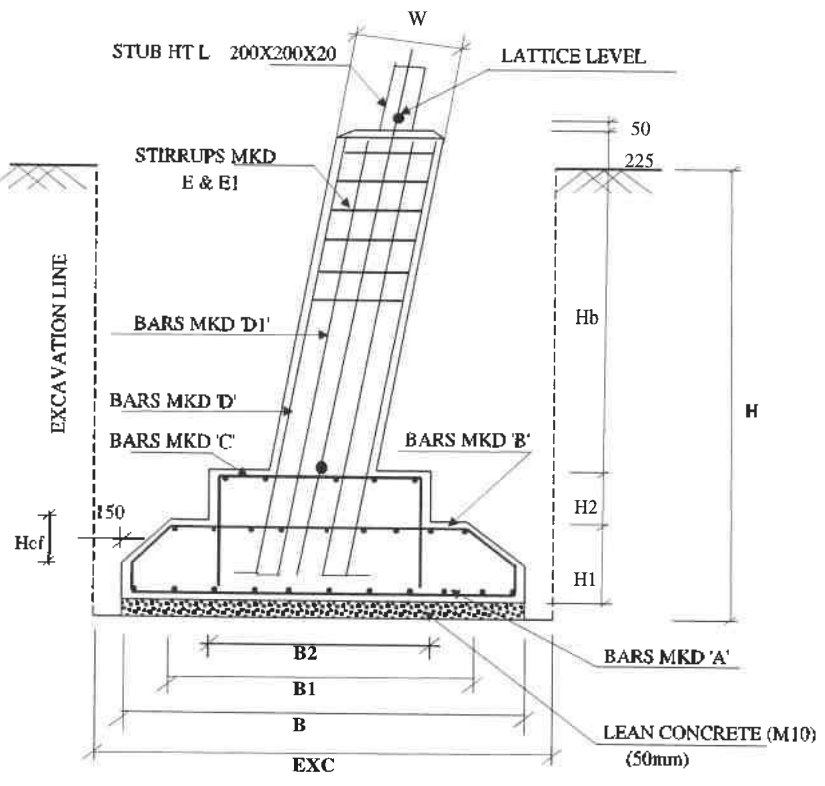
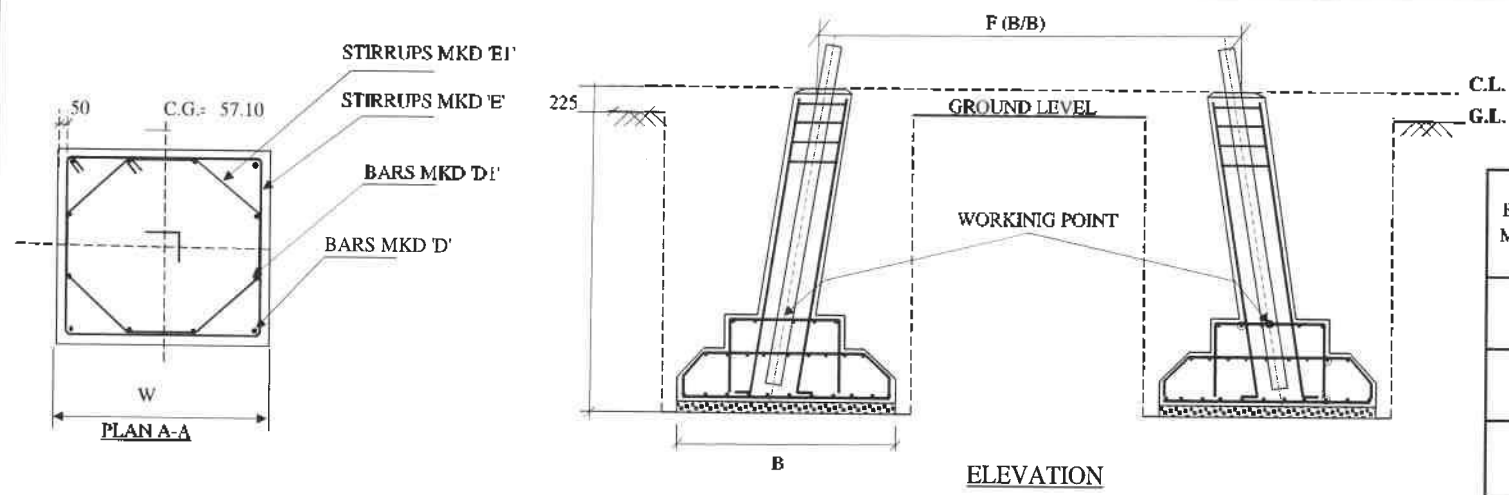


NOTES:

- DRAWING NOT TO SCALE
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3800 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	13-08-18	FOUNDATION DRAWING FOR TOWER TYPE DD-3(+0)+3(+6M 400KV D/C (WZ-1) DRY SOIL (4.0M DEPTH)		
CHKD	AM	13-08-18			
APPD	DL	13-08-18			
DATE	13-08-18	DRAWING NO.	GTTP/40MDGWZ-MDD/F-001	SHEET NO.	2/2 REV 0

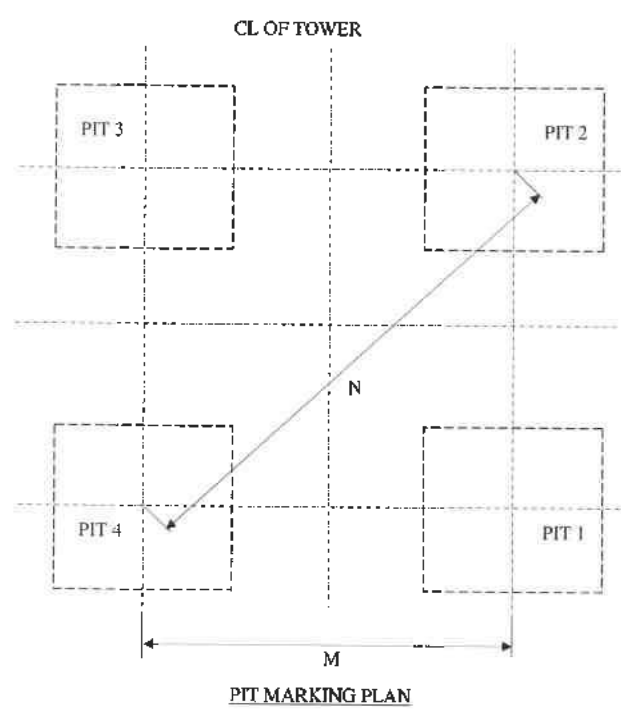
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FOUNDATION ELEVATION (CROSS SECTION)

VERTICAL SLOPE	
TAN B =	0.241965602
2 TAN B =	0.483931204
FACE =	1.028857304
DEV =	1.05692701
IN FACE SLOPE	
TAN B =	0.235178971
SEC B =	1.027282409

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	WET
UNIT WEIGHT (Kg/m ³):	1440 / 940
LIMIT BEARING CAPACITY (Kg/m ²):	12500
ANGLE OF REPOSE :	30 / 15
WATER TABLE (m) :	1.50 BELOW G.L.
FOUNDATION DEPTH (m):	4



PIT MARKING PLAN

EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
5900	5600	4000	700	5000	2000	400	300	300	3250

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	5500	PAD REINFORCEMENT	16	72	5500	1.58	624.76	2499.06
B	4900 50 354 354 50	PAD REINFORCEMENT	16	44	5707	1.58	396.19	1584.76
C	1900 568 50 50 568	PAD REINFORCEMENT	16	16	3136	1.58	79.18	316.74
D	4011	CHIMNEY BAR	32	4	4511	6.31	113.86	455.46
D1	500	CHIMNEY BAR	32	8	4511	6.31	227.72	910.90
E	600 600	CHIMNEY SQUARE SPACER	8	14	2592	0.39	14.31	57.27
E1	200 283	CHIMNEY SQUARE SPACER	8	14	2123	0.39	11.72	46.92
TOTAL REINFORCEMENT/ TOWER=								5871.1

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	57.9
CONCRETE (M10) m ³	6.27
TOTAL CONCRETE m ³	64.17
EXCAVATION m ³	556.96
REINFORCEMENT Kg	5872.0

- NOTES:
- 1.DRAWING NOT TO SCALE
 - 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
 - 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
 - 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
 - 5.STUB BELOW GROUND LEVEL = 3800
 - 6.WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
 - 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
 - 8.CLEAR COVER TO REINFORCEMENT IS 50MM
 - 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
 - 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

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ENG/6/LAT/23 Date 13/08/18
Engineering Deptt.
the above does not release the contractor from their contractual obligations

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	13-08-18	FOUNDATION DRAWING FOR TOWER TYPE DD-3/+0/+3/+6M 400KV D/C (WZ-1) WET SOIL (4.0M DEPTH)		
CHKD	AM	13-08-18			
APPD	DL	13-08-18			
DATE	13-08-18	DRAWING NO.	GTTP/L400DC/WZ-1/DD/F-002	SHEET NO.	1/2 REV 0

REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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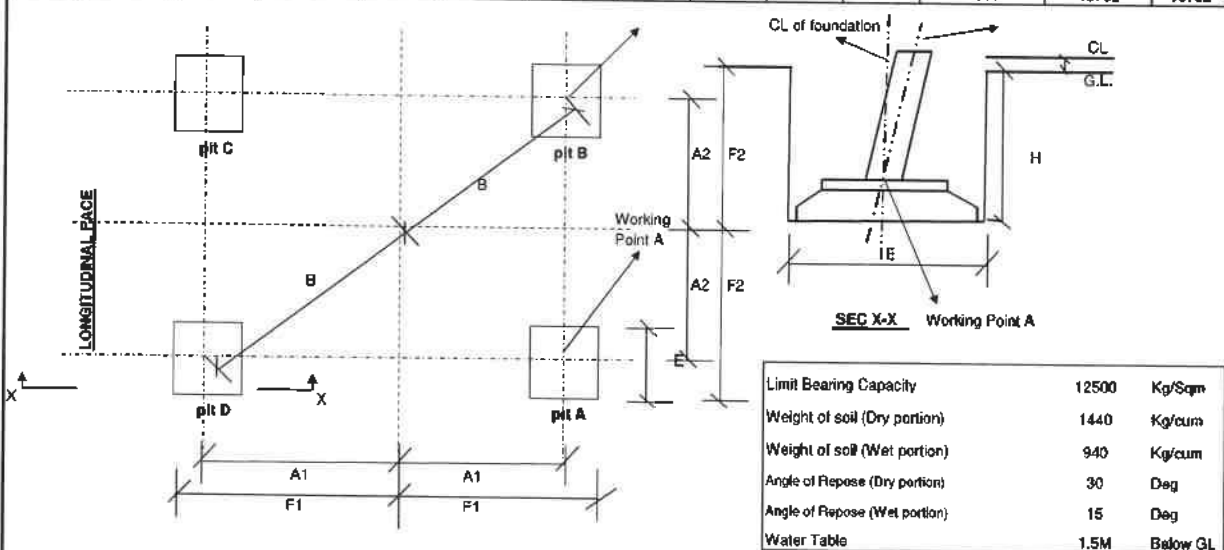
Project
GOA

400 KV D/C -X-M & X-N (WZ-1) - TT "DD" SOIL TYPE - WET (4.0M DEPTH)

PIT DIMENSION TABLE

Client:
SPGVL

400 KV D/C-X-M & X-N- TT "DD"		* F * B/B of Tower at 3MBE(+)-3MLE (TF)		* F * B/B of Tower at 3MBE(+)-3MLE (LF)		Stub Section (HT)		Lattice Level to CL	cg	sec B1	2* Tan B1	sec B2	2* Tan B2
		12713		12713		200X200X20		50	57.1	1.028857	0.483931204	1.028857	0.4839312
Tower Detail	Exdn from -3MBE(+)-3MLE (mm)	cg-cg dim at CL (TF)	cg-cg dim at CL (LF)	Foundation Base Width	work pl	G.L. TO C.L.	A1	A2	B	E	F1	F2	H
-3MBE (+) -3M LE	0	12623	12623	5600	3250	225	7152	7152	10115	5900	10102	10102	4000
-3MBE (+) -1.5M LE	1500	13349	13349	5600	3250	225	7515	7515	10628	5900	10465	10465	4000
-3MBE (+) +0M LE	3000	14074	14074	5600	3250	225	7878	7878	11141	5900	10828	10828	4000
-3MBE (+) +1.5M LE	4500	14800	14800	5600	3250	225	8241	8241	11655	5900	11191	11191	4000
-3MBE (+) +3M LE	6000	15526	15526	5600	3250	225	8604	8604	12168	5900	11554	11554	4000
+0MBE (+) -3M LE	3000	14074	14074	5600	3250	225	7878	7878	11141	5900	10828	10828	4000
+0MBE (+) -1.5M LE	4500	14800	14800	5600	3250	225	8241	8241	11655	5900	11191	11191	4000
+0MBE (+) +0M LE	6000	15526	15526	5600	3250	225	8604	8604	12168	5900	11554	11554	4000
+0MBE (+) +1.5M LE	7500	16252	16252	5600	3250	225	8967	8967	12681	5900	11917	11917	4000
+0MBE (+) +3M LE	9000	16978	16978	5600	3250	225	9330	9330	13194	5900	12280	12280	4000
+3MBE (+) -3M LE	6000	15526	15526	5600	3250	225	8604	8604	12168	5900	11554	11554	4000
+3MBE (+) -1.5M LE	7500	16252	16252	5600	3250	225	8967	8967	12681	5900	11917	11917	4000
+3MBE (+) +0M LE	9000	16978	16978	5600	3250	225	9330	9330	13194	5900	12280	12280	4000
+3MBE (+) +1.5M LE	10500	17704	17704	5600	3250	225	9693	9693	13708	5900	12643	12643	4000
+3MBE (+) +3M LE	12000	18430	18430	5600	3250	225	10056	10056	14221	5900	13006	13006	4000
+6MBE (+) -3M LE	9000	16978	16978	5600	3250	225	9330	9330	13194	5900	12280	12280	4000
+6MBE (+) -1.5M LE	10500	17704	17704	5600	3250	225	9693	9693	13708	5900	12643	12643	4000
+6MBE (+) +0M LE	12000	18430	18430	5600	3250	225	10056	10056	14221	5900	13006	13006	4000
+6MBE (+) +1.5M LE	13500	19156	19156	5600	3250	225	10419	10419	14734	5900	13369	13369	4000
+6MBE (+) +3M LE	15000	19882	19882	5600	3250	225	10782	10782	15248	5900	13732	13732	4000



NOTE:

- BEFORE START OF THE FOUNDATION ACTIVITY, ALL THE RELEVANT INFORMATION PROVIDED IN THE TECHNICAL NOTES AND FOUNDATION DRAWINGS SHALL BE READ AND UNDERSTOOD. IF ANY ERROR OR CHANGES ARE OBSERVED, SAME SHALL BE INTIMATED TO ENGINEERING TEAM FOR CORRECTIVE ACTION.
- FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.241965602
2 TAN B =	0.483931204
FACE =	1.028857304
DEV =	1.05692701
IN FACE SLOPE	
TAN B =	0.235178971
SDC B =	1.027262409

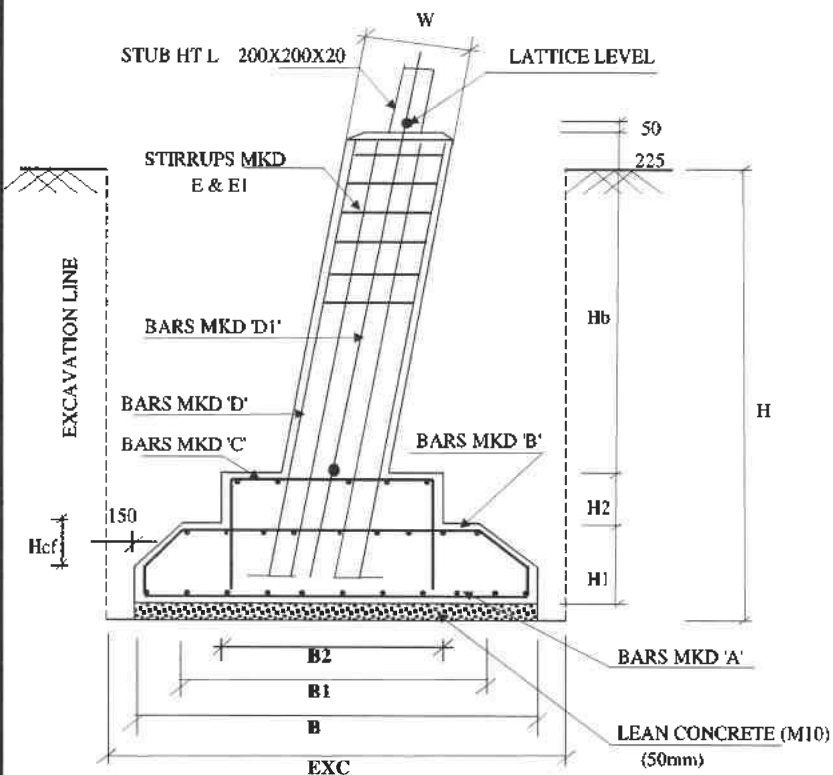
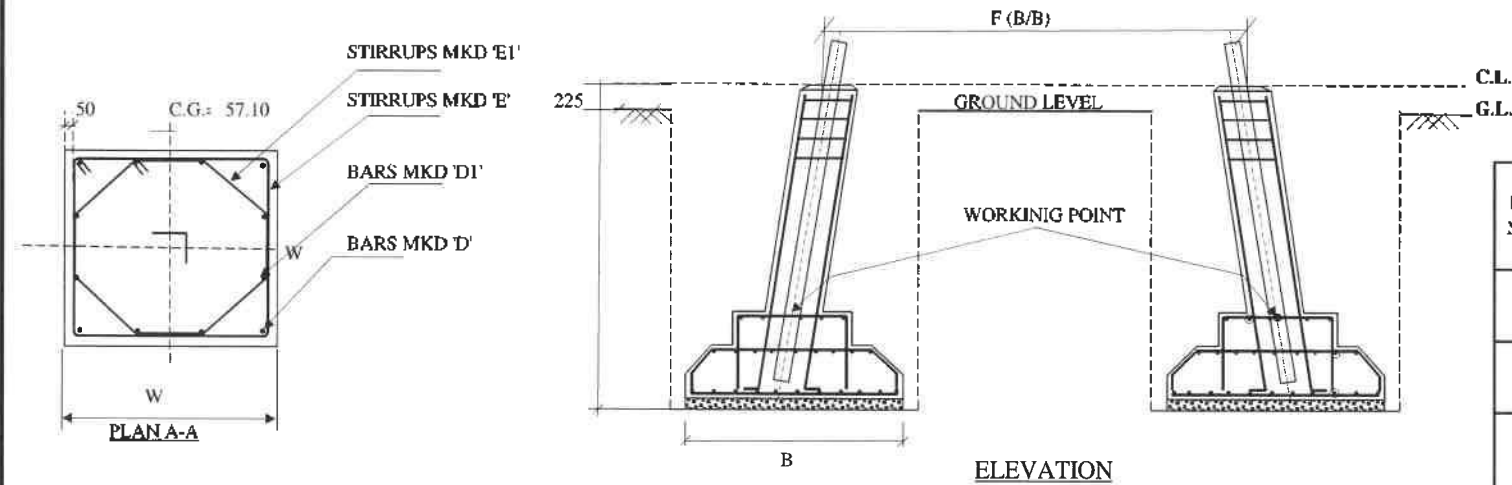
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Engineering Dept.
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NOTES:

- DRAWING NOT TO SCALE
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3800 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	13-08-18	FOUNDATION DRAWING FOR TOWER TYPE DD-3A/0A+3A/4M 400KV D/C (WZ-1) WET SOIL (4.0M DEPTH)		
CHKD	AM	13-08-18			
APPD	DL	13-08-18			
DATE	13-08-18	DRAWING NO.	GTTL400DC/WZ-4/DDMF-002	SHEET NO.	22
		REV			0

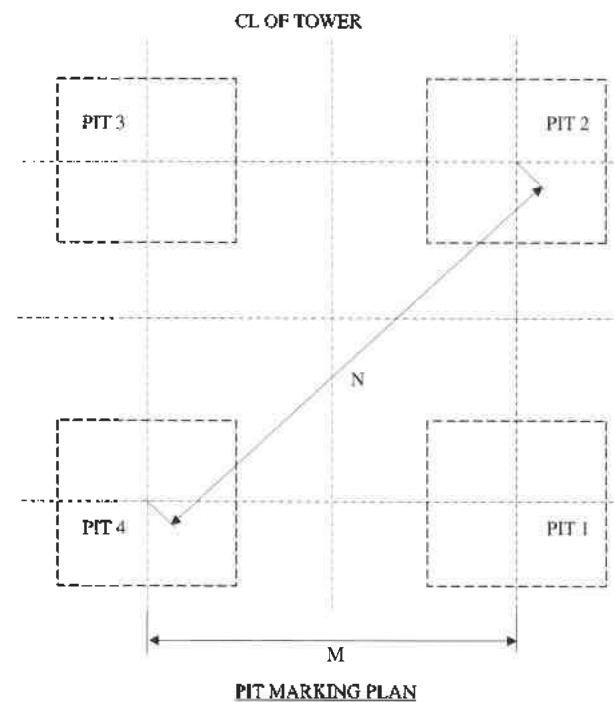
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FOUNDATION ELEVATION (CROSS SECTION)

VERTICAL SLOPE	
TAN B =	0.241965602
2 TAN B =	0.483931204
FACE =	1.028857304
DEV =	1.05692701
IN FACE SLOPE	
TAN B =	0.235178971
SEC B =	1.027282409

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	PARTIALLY SUBMERGED
UNIT WEIGHT (Kg/m ³):	1440 / 940
LIMIT BEARING CAPACITY (Kg/m ²):	12500
ANGLE OF REPOSE :	30 / 15
WATER TABLE (m):	0.75 BELOW G.L.
FOUNDATION DEPTH (m):	4



PIT MARKING PLAN

EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
6400	6100	4000	700	5500	2000	400	300	300	3250

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	6000	PAD REINFORCEMENT	16	80	6000	1.58	757.28	3029.11
B	5400 50 354 354 50	PAD REINFORCEMENT	16	52	6207	1.58	509.23	2036.92
C	1900 568 50 50 568	PAD REINFORCEMENT	16	18	3136	1.58	89.08	356.32
D	4011	CHIMNEY BAR	32	4	4511	6.31	113.86	455.46
D1	500	CHIMNEY BAR	32	8	4511	6.31	227.72	910.90
E	600 600	CHIMNEY SQUARE SPACER	8	14	2592	0.39	14.31	57.27
E1	200 283	CHIMNEY SQUARE SPACER	8	14	2123	0.39	11.72	46.92
TOTAL REINFORCEMENT/ TOWER=								6892.9

NOTES:

- 1.DRAWING NOT TO SCALE
- 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
- 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
- 5.STUB BELOW GROUND LEVEL = 3800
- 6.WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- 8.CLEAR COVER TO REINFORCEMENT IS 50MM
- 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

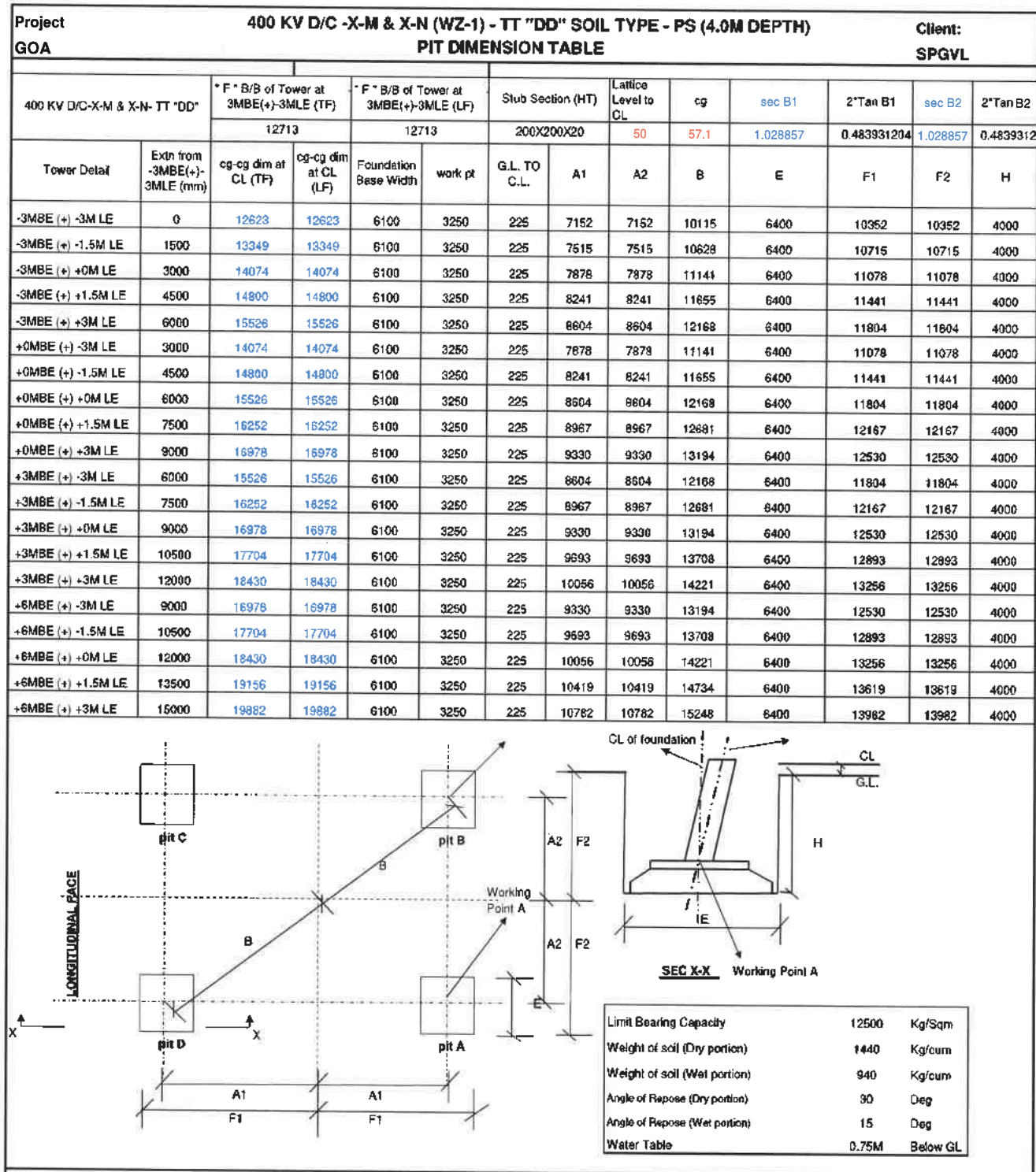
QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	66.9
CONCRETE (M10) m ³	7.44
TOTAL CONCRETE m ³	74.34
EXCAVATION m ³	655.36
REINFORCEMENT Kg	6892.9

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REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	13-08-18	FOUNDATION DRAWING FOR TOWER TYPE DD-3/+0/+3/+6M 400KV D/C (WZ-1) PARTIALLY SUBMERGED SOIL (4.0M DEPTH)		
CHKD	AM	13-08-18			
APPD	DL	13-08-18			
DATE	13-08-18	DRAWING NO.	GTTPU400DC/WZ-1/DD/F-003	SHEET NO.	1/1 REV 0

REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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- FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.241965602
2 TAN B =	0.483931204
FACE =	1.028857304
DEV =	1.05692701
IN FACE SLOPE	
TAN B =	0.235178971
SEC B =	1.027262409

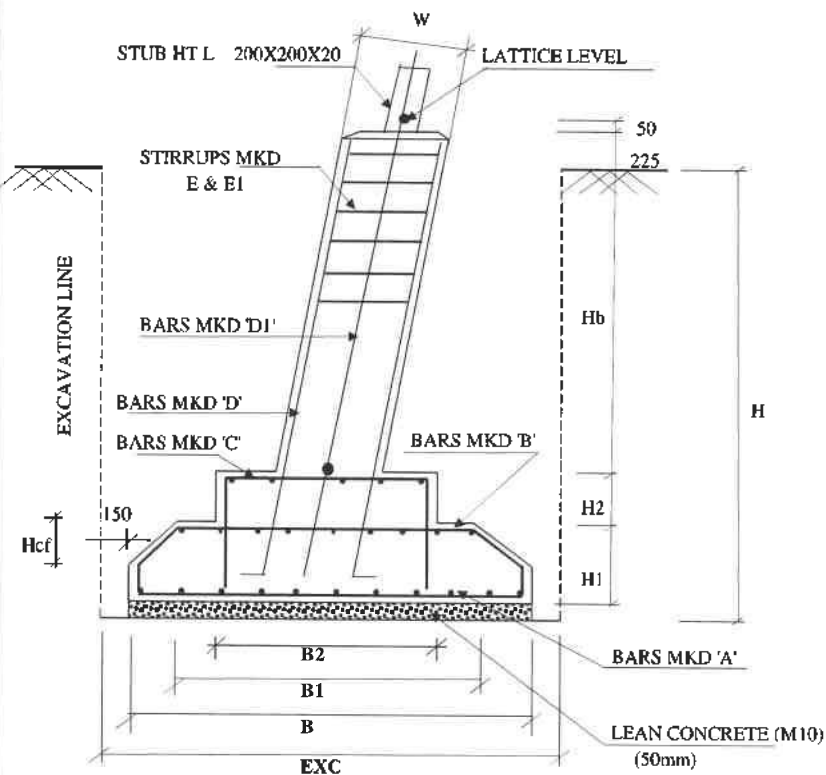
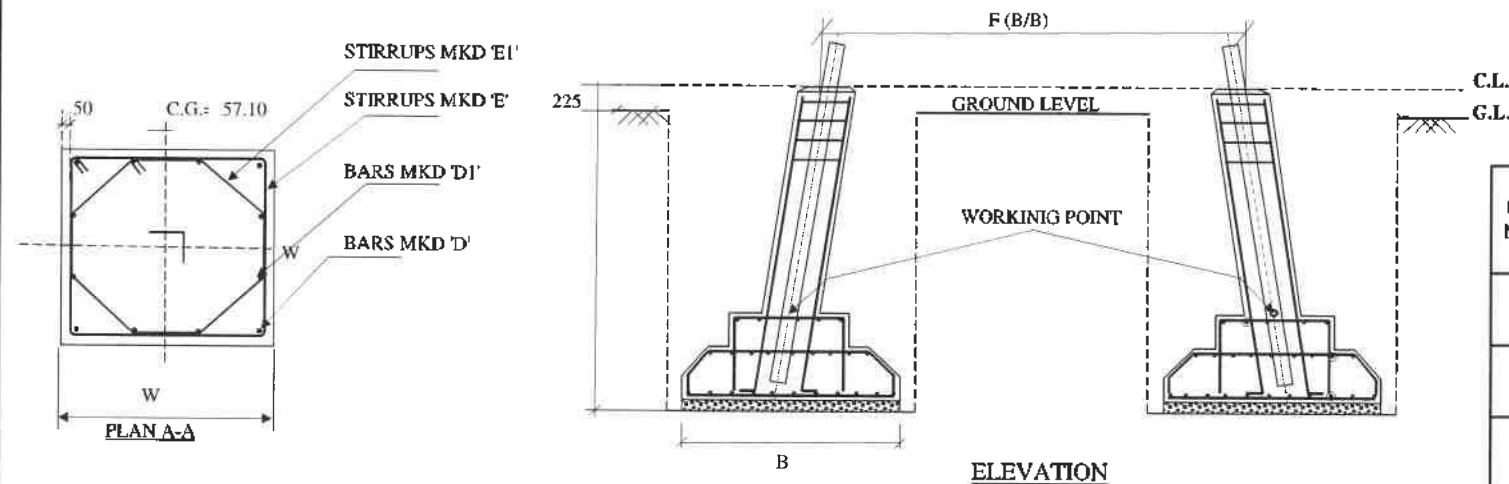
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NOTES:

- DRAWING NOT TO SCALE
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3800 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	13-08-18	FOUNDATION DRAWING FOR TOWER TYPE DD-3/4/4/3/4-6M 400KV D/C (WZ-1) PARTIALLY SUBMERGED SOIL (4.0M DEPTH)		
CHKD	AM	13-08-18			
APPD	DL	13-08-18			
DATE	13-08-18	DRAWING NO.	GTTL/400DCWZ-1/DD/F-003	SHEET NO.	2/2 REV 0

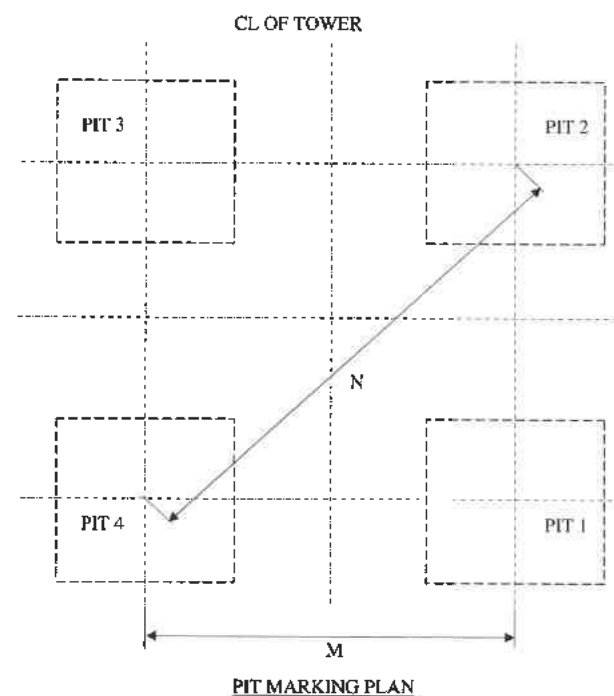
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FOUNDATION ELEVATION (CROSS SECTION)

VERTICAL SLOPE	
TAN B =	0.241965602
2 TAN B =	0.483931204
FACE =	1.028857304
DEV =	1.05692701
IN FACE SLOPE	
TAN B =	0.235178971
SEC B =	1.027282409

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	FULLY SUBMERGED
UNIT WEIGHT (Kg/m ³):	940
LIMIT BEARING CAPACITY (Kg/m ²):	12500
ANGLE OF REPOSE :	15
WATER TABLE (m):	0m BELOW G.L.
FOUNDATION DEPTH (m):	4



PIT MARKING PLAN

EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
6880	6580	4000	700	5980	2000	400	300	300	3250

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	6480	PAD REINFORCEMENT	20	60	6480	2.46	958.41	3833.65
B	5880 50 354 354 50	PAD REINFORCEMENT	16	62	6687	1.58	654.10	2616.39
C	1900 560 50 50 560	PAD REINFORCEMENT	16	18	3120	1.58	88.62	334.50
D	4003	CHIMNEY BAR	32	4	4503	6.31	113.66	454.65
D1	500	CHIMNEY BAR	32	8	4503	6.31	227.32	909.29
E	600 600	CHIMNEY SQUARE SPACER	8	13	2592	0.39	13.29	53.18
E1	200 283	CHIMNEY SQUARE SPACER	8	13	2123	0.39	10.89	43.57
TOTAL REINFORCEMENT/ TOWER=								8265.2

NOTES:

- 1.DRAWING NOT TO SCALE
- 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
- 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
- 5.STUB BELOW GROUND LEVEL = 3800
- 6.WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- 8.CLEAR COVER TO REINFORCEMENT IS 50MM
- 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	76.29
CONCRETE (M10) m ³	8.66
TOTAL CONCRETE m ³	84.95
EXCAVATION m3	757.35
REINFORCEMENT Kg	8265.2

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Engineering Dept.
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REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	13-08-18	FOUNDATION DRAWING FOR TOWER TYPE DD-3/+0/+3/+6M 400KV D/C (WZ-1) FULLY SUBMERGED SOIL (4.0M DEPTH)		
CHKD	AM	13-08-18			
APPD	DL	13-08-18			
DATE	13-08-18	DRAWING NO.			
		GTTPL/400DC/WZ-1/DD/F-004	SHEET NO.	1/2	REV 0

REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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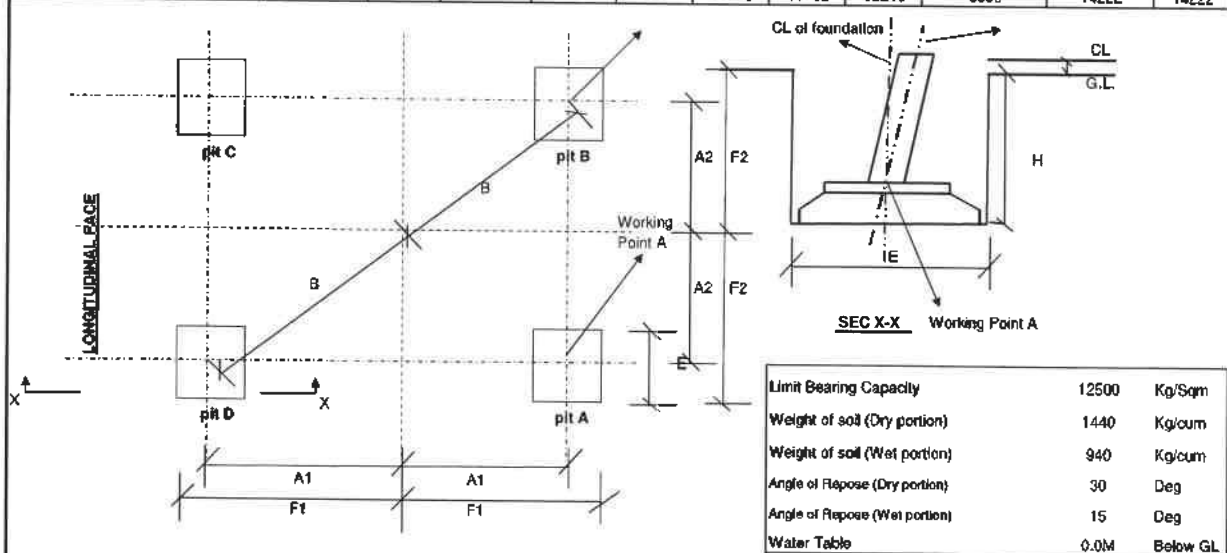
Project
GOA

400 KV D/C -X-M & X-N (WZ-1) - TT "DD" SOIL TYPE - FS (4.0M DEPTH)

PIT DIMENSION TABLE

Client:
SPQVL

400 KV D/C-X-M & X-N- TT "DD"		* F * B/B of Tower at 3MBE(+)-3MLE (TF)		* F * B/B of Tower at 3MBE(+)-3MLE (LF)		Stub Section (HT)		Lattice Level to CL	cg	sec B1	2*Tan B1	sec B2	2*Tan B2
		12713		12713		200X200X20		50	57.1	1.028857	0.483931204	1.028857	0.4839312
Tower Detail	Extn from -3MBE(+)-3MLE (mm)	cg-cg dim at CL (TF)	cg-cg dim at CL (LF)	Foundation Base Width	work pt	G.L. TO C.L.	A1	A2	B	E	F1	F2	H
-3MBE (+) -3M LE	0	12623	12623	6580	3250	225	7152	7152	10115	6880	10592	10592	4000
-3MBE (+) -1.5M LE	1500	13349	13349	6580	3250	225	7515	7515	10628	6880	10955	10955	4000
-3MBE (+) +0M LE	3000	14074	14074	6580	3250	225	7878	7878	11141	6880	11318	11318	4000
-3MBE (+) +1.5M LE	4500	14800	14800	6580	3250	225	8241	8241	11655	6880	11681	11681	4000
-3MBE (+) +3M LE	6000	15526	15526	6580	3250	225	8604	8604	12168	6880	12044	12044	4000
+0MBE (+) -3M LE	3000	14074	14074	6580	3250	225	7878	7878	11141	6880	11318	11318	4000
+0MBE (+) -1.5M LE	4500	14800	14800	6580	3250	225	8241	8241	11655	6880	11681	11681	4000
+0MBE (+) +0M LE	6000	15526	15526	6580	3250	225	8604	8604	12168	6880	12044	12044	4000
+0MBE (+) +1.5M LE	7500	16252	16252	6580	3250	225	8967	8967	12681	6880	12407	12407	4000
+0MBE (+) +3M LE	9000	16978	16978	6580	3250	225	9330	9330	13194	6880	12770	12770	4000
+3MBE (+) -3M LE	6000	15526	15526	6580	3250	225	8604	8604	12168	6880	12044	12044	4000
+3MBE (+) -1.5M LE	7500	16252	16252	6580	3250	225	8967	8967	12681	6880	12407	12407	4000
+3MBE (+) +0M LE	9000	16978	16978	6580	3250	225	9330	9330	13194	6880	12770	12770	4000
+3MBE (+) +1.5M LE	10500	17704	17704	6580	3250	225	9693	9693	13708	6880	13133	13133	4000
+3MBE (+) +3M LE	12000	18430	18430	6580	3250	225	10056	10056	14221	6880	13496	13496	4000
+6MBE (+) -3M LE	9000	16978	16978	6580	3250	225	9330	9330	13194	6880	12770	12770	4000
+6MBE (+) -1.5M LE	10500	17704	17704	6580	3250	225	9693	9693	13708	6880	13133	13133	4000
+6MBE (+) +0M LE	12000	18430	18430	6580	3250	225	10056	10056	14221	6880	13496	13496	4000
+6MBE (+) +1.5M LE	13500	19156	19156	6580	3250	225	10419	10419	14734	6880	13859	13859	4000
+6MBE (+) +3M LE	15000	19882	19882	6580	3250	225	10782	10782	15248	6880	14222	14222	4000



NOTE:

- BEFORE START OF THE FOUNDATION ACTIVITY, ALL THE RELEVANT INFORMATION PROVIDED IN THE TECHNICAL NOTES AND FOUNDATION DRAWINGS SHALL BE READ AND UNDERSTOOD. IF ANY ERROR OR CHANGES ARE OBSERVED, SAME SHALL BE INTIMATED TO ENGINEERING TEAM FOR CORRECTIVE ACTION.
- FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.241965802
2 TAN B =	0.483931204
FACE =	1.028857304
DEV =	1.05692701
IN FACE SLOPE	
TAN B =	0.235178971
SEC B =	1.027282409

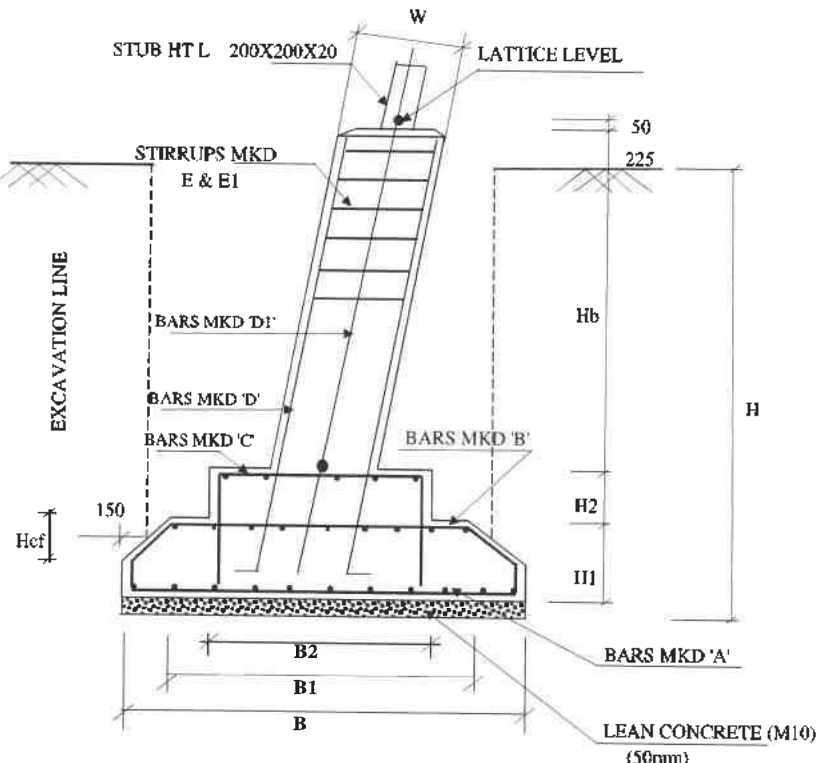
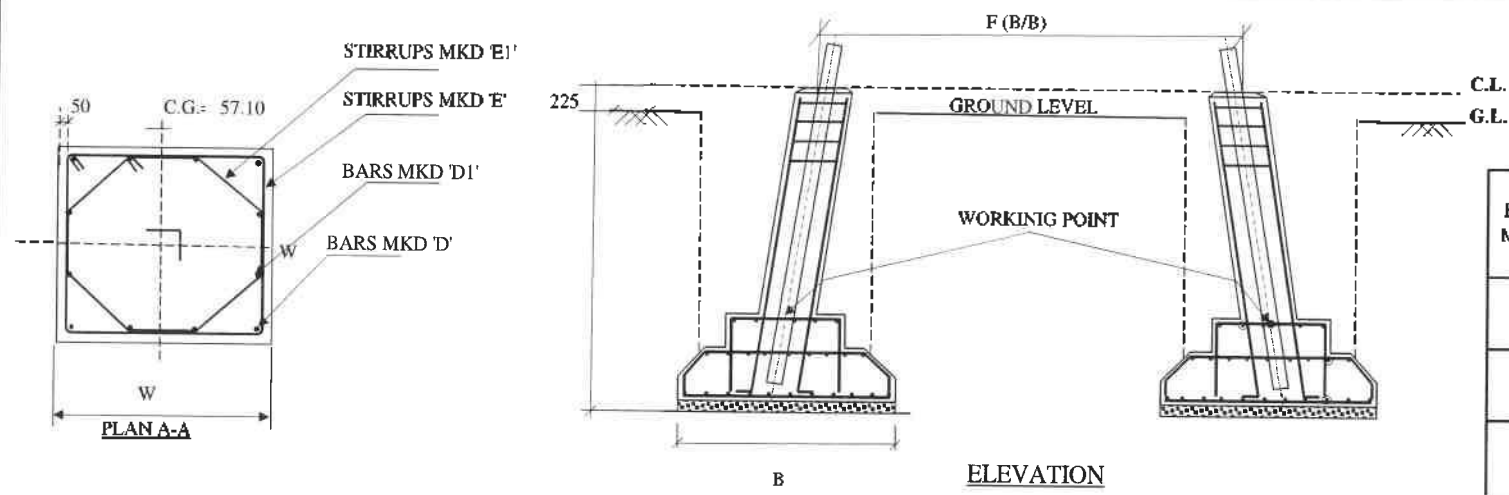
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NOTES:

- DRAWING NOT TO SCALE
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED
- CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3800 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	13-08-18	FOUNDATION DRAWING FOR TOWER TYPE DD-3/4/4-3/4-6M 400KV D/C (WZ-1) FULLY SUBMERGED SOIL (4.0M DEPTH)		
CHKD	AM	13-08-18			
APPD	DL	13-08-18			
DATE	13-08-18	DRAWING NO.	GTTP/400DQWZ-LDDT-004	SHEET NO.	2/2
REV					0

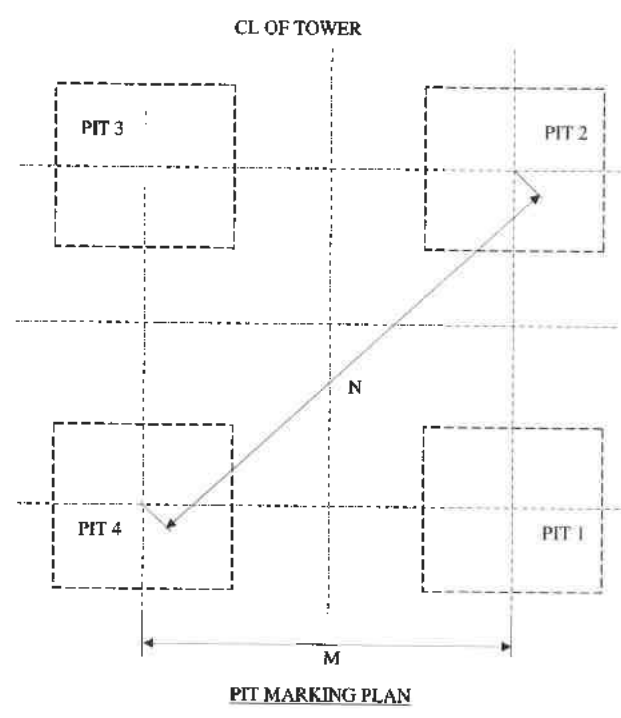
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FOUNDATION ELEVATION (CROSS SECTION)

VERTICAL SLOPE	
TAN B =	0.241965602
2 TAN B =	0.483931204
FACE =	1.028857304
DEV =	1.05692701
IN FACE SLOPE	
TAN B =	0.235178971
SEC B =	1.027282409

FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	DRY FISSURED ROCK
UNIT WEIGHT (Kg/m ³):	1700
LIMIT BEARING CAPACITY (Kg/m ²):	62500
ANGLE OF REPOSE :	20
WATER TABLE (m) :	BELOW 3.5m FROM G.L.
FOUNDATION DEPTH (m):	4



PIT MARKING PLAN

B	H	W	B1	B2	H1	H2	Hcf	Hb
4300	4000	700	3700	2000	400	300	300	3250

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	4200	PAD REINFORCEMENT	16	54	4200	1.58	357.85	1431.38
B	3600 50 354 354 50	PAD REINFORCEMENT	12	40	4407	0.89	156.48	625.91
C	1900 568 50 50 568	PAD REINFORCEMENT	16	16	3136	1.58	79.18	316.74
D	4011	CHIMNEY BAR	32	4	4511	6.31	113.86	455.46
D1	500	CHIMNEY BAR	32	8	4511	6.31	227.72	910.90
E	600 600	CHIMNEY SQUARE SPACER	8	14	2592	0.39	14.31	57.27
E1	200 283	CHIMNEY SQUARE SPACER	8	14	2123	0.39	11.72	46.90
TOTAL REINFORCEMENT/ TOWER=								3844.6

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	38.24
CONCRETE (M10) m ³	3.7
TOTAL CONCRETE m ³	41.94
EXCAVATION m ³	258.24
REINFORCEMENT Kg	3844.6

- NOTES:
- 1.DRAWING NOT TO SCALE
 - 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
 - 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
 - 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
 - 5.STUB BELOW GROUND LEVEL = 3800
 - 6.WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
 - 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
 - 8.CLEAR COVER TO REINFORCEMENT IS 50MM
 - 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
 - 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

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Engineering Dept.
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REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	13-08-18	FOUNDATION DRAWING FOR TOWER TYPE DD-3/+0/+3/+6M 400KV D/C (WZ-1) DRY FISSURED ROCK SOIL (4.0M DEPTH)		
CHKD	AM	13-08-18			
APPD	DL	13-08-18			
DATE	13-08-18	DRAWING NO.	GTTP/400DC/WZ-1/DD/F-005	SHEET NO.	1/2 REV 0

REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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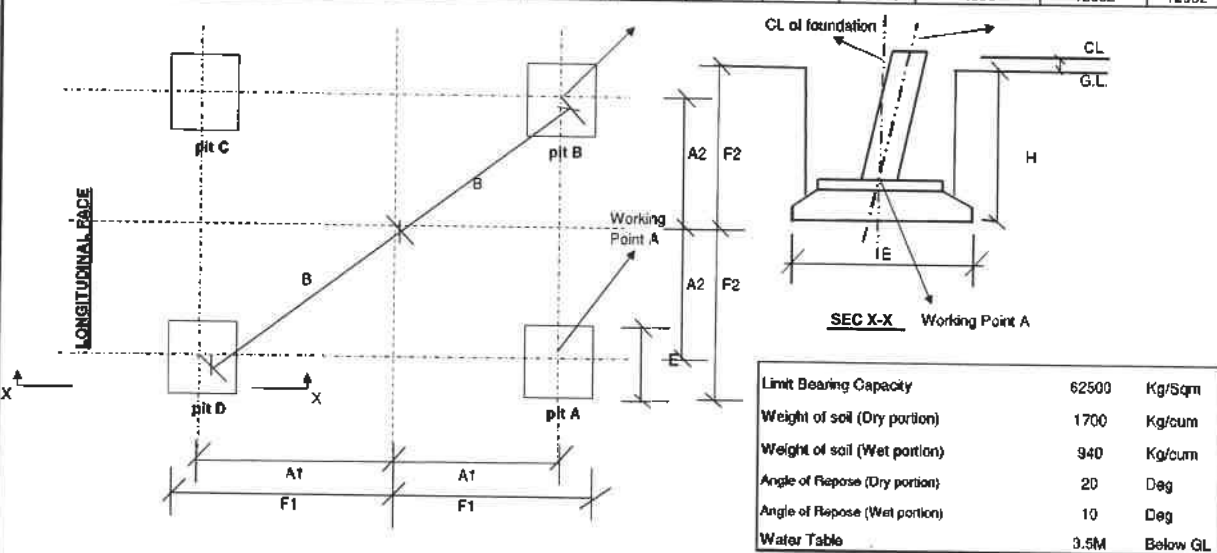
Project
GOA

400 KV D/C -X-M & X-N (WZ-1) - TT "DD" SOIL TYPE - DFR (4.0M DEPTH)

PIT DIMENSION TABLE

Client:
SPGVL

400 KV D/C-X-M & X-N TT "DD"		"F" B/B of Tower at 3MBE(+)-3MLE (TF)		"F" B/B of Tower at 3MBE(+)-3MLE (LF)		Stub Section (HT)		Lattice Level to CL	cg	sec B1	2*Tan B1	sec B2	2*Tan B2
		12713		12713		200X200X20		50	57.1	1.028857	0.483931204	1.028857	0.4839312
Tower Detail	Exin from 3MBE(+)-3MLE (mm)	cg-cg dim at CL (TF)	cg-cg dim at CL (LF)	Foundation Base Width	work pl	G.L TO C.L.	A1	A2	B	E	F1	F2	H
-3MBE (+) -3M LE	0	12623	12623	4300	3250	225	7152	7152	10115	4300	9302	9302	4000
-3MBE (+) -1.5M LE	1500	13349	13349	4300	3250	225	7515	7515	10628	4300	9665	9665	4000
-3MBE (+) +0M LE	3000	14074	14074	4300	3250	225	7878	7878	11141	4300	10028	10028	4000
-3MBE (+) +1.5M LE	4500	14800	14800	4300	3250	225	8241	8241	11655	4300	10391	10391	4000
-3MBE (+) +3M LE	6000	15526	15526	4300	3250	225	8604	8604	12168	4300	10754	10754	4000
+0MBE (+) -3M LE	3000	14074	14074	4300	3250	225	7878	7878	11141	4300	10028	10028	4000
+0MBE (+) -1.5M LE	4500	14800	14800	4300	3250	225	8241	8241	11655	4300	10391	10391	4000
+0MBE (+) +0M LE	6000	15526	15526	4300	3250	225	8604	8604	12168	4300	10754	10754	4000
+0MBE (+) +1.5M LE	7500	16252	16252	4300	3250	225	8967	8967	12681	4300	11117	11117	4000
+0MBE (+) +3M LE	9000	16978	16978	4300	3250	225	9330	9330	13194	4300	11480	11480	4000
+3MBE (+) -3M LE	6000	15526	15526	4300	3250	225	8604	8604	12168	4300	10754	10754	4000
+3MBE (+) -1.5M LE	7500	16252	16252	4300	3250	225	8967	8967	12681	4300	11117	11117	4000
+3MBE (+) +0M LE	9000	16978	16978	4300	3250	225	9330	9330	13194	4300	11480	11480	4000
+3MBE (+) +1.5M LE	10500	17704	17704	4300	3250	225	9693	9693	13708	4300	11843	11843	4000
+3MBE (+) +3M LE	12000	18430	18430	4300	3250	225	10056	10056	14221	4300	12206	12206	4000
+6MBE (+) -3M LE	9000	16978	16978	4300	3250	225	9330	9330	13194	4300	11480	11480	4000
+6MBE (+) -1.5M LE	10500	17704	17704	4300	3250	225	9693	9693	13708	4300	11843	11843	4000
+6MBE (+) +0M LE	12000	18430	18430	4300	3250	225	10056	10056	14221	4300	12206	12206	4000
+6MBE (+) +1.5M LE	13500	19156	19156	4300	3250	225	10419	10419	14734	4300	12569	12569	4000
+6MBE (+) +3M LE	15000	19882	19882	4300	3250	225	10782	10782	15248	4300	12932	12932	4000



NOTE:

- BEFORE START OF THE FOUNDATION ACTIVITY, ALL THE RELEVANT INFORMATION PROVIDED IN THE TECHNICAL NOTES AND FOUNDATION DRAWINGS SHALL BE READ AND UNDERSTOOD. IF ANY ERROR OR CHANGES ARE OBSERVED, SAME SHALL BE INTIMATED TO ENGINEERING TEAM FOR CORRECTIVE ACTION.
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- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.241965602
2 TAN B =	0.483931204
FACE =	1.028857904
DEV =	1.05692701
IN FACE SLOPE	
TAN B =	0.235178971
SEC B =	1.027282409

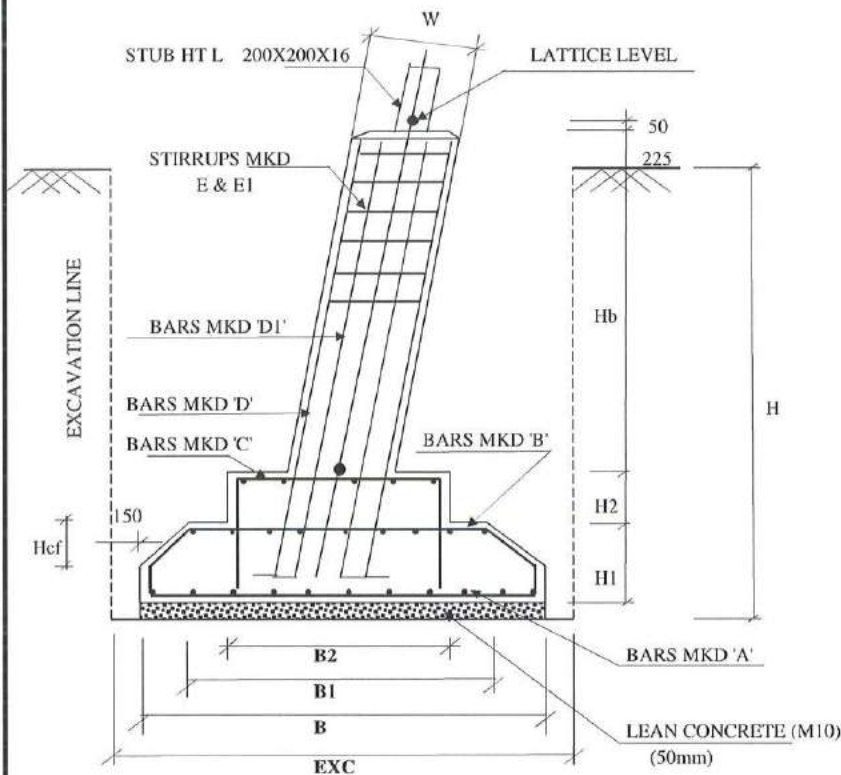
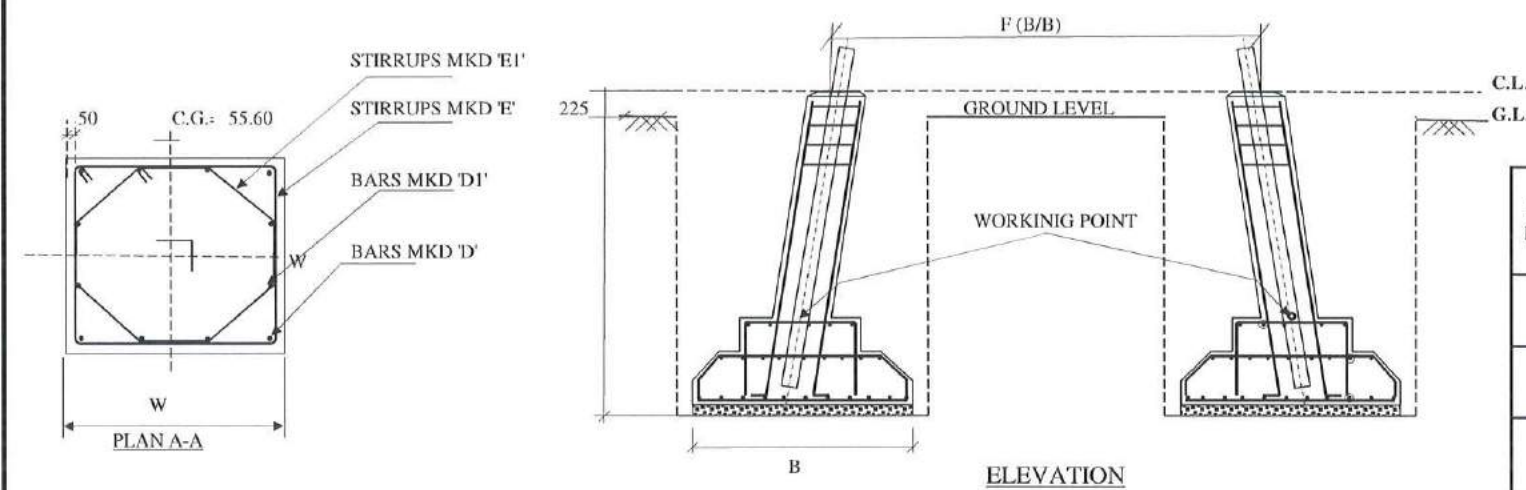
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NOTES:

- DRAWING NOT TO SCALE
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 11139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3800 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	13-08-18	FOUNDATION DRAWING FOR TOWER TYPE DD-3/H-Q/+3/+6M 400KV D/C (WZ-1) DRY FISSIONED ROCK SOIL (4.0M DEPTH)		
CHKD	AM	13-08-18			
APPD	DL	13-08-18			
DATE	13-08-18	DRAWING NO.	GTTP/4/00DCWZ-1/DDT-003	SHEET NO.	2/2
		REV			0

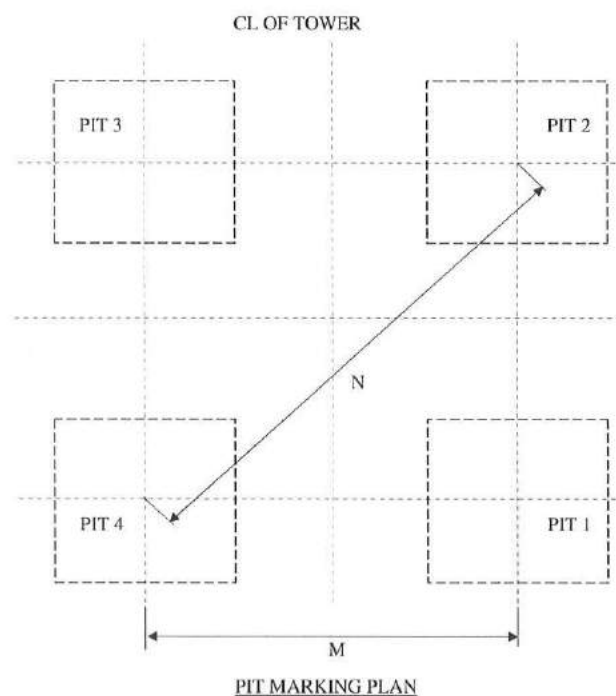
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FOUNDATION ELEVATION (CROSS SECTION)

VERTICAL SLOPE	
TAN B =	0.241837837
2 TAN B =	0.483675674
FACE =	1.028827264
DEV =	1.056868525
IN FACE SLOPE	
TAN B =	0.241837837
SEC B =	1.027254576

FOUNDATION DESIGN PARAMENTERS:	
TYPE OF SOIL :	DRY
UNIT WEIGHT (Kg/m ³):	1440
LIMIT BEARING CAPACITY (Kg/m ²):	25000
ANGLE OF REPOSE :	30
WATER TABLE (m):	BELOW 4.0m FROM G.L.
FOUNDATION DEPTH (m):	4



PIT MARKING PLAN

EXC	B	H	W	B1	B2	H1	H2	Heff	Hb
4200	3900	4000	700	3300	2000	400	300	300	3250

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	3800	PAD REINFORCEMENT	16	42	3800	1.58	251.83	1007.34
B	3200	PAD REINFORCEMENT	12	28	4007	0.89	99.61	398.45
C	1900	PAD REINFORCEMENT	12	28	3136	0.89	77.95	311.79
D	4011	CHIMNEY BAR	32	4	4511	6.31	113.86	455.46
D1	500	CHIMNEY BAR	32	8	4511	6.31	227.72	910.90
E	600	CHIMNEY SQUARE SPACER	8	14	2592	0.39	14.31	57.27
E1	200	CHIMNEY SQUARE SPACER	8	14	2123	0.39	11.72	46.92
TOTAL REINFORCEMENT/ TOWER=								3188.1

NOTES:

- 1.DRAWING NOT TO SCALE
- 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
- 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
- 5.STUB BELOW GROUND LEVEL = 3800
- 6.WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- 8.CLEAR COVER TO REINFORCEMENT IS 50MM
- 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

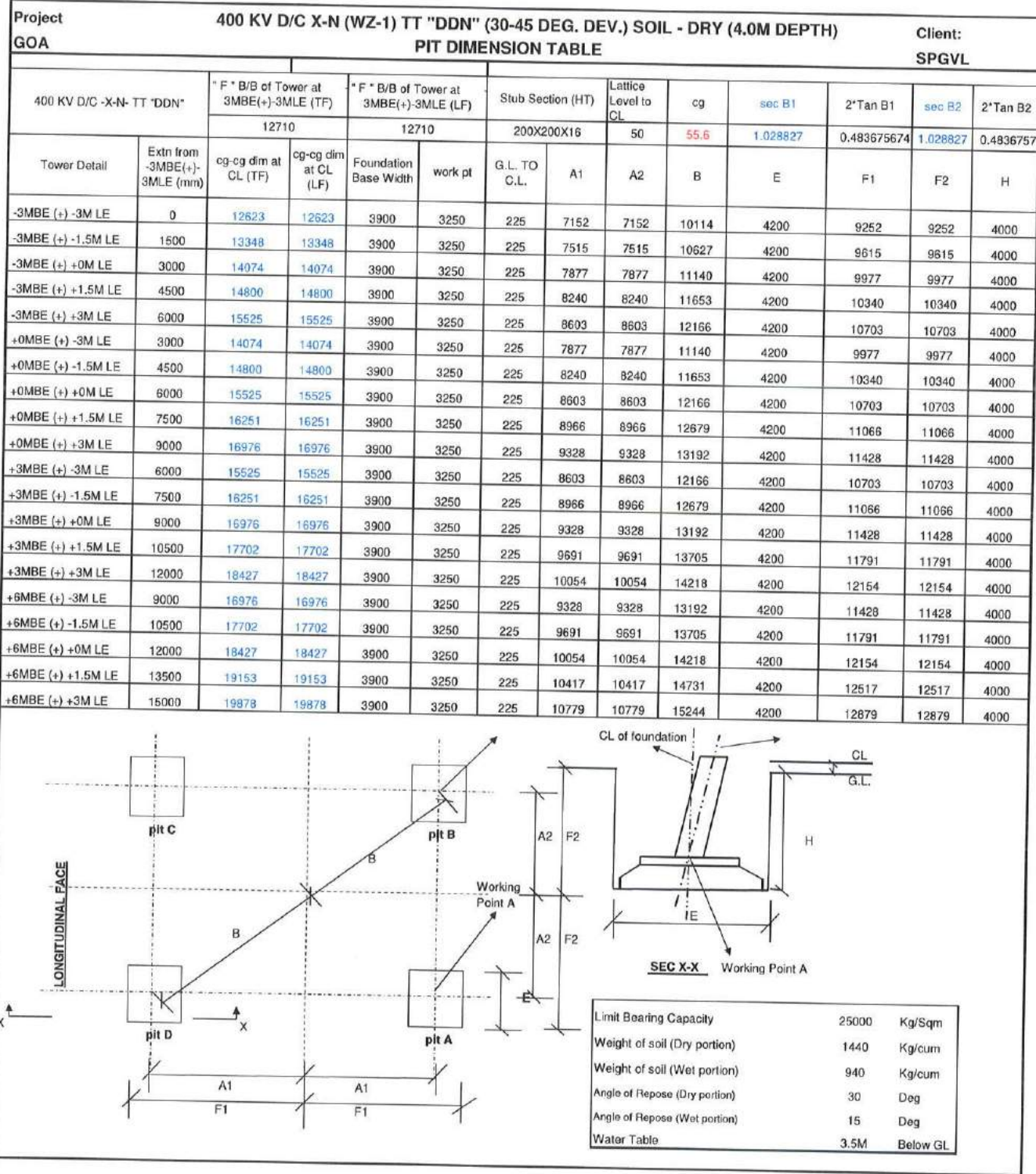
QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	33.28
CONCRETE (M10) m ³	3.04
TOTAL CONCRETE m ³	36.32
EXCAVATION m ³	282.24
REINFORCEMENT Kg	3188.1

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REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT	400KV D/C XELDAM-NARENDRA TRANSMISSION LTD				
CLIENT	STERLITE POWER GRID VENTURES LIMITED				
DESIGNER:	STERLITE POWER GRID VENTURES LIMITED				
DRWN	RT	20-09-18	FOUNDATION DRAWING FOR TOWER TYPE DDN-3/+0/+3/+6M (30-45 DEG. DEV. ANGLE) 400KV D/C (WZ-1) DRY SOIL (4.0M DEPTH)		
CHKD	AM	20-09-18			
APPD	DL	20-09-18			
DATE	20-09-18	DRAWING NO.	GTTPH/400DC/WZ-1/DDN/F-001	SHEET NO.	1/2 REV 0

REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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- FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.241837837
2 TAN B =	0.483675674
FACE =	1.028827264
DEV =	1.056868525
IN FACE SLOPE	
TAN B =	0.241837837
SEC B =	1.027254576

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contractual obligations

NOTES:

- DRAWING NOT TO SCALE
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3800 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	20-09-18	FOUNDATION DRAWING FOR TOWER TYPE DDN-3/+0/+3/+6M (30-45 DEG. DEV. ANGLE) 400KV D/C (WZ-1) DRY SOIL (4.0M DEPTH)		
CHKD	AM	20-09-18			
APPD	DL	20-09-18			
DATE	20-09-18	DRAWING NO.	GTPL/400DC/WZ-1/DDN/F-001	SHEET NO.	2/2
				REV	0

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liable for heavy damages and penalties with a prior notice.

EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
5450	5150	4000	700	4550	2000	400	300	300	3250

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	5050	PAD REINFORCEMENT	16	58	5050	1.58	462.12	1848.48
B	4450 50 354 354 50	PAD REINFORCEMENT	12	54	5257	0.89	251.96	1007.83
C	1900 568 50 50 568	PAD REINFORCEMENT	12	28	3136	0.89	77.95	311.79
D	4011	CHIMNEY BAR	32	4	4511	6.31	113.86	455.46
D1	500	CHIMNEY BAR	32	8	4511	6.31	227.72	910.90
E	600 600	CHIMNEY SQUARE SPACER	8	14	2592	0.39	14.31	57.27
E1	200 283	CHIMNEY SQUARE SPACER	8	14	2123	0.39	11.72	46.92
TOTAL REINFORCEMENT/ TOWER=								4638.6

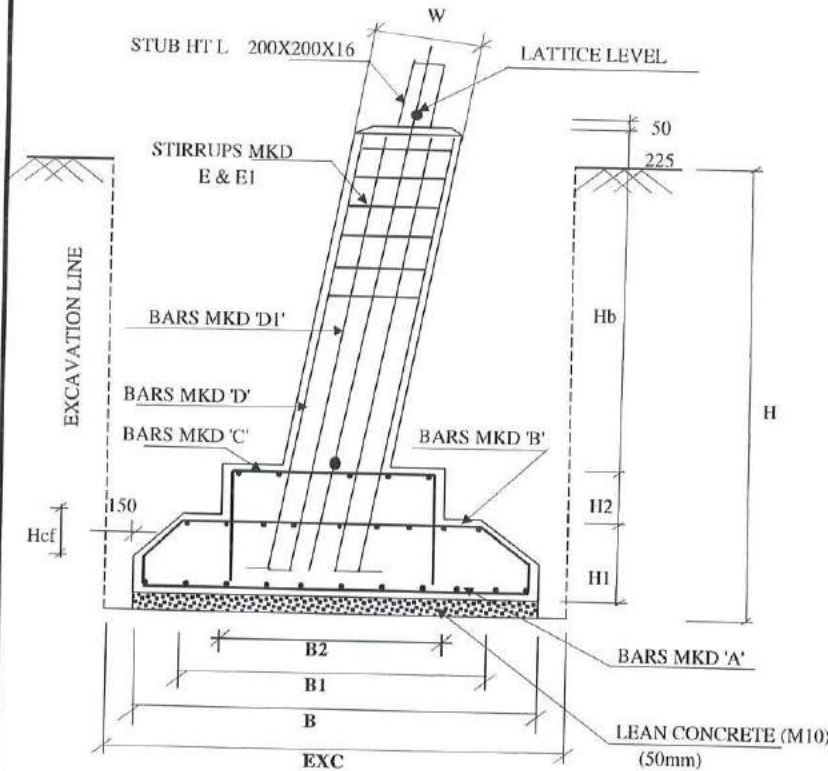
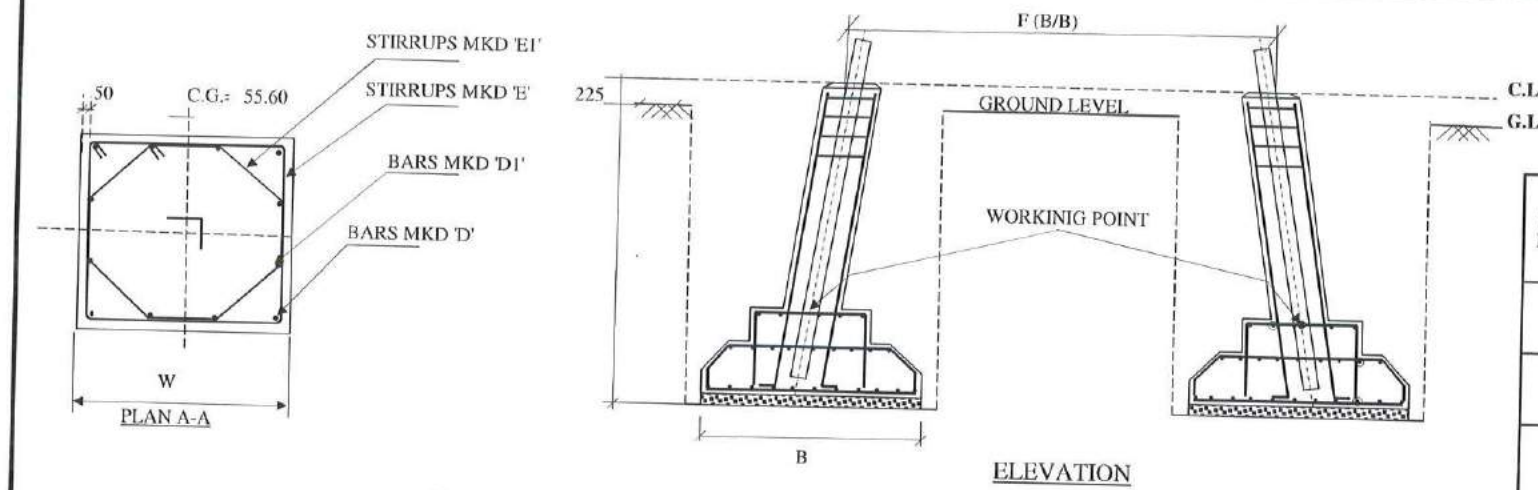
FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	WET
UNIT WEIGHT (Kg/m ³):	1440 / 940
LIMIT BEARING CAPACITY (Kg/m ²):	12500
ANGLE OF REPOSE :	30 / 15
WATER TABLE (m) :	1.50 BELOW G.L.
FOUNDATION DEPTH (m):	4

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	50.48
CONCRETE (M10) m ³	5.3
TOTAL CONCRETE m ³	55.78
EXCAVATION m ³	475.24
REINFORCEMENT Kg	4639.0

- NOTES:
- 1.DRAWING NOT TO SCALE
 - 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
 - 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
 - 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
 - 5.STUB BELOW GROUND LEVEL = 3800
 - 6.WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
 - 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
 - 8.CLEAR COVER TO REINFORCEMENT IS 50MM
 - 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
 - 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

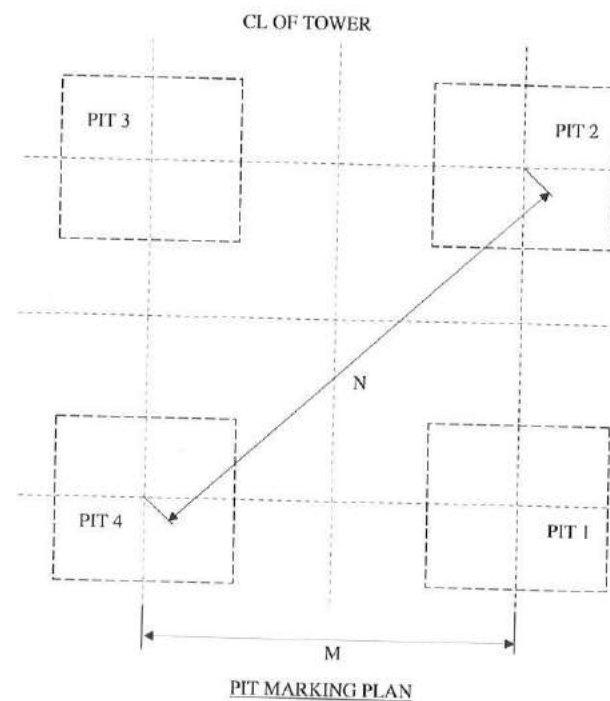
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ENCL 1 & 2/26 Date: 20/09/18
Engineering Deptt.
the above does not relieve the contractor from their contractual obligations

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	20-09-18	FOUNDATION DRAWING FOR TOWER TYPE DDN-3/+0/+3/+6M (30-45 DEG. DEV. ANGLE) 400KV D/C (WZ-1) WET SOIL (4.0M DEPTH)		
CHKD	AM	20-09-18			
APPD	DL	20-09-18			
DATE	20-09-18	DRAWING NO.	GTPL/400DC/WZ-1/DDN/F-002	SHEET NO.	1/2 REV 0



FOUNDATION ELEVATION (CROSS SECTION)

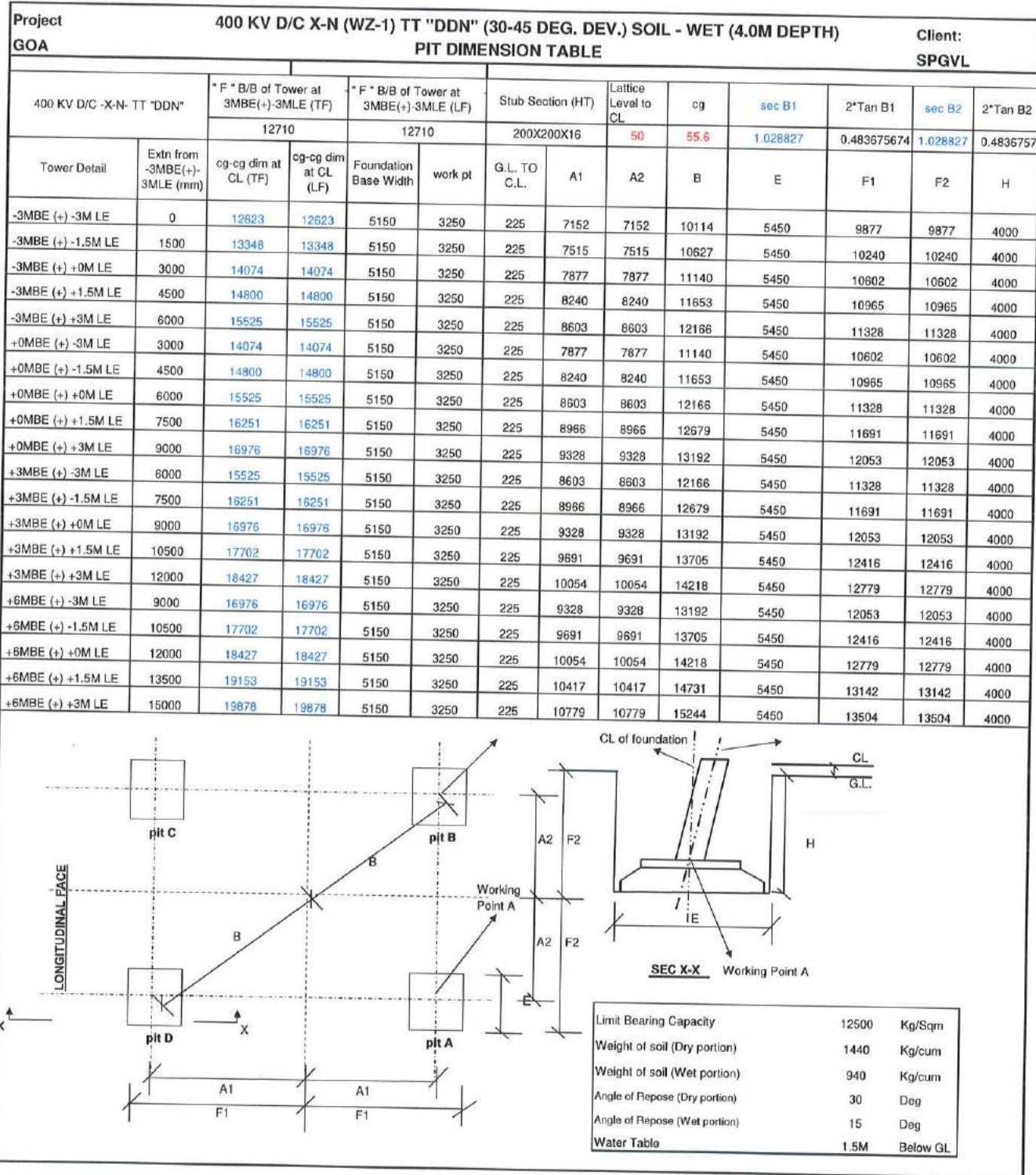
VERTICAL SLOPE	
TAN B =	0.241965602
2 TAN B =	0.483931204
FACE =	1.028857304
DEV =	1.05692701
IN FACE SLOPE	
TAN B =	0.241837837
SEC B =	1.027254576



PIT MARKING PLAN

REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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NOTE:

- BEFORE START OF THE FOUNDATION ACTIVITY, ALL THE RELEVANT INFORMATION PROVIDED IN THE TECHNICAL NOTES AND FOUNDATION DRAWINGS SHALL BE READ AND UNDERSTOOD. IF ANY ERROR OR CHANGES ARE OBSERVED, SAME SHALL BE INTIMATED TO ENGINEERING TEAM FOR CORRECTIVE ACTION.
- FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.241965602
2 TAN B =	0.483931204
FACE =	1.028857304
DEV =	1.05682701
IN FACE SLOPE	
TAN B =	0.241837837
SEC B =	1.027254576

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Engineering Deptt.
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contractual obligations

NOTES:

- DRAWING NOT TO SCALE
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3800 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDA-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	20-09-18	FOUNDATION DRAWING FOR TOWER TYPE DDN-3/+0/+3/+6M (30-45 DEG. DEV. ANGLE) 400KV D/C (WZ-1) WET SOIL (4.0M DEPTH)		
CHKD	AM	20-09-18			
APPD	DL	20-09-18			
DATE	20-09-18	DRAWING NO.			
		GTPLA00DC/WZ-1/DDN/F-002	SHEET NO.	2/2	REV 0

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liable for heavy damages and prosecution with imprisonment.

EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
5930	5630	4000	700	5030	2000	400	300	300	3250

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	5530	PAD REINFORCEMENT	16	62	5530	1.58	540.93	2163.74
B	4930 50 354 354 50	PAD REINFORCEMENT	12	68	5737	0.89	346.23	1384.93
C	1900 568 50 50 568	PAD REINFORCEMENT	12	28	3136	0.89	77.95	311.79
D	4011	CHIMNEY BAR	32	4	4511	6.31	113.86	455.46
D1	500	CHIMNEY BAR	32	8	4511	6.31	227.72	910.90
E	600 600	CHIMNEY SQUARE SPACER	8	14	2592	0.39	14.31	57.27
E1	200 283	CHIMNEY SQUARE SPACER	8	14	2123	0.39	11.72	46.92
TOTAL REINFORCEMENT/ TOWER=								5331.0

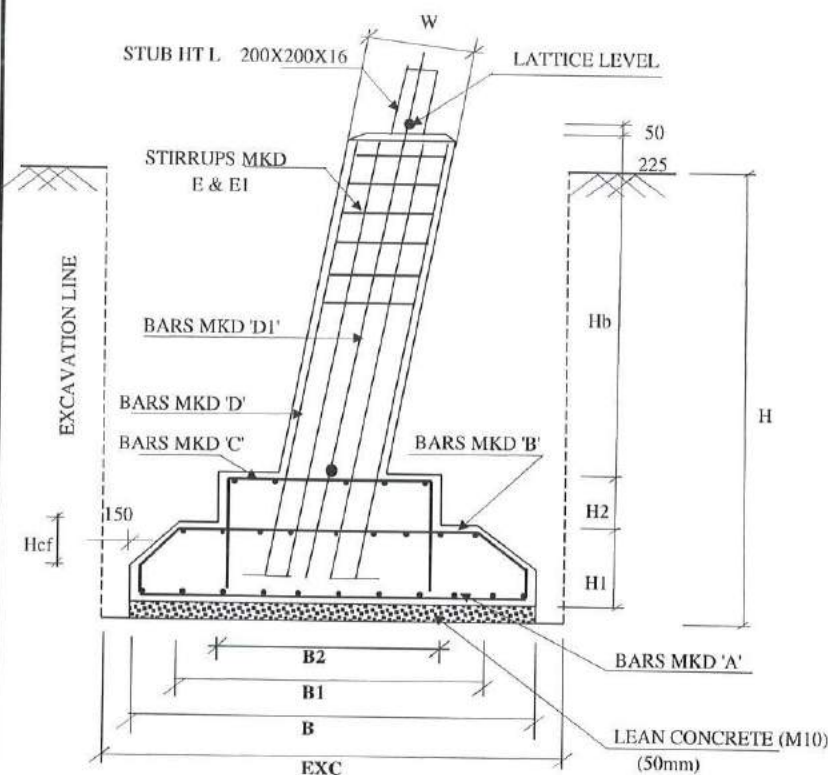
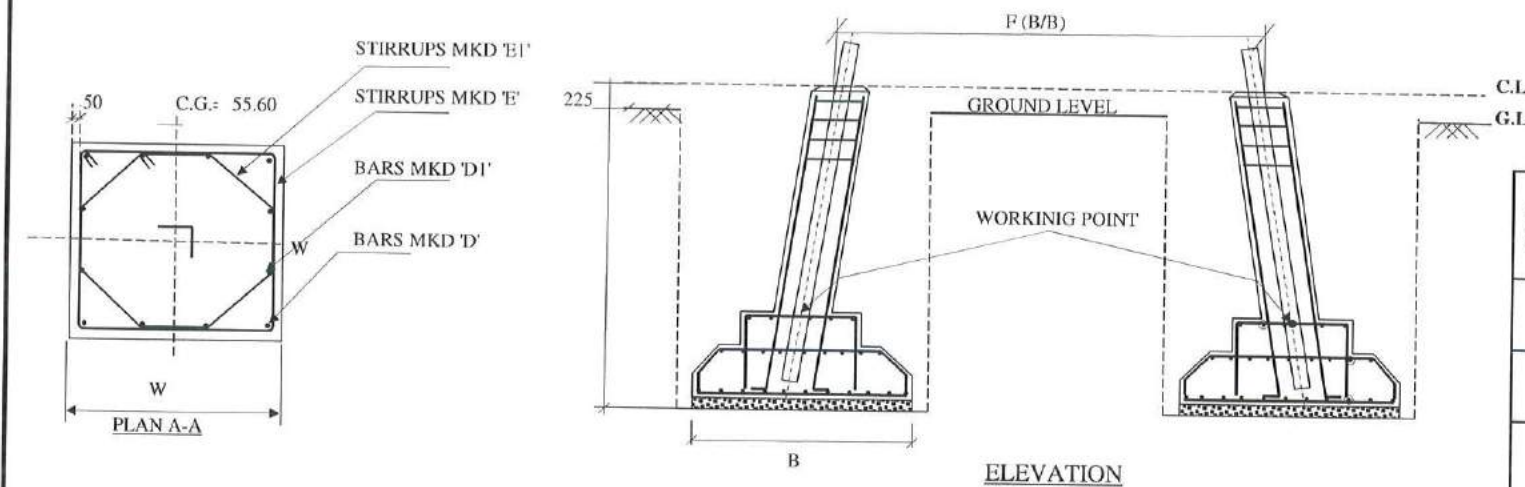
FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	PARTIALLY SUBMERGED
UNIT WEIGHT (Kg/m ³):	1440 / 940
LIMIT BEARING CAPACITY (Kg/m ²):	12500
ANGLE OF REPOSE :	30 / 15
WATER TABLE (m):	0.75 BELOW G.L.
FOUNDATION DEPTH (m):	4

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	58.42
CONCRETE (M10) m ³	6.34
TOTAL CONCRETE m ³	64.76
EXCAVATION m ³	562.64
REINFORCEMENT Kg	5331.0

- NOTES:
- 1.DRAWING NOT TO SCALE
 - 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
 - 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
 - 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
 - 5.STUB BELOW GROUND LEVEL = 3800
 - 6.WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
 - 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
 - 8.CLEAR COVER TO REINFORCEMENT IS 50MM
 - 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
 - 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

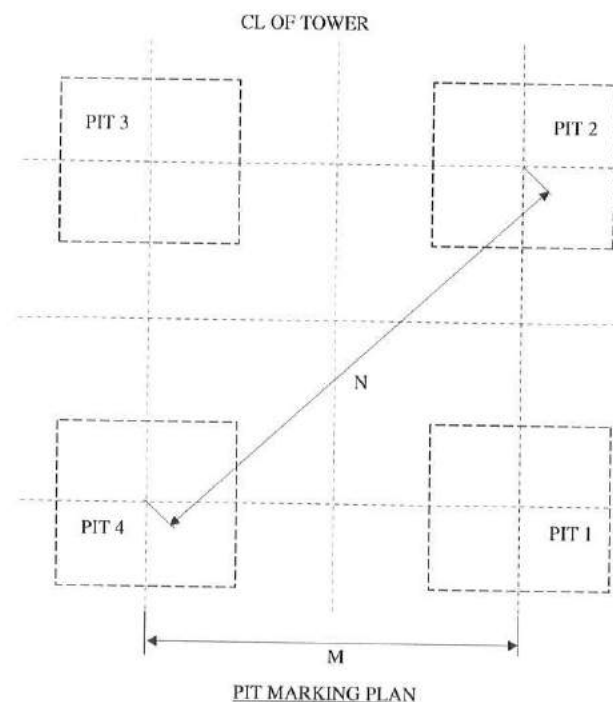
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ENG/LRT/26 Date: 20/09/18
Engineering Dept.
the above does not relieve the contractor from their contractual obligations

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT	400KV D/C XELDAM-NARENDRA TRANSMISSION LTD				
CLIENT	STERLITE POWER GRID VENTURES LIMITED				
DESIGNER:	STERLITE POWER GRID VENTURES LIMITED				
DRWN	RT	20-09-18	FOUNDATION DRAWING FOR TOWER TYPE DDN-3/+0/+3/+6M (30-45 DEG. DEV. ANGLE) 400KV D/C (WZ-1) PS SOIL (4.0M DEPTH)		
CHKD	AM	20-09-18			
APPD	DL	20-09-18			
DATE	20-09-18	DRAWING NO.	GTTP4/400DC/WZ-1/DDN/F-003	SHEET NO.	1/2 REV 0



FOUNDATION ELEVATION (CROSS SECTION)

VERTICAL SLOPE	
TAN B =	0.241837837
2 TAN B =	0.483675674
FACE =	1.028827264
DEV =	1.056868525
IN FACE SLOPE	
TAN B =	0.241837837
SEC B =	1.027254576

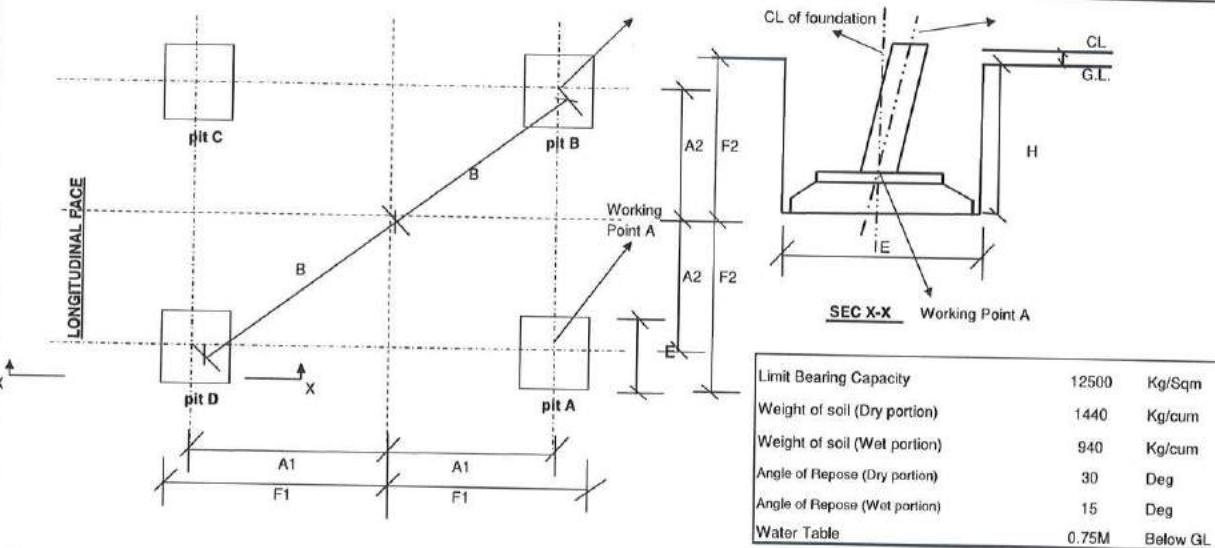


PIT MARKING PLAN

REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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Project GOA		400 KV D/C X-N (WZ-1) TT "DDN" (30-45 DEG. DEV.) SOIL - PS (4.0M DEPTH)										Client: SPGVL	
PIT DIMENSION TABLE													
400 KV D/C X-N- TT "DDN"		* F " B/B of Tower at 3MBE(+)-3MLE (TF)		* F " B/B of Tower at 3MBE(+)-3MLE (LF)		Stub Section (HT)		Lattice Level to CL	cg	sec B1	2°Tan B1	sec B2	2°Tan B2
		12710		12710		200X200X16		50	55.6	1.028827	0.483675674	1.028827	0.4836757
Tower Detail	Extn from -3MBE(+)- 3MLE (mm)	cg-cg dim at CL (TF)	cg-cg dim at CL (LF)	Foundation Base Width	work pt	G.L. TO C.L.	A1	A2	B	E	F1	F2	H
-3MBE (+) -3M LE	0	12623	12623	5630	3250	225	7152	7152	10114	5930	10117	10117	4000
-3MBE (+) -1.5M LE	1500	13348	13348	5630	3250	225	7515	7515	10627	5930	10480	10480	4000
-3MBE (+) +0M LE	3000	14074	14074	5630	3250	225	7877	7877	11140	5930	10842	10842	4000
-3MBE (+) +1.5M LE	4500	14800	14800	5630	3250	225	8240	8240	11653	5930	11205	11205	4000
-3MBE (+) +3M LE	6000	15525	15525	5630	3250	225	8603	8603	12166	5930	11568	11568	4000
+0MBE (+) -3M LE	3000	14074	14074	5630	3250	225	7877	7877	11140	5930	10842	10842	4000
+0MBE (+) -1.5M LE	4500	14800	14800	5630	3250	225	8240	8240	11653	5930	11205	11205	4000
+0MBE (+) +0M LE	6000	15525	15525	5630	3250	225	8603	8603	12166	5930	11568	11568	4000
+0MBE (+) +1.5M LE	7500	16251	16251	5630	3250	225	8966	8966	12679	5930	11931	11931	4000
+0MBE (+) +3M LE	9000	16976	16976	5630	3250	225	9328	9328	13192	5930	12293	12293	4000
+3MBE (+) -3M LE	6000	15525	15525	5630	3250	225	8603	8603	12166	5930	11568	11568	4000
+3MBE (+) -1.5M LE	7500	16251	16251	5630	3250	225	8966	8966	12679	5930	11931	11931	4000
+3MBE (+) +0M LE	9000	16976	16976	5630	3250	225	9328	9328	13192	5930	12293	12293	4000
+3MBE (+) +1.5M LE	10500	17702	17702	5630	3250	225	9691	9691	13705	5930	12656	12656	4000
+3MBE (+) +3M LE	12000	18427	18427	5630	3250	225	10054	10054	14218	5930	13019	13019	4000
+6MBE (+) -3M LE	9000	16976	16976	5630	3250	225	9328	9328	13192	5930	12293	12293	4000
+6MBE (+) -1.5M LE	10500	17702	17702	5630	3250	225	9691	9691	13705	5930	12656	12656	4000
+6MBE (+) +0M LE	12000	18427	18427	5630	3250	225	10054	10054	14218	5930	13019	13019	4000
+6MBE (+) +1.5M LE	13500	19153	19153	5630	3250	225	10417	10417	14731	5930	13382	13382	4000
+6MBE (+) +3M LE	15000	19878	19878	5630	3250	225	10779	10779	15244	5930	13744	13744	4000



NOTE:

- BEFORE START OF THE FOUNDATION ACTIVITY, ALL THE RELEVANT INFORMATION PROVIDED IN THE TECHNICAL NOTES AND FOUNDATION DRAWINGS SHALL BE READ AND UNDERSTOOD. IF ANY ERROR OR CHANGES ARE OBSERVED, SAME SHALL BE INTIMATED TO ENGINEERING TEAM FOR CORRECTIVE ACTION.
- FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
- DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.241837837
2 TAN B =	0.483675674
FACE =	1.028827264
DEV =	1.056868525
IN FACE SLOPE	
TAN B =	0.241837837
SEC B =	1.027254576



NOTES:

- DRAWING NOT TO SCALE
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
- REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
- STUB BELOW GROUND LEVEL = 3800 mm
- WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- CLEAR COVER TO REINFORCEMENT IS 50MM
- STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XEL DAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	20-09-18	FOUNDATION DRAWING FOR TOWER TYPE DDN-3/0/4/3/6M (30-45 DEG. DEV. ANGLE) 400KV D/C (WZ-1) PS SOIL (4.0M DEPTH)		
CHKD	AM	20-09-18			
APPD	DL	20-09-18			
DATE	20-09-18	DRAWING NO.	GTPL400DCWZ-1/DDN/1-001	SHEET NO.	2/2
		REV			0

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liable for heavy damages and punishment with imprisonment.

EXC	B	H	W	B1	B2	H1	H2	Hcf	Hb
6400	6100	4000	700	5500	2000	400	300	300	3250

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	6000	PAD REINFORCEMENT	20	62	6000	2.46	917.00	3668.01
B	5400 50 354 354 50	PAD REINFORCEMENT	12	82	6207	0.89	451.70	1806.81
C	1900 560 50 50 560	PAD REINFORCEMENT	12	28	3120	0.89	77.55	310.20
D	4003	CHIMNEY BAR	32	4	4503	6.31	113.66	454.65
D1	500	CHIMNEY BAR	32	8	4503	6.31	227.32	909.29
E	600 600	CHIMNEY SQUARE SPACER	8	13	2592	0.39	13.29	53.18
E1	200 283	CHIMNEY SQUARE SPACER	8	13	2123	0.39	10.89	43.57
TOTAL REINFORCEMENT/ TOWER=								7245.7

TOTAL REINFORCEMENT/ TOWER= 7245.7

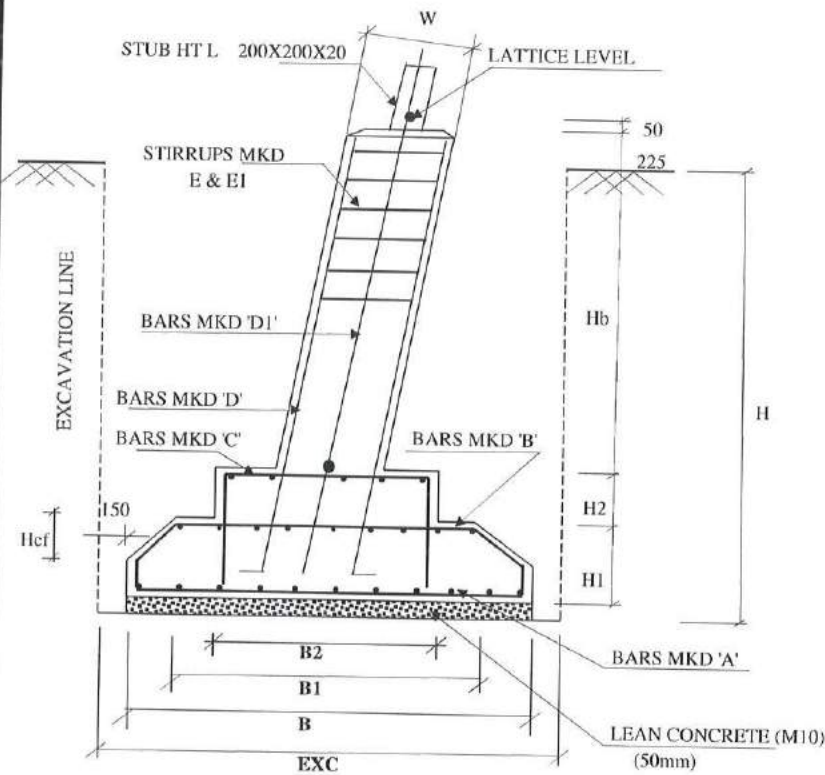
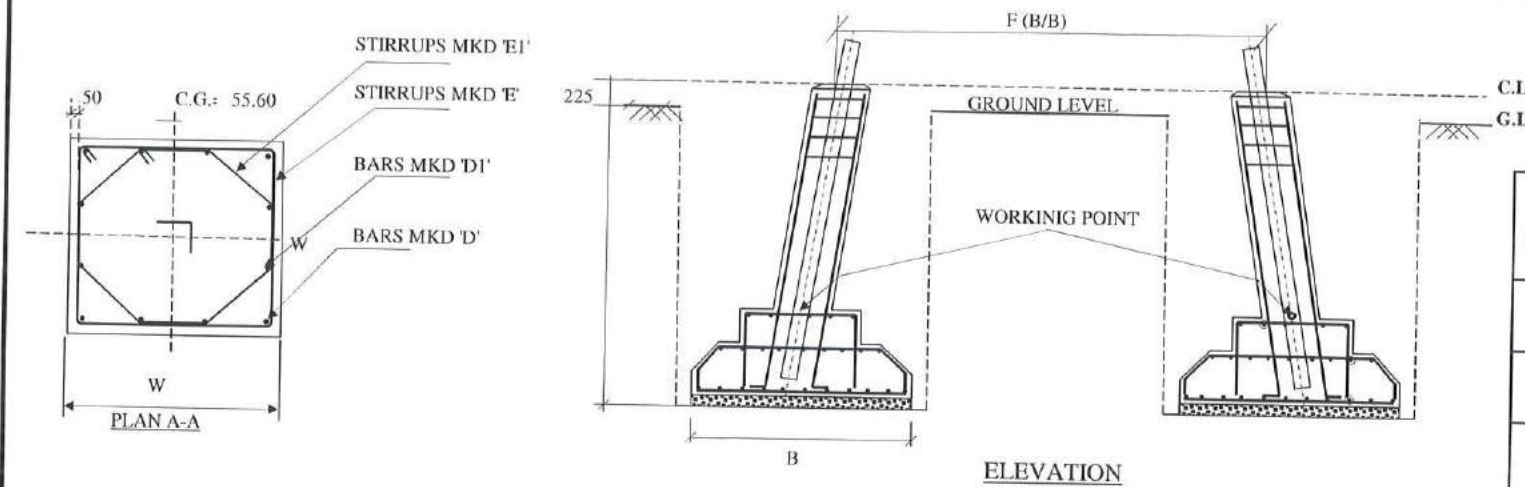
QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	66.9
CONCRETE (M10) m ³	7.44
TOTAL CONCRETE m ³	74.34
EXCAVATION m ³	655.36
REINFORCEMENT Kg	7245.7

NOTES:

- 1.DRAWING NOT TO SCALE
- 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
- 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
- 5.STUB BELOW GROUND LEVEL = 3800
- 6.WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
- 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
- 8.CLEAR COVER TO REINFORCEMENT IS 50MM
- 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
- 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

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Engineering Deptt.
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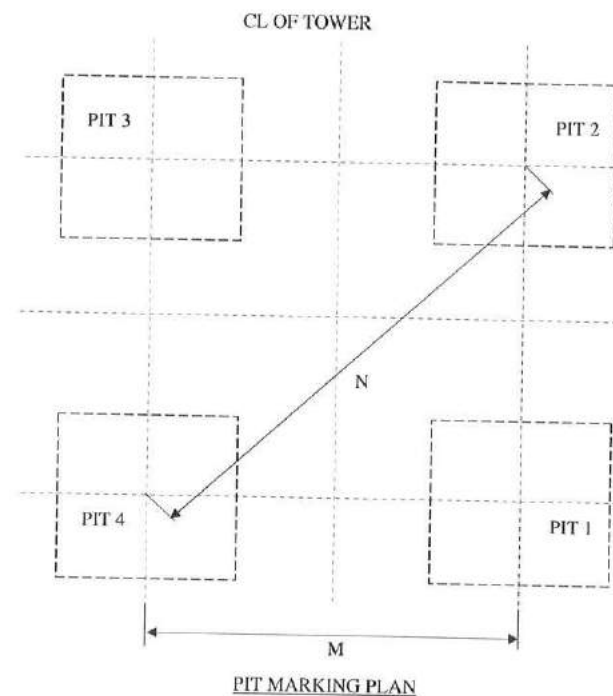
REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	20-09-18	FOUNDATION DRAWING FOR TOWER TYPE DDN-3/+0/+3/+6M (30-45 DEG. DEV. ANGLE) 400KV D/C (WZ-1) FS SOIL (4.0M DEPTH)		
CHKD	AM	20-09-18			
APPD	DL	20-09-18			
DATE	20-09-18	DRAWING NO.	GTTP/400DC/WZ-1/DDN/F-004	SHEET NO.	1/2 REV 0



FOUNDATION ELEVATION (CROSS SECTION)

VERTICAL SLOPE	
TAN B =	0.241837837
2 TAN B =	0.483675674
FACE =	1.028827264
DEV =	1.056868525
IN FACE SLOPE	
TAN B =	0.241837837
SEC B =	1.027254576

FOUNDATION DESIGN PARAMENTERS:	
TYPE OF SOIL :	FULLY SUBMERGED
UNIT WEIGHT (Kg/m ³):	940
LIMIT BEARING CAPACITY (Kg/m ²):	12500
ANGLE OF REPOSE :	15
WATER TABLE (m):	0m BELOW G.L.
FOUNDATION DEPTH (m):	4



REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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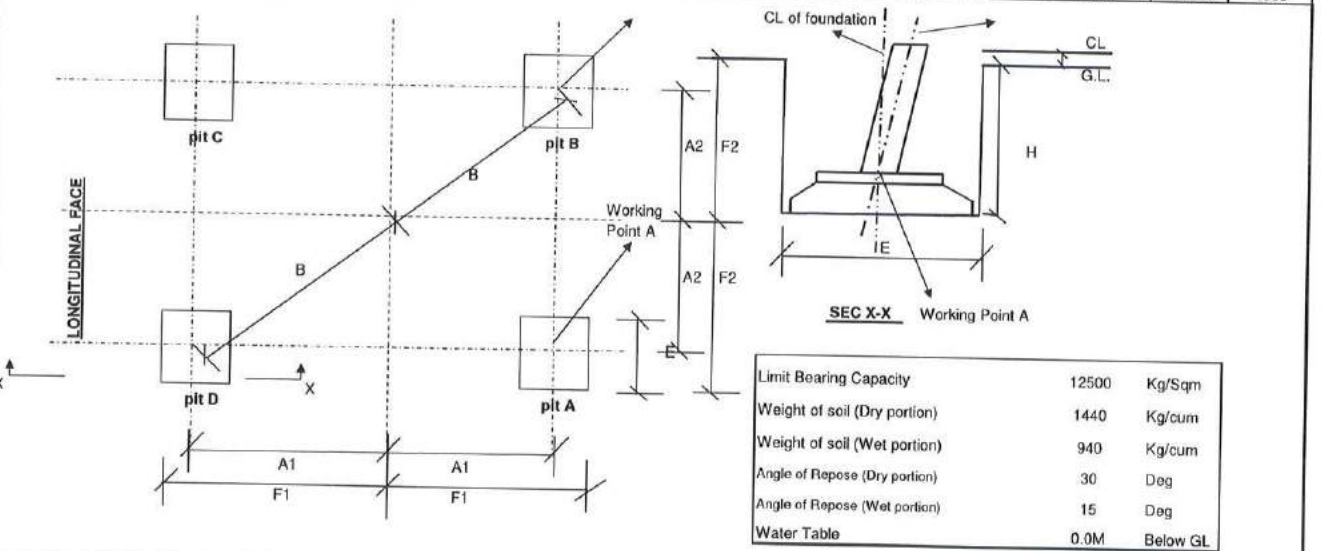
Project
GOA

400 KV D/C X-N (WZ-1) TT "DDN" (30-45 DEG. DEV.) SOIL - FS (4.0M DEPTH)

PIT DIMENSION TABLE

Client:
SPGVL

400 KV D/C -X-N- TT "DDN"		F * B/B of Tower at 3MBE(+)-3MLE (TF)		F * B/B of Tower at 3MBE(+)-3MLE (LF)		Stub Section (HT)		Lattice Level to CL	cg	sec B1	2*Tan B1	sec B2	2*Tan B2
		12710		12710		200X200X16		60	55.6	1.028827	0.483675674	1.028827	0.4836757
Tower Detail	Extn from -3MBE(+)-3MLE (mm)	cg-cg dim at CL (TF)	cg-cg dim at CL (LF)	Foundation Base Width	work pt	G.L. TO C.L.	A1	A2	B	E	F1	F2	H
-3MBE (+) -3M LE	0	12623	12623	6100	3250	225	7152	7152	10114	6400	10352	10352	4000
-3MBE (+) -1.5M LE	1500	13348	13348	6100	3250	225	7515	7515	10627	6400	10715	10715	4000
-3MBE (+) +0M LE	3000	14074	14074	6100	3250	225	7877	7877	11140	6400	11077	11077	4000
-3MBE (+) +1.5M LE	4500	14800	14800	6100	3250	225	8240	8240	11653	6400	11440	11440	4000
-3MBE (+) +3M LE	6000	15525	15525	6100	3250	225	8603	8603	12166	6400	11803	11803	4000
+0MBE (+) -3M LE	3000	14074	14074	6100	3250	225	7877	7877	11140	6400	11077	11077	4000
+0MBE (+) -1.5M LE	4500	14800	14800	6100	3250	225	8240	8240	11653	6400	11440	11440	4000
+0MBE (+) +0M LE	6000	15525	15525	6100	3250	225	8603	8603	12166	6400	11803	11803	4000
+0MBE (+) +1.5M LE	7500	16251	16251	6100	3250	225	8966	8966	12679	6400	12166	12166	4000
+0MBE (+) +3M LE	9000	16976	16976	6100	3250	225	9328	9328	13192	6400	12528	12528	4000
+3MBE (+) -3M LE	6000	15525	15525	6100	3250	225	8603	8603	12166	6400	11803	11803	4000
+3MBE (+) -1.5M LE	7500	16251	16251	6100	3250	225	8966	8966	12679	6400	12166	12166	4000
+3MBE (+) +0M LE	9000	16976	16976	6100	3250	225	9328	9328	13192	6400	12528	12528	4000
+3MBE (+) +1.5M LE	10500	17702	17702	6100	3250	225	9691	9691	13705	6400	12891	12891	4000
+3MBE (+) +3M LE	12000	18427	18427	6100	3250	225	10054	10054	14218	6400	13254	13254	4000
+6MBE (+) -3M LE	9000	16976	16976	6100	3250	225	9328	9328	13192	6400	12528	12528	4000
+6MBE (+) -1.5M LE	10500	17702	17702	6100	3250	225	9691	9691	13705	6400	12891	12891	4000
+6MBE (+) +0M LE	12000	18427	18427	6100	3250	225	10054	10054	14218	6400	13254	13254	4000
+6MBE (+) +1.5M LE	13500	19153	19153	6100	3250	225	10417	10417	14731	6400	13617	13617	4000
+6MBE (+) +3M LE	15000	19878	19878	6100	3250	225	10779	10779	15244	6400	13979	13979	4000



- NOTE:
- BEFORE START OF THE FOUNDATION ACTIVITY, ALL THE RELEVANT INFORMATION PROVIDED IN THE TECHNICAL NOTES AND FOUNDATION DRAWINGS SHALL BE READ AND UNDERSTOOD. IF ANY ERROR OR CHANGES ARE OBSERVED, SAME SHALL BE INTIMATED TO ENGINEERING TEAM FOR CORRECTIVE ACTION.
 - FOUNDATION SHALL BE EXECUTED IN THE PRESENCE OF SITE ENGINEER ONLY.
 - DIMENSIONS OF BACK TO BACK OF STUB AT CONCRETE LEVEL SHALL BE READ CHECKED WITH FOUNDATION DRAWINGS PIT DIMENSION TABLE FURNISHED IN THE SHEET 2 OF 2 OF THIS DRAWINGS BEFORE START OF THE FOUNDATION PIT MARKING.

VERTICAL SLOPE	
TAN B =	0.241837837
2 TAN B =	0.483675674
FACE =	1.028827264
DEV =	1.05608525
IN FACE SLOPE	
TAN B =	0.241837837
SEC B =	1.027254576

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ENG/L&T/26 Date: 20/09/18
Engineering Dept.
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- NOTES:
- DRAWING NOT TO SCALE
 - ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
 - CONCRETE MIX USED M20, LEAN CONCRETE MIX M10.
 - REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786 (Grade Fe - 500N/mm²)
 - STUB BELOW GROUND LEVEL, = 3800 mm
 - WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
 - FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
 - CLEAR COVER TO REINFORCEMENT IS 50MM
 - STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
 - AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	20-09-18	FOUNDATION DRAWING FOR TOWER TYPE DDN-3/+0/+3/+6M (30-45 DEG. DEV. ANGLE) 400KV D/C (WZ-1) FS SOIL (4.0M DEPTH)		
CHKD	AM	20-09-18			
APPD	DL	20-09-18			
DATE	20-09-18	DRAWING NO.			
		GTTP/L/00DCWZ-1/DDN/F-004	SHEET NO.	2/2	REV 0

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liable for heavy damages and penalties with respect to it.

B	H	W	B1	B2	H1	H2	Hcf	Hb
3910	4000	700	3310	2000	400	300	300	3250

BAR MKD	BAR BENDING SKETCH	BAR DETAILS	SECTION DIAMETER (mm)	NO. OF BARS PER FDN (no)	LENGTH (mm)	UNIT WEIGHT (kg/m)	WEIGHT PER LEG (kg)	WEIGHT PER TOWER (kg)
A	3810	PAD REINFORCEMENT	16	42	3810	1.58	252.50	1009.99
B	3210 50 354 354 50	PAD REINFORCEMENT	12	28	4017	0.89	99.86	399.44
C	1900 568 50 50 568	PAD REINFORCEMENT	12	28	3136	0.89	77.95	311.79
D	4011	CHIMNEY BAR	32	4	4511	6.31	113.86	455.46
D1	500	CHIMNEY BAR	32	8	4511	6.31	227.72	910.90
E	600 600	CHIMNEY SQUARE SPACER	8	14	2592	0.39	14.31	57.27
E1	200 283	CHIMNEY SQUARE SPACER	8	14	2123	0.39	11.72	46.90
TOTAL REINFORCEMENT/ TOWER=								3191.7

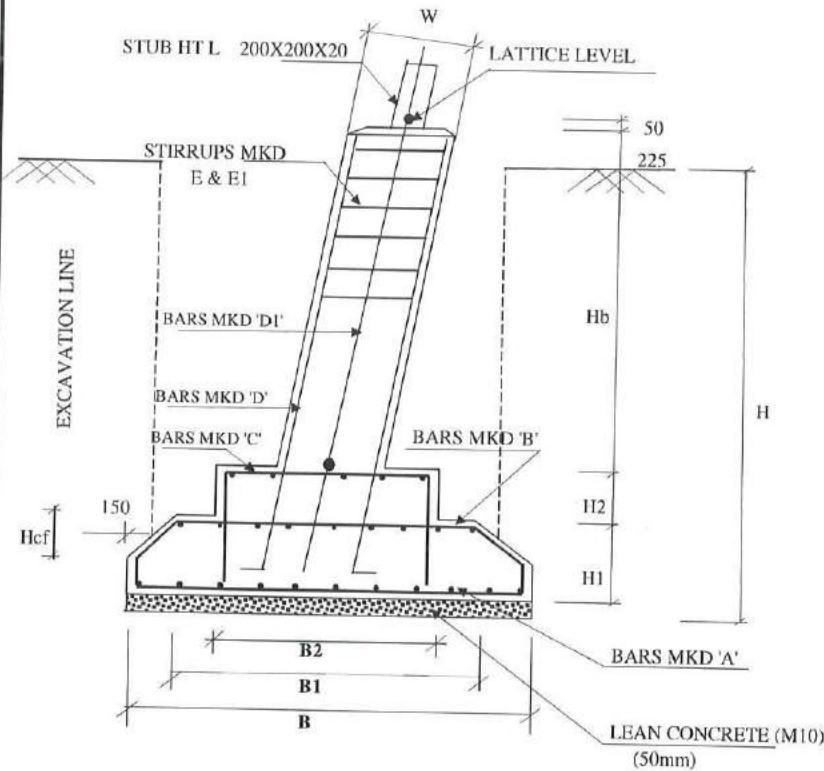
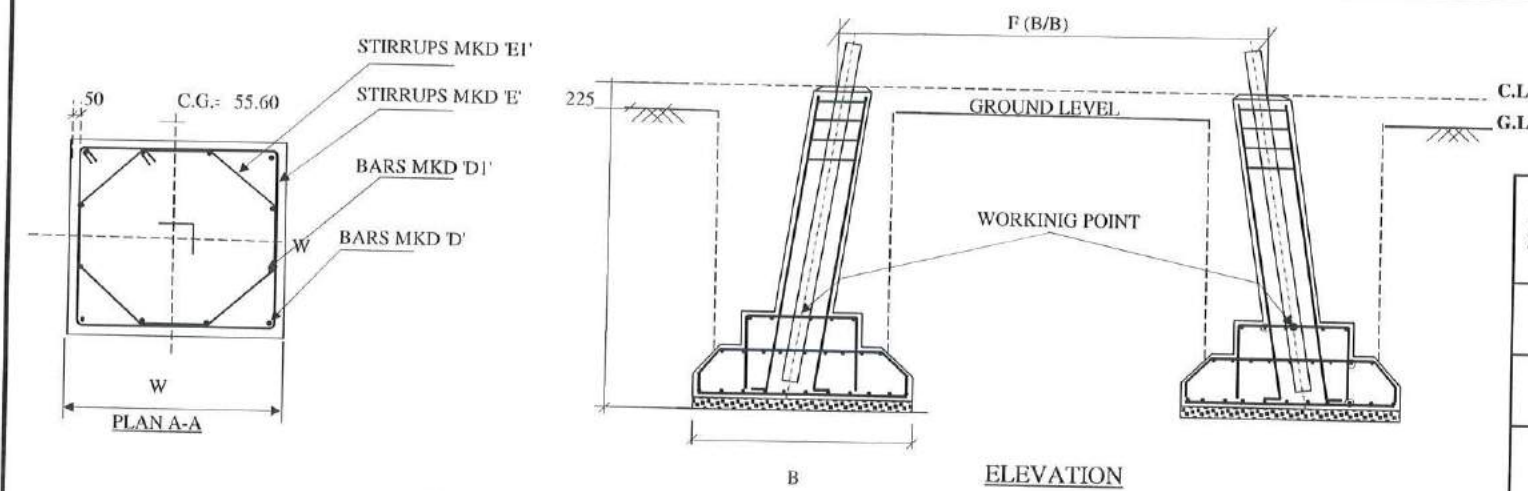
FOUNDATION DESIGN PARAMETERS:	
TYPE OF SOIL :	DRY FISSURED ROCK
UNIT WEIGHT (Kg/m ³):	1700
LIMIT BEARING CAPACITY (Kg/m ²):	62500
ANGLE OF REPOSE :	20
WATER TABLE (m) :	BELOW 4.0m FROM G.L.
FOUNDATION DEPTH (m):	4

QUANTITIES/ STRUCTURE	
CONCRETE (M20) m ³	33.4
CONCRETE (M10) m ³	3.06
TOTAL CONCRETE m ³	36.46
EXCAVATION m ³	210.52
REINFORCEMENT Kg	3191.7

- NOTES:
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 - 2.ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
 - 3.CONCRETE MIX USED M20,LEAN CONCRETE MIX M10.
 - 4.REINFORCEMENT ARE HIGH STRENGTH DEFORMED BARS CONFIRMING TO IS 1139/1786(Grade Fe - 500N/mm²)
 - 5.STUB BELOW GROUND LEVEL = 3800
 - 6.WHENEVER NECESSARY TO CLEAR STUB CLEAT FROM BARS & STIRRUPS SAME IS TO BE ADJUSTED AT SITE.
 - 7.FOR FOUNDATION DESIGN REFER DESIGN DOCUMENTS.
 - 8.CLEAR COVER TO REINFORCEMENT IS 50MM
 - 9.STUB SETTING/PROP SETTING TEMPLATE HAS TO BE USED IN EACH LOCATION OF TOWER.
 - 10.AT SITE PROPER COMPACTION OF THE BACK FILLED EARTH MUST BE DONE.

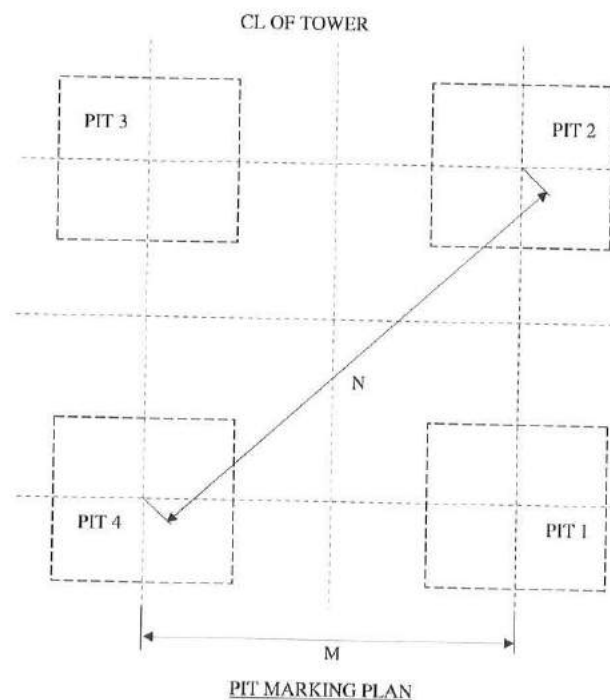
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ENGL/L&T/26 Date: 20/09/18
Engineering Dept.
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REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDAM-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	20-09-18	FOUNDATION DRAWING FOR TOWER TYPE DDN-3/+0/+3/+6M (30-45 DEG. DEV. ANGLE) 400KV D/C (WZ-1) DFR SOIL (4.0M DEPTH)		
CHKD	AM	20-09-18			
APPD	DL	20-09-18			
DATE	20-09-18	DRAWING NO.	GTTP/400DC/WZ-1/DDN/F-005	SHEET NO.	1/2 REV 0



FOUNDATION ELEVATION (CROSS SECTION)

VERTICAL SLOPE	
TAN B =	0.241837837
2 TAN B =	0.483675674
FACE =	1.028827264
DEV =	1.056868525
IN FACE SLOPE	
TAN B =	0.241837837
SEC B =	1.027254576



REFER SHEET 2 OF 2 FOR PIT DIMENSION TABLE FOR SETTING OF STUB FOR BODY AND LEG EXTENSIONS.

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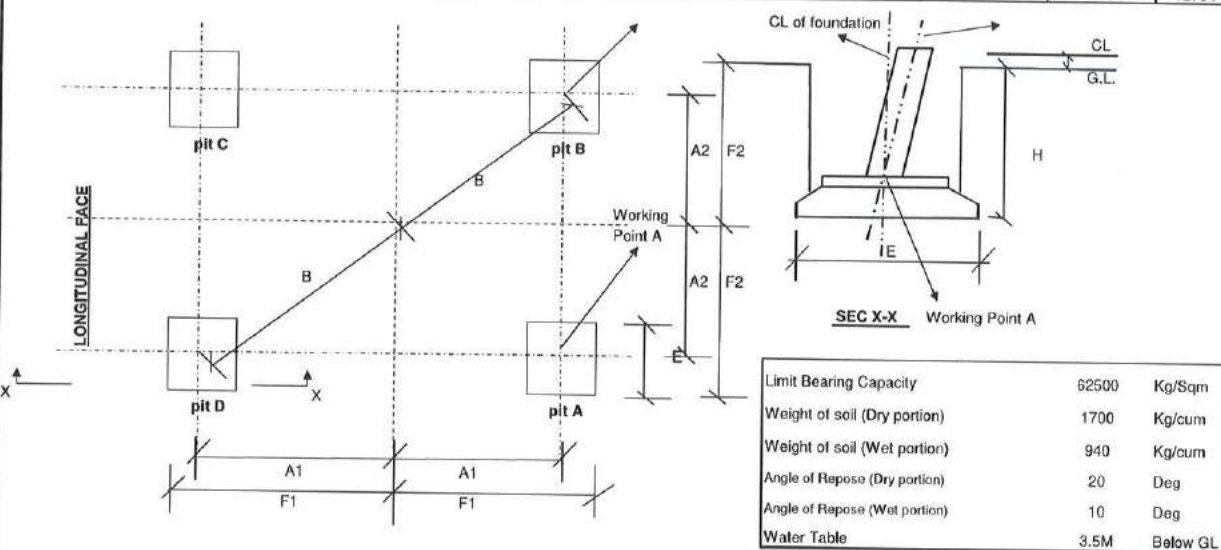
Project
GOA

400 KV D/C X-N (WZ-1) TT "DDN" (30-45 DEG. DEV.) SOIL - DFR (4.0M DEPTH)

PIT DIMENSION TABLE

Client:
SPQVL

400 KV D/C -X-N- TT "DDN"		* F * B/B of Tower at 3MBE(+)-3MLE (TF)		* F * B/B of Tower at 3MBE(+)-3MLE (LF)		Stub Section (HT)		Lattice Level to CL	cg	sec B1	2*Tan B1	sec B2	2*Tan B2
		12710		12710		200X200X16		50	55.6	1.028827	0.483675674	1.028827	0.4836757
Tower Detail	Extn from -3MBE(+)-3MLE (mm)	cg-cg dim at CL (TF)	cg-cg dim at CL (LF)	Foundation Base Width	work pt	G.L. TO C.L.	A1	A2	B	E	F1	F2	H
-3MBE (+) -3M LE	0	12623	12623	3910	3250	225	7152	7152	10114	3910	9107	9107	4000
-3MBE (+) -1.5M LE	1500	13348	13348	3910	3250	225	7515	7515	10627	3910	9470	9470	4000
-3MBE (+) +0M LE	3000	14074	14074	3910	3250	225	7877	7877	11140	3910	9832	9832	4000
-3MBE (+) +1.5M LE	4500	14800	14800	3910	3250	225	8240	8240	11653	3910	10195	10195	4000
-3MBE (+) +3M LE	6000	15525	15525	3910	3250	225	8603	8603	12166	3910	10558	10558	4000
+0MBE (+) -3M LE	3000	14074	14074	3910	3250	225	7877	7877	11140	3910	9832	9832	4000
+0MBE (+) -1.5M LE	4500	14800	14800	3910	3250	225	8240	8240	11653	3910	10195	10195	4000
+0MBE (+) +0M LE	6000	15525	15525	3910	3250	225	8603	8603	12166	3910	10558	10558	4000
+0MBE (+) +1.5M LE	7500	16251	16251	3910	3250	225	8966	8966	12679	3910	10921	10921	4000
+0MBE (+) +3M LE	9000	16976	16976	3910	3250	225	9328	9328	13192	3910	11283	11283	4000
+3MBE (+) -3M LE	6000	15525	15525	3910	3250	225	8603	8603	12166	3910	10558	10558	4000
+3MBE (+) -1.5M LE	7500	16251	16251	3910	3250	225	8966	8966	12679	3910	10921	10921	4000
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+3MBE (+) +1.5M LE	10500	17702	17702	3910	3250	225	9691	9691	13705	3910	11646	11646	4000
+3MBE (+) +3M LE	12000	18427	18427	3910	3250	225	10054	10054	14218	3910	12009	12009	4000
+6MBE (+) -3M LE	9000	16976	16976	3910	3250	225	9328	9328	13192	3910	11283	11283	4000
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+6MBE (+) +1.5M LE	13500	19153	19153	3910	3250	225	10417	10417	14731	3910	12372	12372	4000
+6MBE (+) +3M LE	15000	19878	19878	3910	3250	225	10779	10779	15244	3910	12734	12734	4000



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VERTICAL SLOPE	
TAN B =	0.241837837
2 TAN B =	0.483675674
FACE =	1.028827204
DEV =	1.050868525
IN FACE SLOPE	
TAN B =	0.241837837
SEC B =	1.027254576

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- NOTES:
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REV NO	DATE	DESCRIPTION	DRAWN	CHKD	APPD
PROJECT		400KV D/C XELDA-NARENDRA TRANSMISSION LTD			
CLIENT		STERLITE POWER GRID VENTURES LIMITED			
DESIGNER:		STERLITE POWER GRID VENTURES LIMITED			
DRWN	RT	20-09-18	FOUNDATION DRAWING FOR TOWER TYPE DDN-3/4/0/+3/+6M (30-45 DEG. DEV. ANGLE) 400KV D/C (WZ-1) DFR SOIL (4.0M DEPTH)		
CHKD	AM	20-09-18			
APPD	DL	20-09-18			
DATE	20-09-18	DRAWING NO.	GTTP/L400DC/WZ-1/DDN/T-005	SHEET NO.	2/2
		REV	0		

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