

BHARAT HEAVY ELECTRICALS LIMITED

ROUTE ALIGNMENT SURVEY REPORT

220 kV DC Transmission Line
From 220kV Switchyard to 400 kV Switchyard for
Rayalseema Thermal Power Plant Stage-IV



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1. Introduction

APGENCO have initiated the activities related to extension of Rayalseema Thermal Power Plant for Stage-IV, Unit#6. The Bharat Heavy Electricals Ltd (BHEL) have been awarded the work as Contractor. M/s Tata Consulting Engineers Limited (TCE) are the Engineering Service Providers for proposed 200kV Double Circuit Transmission Line (DCTL) connection from existing 220kV existing Switchyard to proposed 400kV switchyard.

The following Report describes the Route Survey of this 220 kV DCTL connection with the optimized routing as practically possible, avoiding any forest/water areas (wherever possible) and other heritage points.

In this revision, a new Gantry is proposed near the existing gantry and location of Tower T1 is revised to obtain the required railway clearances.

2. Scope of Work

- i. Identification of optimum routes
- ii. Selection of shortest and feasible route
- iii. Conducting detailed survey for the selected route using total station and hand held GPS devices with positional accuracy
- iv. Fix and finalize the angle points by using the survey data
- v. Preparation of route alignment survey report in line with the requirement of the Owner and the project specification
- vi. Tower spotting and Tower Types

3. Reconnaissance Survey

This is the initial phase of the route alignment survey.

For this Project, being a small route length, the site layout provided by APGENCO/BHEL as base map is used. During the survey, all the crossings has been identified and used while planning the route.

During the survey, water body of stretching over 150 m x 100 m was encountered. To avoid this water body from the point of view of construction, the location of Tower T2 was revised.

4. Route Alignment Survey

The selected route has been demarcated on the Site plan with the details collected from survey with all the angle point coordinates.

a. Walk-over survey

- Walk-over survey was carried out with the hand-held GPS receivers.
- Data acquired from site layout provided by APGENCO/BHEL has been used as a reference data.
- Tentative angle point coordinates extracted from reconnaissance survey have been used for GPS navigation.
- During this walk-over survey, location/position of all major crossings like those with pipe line / water body, railway, etc. have been recorded and stored in the GPS device.
- In addition to the above mentioned crossings, structures like building, pump house, fire water tanks, etc. have also been recorded.
- Existing features like road, cart track, canal, nallah, electrical tower/pole locations were also recorded.
- All topographical features along and across the route have been recorded.

b. Route Alignment Finalization

After completion of the walk-over survey, all the relevant data has been downloaded and plotted on the geo-referenced Topo sheets, to finalize the route alignment.

5. Selection of Route

Route selection is the combination of reading details from Topo sheets and superimposing the survey data on the Topo sheets.

Route selection involves processing and analysis of the data collected through the survey. Selected route should be easily approachable from the point of view of ease of construction and maintenance. All the towers in the selected route should be approachable throughout the year.

Route has been finalized by keeping the following points in mind:

- The distance between the terminal points specified shall be kept shortest possible, consistent with the terrain that is encountered.
- The number of angle points shall be kept to a minimum.
- The route should have minimum number of crossings of Major Rivers/water, Railway lines, overhead power line and communication lines.
- Marshy and low lying areas, water bodies, river beds and earth slip zones shall be avoided to minimize risk to the foundations.
- It would be preferable to utilize levelled ground for the alignment.
- Crossing of power lines shall be minimal. Alignment will be kept at a safe distance from power lines to avoid induction problems on the lower voltage lines. The actual horizontal/vertical clearances as per the codal requirements have to be maintained based on the voltage levels of the crossing lines.
- Crossings with communication lines shall be minimized and it shall be preferably at right angle. Proximity and parallelism with telecom lines shall be eliminated to avoid danger of inducing power frequency high voltages on communication lines.
- Areas subjected to flooding such as canal, nallah shall be avoided.
- Restricted areas such as civil and military airfield shall be avoided. Care shall also be taken to avoid aircraft landing approaches.
- The alignment should be easily accessible both in dry and rainy seasons to enable maintenance throughout the year.

6. Major Crossings

Major crossing of route alternative has been listed below

Sl. No	Section Name	Crossing Feature
1	GANTRY-T1	Railway Track (line is crossing the APGENCO internal rail track utilized for non-commercial purpose near dead end of rail track)

7. Alternate Route Coordinates

There is no alternate route envisaged as the route length of the proposed 220kV line is very short and there are existing ground features along the route.

8. Route Description

Route length of the selected Route has been measured as **728.91 m**, while the Bee Line length is **582.08 m**.

- Entire alignment passes through APGENCO owned land only.
- After the existing 220 kV Switchyard gantry, between the proposed new gantry and Tower T1, the alignment crosses the railway track. The line is crossing the APGENCO internal railway track utilized for non-commercial purpose, and that too the near dead end of railway track.
- Between Tower T1 and Tower T2, alignment passes through water body. Tower at location T2 is revised to avoid the tower location within the water body. This results in cost optimization and also avoids issues related to execution inside the water body.

Span details

Span	Length (m)	Remarks
Gantry – T1	107.23	Pipe line crossing, Railway crossing, Canal crossing
T1 – T2	192.92	Passing over water body
T2 – T3	244.30	
T3 – T4	104.52	
T4 – Gantry	79.94	
Total Line length	728.91	

Tower Co-ordinates

Sr. No.	AP	Easting	Northing
1	Gantry	2,26,487.782	16,26,890.357
2	T1	2,26,583.938	16,26,830.415
3	T2	2,26,731.101	16,26,705.581
4	T3	2,26,632.984	16,26,481.903
5	T4	2,26,620.457	16,26,378.135
6	Gantry	2,26,691.086	16,26,340.688

9. Comparative Statement

Sl. No.	Crossing Feature	Details
1	Route Length (m)	728.91
2	Power Line Crossings	
	a. 66kV Crossing	-
	b. 110kV Crossing	-
	c. 132kV Crossing	-
	d. 220kV Crossing	-
	e. 400kV Crossing	-
3	Railway Crossing	1
4	NH Crossing	-
5	SH Crossing	-
6	Water Body Crossing	1
7	Forest Crossing	-
8	Mango Plantation	-
9	Number of Angle Points	2
10	No. of Dead end towers	2
11	Total Towers	4

10. Tower Types

Tower Location	Tower Type Used	Angle of Deviation
T1	DE+09m (body extension)	07° - 45' - 23"
T2	DE+09m (body extension)	73° - 22' - 40"
T3	DC+0m (body extension)	16° - 48' - 05"
T4	DE+0m (body extension)	68° - 57' - 04"

11. Conclusion

- For achieving required clearances for railway line crossing, new gantry is introduced near the existing substation gantry and Tower T1 is relocated. At the railway crossing location, available clearance above the rail track is 18.50 m against 18.00m . Also horizontal distance of the tower is 51.00 m from the track against requirement of 50.20 m (i.e. 35.20m normal tower height + 9.00 m Extension + 6.00m horizontal clearance from rail track)
- To avoid water body, Tower at location T2 is relocated.
- By keeping all technical specifications and scope of this project in mind, it is recommended to consider the indicated Route in the drawing as the final route.

Also the entire alignment passes through APGENCO owned land only. Tower installation in the water body is avoided.

Annexure – 1 - Drawings

ROUTE ALIGNMENT SURVEY: PLAN AND PROFILE (3 SHEETS)

Annexure – 2 – Site Photos



EXISTING 220kV SWITCHYARD



EXISTING RAILWAY LINE



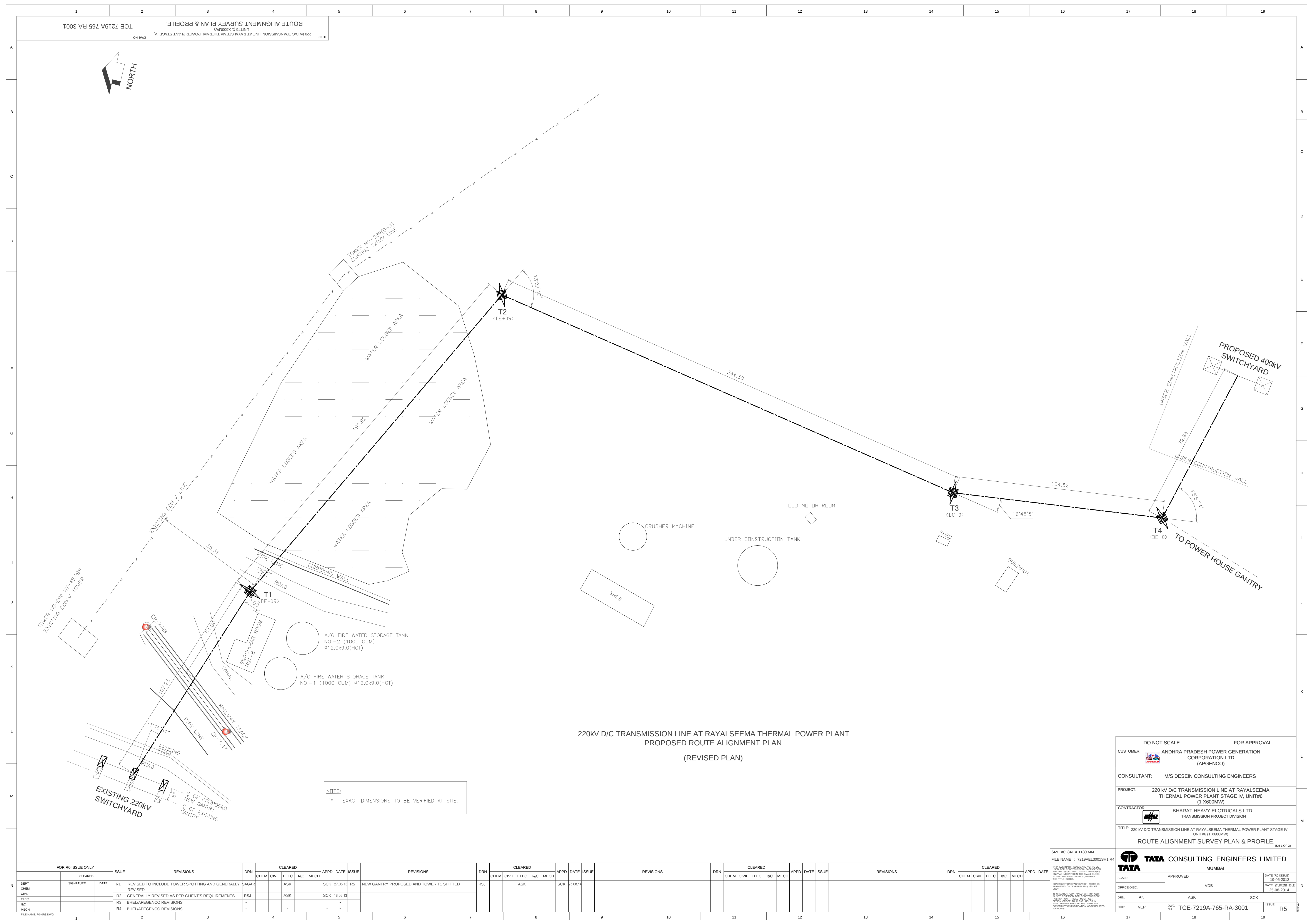
WATER BODY NEAR PROPOSED TOWER T2

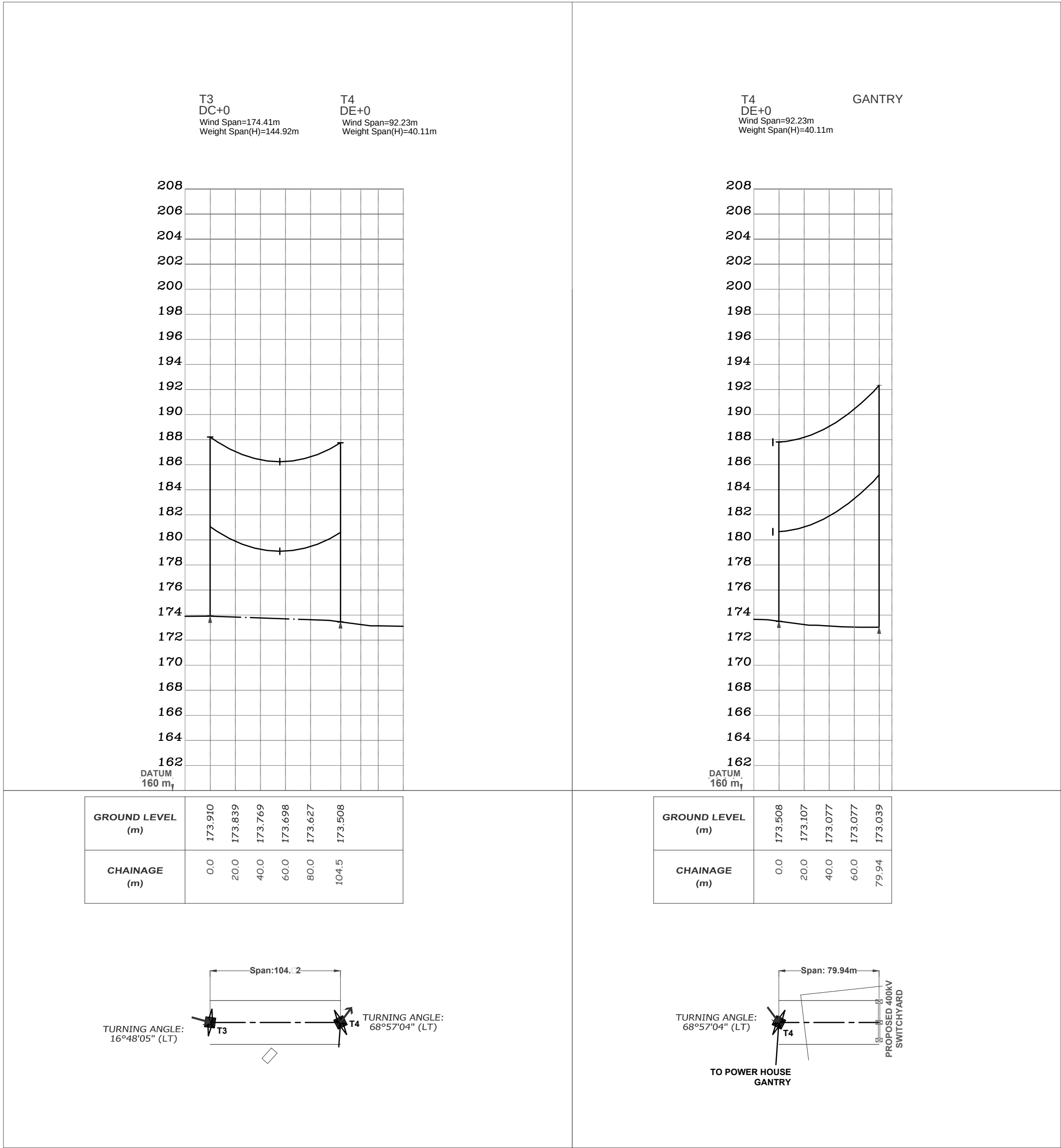


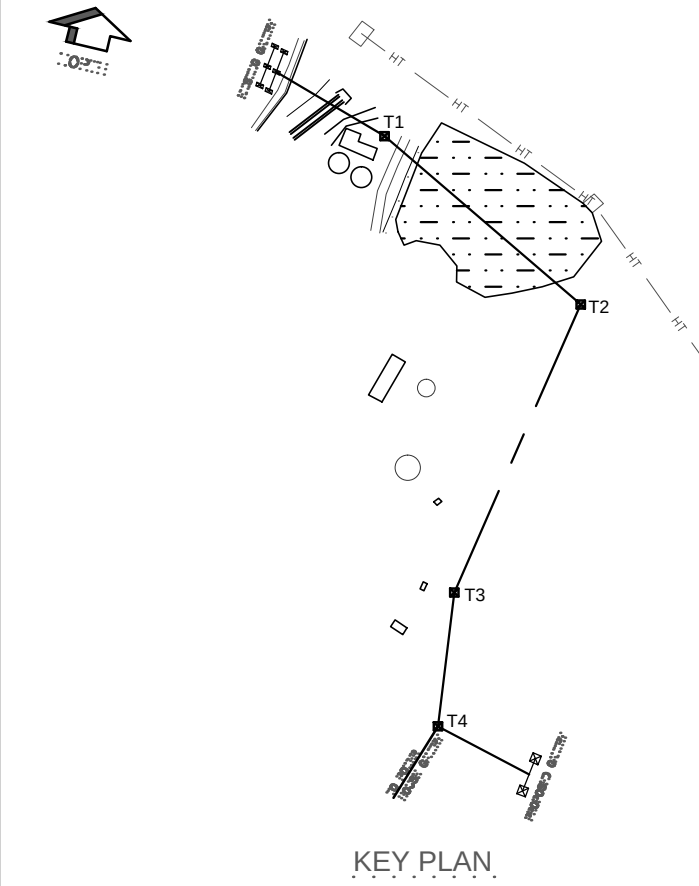
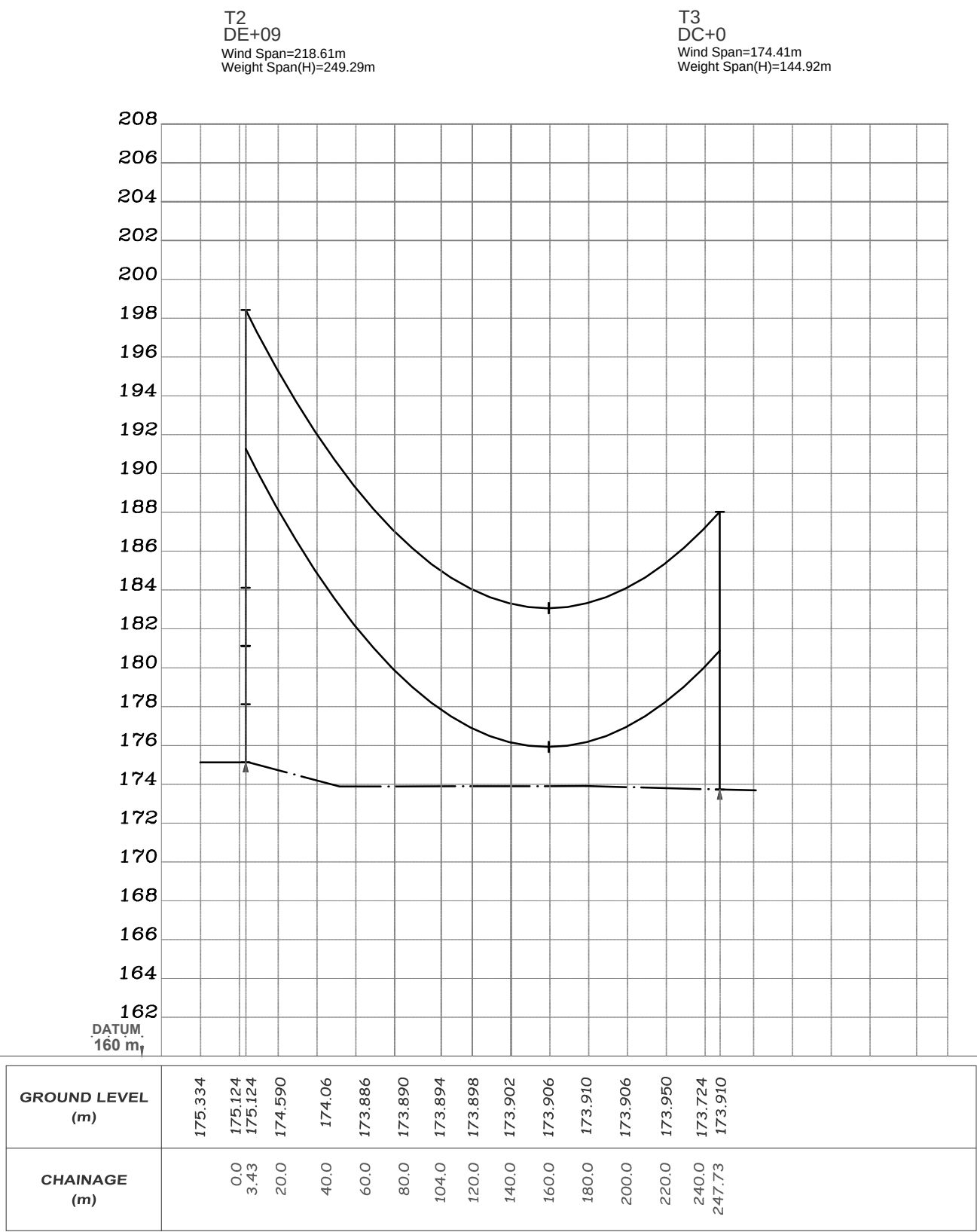
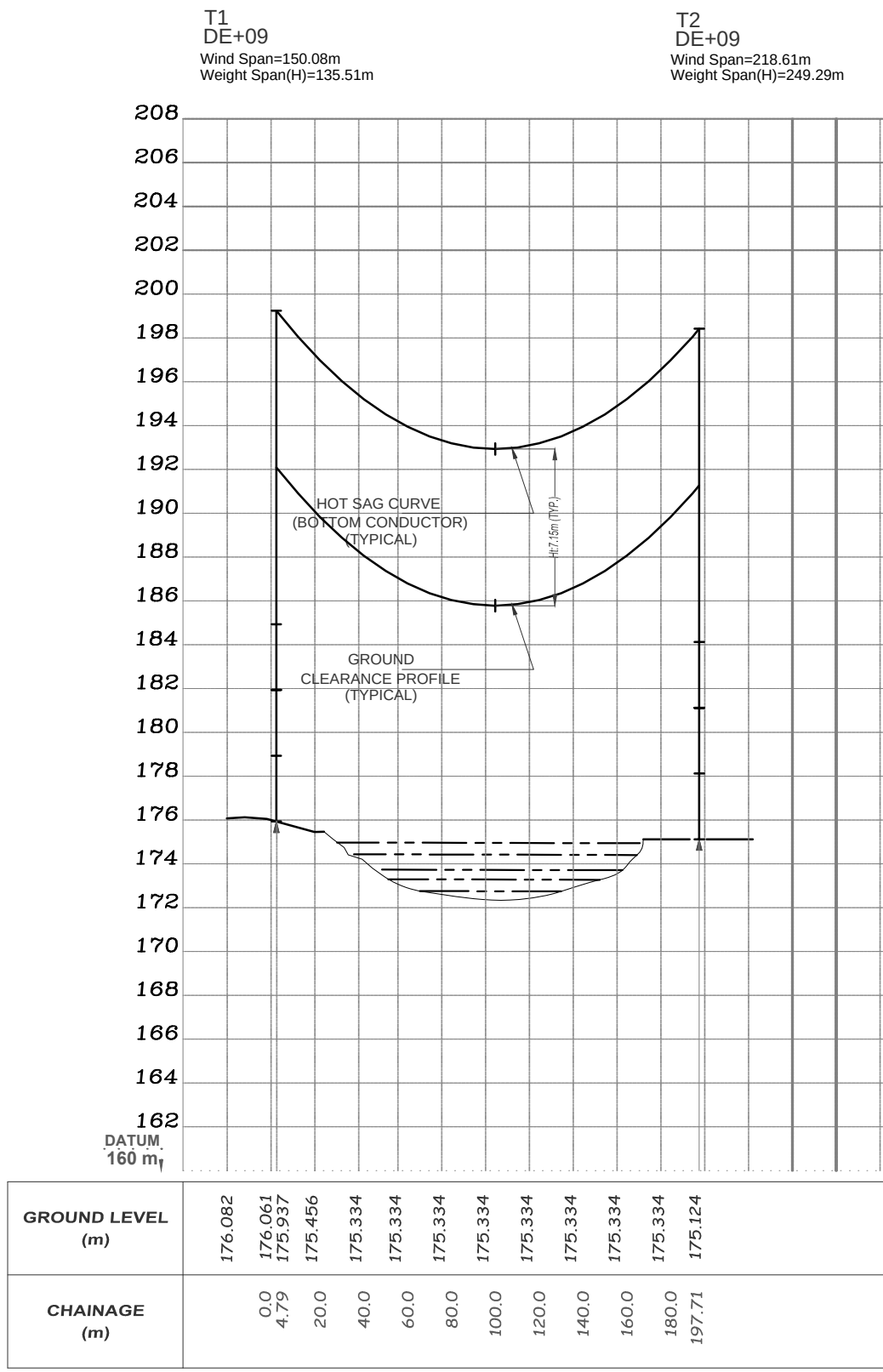
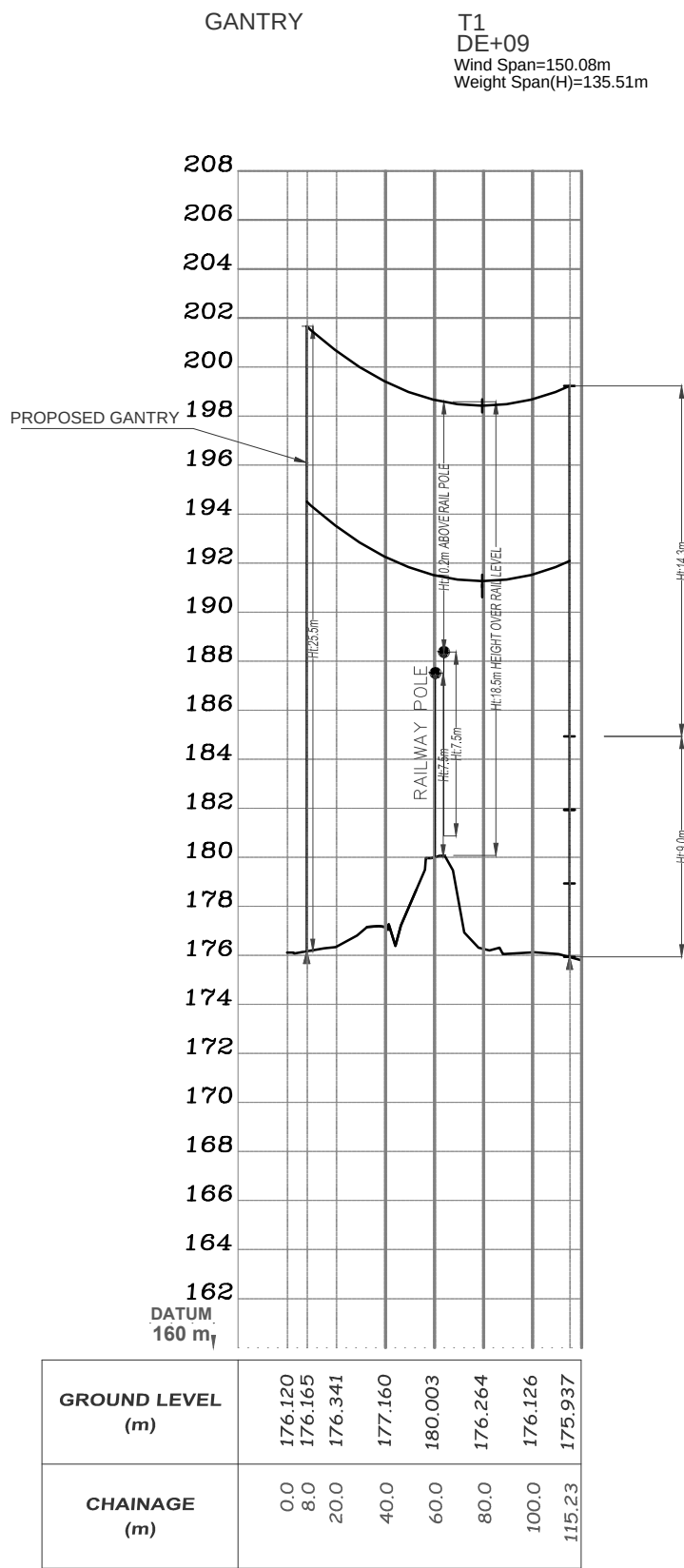
EXISTING 220KV LINE



LANDSCAPE NEAR PROPOSED TOWER T4



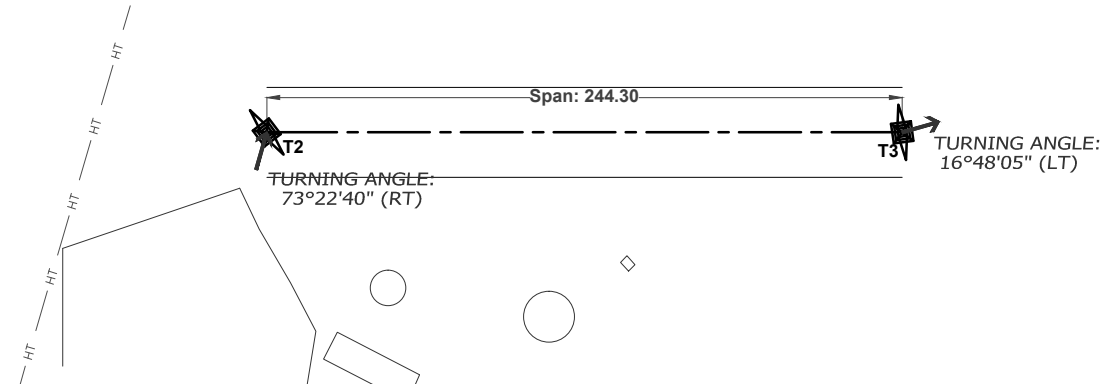
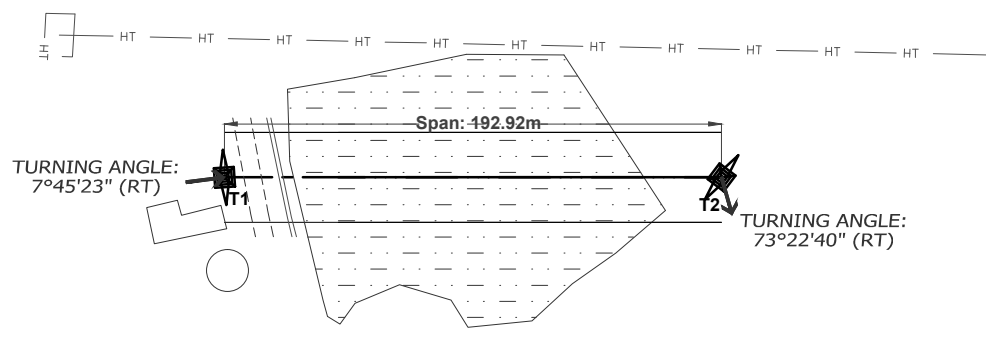
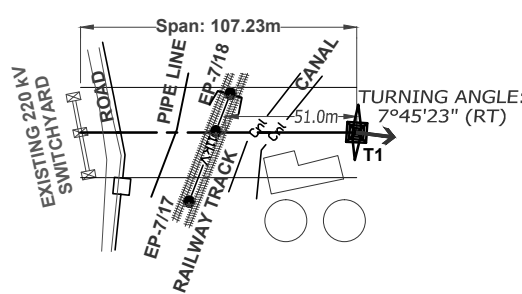




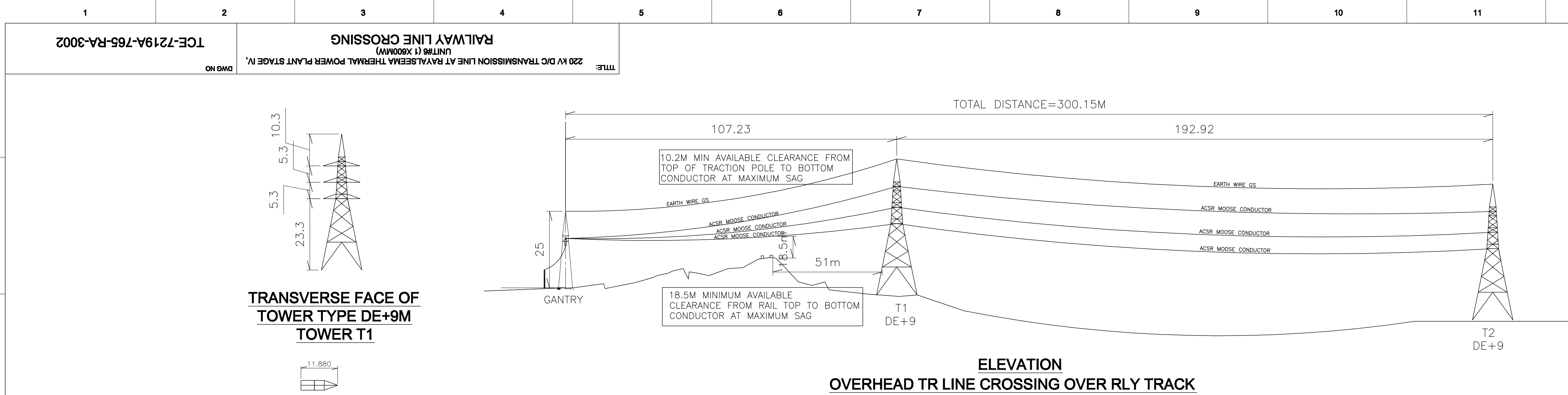
- LEGEND
- T1 — TOWER 1
 - T2 — TOWER 2
 - T3 — TOWER 3
 - T4 — TOWER 4
 - GL — GROUND LEVEL
 - HT — HIGH TENSION
 - EP — ELECTRIC POLE
 - WB — WATER BODY

NOTES:

- ALL DIMENSIONS ARE IN METRES AND LEVEL ARE IN METRES.
- ALL LEVEL ARE WITH THE REFERENCE DATUM OF 160.00 METRES.



FOR RD ISSUE ONLY				ISSUE	REVISIONS	DRN	CLEARED				APPD	DATE
CLEARED			CHEM				CIVIL	ELEC	I&C	MECH		
DEPT	SIGNATURE	DATE	R1	REVISED TO INCLUDE TOWER SPOTTING AND GENERALLY REVISED	SAGAR			ASK			SCK	27.05.19
CHRM			R2	GENERALLY REVISED AS PER CLIENT'S REQUIREMENTS.	RSJ			ASK			SCK	18.06.19
CIVIL			R3	NEW GANTRY PROPOSED AND TOWER T1 SHIFTED				ASK			SCK	26.08.14
ELEC												
I&C												
MECH												
P.L.C. NUMBER: 12410037 7000												



- NOTES:**
1. ALL TRANSMISSION LINE SUPPORTING STRUCTURES OF RAILWAY CROSSING SPAN SHALL BE EFFICIENTLY EARTHED WITH 2 NUMBERS MAINTENANCE-FREE EARTHING AS PER RDSO SPEC.RDSO/PE/SPEC/PS/0109 REV-01- 2008.
 2. ALL THE INSULATORS STRINGS SHALL BE DOUBLE TENSION STRINGS.
 3. THERE IS A PROVISION FOR INSTANTANEOUS ISOLATION OF LINE IN CASE OF FAULT.
 4. THE STRUCTURE FOUNDATION, CONDUCTOR & OTHER MATERIALS UTILISED FOR THE CROSSING ARE DESIGNED TO GIVE REQUIRED FACTOR SAFETY AS SPECIFIED IN THE REGULATION FOR ELECTRICAL CROSSING OF RAILWAY TRACK UNDER THE WORST CONDITION.
 5. DISTANCE OF RAILWAY CROSSING IS 0.013KM FROM DEAD END OF APGENCO INTERNAL NON-COMMERCIAL RAILWAY LINE.
 6. RAILWAY CROSSING ANGLE IS 69°.
 7. PROPER AGREEMENT SHOULD BE EXECUTED.
 8. SUITABLE BLOCKS (INCLUDING POWER BLOCK AND TRAFFIC BLOCK IF REQUIRED) SHOULD BE TAKEN FOR STRINGING OF CONDUCTOR.
 9. BEARING CAPACITY OF SOIL SHOULD BE CONFIRMED AT SITE WHICH SHOULD BE MORE THAN BASE PRESSURE COMING FROM TOWERS.
 10. ALL SPANS ARE IN METRES AND OTHER DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

- CERTIFICATES:**
1. CERTIFIED THAT STRUCTURES, FOUNDATIONS AND OTHER MATERIALS UTILISED FOR THE CROSSING ARE DESIGNED TO GIVE THE REQUIRED FACTOR OF SAFETY AS SPECIFIED FOR THE ELECTRICAL TRACK CROSSING 1987/LATEST REVISION FOR THE WORST CONDITION.
 2. CERTIFIED THAT THE OVER HEAD X-ING PROVIDES CLEARANCE AS STIPULATED IN THE SCHEDULE OF DIMENSIONS IN INDIAN RAILWAY, STRUCTURALLY SAFE STRUCTURE HAS BEEN DESIGNED AS PER I.S CODE OF PRACTICE NOS. 15800, 15802(PART-2), 15875 AND 15456 TO STRUCTURAL STEEL LOADINGS AND FOR REINFORCED CONCRETE.
 3. CERTIFIED THAT THE DETAILS OF EQUIPMENT PROVIDED ARE DESIGNED WITH THE OBJECT OF MINIMISING DANGER IN EVENT OF BREAKAGE AND IS IN ACCORDANCE WITH RECOGNISED MODERN IN ELECTRICAL ENGINEERING PRACTICE.
 4. CERTIFIED THAT THE TRANSMISSION LINE IS PROVIDED AND PROTECTED BY FAST ACTING RELAY OPERATED CIRCUIT BREAKER OF MODERN DESIGN WITH A TRIPPING TIME 0.1SECOND FROM OCCURANCE OF FAULT TO CLEARANCE.
 5. CERTIFIED THAT THE ABOVE CROSSING IS TO BE ALTERED ON ACCOUNT OF ANTICIPATED RAILWAY DEVELOPMENT, INTRODUCTION OF ADDITIONAL LINE ON THE SECTION, THE FULL COST OF ALTERATION AS MAY BE REQUIRED BY RAILWAY WILL BE PAID BY THE OWNER.
 6. CERTIFIED THAT THE STRUCTURALLY SAFE STRUCTURES HAVE BEEN DESIGNED AS PER CODE OF PRACTICE OF LATEST EDITION OF IS 456, 800, 802, 875 & 409 FOR THE PLAIN/REINFORCED CONCRETE, STRUCTURAL STEEL, TRANSMISSION LINE & LOADING STANDARDS.
 7. THE OWNER OF THE TRANSMISSION LINE IS APGENCO.
 8. CROSSING STRUCTURE IS SUITABLE FOR 125% OF CROSSING SPAN LENGTH.
 9. OWNER OF THE POWER LINE CROSSING SHALL BE FULLY RESPONSIBLE FOR MAINTAINING FOR THE CROSSING IN GOOD FETTER AND TO ENSURE THAT IT DOES NOT FAIL AFFECTING RAILWAY SERVICES. DISRUPTION TO RAILWAY TRAFFIC DUE TO FAILURE OF POWER LINE CROSSING, THE RAILWAY SHALL IMPOSE PENALTY FOR THE DURATION OF TRAFFIC DISRUPTION ON THE OWNER OF THE POWER LINE CROSSING.

- BASIC DATA OF DESIGN:**
1. TEMPERATURE OF CONDUCTOR 0°C TO 75°
 2. DESIGN WIND PRESSURE ON CONDUCTOR & GUARD WIRE 49.26 Kg/Sq.m ON FULL PROJECTED AREA.
 3. ICE LOADING NIL.

- SYSTEM DATA:**
1. 3 PHASE DOUBLE CIRCUIT TRANSMISSION LINE.
 2. FREQUENCY 50HZ.
 3. VOLTAGE 220kV.

- OTHER IMPORTANT PARTICULAR INFORMATION:**
1. HEIGHT OF LOWEST CONDUCTOR FROM RAILWAY TRACK AT 75 DEG. C AND NO WIND 18.50M.
 2. RAILWAY CROSSING SPAN 107.23M.
 3. CROSSING OCCURS OUTSIDE THE STATION LIMIT VERY CLOSE TO DEAD END OF APGENCO INTERNAL NON-COMMERCIAL RAILWAY LINE.
 4. RAILWAY CROSSING IN BETWEEN GANTRY AND TOWER T1. HORIZONTAL DISTANCE OF THE TOWER T1 IS 51M FROM THE TRACK WHICH IS MORE THAN STRUCTURE HT+6M REQUIREMENT.
 5. HIGH SPEED PROTECTION (DIFFERENTIAL/DISTANCE) IS PROVIDED AT BOTH THE END OF THE LINE.
 6. LINE SUPPORT TOWER NO. AND TYPE:
(A) TOWER LOC NO GANTRY: TYPE GANTRY
(B) TOWER LOC NO T1: TYPE DE+9
 7. STEEL USED FOR STRUCTURE (AS APPLICABLE IN DESIGN)
(A) HIGH TENSION STEEL AS PER IS 2062 WITH YIELD STRESS 350 MPa
(B) MILD STEEL AS PER IS 2062 WITH YIELD STRESS 250 MPa
 8. USED BOX X-ARM ON OUTER SIDE OF DEVIATION AND POINTED X-ARM ON INNER SIDE OF DEVIATION.
 9. POWER CONDUCTOR ACSR MOOSE (PROPERTIES GIVEN BELOW)
(A) CONDUCTOR NAME ACSR 54/7/3.54MM MOOSE CONDUCTOR
(B) AREA OF CONDUCTOR 597.0 MM²
(C) WEIGHT OF CONDUCTOR 2004.0 KG/KM
(D) DIAMETER OF CONDUCTOR 31.77MM
(E) MODULUS OF ELASTICITY 7040 KG/MM²
(F) COEFFICIENT OF LINEAR EXPANSION (PER DEGREE C) 19.3x10⁻⁶
 10. EARTH WIRE USED IS 7/3.68 GSS WIRE.
 11. ONE DOUBLE TENSION INSULATOR STRING PER PHASE AT CROSSING TOWER.

DO NOT SCALE		FOR APPROVAL	
CUSTOMER:	ANDHRA PRADESH POWER GENERATION CORPORATION LTD (APGENCO)	DATE: (RD ISSUE) 19-06-2013	
CONSULTANT:	M/S DESEIN CONSULTING ENGINEERS	DATE: (CURRENT ISSUE) 20-11-2014	
PROJECT:	220 kV D/C TRANSMISSION LINE AT RAYALSEEMA THERMAL POWER PLANT STAGE IV, UNIT#6 (1 X600MW)		
CONTRACTOR:	BHARAT HEAVY ELECTRICALS LTD TRANSMISSION PROJECT DIVISION NEW DELHI		
TITLE: 220 kV D/C TRANSMISSION LINE AT RAYALSEEMA THERMAL POWER PLANT STAGE IV, UNIT#6 (1 X600MW)			
RAILWAY LINE CROSSING			
TATA CONSULTING ENGINEERS LIMITED MUMBAI			
SCALE: AS SHOWN	APPROVED	DATE: (RD ISSUE) 19-06-2013	
OFFICE-DRG: ELEC	GROUP HEAD	DATE: (CURRENT ISSUE) 20-11-2014	
DRN: RSJ	ASK	SCK	
CHD: KKK	DWG NO: TCE-7219A-765-RA-3002	ISSUE: R1	
SIZE A0: 841 X 1189 MM		FILE NAME: 7219AEL3002 R0	

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