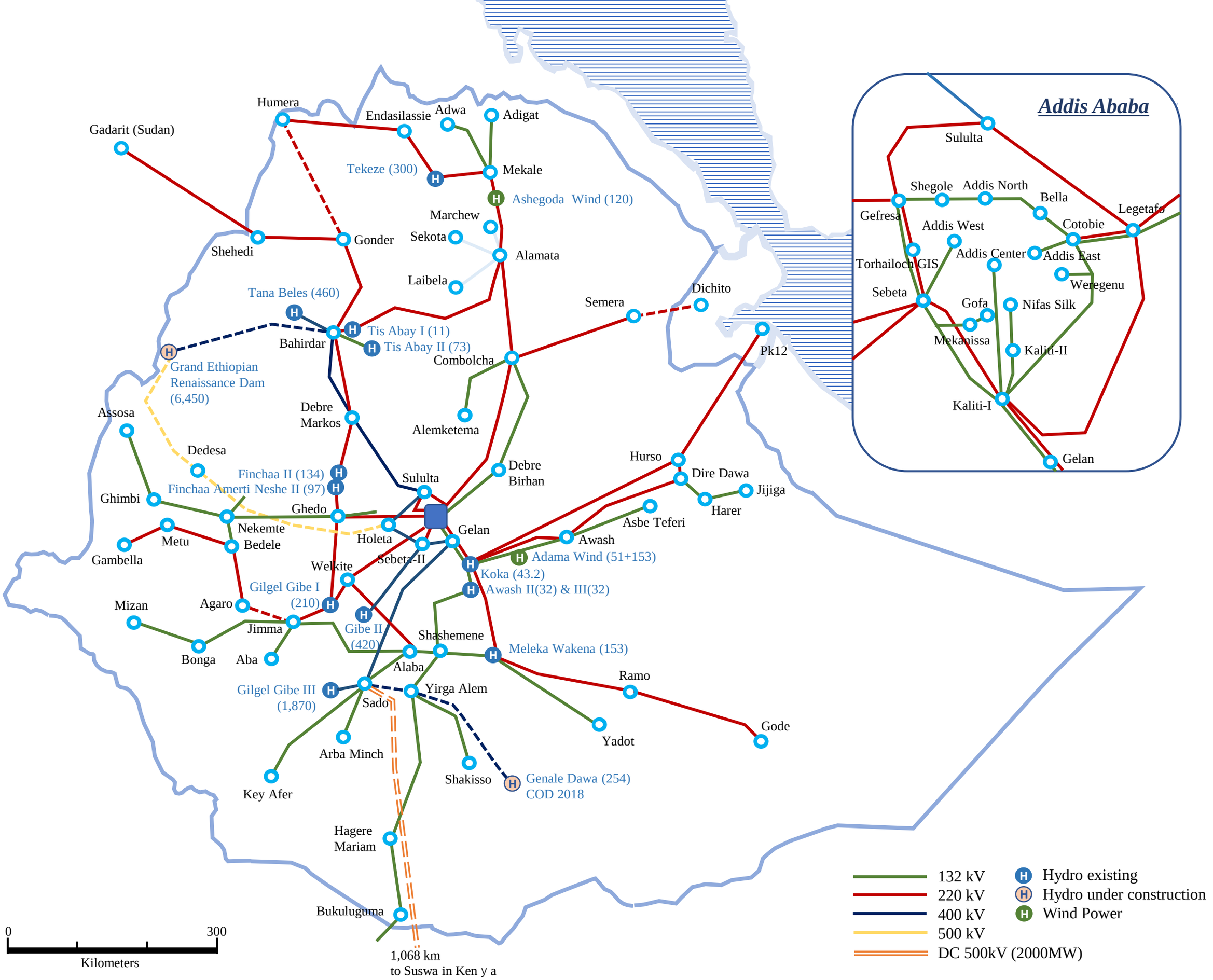
APPENDIX-4

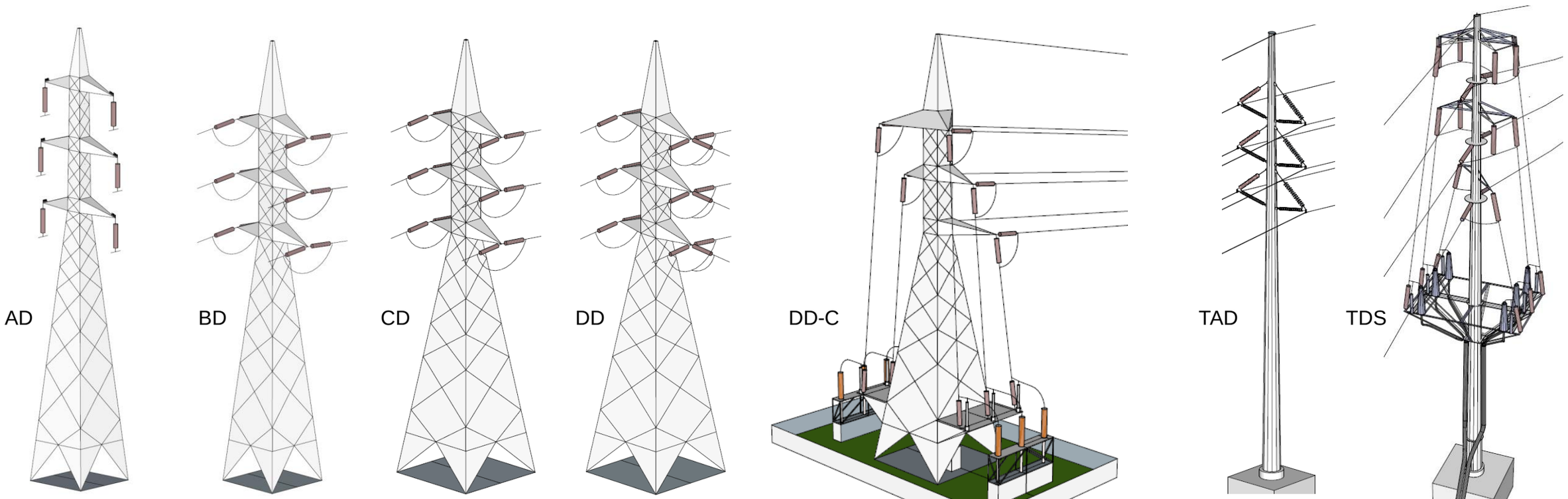
PROFILE DRAWINGS AND TOWER SCHEDULE


Addis Ababa
Sululta
Shegole
Addis North
Bella
Legetafo
Gefresa
Addis West
Cotobie
Torhailoch GIS
Addis Center
Addis East
Weregenu
Sebeta
Gofa
Nifas Silk
Mekanissa
Kaliti-II
Kaliti-I
Gelan
Humera
Endasilassie
Adwa
Adigat
Gadarit (Sudan)
Tekeze (300)
Mekale
Ashegoda Wind (120)
Marchew
Sekota
Alamata
Laibela
Shehedi
Gonder
Tana Beles (460)
Tis Abay I (11)
Tis Abay II (73)
Bahirdar
Grand Ethiopian
Renaissance Dam
(6,450)
Semera
Dichito
Pk12
Combolcha
Alemketema
Assosa
Debre
Markos
Dedesa
Finchaa II (134)
Finchaa Amerti Neshe II (97)
Sululta
Debre
Birhan
Hurso
Dire Dawa
Jijiga
Harer
Asbe Teferi
Awash
Ghimbi
Ghedo
Nekemte
Holeta
Gelan
Metu
Bedele
Gambella
Welkite
Sebeta-II
Adama Wind (51+153)
Koka (43.2)
Awash II(32) & III(32)
Gilgel Gibe I
(210)
Mizan
Agaro
Jimma
Gibe II
(420)
Shashemene
Meleka Wakena (153)
Bonga
Aba
Alaba
Ramo
Gilgel Gibe III
(1,870)
Yirga Alem
Sado
Yadot
Gode
Arba Minch
Shakisso
Genale Dawa (254)
COD 2018
Key Afer
Hagere
Mariam
Bukuluguma
1,068 km
to Suswa in Ken y a
0
300
Kilometers
132 kV
220 kV
400 kV
500 kV
DC 500kV (2000MW)
Hydro existing
Hydro under construction
Wind Power
as of 2018

Tower Type

Remarks 2cct : Double Circuit and 1cct : Single Circuit

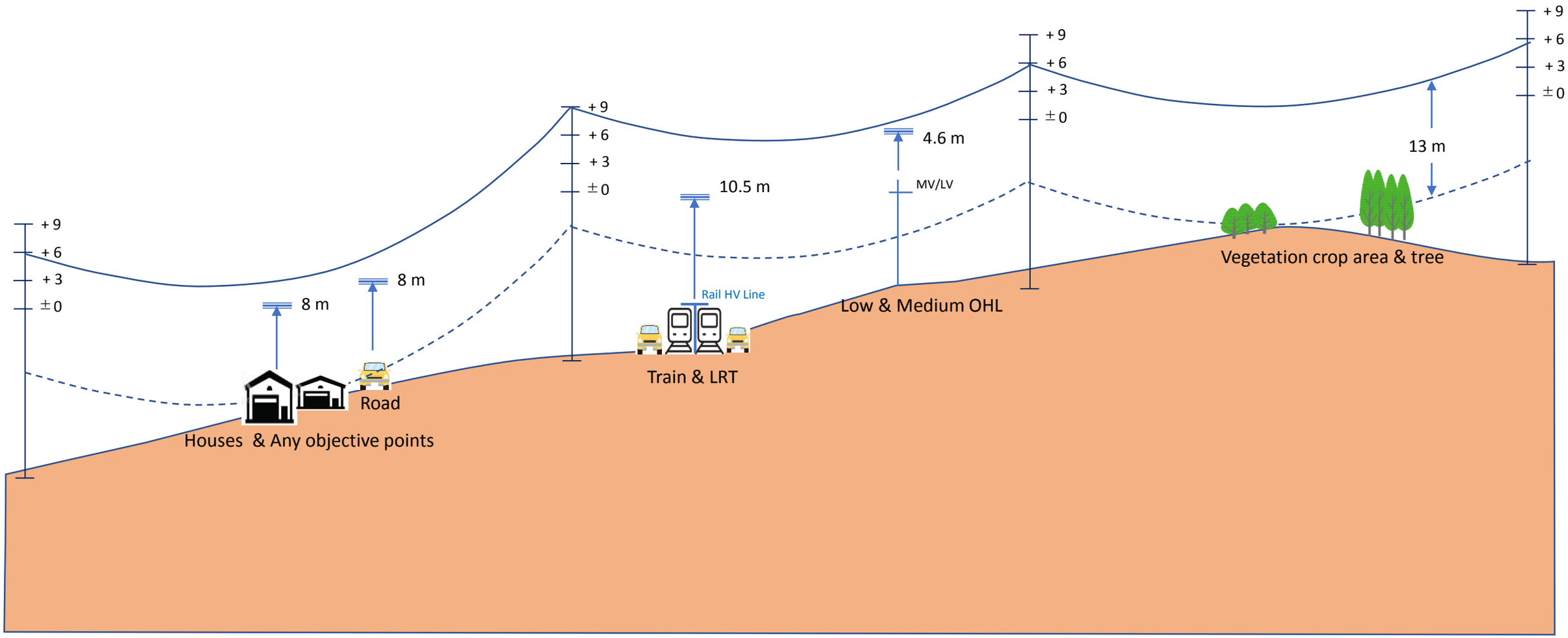
Code		Tower Type		
AD	2 cct Lattice Tower	Suspension	00° - 02°	
BD	2 cct Lattice Tower	Tension	00° - 30°	
CD	2 cct Lattice Tower	Tension	00° - 60°	No.53 as a section tower
DD	2 cct Lattice Tower	Dead End		T-Connection (1cct) to Gofa
DD-G	2 cct Lattice Tower	Dead End		At Kality Substation
DD-C	2 cct Lattice Tower	Dead End		Cable Termination Tower
TAD	2 cct Tubular Tower	Suspension	00° - 02°	
TDS	1 cct Tubular Tower	Tension		Cable Termination Tower

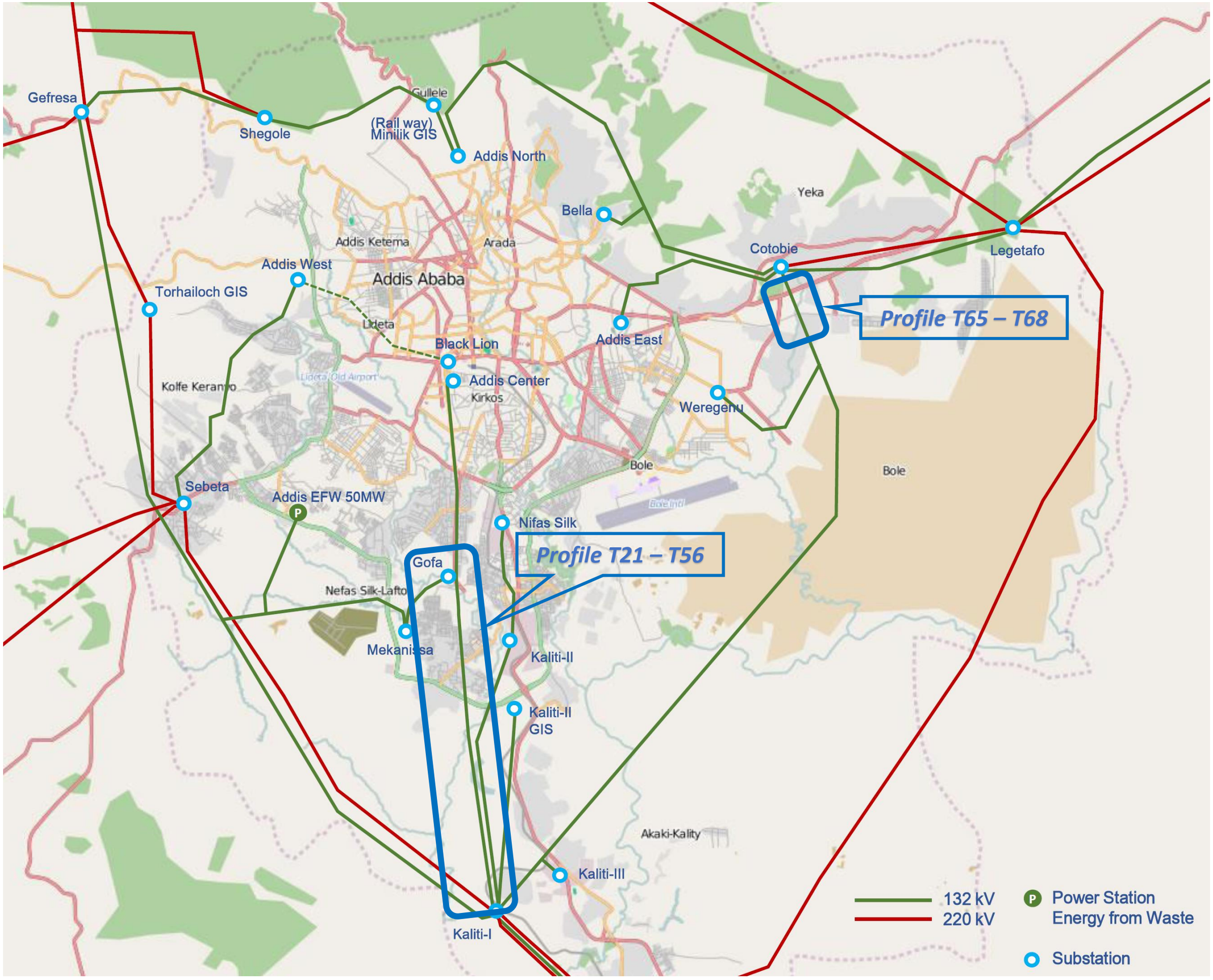


Clearance Requirement

Directive on Clearance of Overhead Electric Lines, and Quality of Supply No. EEA/1/2005

Clearance	Objects
8 meters	Vehicle accessible road and any other objective points
10.5 meters	Railway and tramway
13 meters	Vegetation where may be planted by tree, crop and vegetation
4.6 meters	Any other overhead line including communication line




Gefresa
Shegole
Gullele
(Rail way)
Minilik GIS
Addis North
Bella
Yeka
Cotobie
Legetafo
Addis Ketema
Arada
Addis West
Addis Ababa
Torhailoch GIS
Lideta
Black Lion
Addis East
Addis Center
Kirkos
Kolfe Keranio
Lideta Old Airport
Weregenu
Bole
Bole
Sebeta
Addis EFW 50MW
Nifas Silk
Profile T21 – T56
Gofa
Nefas Silk-Lafto
Mekanissa
Kaliti-II
Kaliti-II
GIS
Akaki-Kality
Kaliti-III
Kaliti-I
Profile T65 – T68
132 kV
220 kV
Power Station
Energy from Waste
Substation

Black Lion ADC

New ADC

T21

T25

T33/34

T53

T54/55

1950m

4280m

Under Ground Cable

1138m

2170m

5350m

445m

2351 m

2300 m

2250 m

2200 m

2150 m

2100 m

-3.6%

River

Ring Road

River

T52

Kaliti III (North)

NIFAS SILK S/S

Kaliti II S/S

Kaliti-II GIS LRT

Kaliti I

New Addis Center

ADC

Black Lion

Gofa (Addis South II)

EEP store

Road Plan on ROW

Housing

Industrial Area (Leveling up by Embankment)

Kaliti S/S

Mekanissa

Cable Terminal
DD-C + 0
I----

No. 21
AD + 6
I

No. 22
DD + 6
---- ----

No. 23
BD + 6
---- ===

2270
2260
2250
2240
2230
2220
2210

+ 9
+ 6
+ 3
± 0

13 m

Road

River

Warehouse/Store for EEU & EEP

106° 00” R

0° 00”

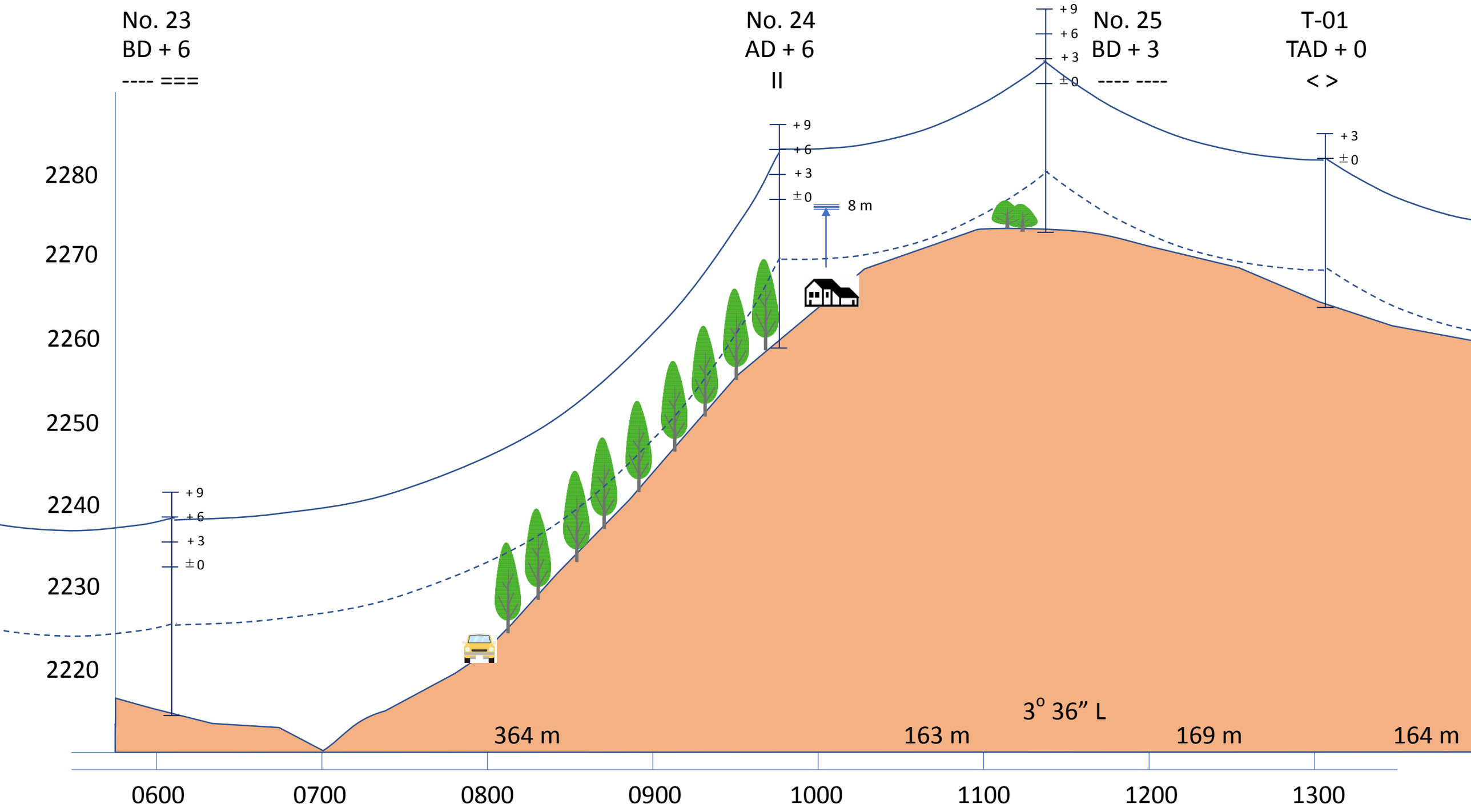
115 m

269 m

227 m

364 m

0000 0100 0200 0300 0400 0500 0600 0700


No. 23
BD + 6
---- ===
No. 24
AD + 6
II
No. 25
BD + 3
---- ----
T-01
TAD + 0
< >
+ 9
+ 6
+ 3
± 0
8 m
2280
2270
2260
2250
2240
2230
2220
3° 36” L
364 m
163 m
169 m
164 m
0600
0700
0800
0900
1000
1100
1200
1300


23
24
25
T-1
26

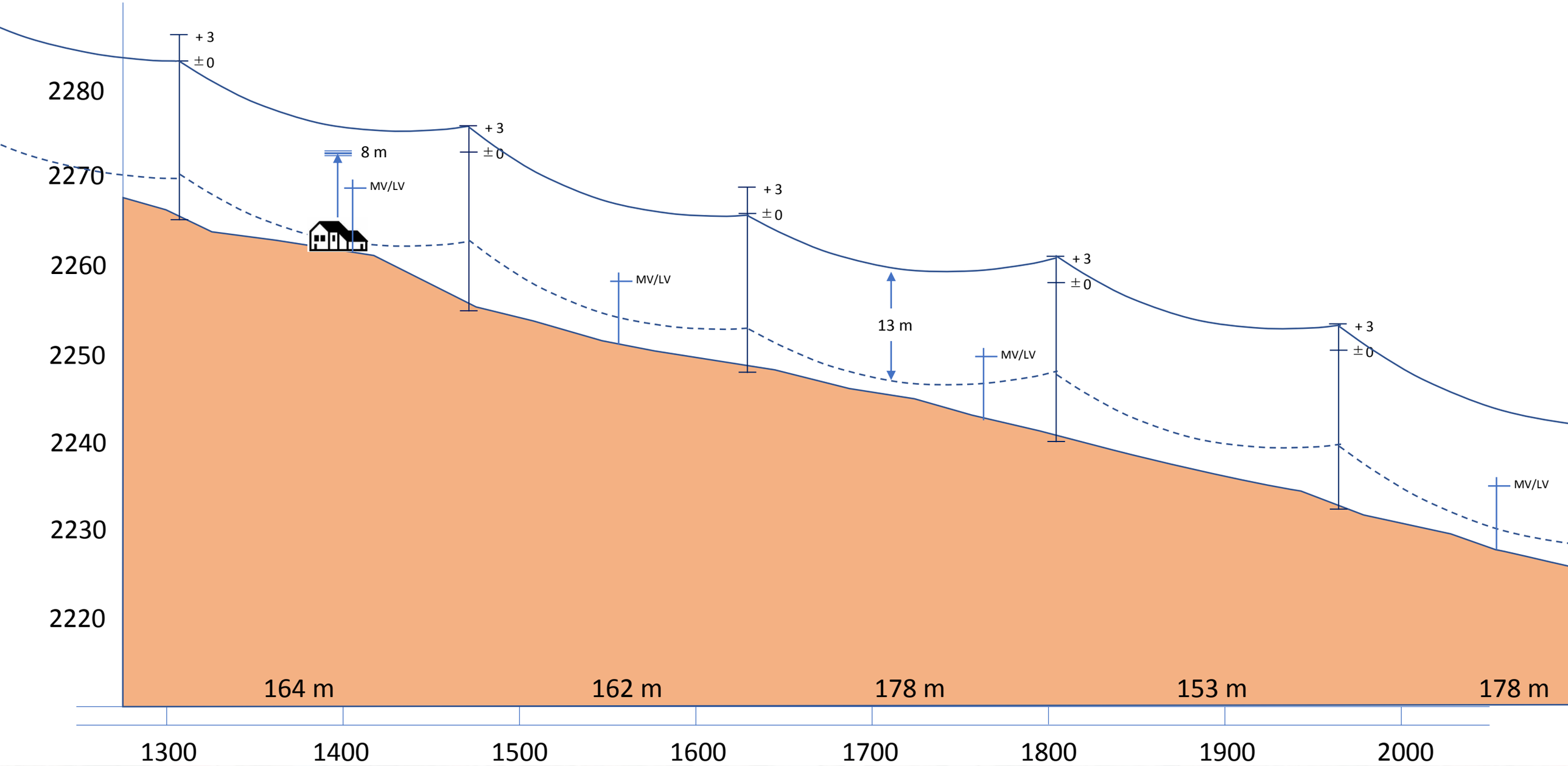
T-01
TAD + 0
< >

T-02
TAD + 3
< >

T-03
TAD + 0
< >

T-04
TAD + 3
< >

T-05
TAD + 3
< >



T-05
TAD + 3
< >

T-06
TAD + 0
< >

T-07
TAD + 0
< >

T-08
TAD + 0
< >

T-09
TAD + 0
< >

+ 3
± 0
MV/LV

2240
2230
2220
2210
2200
2190
2180

178 m
168 m
172 m
193 m
124 m

2000
2100
2200
2300
2400
2500
2600
2700

T-09
TAD + 0
< >

T-10
TAD + 3
< >

T-11
TAD + 3
< >

T-12
TAD + 3
< >

No. 33
BD + 6
---- ===

2240
2230
2220
2210
2200
2190
2180

+ 3
± 0
+ 3
± 0
+ 3
± 0
+ 3
± 0
+ 9
+ 6
+ 3
± 0
MV/LV
MV/LV
MV/LV
8 m
13 m
Road

124 m
174 m
160 m
176 m
289 m

2700
2800
2900
3000
3100
3200
3300
3400

No. 33
BD + 6
---- ===

No. 34
AD + 6
II

No. 35
AD + 3
I

No.36
AD + 3
I

+ 9
+ 6
+ 3
± 0

2210
2200
2190
2180
2170
2160
2150

MV/LV
Road
Rigid Foundation
Future Embankment level
Rigid Foundation
Future Embankment level
Rigid Foundation

289 m
273 m
291 m

3400
3500
3600
3700
3800
3900
4000
4100

No. 36
AD + 3
I

No. 37
AD + 6
I

No. 38
AD + 6
I

+ 9
+ 6
+ 3
± 0

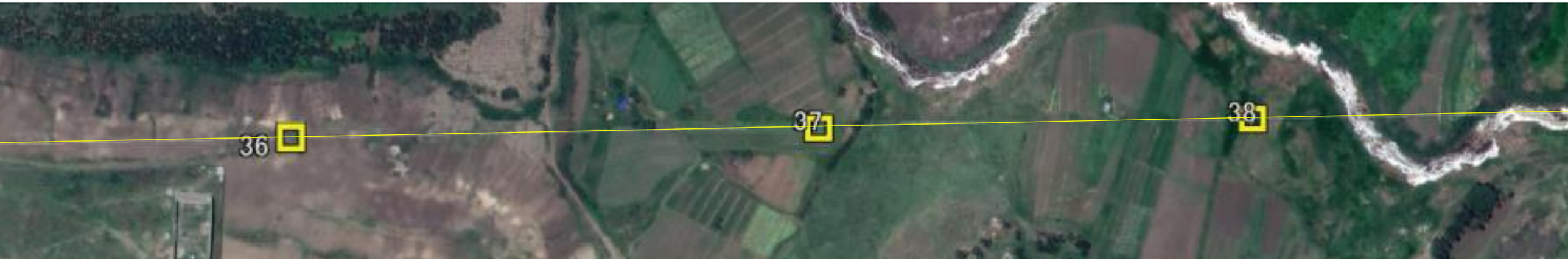
2280
2170
2160
2150
2140
2130
2120

Future Embankment level
Rigid Foundation

River

291 m
303 m
252 m
350 m

4100
4200
4300
4400
4500
4600
4700
4800



No. 38
AD + 6

No. 39
AD + 6

No. 40
AD + 3

No.41
AD + 0

2280
2170
2160
2150
2140
2130
2120

+ 9
+ 6
+ 3
± 0

13 m

Future Embankment level

350 m
223 m
225 m

4800
4900
5000
5100
5200
5300
5400
5500

No. 41
AD + 0
I

No. 42
AD + 3
I

No. 43
AD + 9
I

2290
2180
2170
2160
2150
2140
2130

+ 9
+ 6
+ 3
± 0

13 m

Future Embankment level

8 m

263 m
286 m
301 m

5500
5600
5700
5800
5900
6000
6100
6200

No. 44
BD + 9
---- ----

No. 45
AD + 3
I

No. 46
AD + 0
I

2290
2180
2170
2160
2150
2140
2130

+ 9
+ 6
+ 3
± 0

13 m
8 m
MV/LV

Future Embankment level

301 m
280 m
264 m
364 m

6200
6300
6400
6500
6600
6700
6800
6900

No. 46
AD + 0

No. 47
AD + 3

No. 48
AD + 0

No. 49
AD + 3

2170
2160
2150
2140
2130
2120
2110

+ 9
+ 6
+ 3
± 0

Future Embankment level

264 m
255 m
221 m

6900
7000
7100
7200
7300
7400
7500
7600

No. 49
AD + 3
I

No. 50
AD + 6
I

No. 51
AD + 6
I

2160
2150
2140
2130
2120
2110
2100

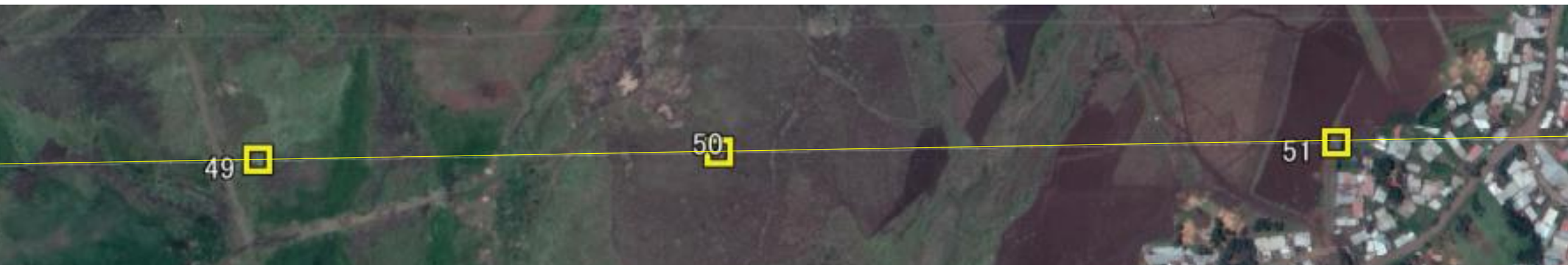
+ 9
+ 6
+ 3
± 0

13 m

8 m

221 m
261 m
349 m
244 m

7600
7700
7800
7900
8000
8100
8200
8300



No. 52
BD + 6
---- ----

No. 53
CD + 6
---- ---- (slack)

No. 54
BD + 0 (existing)
---- ----

No. 55
CD + 0 (existing)
---- ----

2160
2150
2140
2130
2120
2110
2100

+ 9
+ 6
+ 3
± 0

13 m

EEP Kaliti Substation

5° 42” L
244 m

2° 30” L
159 m

9° 18” L
197 m

73° 42” L
124 m

8300 8400 8500 8600 8700 8800 8900 9000

No. 52 BD + 6 ---- ----

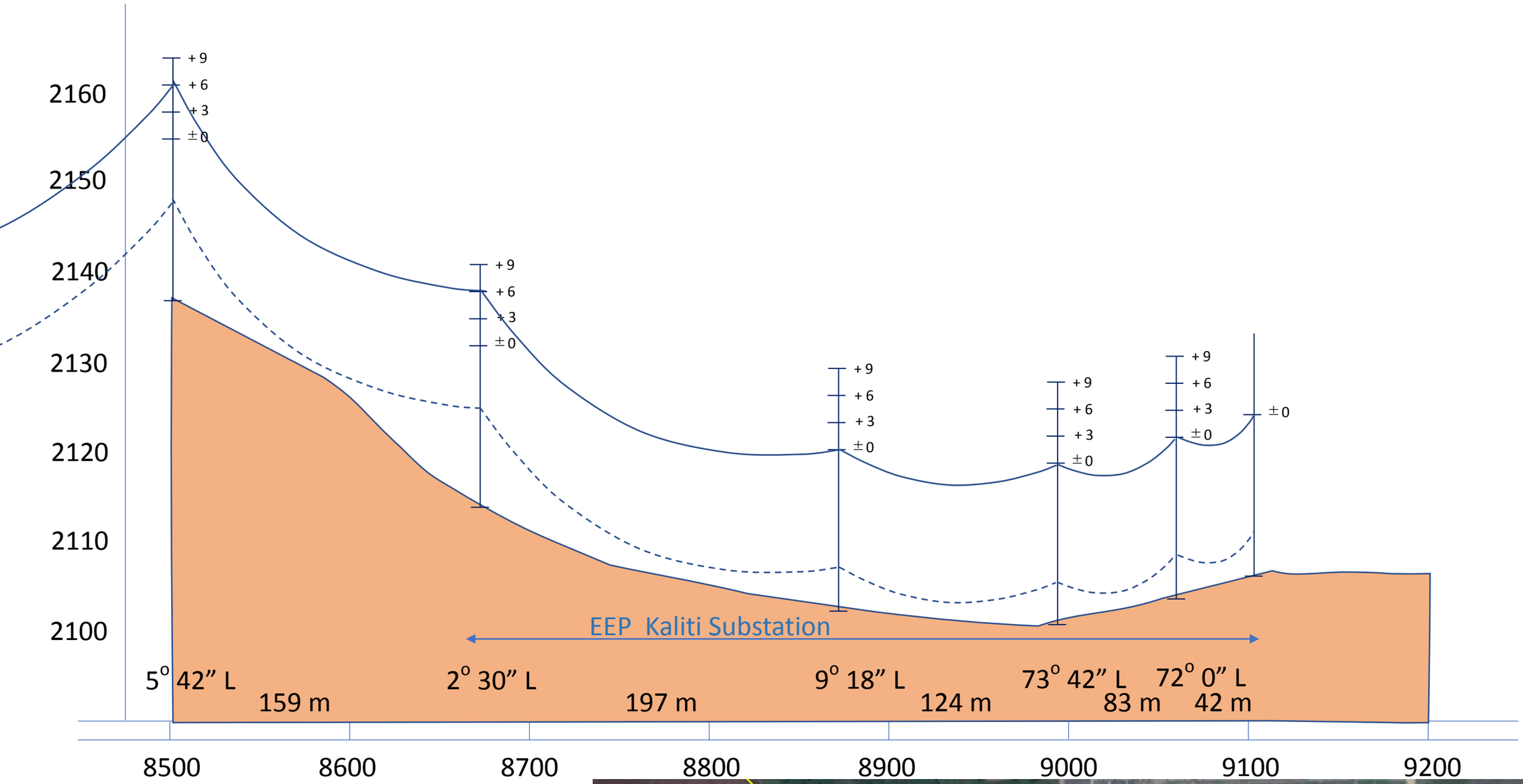
No. 53 CD + 6 ---- ----

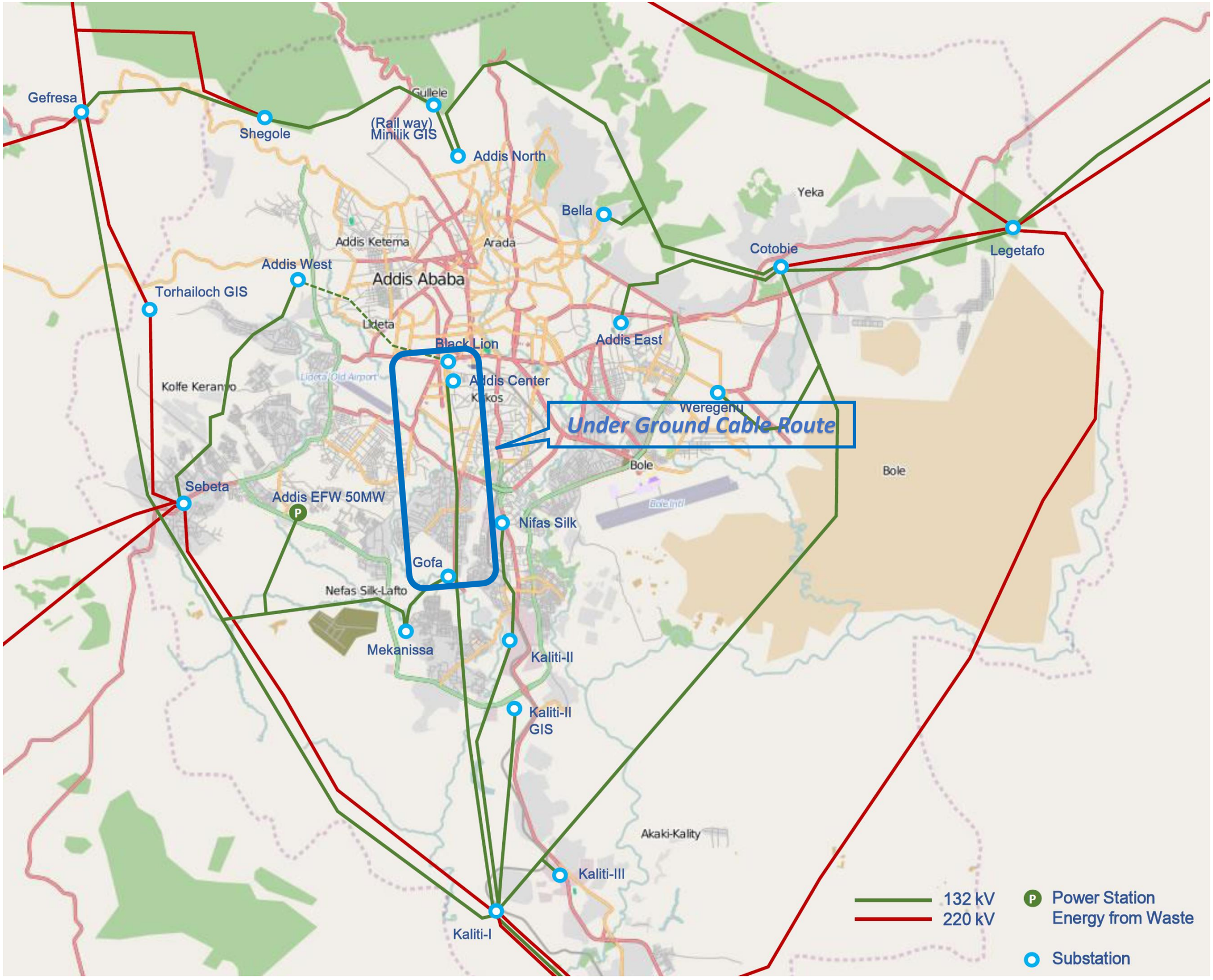
No. 54 BD + 0 (existing) ---- ----

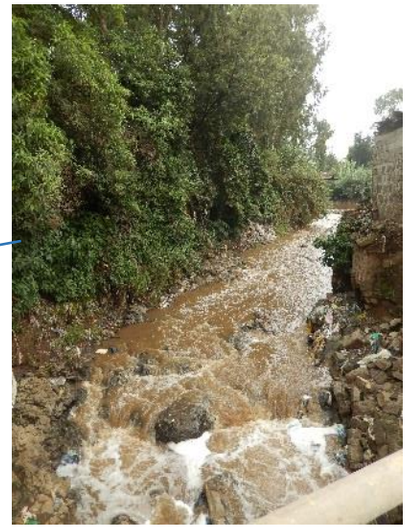
No. 55 CD + 0 (existing) ---- ----

No.56 DD-G ---- ----

Kaliti Substation Gantry ----I




Gefresa
Shegole
Gullele
(Rail way)
Minilik GIS
Addis North
Bella
Yeka
Cotobie
Legetafo
Addis Ketema
Arada
Addis West
Addis Ababa
Torhailoch GIS
Lideta
Black Lion
Addis East
Addis Center
Kolfe Keranio
Weregenu
Under Ground Cable Route
Bole
Bole
Sebeta
Addis EFW 50MW
Nifas Silk
Gofa
Nefas Silk-Lafto
Mekanissa
Kaliti-II
Kaliti-II
GIS
Akaki-Kality
Kaliti-III
Kaliti-I
132 kV
220 kV
Power Station
Energy from Waste
Substation



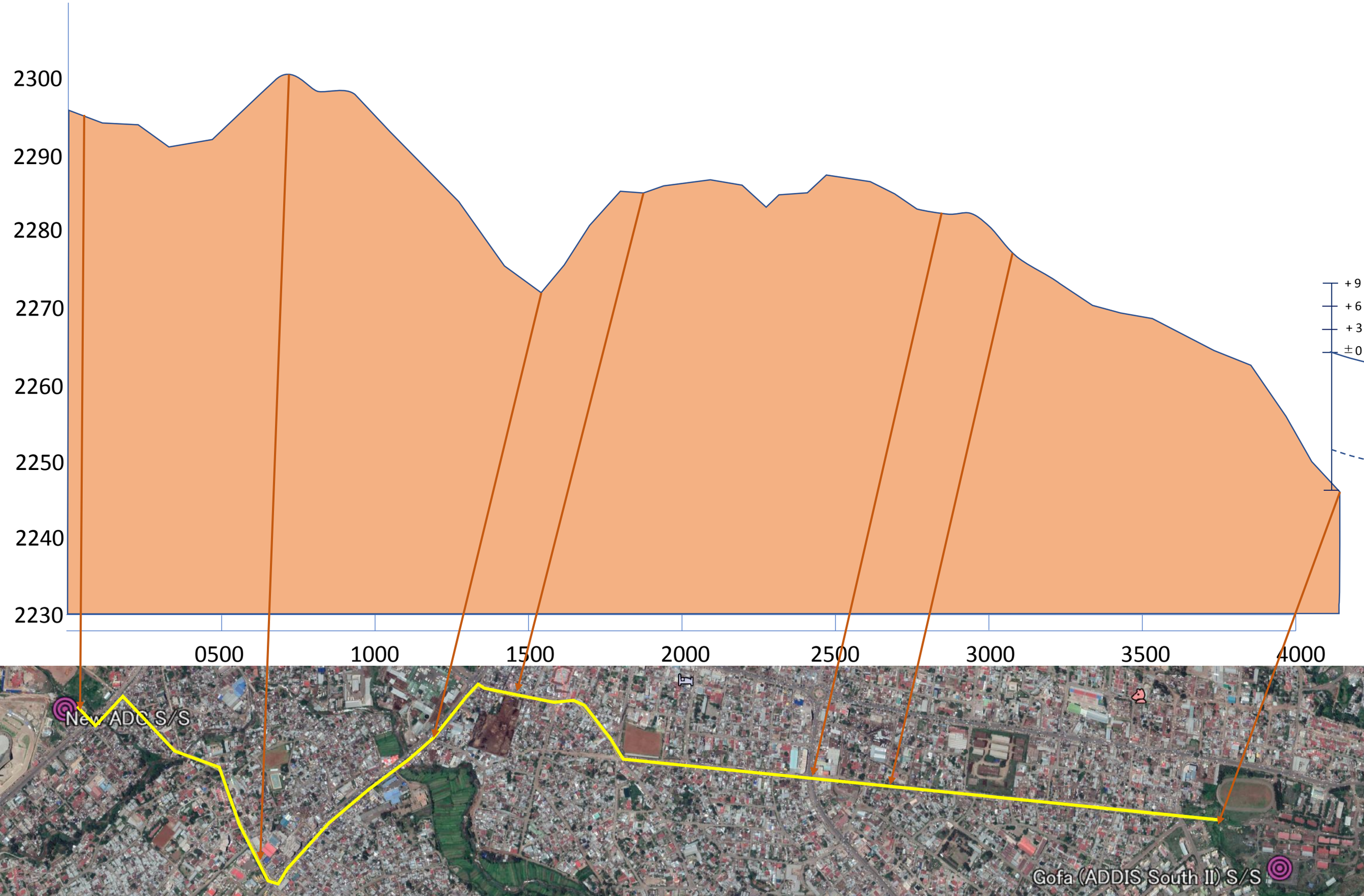
Underground Cable (New ADC – Gofa)

Underground Cable (Black Lion – New ADC)

Existing Transmission Line (ADC – Kaliti-I)

River

Under Ground Cable Route : New Addis Center S/S to Cable Termination Tower at Gofa S/S



Gefresa
Shegole
Gullele
(Rail way)
Minilik GIS
Addis North
Bella
Yeka
Addis Ketema
Arada
Addis West
Addis Ababa
Cotobie
Legetafo
Torhailoch GIS
Lideta
Black Lion
Addis East
Addis Center
Kirkos
Kolfe Keranio
Lideta Old Airport
Weregenu
Bole
Bole
Sebeta
Addis EFW 50MW
Nifas Silk
Gofa
Profile T22 – Gofa
Nefas Silk-Lafto
Mekanissa
Kaliti-II
Kaliti-II
GIS
Akaki-Kality
Kaliti-III
Kaliti-I
132 kV
220 kV
Power Station
Energy from Waste
Substation

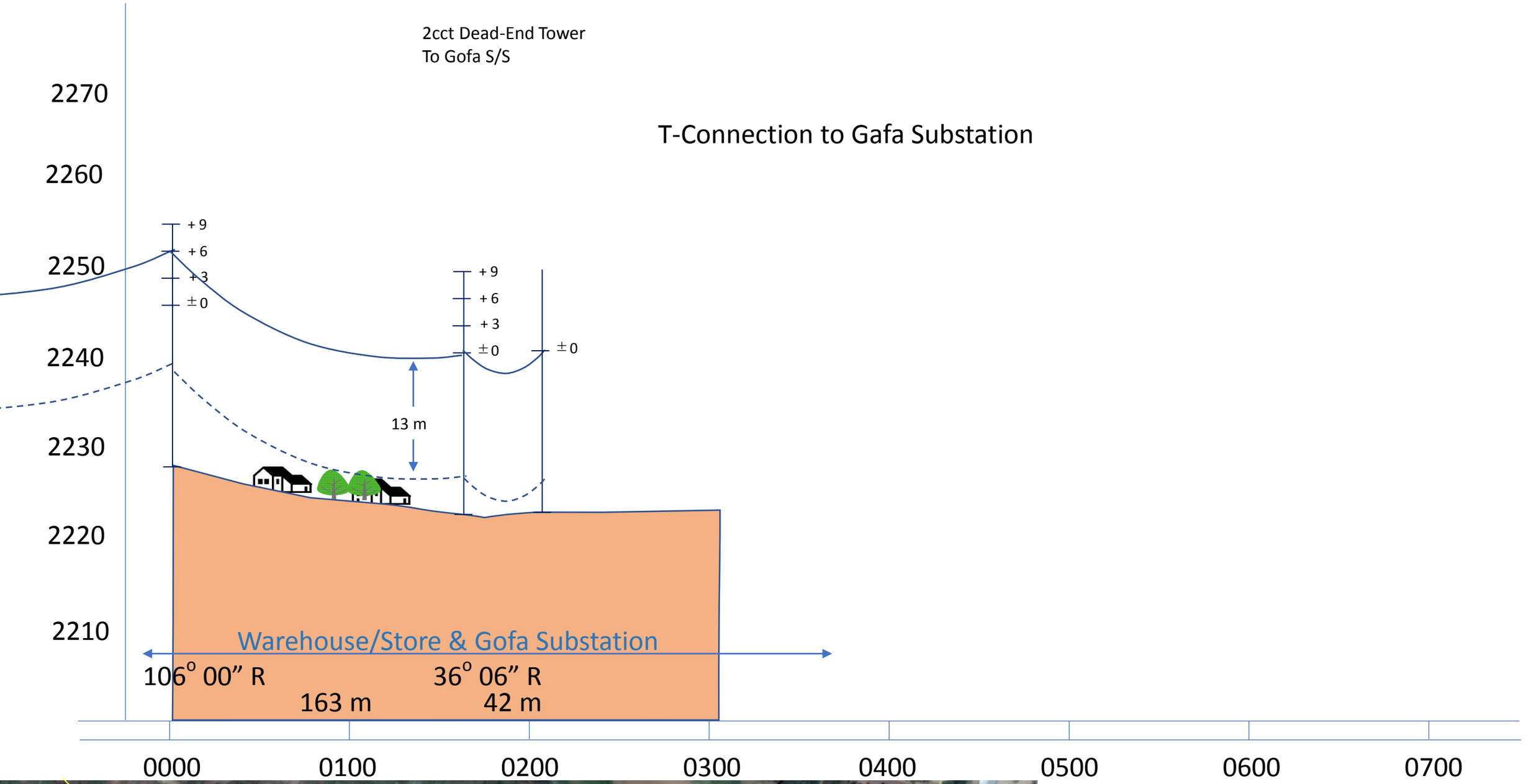
No. 22
DD + 6

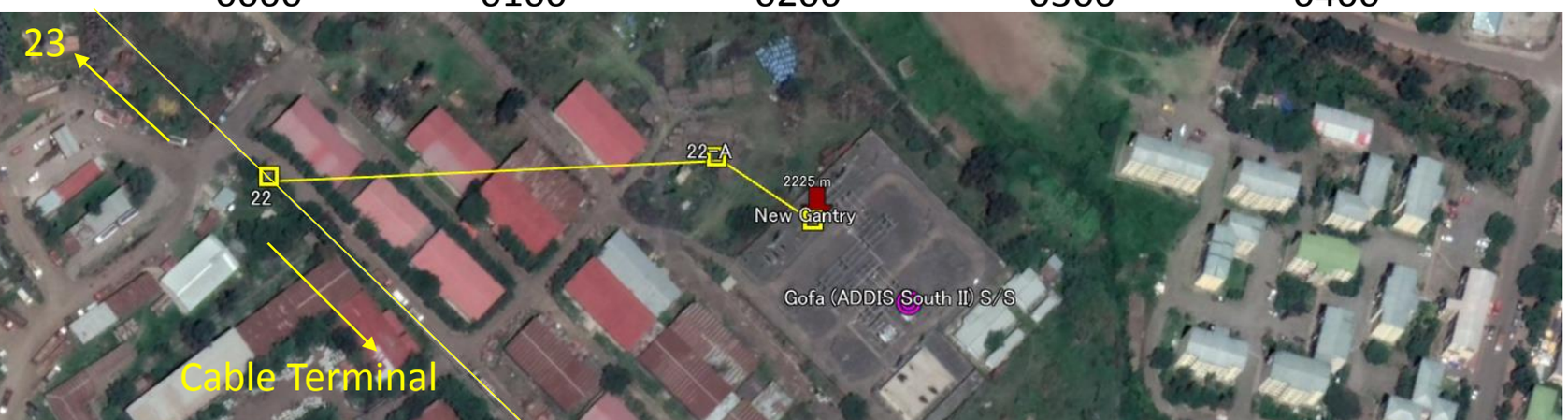
No. 22A
DD + 0
---- ----

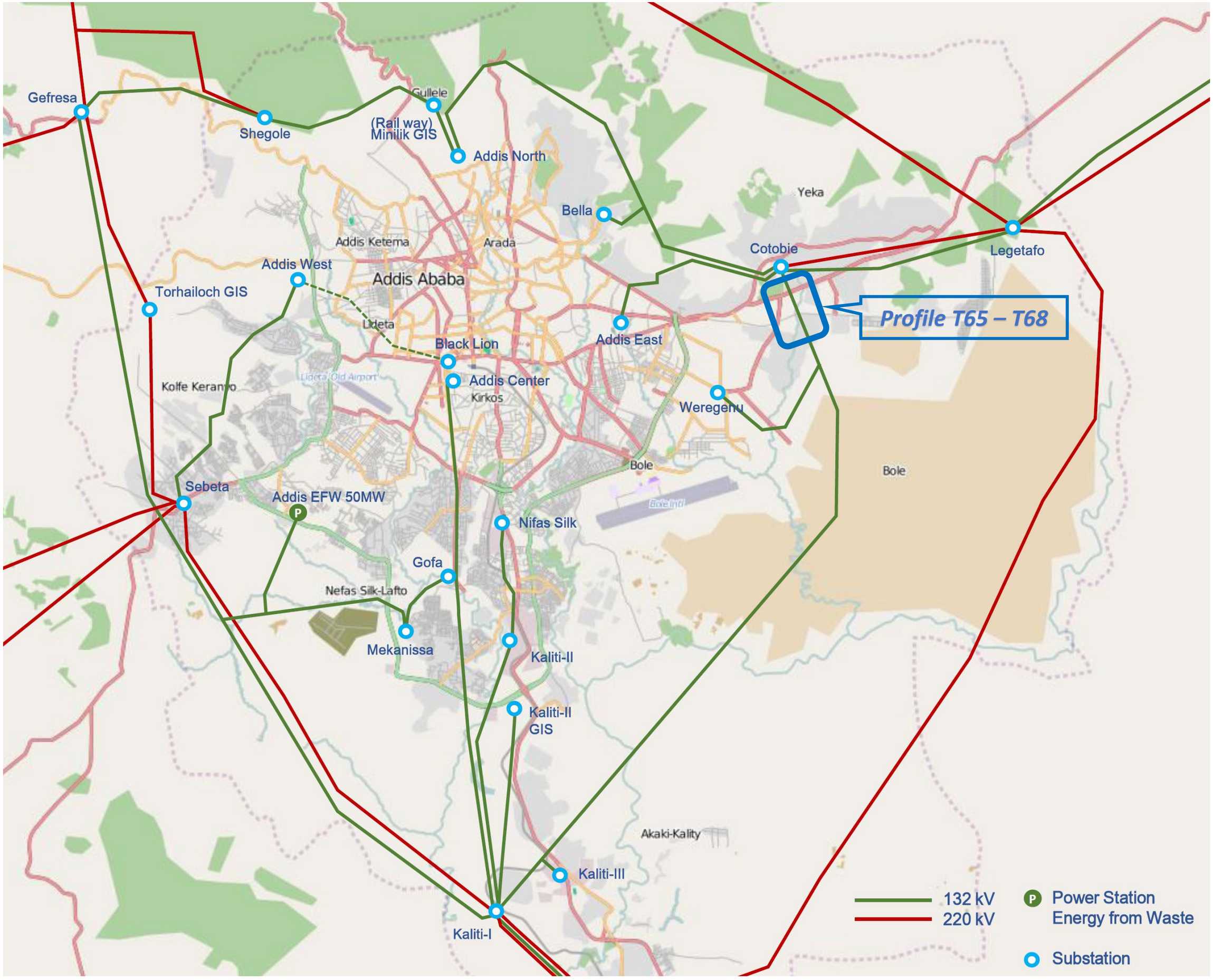
New Gantry in Gofa S/S

2cct Dead-End Tower
To Gofa S/S

T-Connection to Gafa Substation






Gefresa
Shegole
Gullele
(Rail way)
Minilik GIS
Addis North
Bella
Yeka
Cotobie
Legetafo
Addis Ketema
Arada
Addis West
Addis Ababa
Torhailoch GIS
Lideta
Black Lion
Addis East
Profile T65 – T68
Kolfe Keranio
Addis Center
Kirkos
Weregenu
Bole
Bole
Sebeta
Addis EFW 50MW
Nifas Silk
Gofa
Nefas Silk-Lafto
Mekanissa
Kaliti-II
Kaliti-II
GIS
Akaki-Kality
Kaliti-III
Kaliti-I
132 kV
220 kV
Power Station
Energy from Waste
Substation

No. 65-L1
L + 0
I

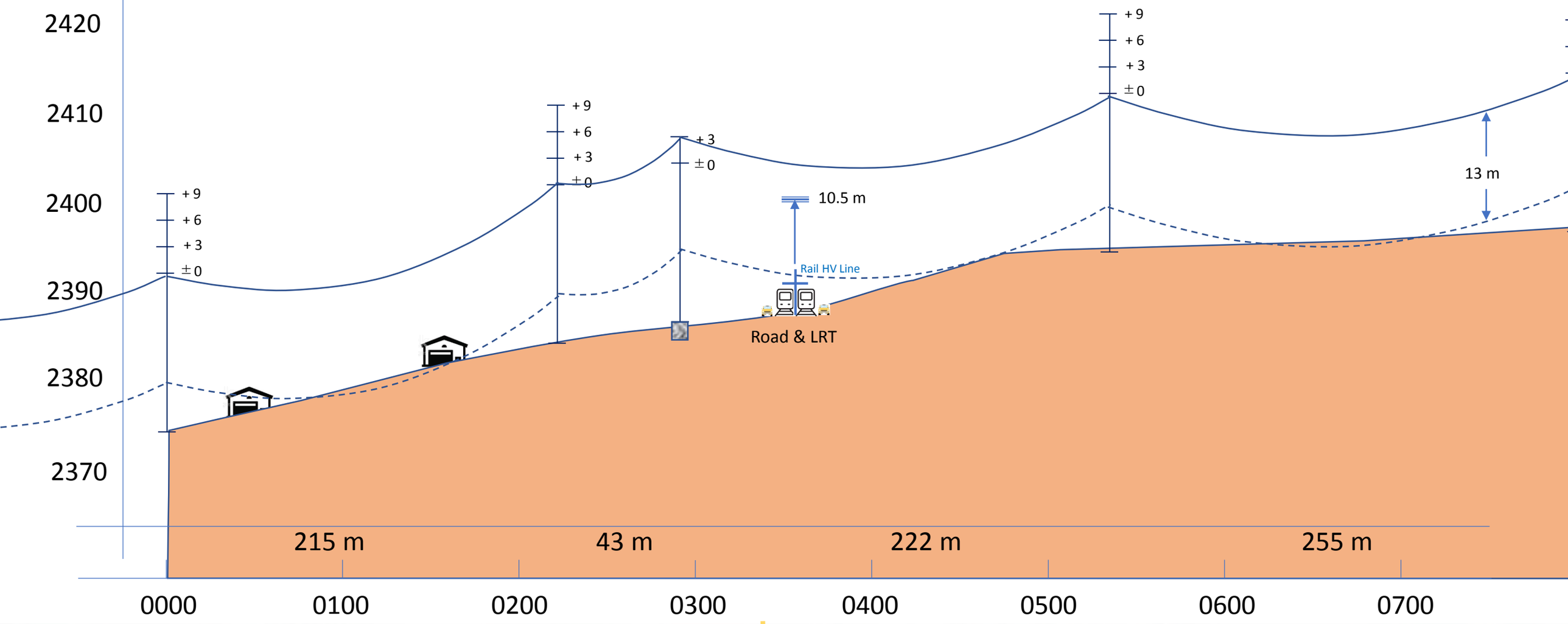
No. 66-L1
L + 0
I

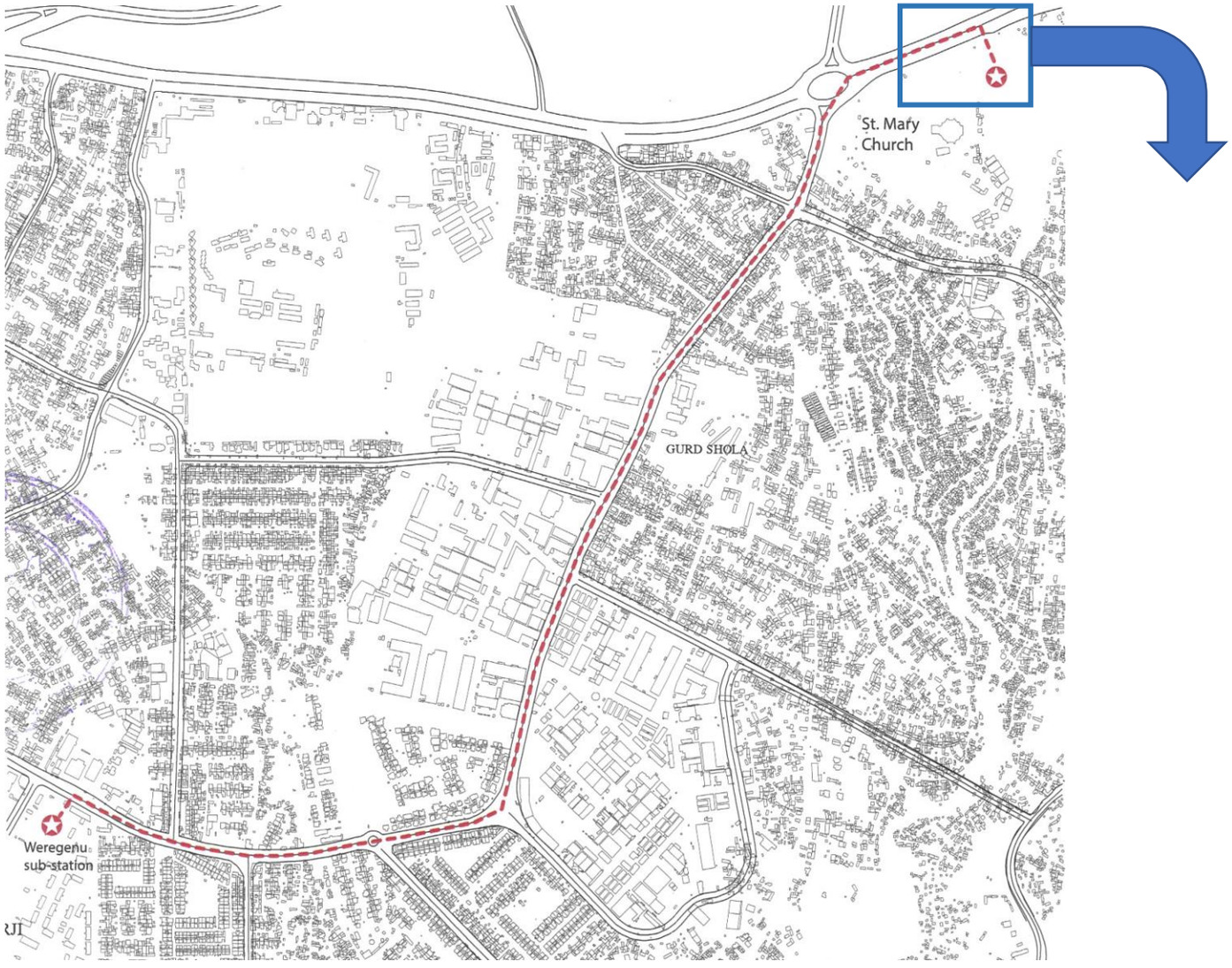
No.67A-L1 (New Cable Terminal)
TDS + 0
---- ----

No. 67-L1
L + 0
I

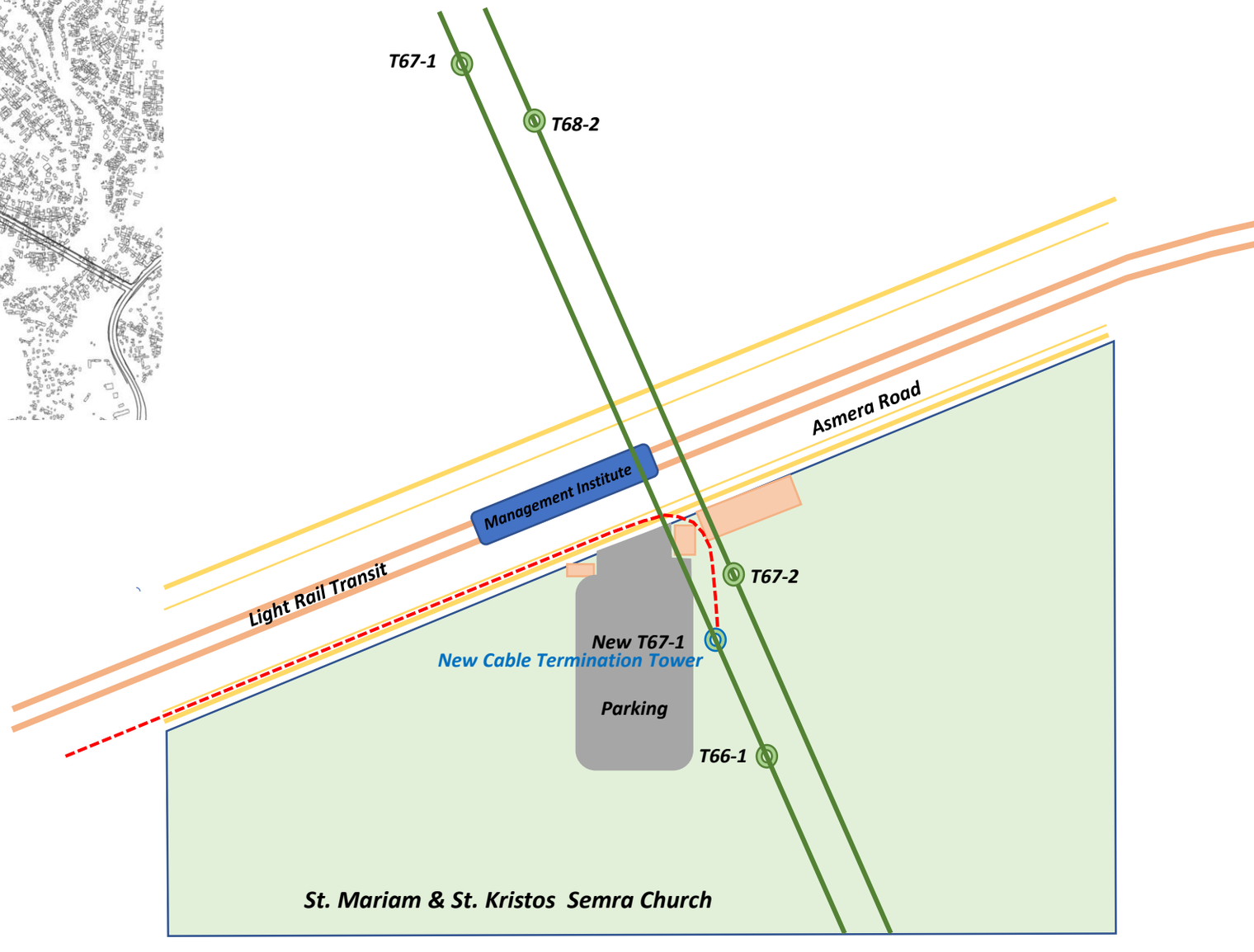
New Tubular Tower
Cable Termination
To Weregenu S/S

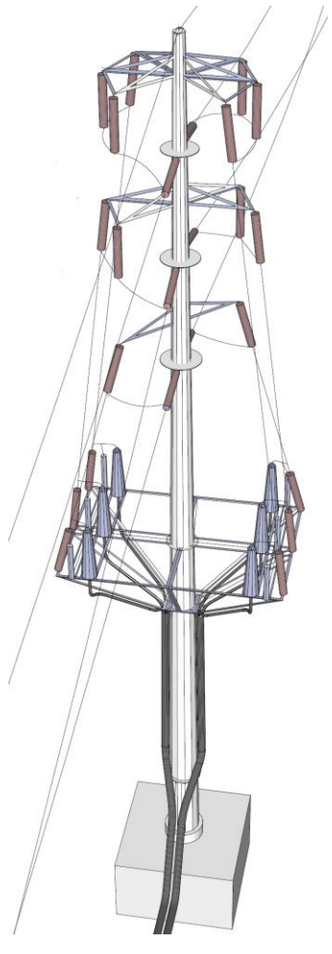
T-Connection to Weregenu Substation




St. Mary
Church
GURD SHOLA
Weregenu
sub-station


New Cable Termination Tower


T67-1
T68-2
Asmera Road
Management Institute
Light Rail Transit
T67-2
New T67-1
New Cable Termination Tower
Parking
T66-1
St. Mariam & St. Kristos Semra Church



Tower Schedule 1/3 : (T21 Cable Termination to Kaliti Substation)

IP No.	Section	Survey Number			Crossings	Tower Type	Deviation	Foundation	Span (m)	Total Distance (m)	Elevation (m)	Cooridination 37 P X	Y
1	Lattice	New Cable Terminal			Cable Terminal Tower	NDS-C + 0			114.5	115	2,242	472196.35 m E	991011.49 mN
2	Lattice	No.21			inside EEP/EEU warehouse	AD + 6			269.2	384	2,237	472200.00 mE	990897.00 mN
3	Lattice	No.22			inside EEP/EEU warehouse	DD + 6			227.2	611	2,230	472210.00 mE	990628.00 mN
4	Lattice	No.23			inside EEP/EEU warehouse	BD + 6			364.2	975	2,217	472220.00 mE	990401.00 mN
5	Lattice	No.24				AD + 6			163.1	1,138	2,259	472233.00 mE	990037.00 mN
6	Lattice	No.25			Keep same foundation size	BD + 3	3 ° 36 L		168.9	1,307	2,275	472239.00 mE	989874.00 mN
7	Tubular		T-01		Tubular tower at new position	TAD + 0			163.9	1,471	2,266	472256.00 mE	989706.00 mN
8	Tubular		T-02			TAD + 3			161.8	1,633	2,258	472273.00 mE	989543.00 mN
9	Tubular		T-03			TAD + 0			177.9	1,811	2,251	472289.00 mE	989382.00 mN
10	Tubular		T-04			TAD + 3			152.8	1,964	2,242	472307.00 mE	989205.00 mN
11	Tubular		T-05			TAD + 3			177.9	2,141	2,235	472323.00 mE	989053.00 mN
12	Tubular		T-06			TAD + 0			167.9	2,309	2,226	472341.00 mE	988876.00 mN
13	Tubular		T-07			TAD + 0			171.9	2,481	2,214	472358.00 mE	988709.00 mN
14	Tubular		T-08			TAD + 0			192.9	2,674	2,205	472376.00 mE	988538.00 mN
15	Tubular		T-09			TAD + 0			123.6	2,798	2,190	472395.00 mE	988346.00 mN
16	Tubular	No.31	T-10			TAD + 3			174.0	2,972	2,193	472407.00 mE	988223.00 mN
17	Tubular		T-11			TAD + 3			159.8	3,132	2,204	472426.00 mE	988050.00 mN
18	Tubular		T-12		Tubular tower at new position	TAD + 3			175.8	3,307	2,210	472442.00 mE	987891.00 mN
19	Lattice	No.33				BD + 6			288.6	3,596	2,220	472459.00 mE	987716.00 mN
20	Lattice	No.34				AD + 6		+3m Rigid Foundation	273.4	3,869	2,182	472489.00 mE	987429.00 mN
21	Lattice	No.35				AD + 3		+3m Rigid Foundation	290.6	4,160	2,170	472517.00 mE	987157.00 mN
22	Lattice	No.36				AD + 3		+3m Rigid Foundation	302.5	4,462	2,156	472547.00 mE	986868.00 mN
23	Lattice	No.37				AD + 6			252.3	4,715	2,143	472577.00 mE	986567.00 mN
24	Lattice	No.38				AD + 6			349.8	5,065	2,136	472603.00 mE	986316.00 mN
25	Lattice	No.39				AD + 6			223.2	5,288	2,140	472638.00 mE	985968.00 mN
26	Lattice	No.40				AD + 3		+3m Rigid Foundation	225.2	5,513	2,155	472661.00 mE	985746.00 mN
27	Lattice	No.41				AD + 0		+3m Rigid Foundation	263.4	5,776	2,159	472684.00 mE	985522.00 mN
28	Lattice	No.42				AD + 3		+3m Rigid Foundation	285.5	6,062	2,162	472711.00 mE	985260.00 mN
29	Lattice	No.43				AD + 9			300.5	6,362	2,155	472740.00 mE	984976.00 mN
30	Lattice	No.44				BD + 9			279.5	6,642	2,146	472770.00 mE	984677.00 mN
31	Lattice	No.45				AD + 3			264.4	6,906	2,138	472799.00 mE	984399.00 mN
32	Lattice	No.46				AD + 0		+3m Rigid Foundation	264.4	7,171	2,135	472826.00 mE	984136.00 mN
33	Lattice	No.47				AD + 3		+3m Rigid Foundation	254.7	7,425	2,127	472853.00 mE	983873.00 mN
34	Lattice	No.48				AD + 0		+3m Rigid Foundation	220.9	7,646	2,110	472882.00 mE	983620.00 mN
35	Lattice	No.49				AD + 3			261.3	7,908	2,108	472902.00 mE	983400.00 mN
36	Lattice	No.50				AD + 6			348.8	8,256	2,112	472928.00 mE	983140.00 mN
37	Lattice	No.51				AD + 6			244.3	8,501	2,120	472963.00 mE	982793.00 mN
38	Lattice	No.52				BD + 6	5 ° 42 L		159.2	8,660	2,139	472988.00 mE	982550.00 mN
39	Lattice	No.53			Hold unbalanced tension	CD + 6	2 ° 30 L		196.9	8,857	2,116	473020.00 mE	982394.00 mN
40	Existing	No.54			In the Kaliti substation (slack span)	(Existing)	9 ° 18 L		124.1	8,981	2,105	473068.00 mE	982203.00 mN
41	Existing	No.55			In the Kaliti substation (slack span)	(Existing)	73 ° 42 L		82.6	9,063	2,103	473117.00 mE	982089.00 mN
42	Lattice	No.56 (No54)			In the Kaliti substation (slack span)	DD-G + 0	72 ° 0 L		41.8	9,105	2,107	473199.00 mE	982099.00 mN
		Kaliti SS									2,109		

Tower Schedule 2/3 : T22 (1cct branch to Gofa Substation)

IP No.	Section	Survey Number			Crossings	Tower Type	Deviation	Foundation	Span (m)	Total Distance (m)	Elevation (m)	Cooridination 37 P X	Y
43	Lattice	22			inside EEP/EEU warehouse				162.9	9,268	2,230	472088.00 mE	990736.00 mN
		22-A			inside EEP/EEU warehouse	DD + 0			42.0	9,310	2,227	472210.00 mE	990628.00 mE
		Gofa SS			inside EEP/EEU warehouse						2,228	472079.00 mE	990777.00 mS

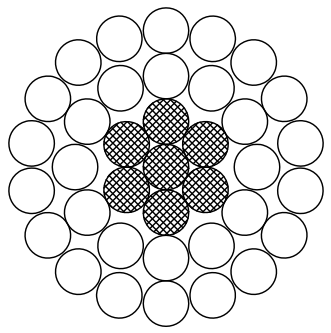
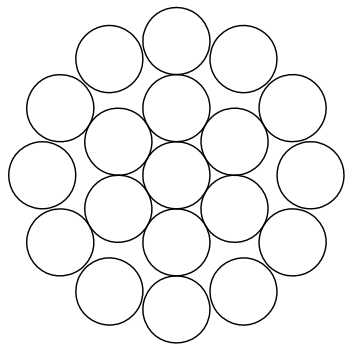
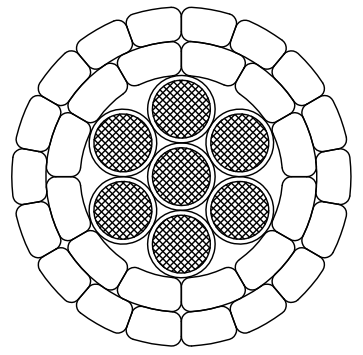
Tower Schedule 2/3 : T22 (1cct branch to Gofa Substation)

IP No.	Section	Survey Number			Crossings	Tower Type	Deviation	Foundation	Span (m)	Total Distance (m)	Elevation (m)	Cooridination 37 P X	Y
	Existing	KC62-L1										481623.00 mE	996128.00 mN
	Existing	KC63-L1										481550.00 mE	996294.00 mN
	Existing	KC64-L1										481447.00 mE	996529.00 mN
	Existing	KC65-L1										481308.00 mE	996840.00 mN
	Existing	KC66-L1									2,384	481211.00 mE	997058.00 mN
44	Tubular	KC67-L1			New Cable Terminal Tower		0 ° 0		43.0		2,385	481193.00 mE	997101.00 mN
	Existing	KC68-L1							222.0		2,394	481096.00 mE	997323.00 mN

APPENDIX-5

CONDUCTOR, TOWER AND FOUNDATION DESIGN

Comparison for Specification of Conductors

Description		Unit	Tiger ACSR166	ASH/AAAC 180	Invar XTACIR 210
Construction	Aluminum	No. /mm	30 / 2.36 mm	19 / 3.48 mm	16 / 2.5 + 12 / 2.6 mm
	Steel Core		7 / 2.36 mm		7 / 3.5 mm
Diameter		mm	16.52 mm	17.40 mm	17.60 mm
Cross Section Area	Aluminum	mm2	131.20 mm2	180.7 mm2	142.4 mm2
	Core		30.62 mm2		63.3 mm2
	Total		161.82 mm2	180.7 mm2	209.7 mm2
Nominal Weight		kg/km	602 kg/km	497 kg/km	872 kg/km
Ultimate Tensile Strength		kN	58.0 kN	50.6 kN	81.1 kN
DC Resistant at 20℃		Ω/km	0.2202 ohm/km	0.1830 ohm/km	0.191 ohm/km
Elastic Modulus		GPa	82.0 GPa	68.0 GPa	90.8.0 GPa
Thermal Expansion coefficiency		1 / ℃	0.000019	0.000023	0.0000126
Continuous Allowable Temperature		℃	90 ℃	90 ℃	230 ℃
Short Time Allowable Temperature			120 ℃ (400 hrs)	120 ℃ (400 hrs)	290 ℃ (400 hrs)
Continuous Current Capacity at continuous allowable temperature		A	490 A	510 A	1,000 A
Cross Section		—			

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	APP'D

OWNER

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NEWJEC Inc.

PROJECT

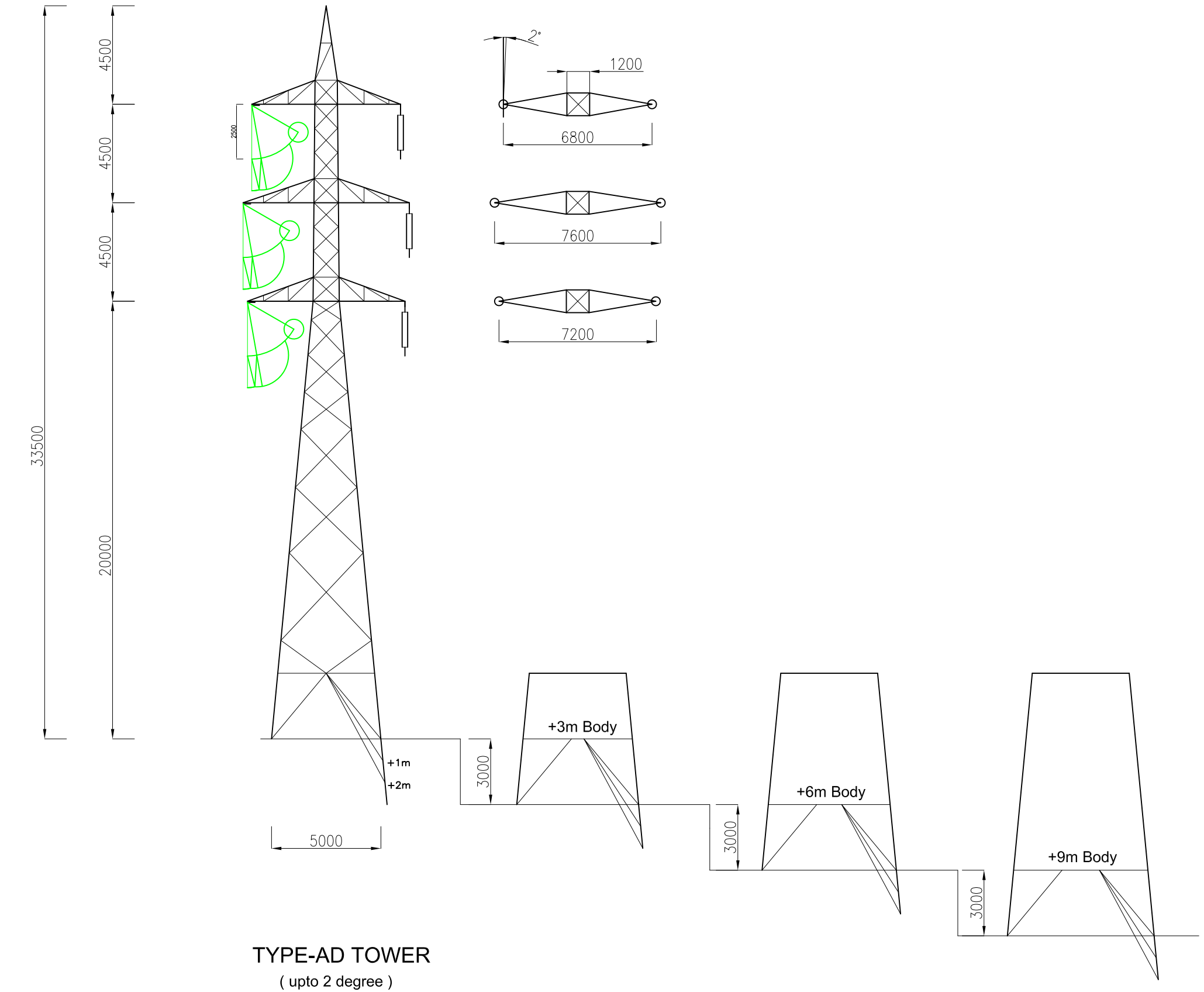
ADDIS ABABA TRANSMISSION AND DISTRIBUTION SYSTEM REHABILITATION AND UPGRADING PROJECT

TITLE

Over Head Transmission Line

Detailed Specification of Conductor

DWG SIZE:	DATE	DRAWN	CHECKED	APPROVED
A3	17-04-06	Nagaseki	Suzuki	K.Yagi
SCALE: As shown	DRAWING NO.: OHTL-003		SHEET: 1 OF 1	REV.: 0



TYPE-AD TOWER

(upto 2 degree)

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	APP'D

OWNER

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TITLE

Transmission Line

Tower Configuration AD type

DWG SIZE:	DATE	DRAWN	CHECKED	APPROVED
A3	18-07-20	Nagaseki	Suzuki	K.Yagi
SCALE:	DRAWING NO.:		SHEET:	REV.:
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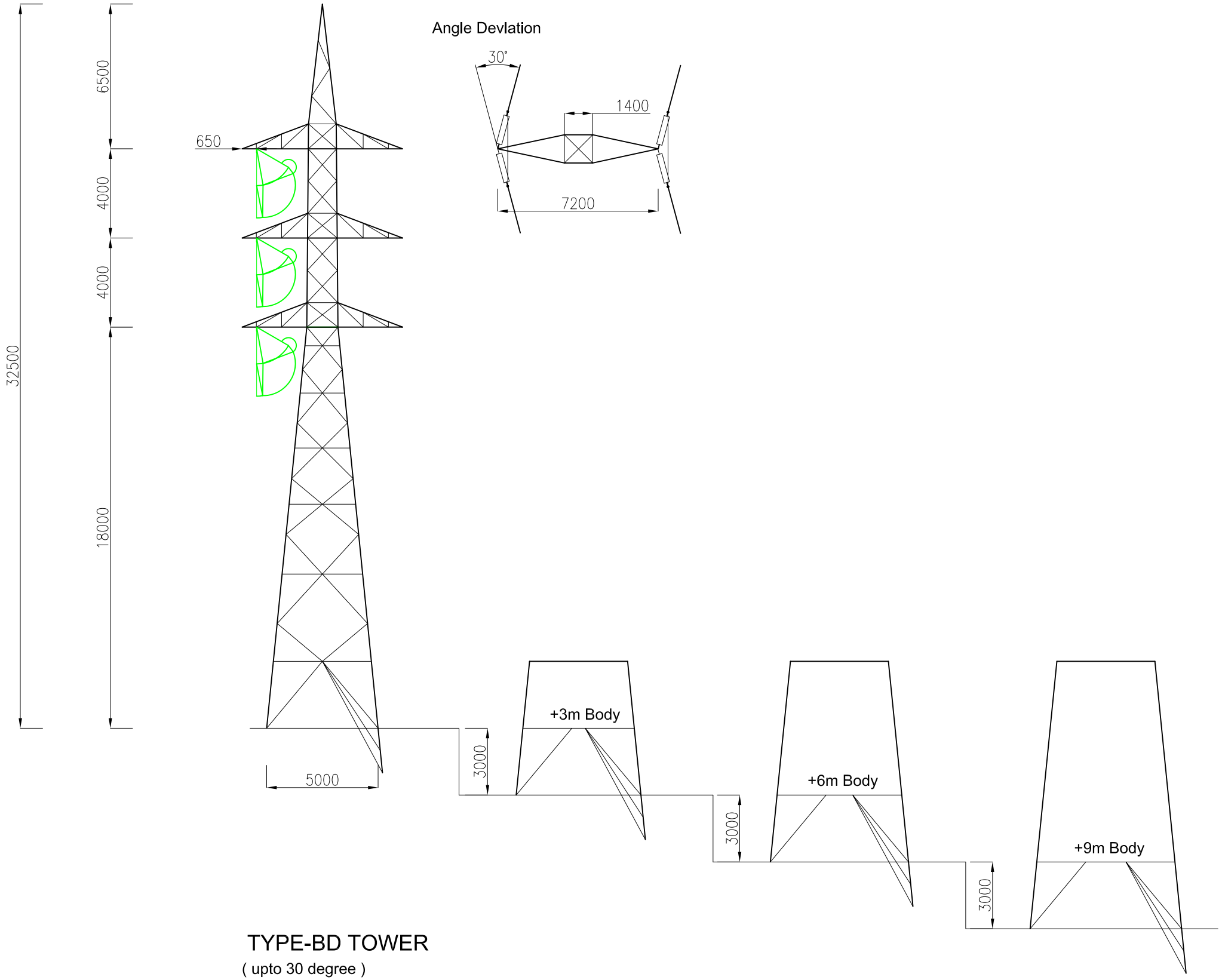

Angle Devlation

TYPE-BD TOWER

(upto 30 degree)

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	APP'D

OWNER

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TITLE

Transmission Line

Tower Configuration BD type

DWG SIZE:	DATE	DRAWN	CHECKED	APPROVED
A3	18-07-20	Nagaseki	Suzuki	K.Yagi
SCALE:	DRAWING NO.:		SHEET:	REV.:
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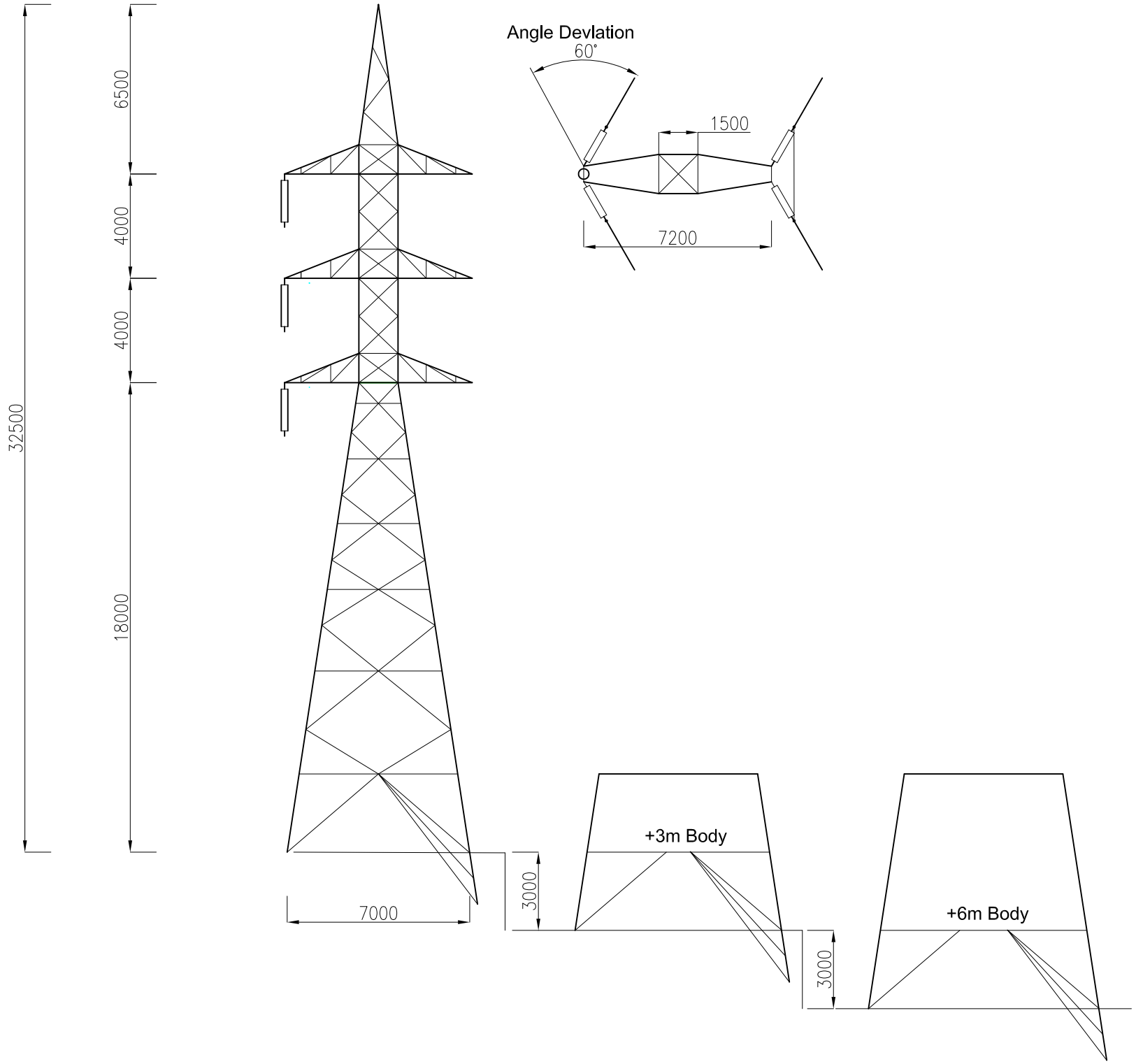

TYPE-CD TOWER

(upto 60 degree & Section)

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	APP'D

OWNER

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TITLE

Transmission Line

Tower Configuration CD type

DWG SIZE:	DATE	DRAWN	CHECKED	APPROVED
A3	18-07-20	Nagaseki	Suzuki	K.Yagi
SCALE:	DRAWING NO.:		SHEET:	REV.:
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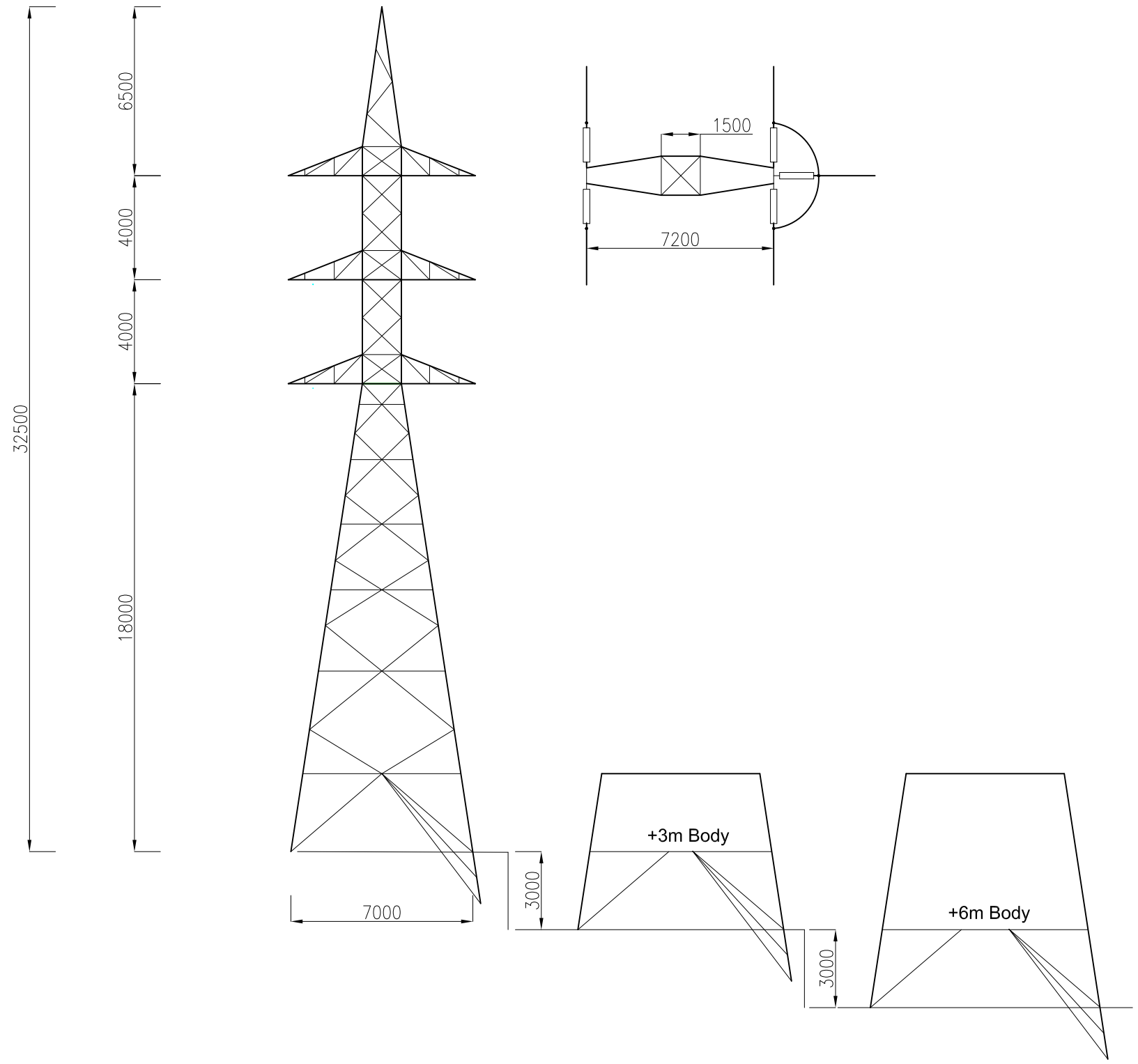

TYPE-DD TOWER

(Deadend 1 cct : T-cnnection)

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	APP'D

OWNER

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TITLE

Transmission Line

Tower Configuration DD type

DWG SIZE:	DATE	DRAWN	CHECKED	APPROVED
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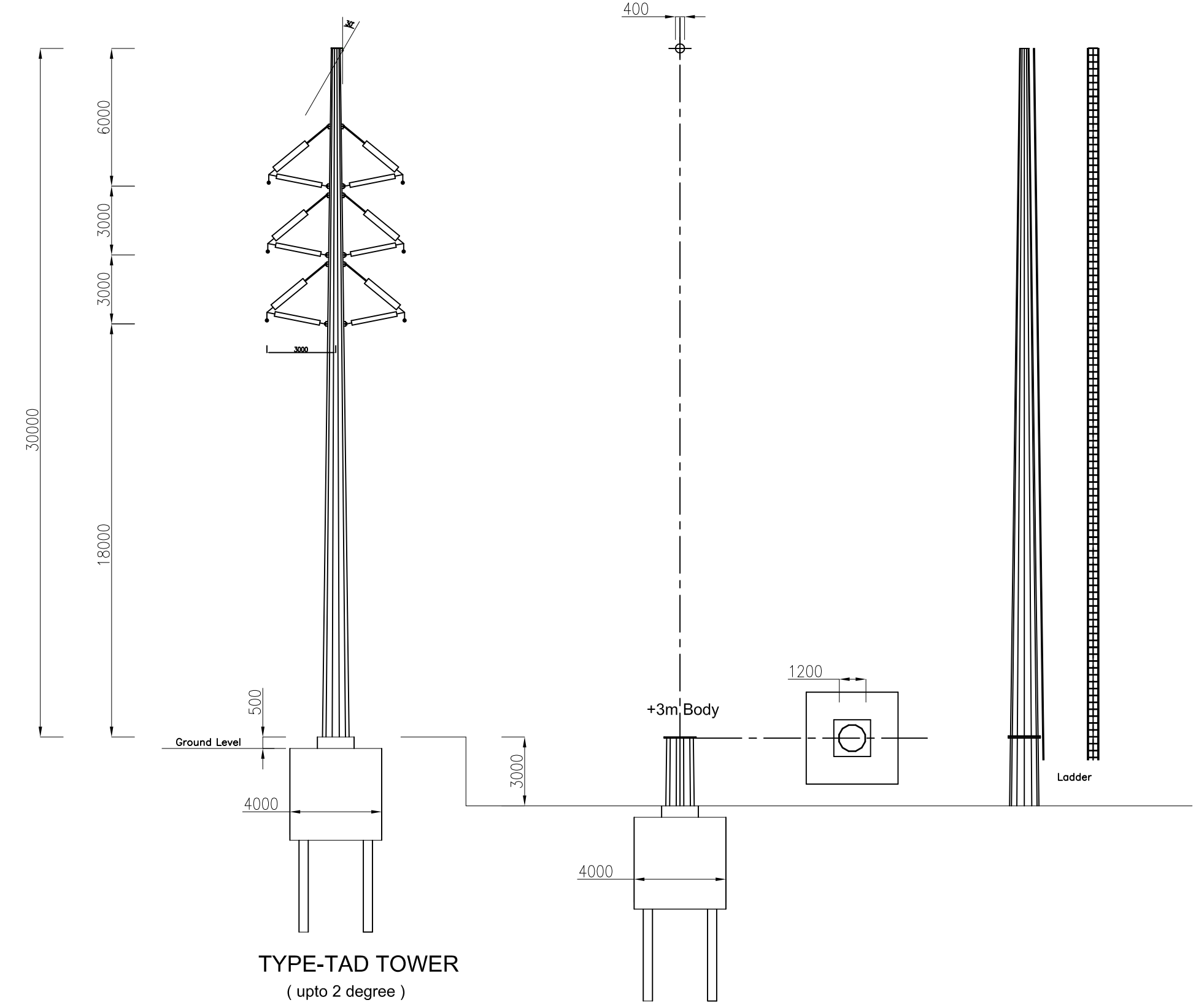
SCALE: No Scale	DRAWING NO.: □HTL-004		SHEET: 1 OF 1	REV.: 1



TYPE-TAD TOWER

(upto 2 degree)

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	APP'D

OWNER

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TITLE

Transmission Line

Tower Configuration TAD type

DWG SIZE:	DATE	DRAWN	CHECKED	APPROVED
A3	18-07-20	Nagaseki	Suzuki	K.Yagi
SCALE:	DRAWING NO.:		SHEET:	REV.:
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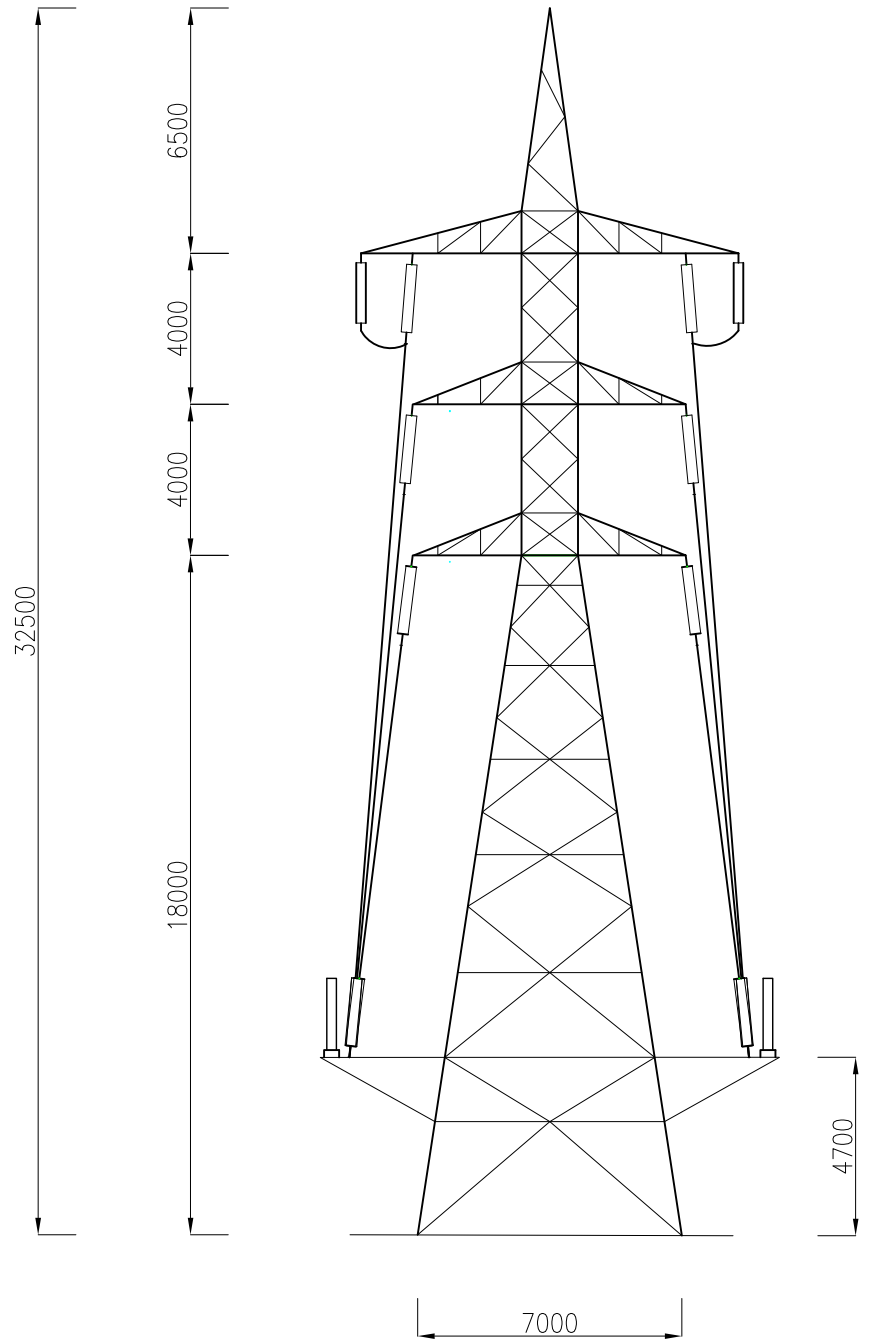

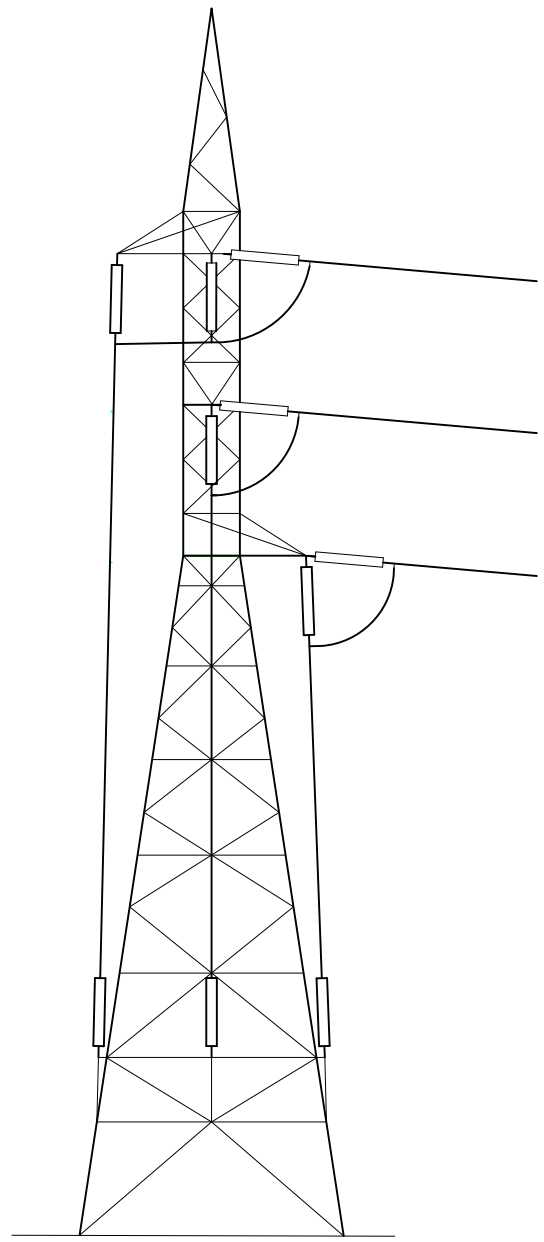

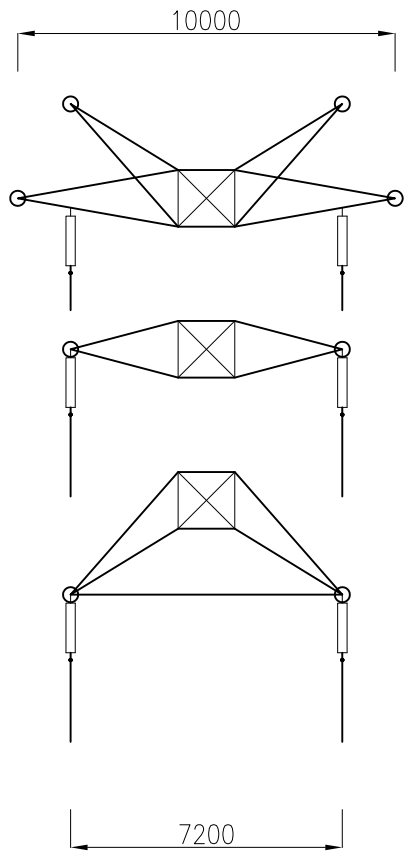

TYPE-DD-C TOWER

(Deadend Cable Termination)

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	APP'D

OWNER

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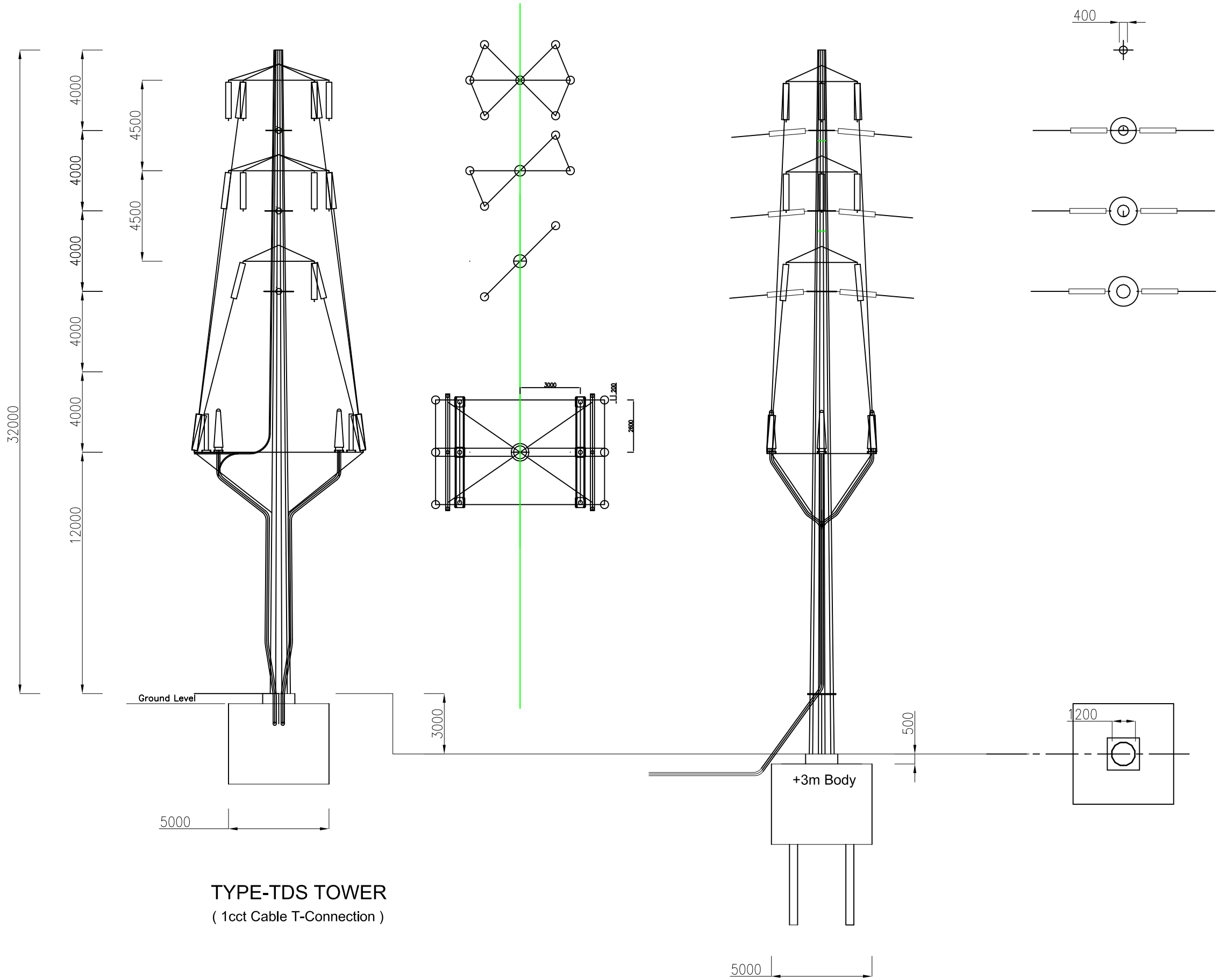
TITLE

Transmission Line

Tower Configuration DD-C type

DWG SIZE:	DATE	DRAWN	CHECKED	APPROVED
A3	18-07-20	Nagaseki	Suzuki	K.Yagi
SCALE:	DRAWING NO.:		SHEET:	REV.:
No Scale	DHTL-005		1 OF 1	1



TYPE-TDS TOWER

(1cct Cable T-Connection)

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	APP'D

OWNER

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TITLE

Transmission Line

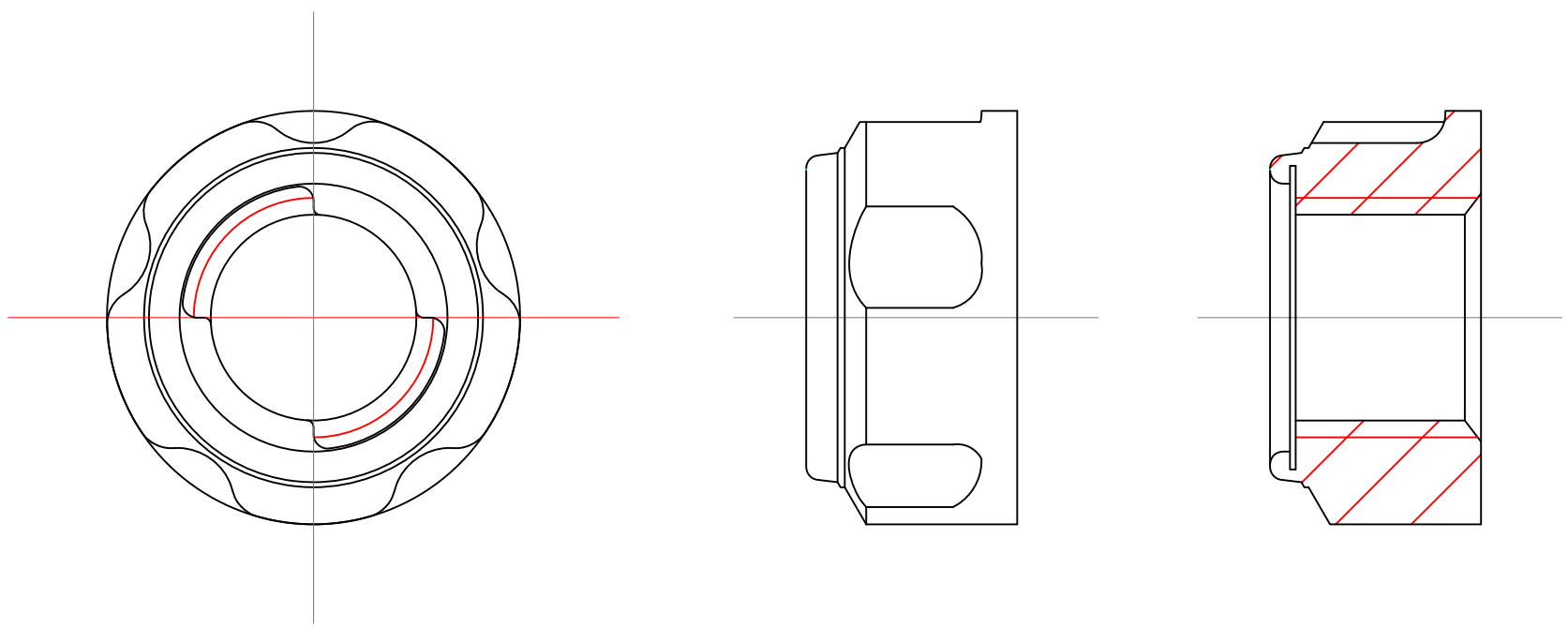
Tower Configuration TAD type

DWG SIZE:	DATE	DRAWN	CHECKED	APPROVED
A3	18-07-20	Nagaseki	Suzuki	K.Yagi
SCALE:	DRAWING NO.:		SHEET:	REV.:
No Scale	□HTL-005		1 OF 1	1

Anti-Theft Nut

Nut shall have anti-theft function with locking device.

Nut shall be tighten and removed by special tool only.



REV.	DESCRIPTION	DATE	DRAWN	CHK'D	APP'D

OWNER

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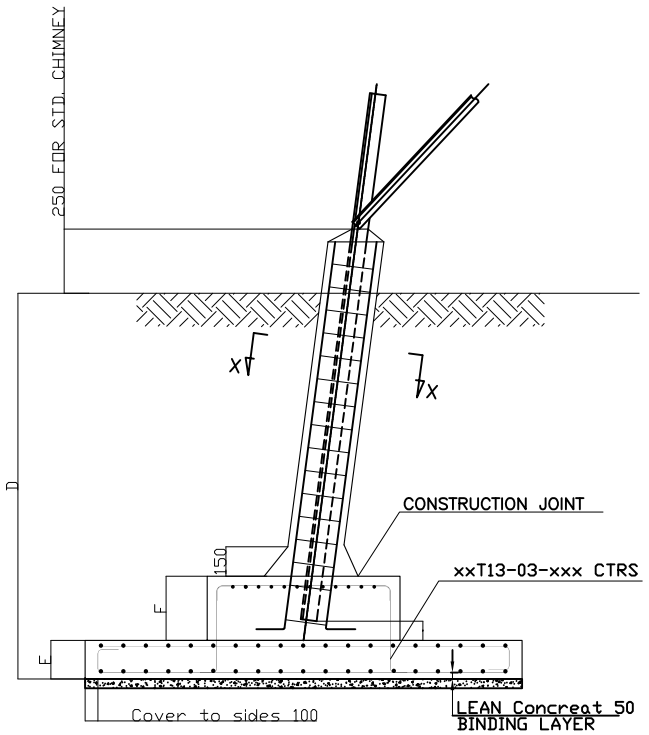
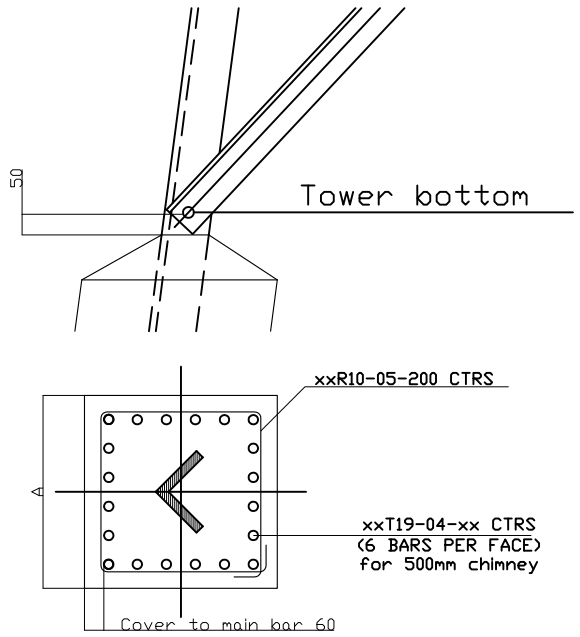
TITLE

Transmission Line

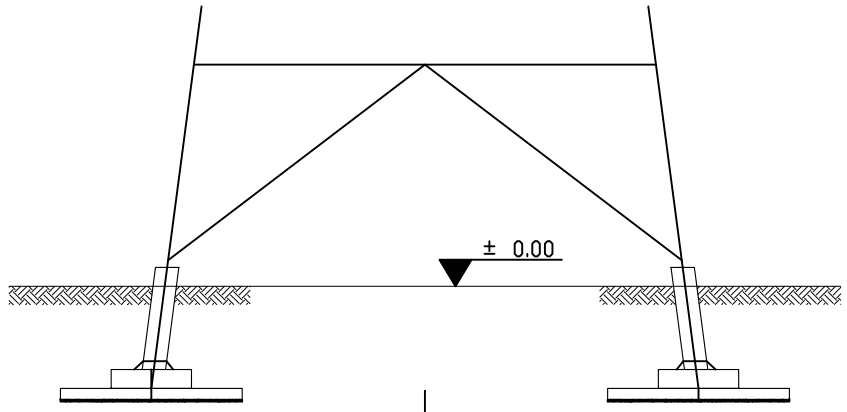
Unti-theft Nut

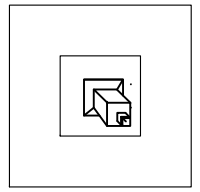
DWG SIZE:	DATE	DRAWN	CHECKED	APPROVED
A3	18-07-20	Nagaseki	Suzuki	K.Yagi
SCALE:	DRAWING NO.:		SHEET:	REV.:
No Scale	DHTL-005		1 OF 1	1

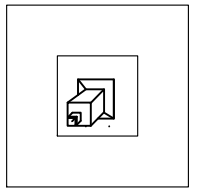




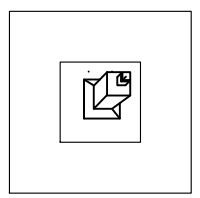
Section X–X

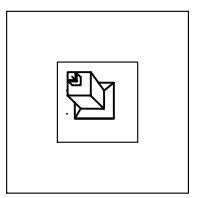


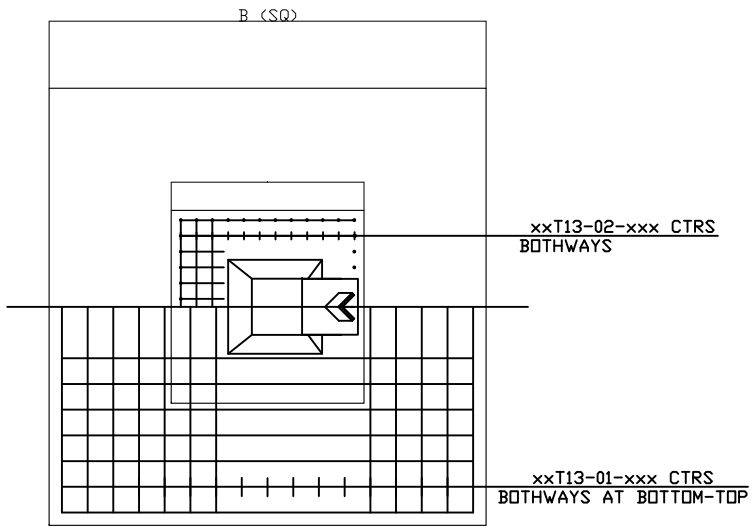




LINE AXIS







BENDING FORM

No.	Shape	Remark
01.		Lower PAD
02.		Upper PAD
03.		Upper PAD
04.		Chimny
05.		Ring

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	APP'D

OWNER

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PROJECT

ADDIS ABABA TRANSMISSION AND DISTRIBUTION SYSTEM REHABILITATION AND UPGRADING PROJECT

TITLE

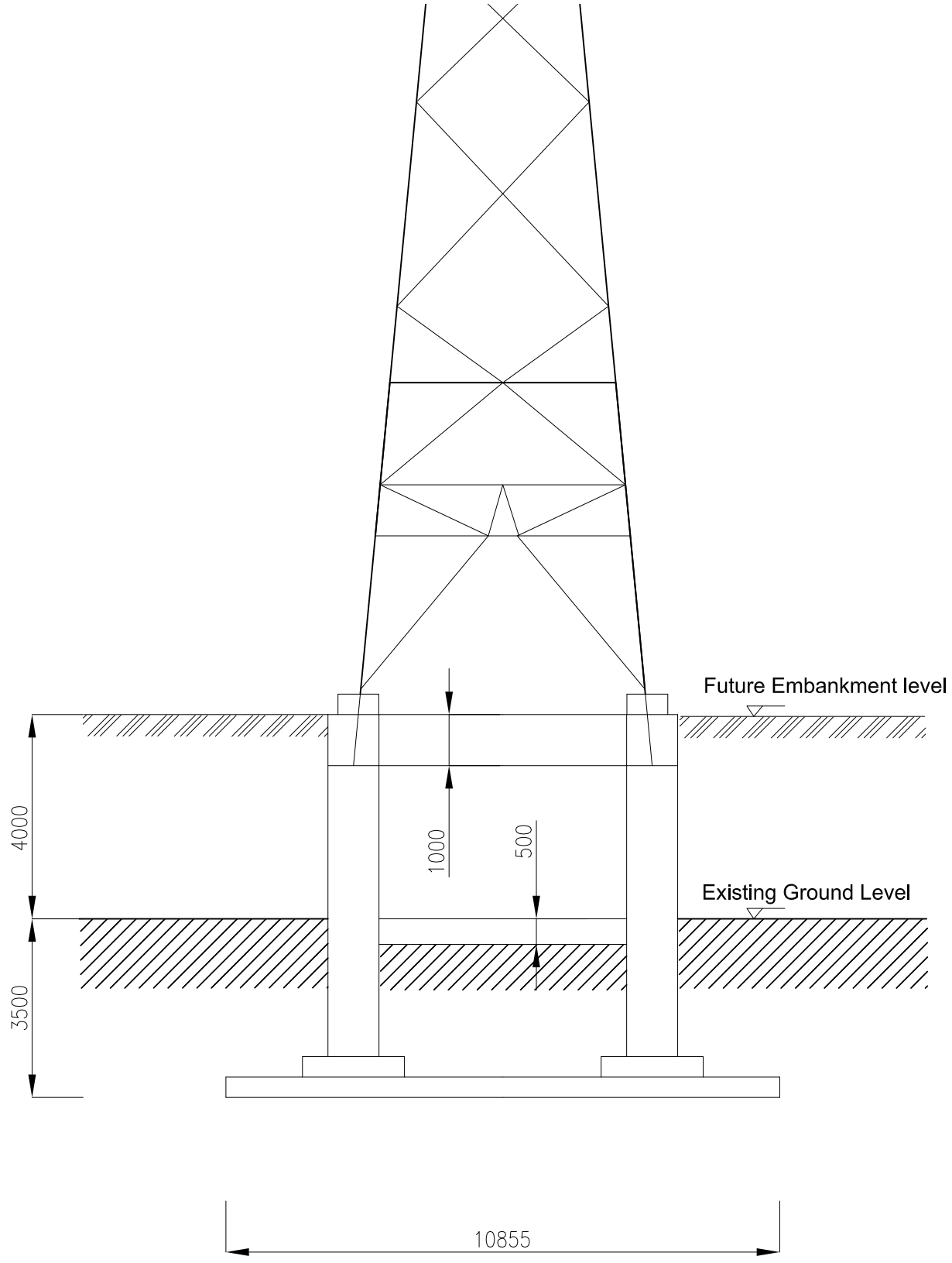
Transmission Line

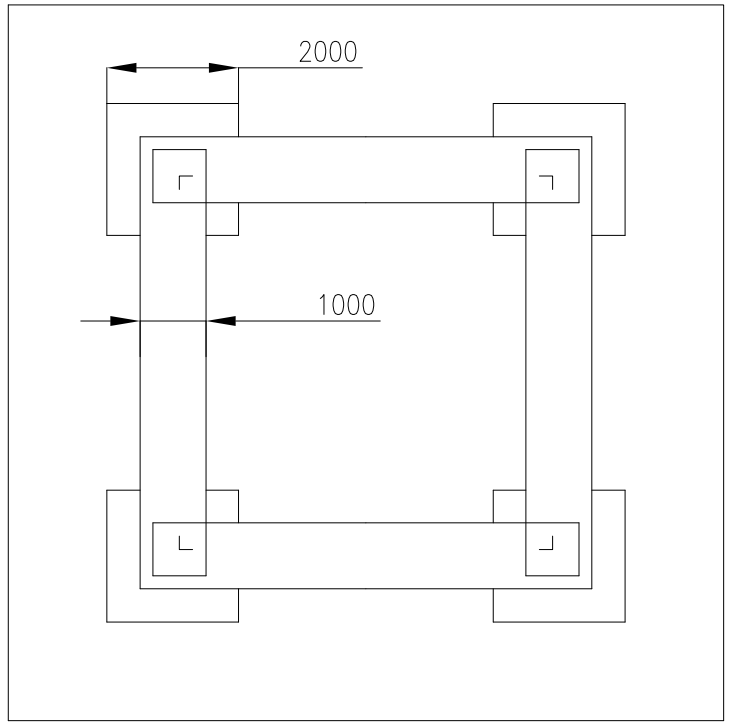
Foundation Outline

DWG SIZE:	DATE	DRAWN	CHECKED	APPROVED
A3	18-08-09	NAGASEKI	Suzuki	K.Yagi
SCALE:	DRAWING NO.:		SHEET:	REV.:
As shown	CIHL 003		1 OF 1	1

132kV Overhead Transmission Line
Recommended Design Parameter for Foundation

No.	Tower Type	A Chimney	B Base Pad	C Upper Pad	E Base thick	F Upper Pad thick	D Depth	M200 Concrete [m3]	M50 Concrete Lean Concrete [m3]	Total Rebars [kg]
Foundation 2cct Tower										
1	AD (LD)	0.6	3.6	2.0	0.4	0.4	3.5	32.5	5.2	4,340
2	AD (Rigid)	1.0	10.9	2.0	0.4	0.4	3.5	103.4	11.8	13,209
3	BD (MD)	0.8	4.0	2.0	0.6	0.5	3.5	55.1	6.4	5,780
4	CC (ND)	0.8	4.5	3.0	0.6	0.5	3.5	75.3	8.1	7,530
5	DD (ND dead-end)	1.0	6.0	3.0	0.6	0.6	3.5	121.2	14.4	12,580
6	TAD (Mono-Tubular)	Dia. 1.8	4.0	-	4.0	-	4.0	65.3	1.6	1,611
Foundation 1cct Tower										
7	TDS (Mono-Tubular)	Dia. 1.8	5.0	-	5.0	-	4.0	101.3	2.5	2,425





Rigid Foundation

T34, T35, T36, T40, T41, T42, T46, T47 and T48

REV.	DESCRIPTION	DATE	DRAWN	CHK'D	APP'D

OWNER

የኢትዮጵያ ኤሌክትሪክ ኃይል
ETHIOPIAN ELECTRIC POWER

ETHIOPIA ELECTRIC POWER

CONSULTANT

NEWJEC Inc.

PROJECT

ADDIS ABABA TRANSMISSION AND DISTRIBUTION SYSTEM REHABILITATION AND UPGRADING PROJECT

TITLE

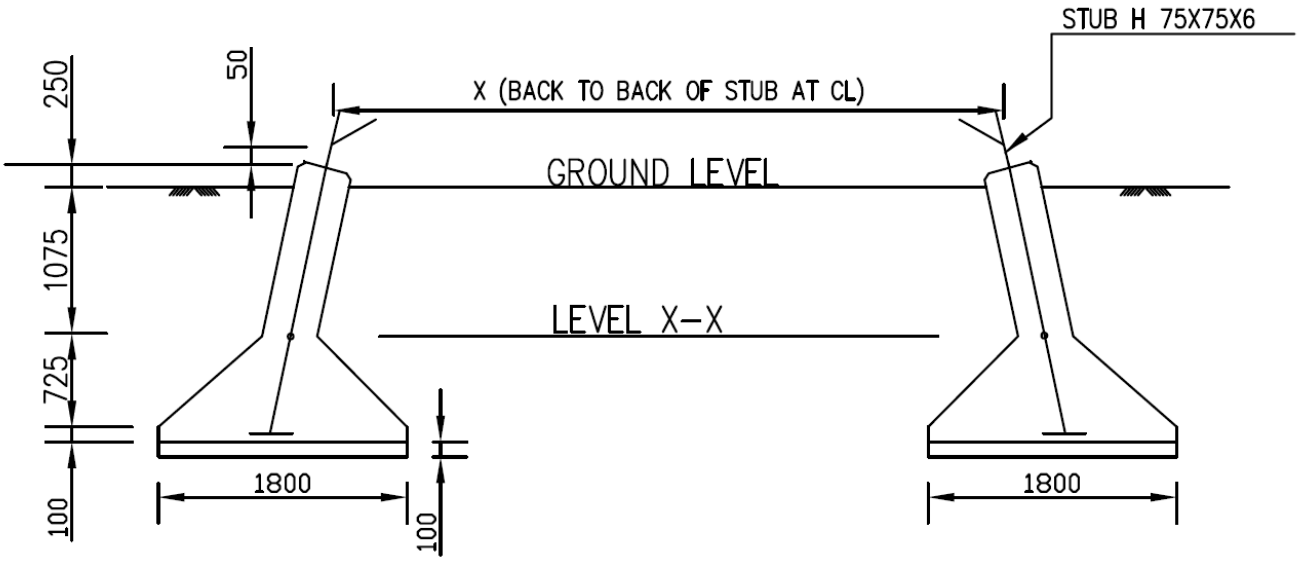
Transmission Line

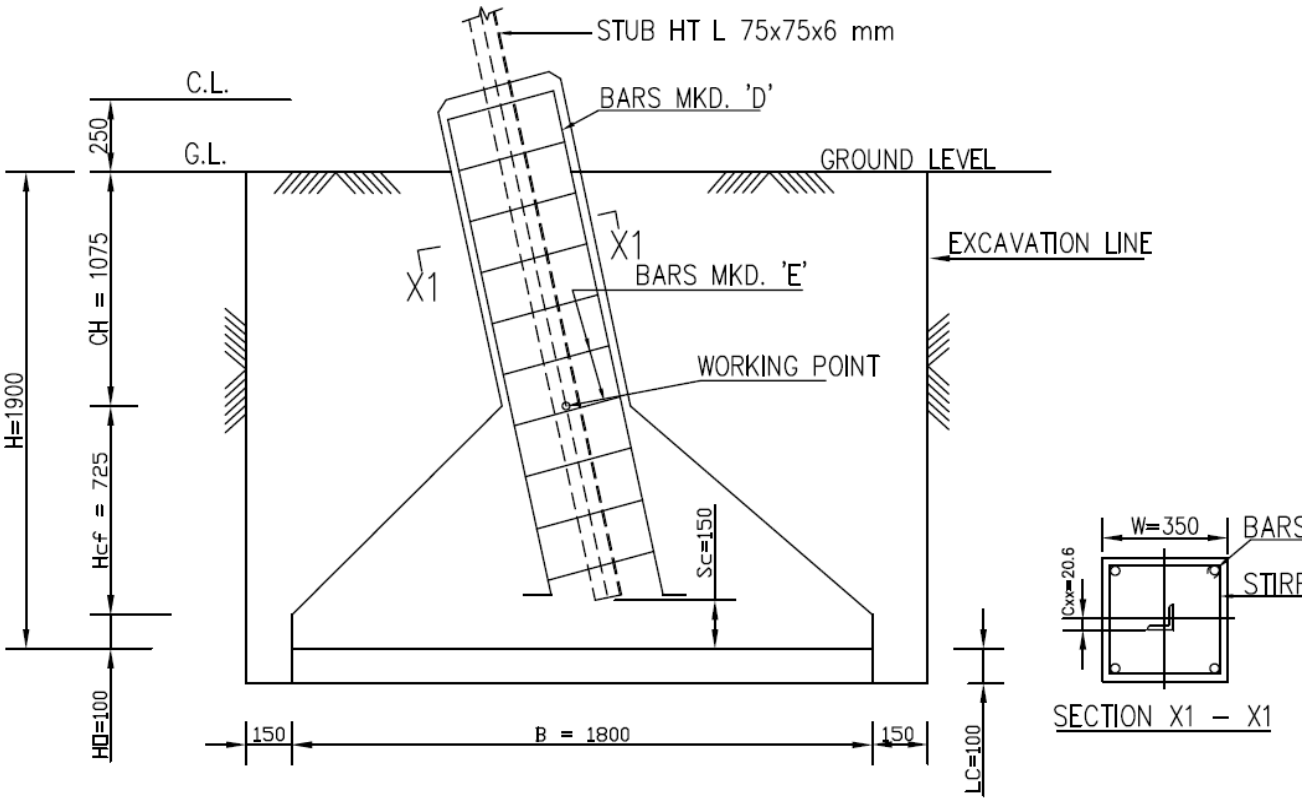
Rigid Foundation

DWG SIZE:	DATE	DRAWN	CHECKED	APPROVED
A3	18-07-20	Nagaseki	Suzuki	K.Yagi
SCALE:	DRAWING NO.:		SHEET:	REV.:
No Scale	□HTL-006		1 OF 1	1

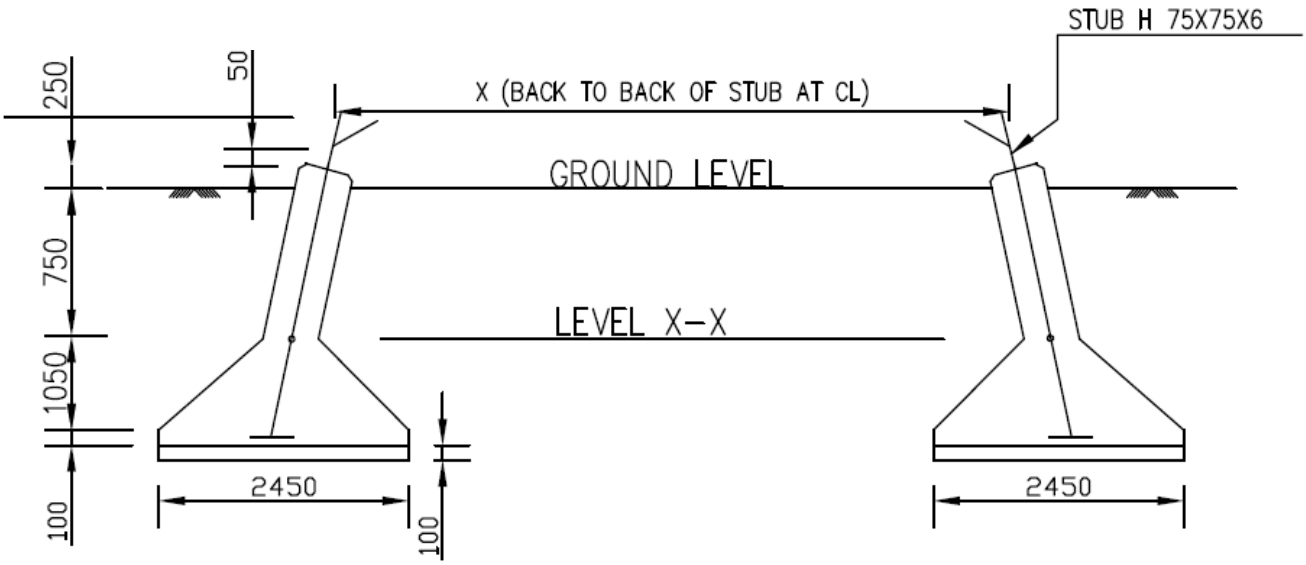
132kV 1cct Overhead Transmission Line
Existing Foundation Design L type (A type) Suspension Tower

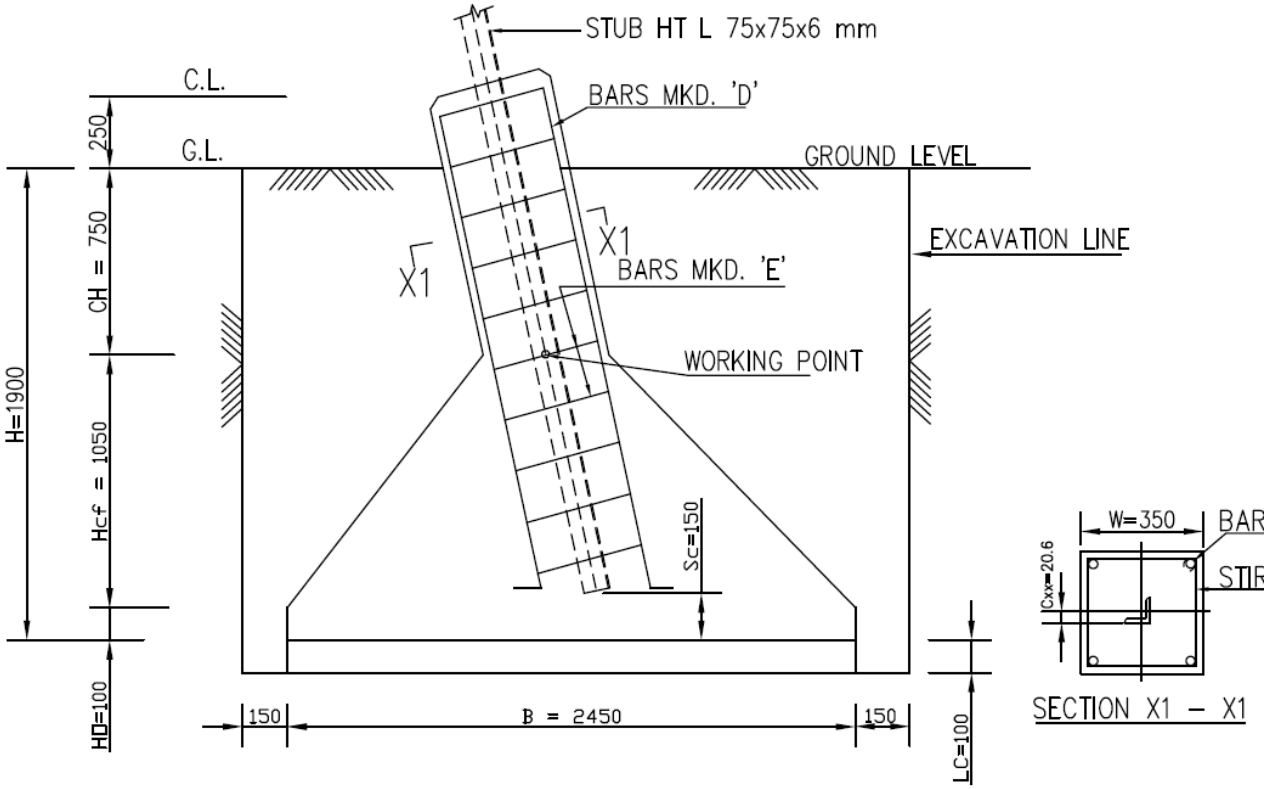
Type of Soil	Good Soil
Soil Unit Weight	1,600 kg/m^3
Safe Bearing Capacity	200 kN/m^2
Angle of Repose	30 ^{o}



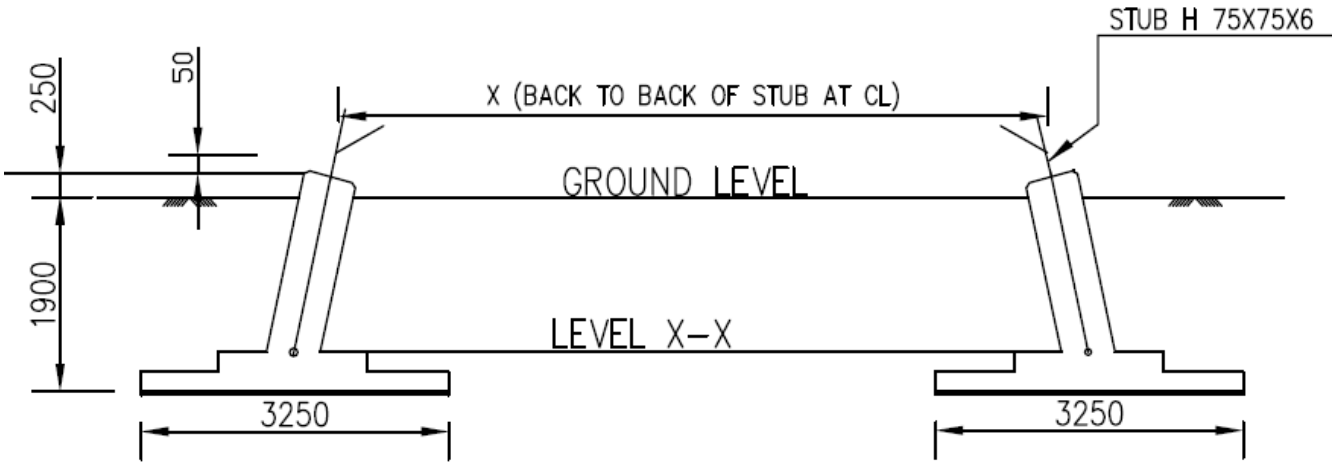


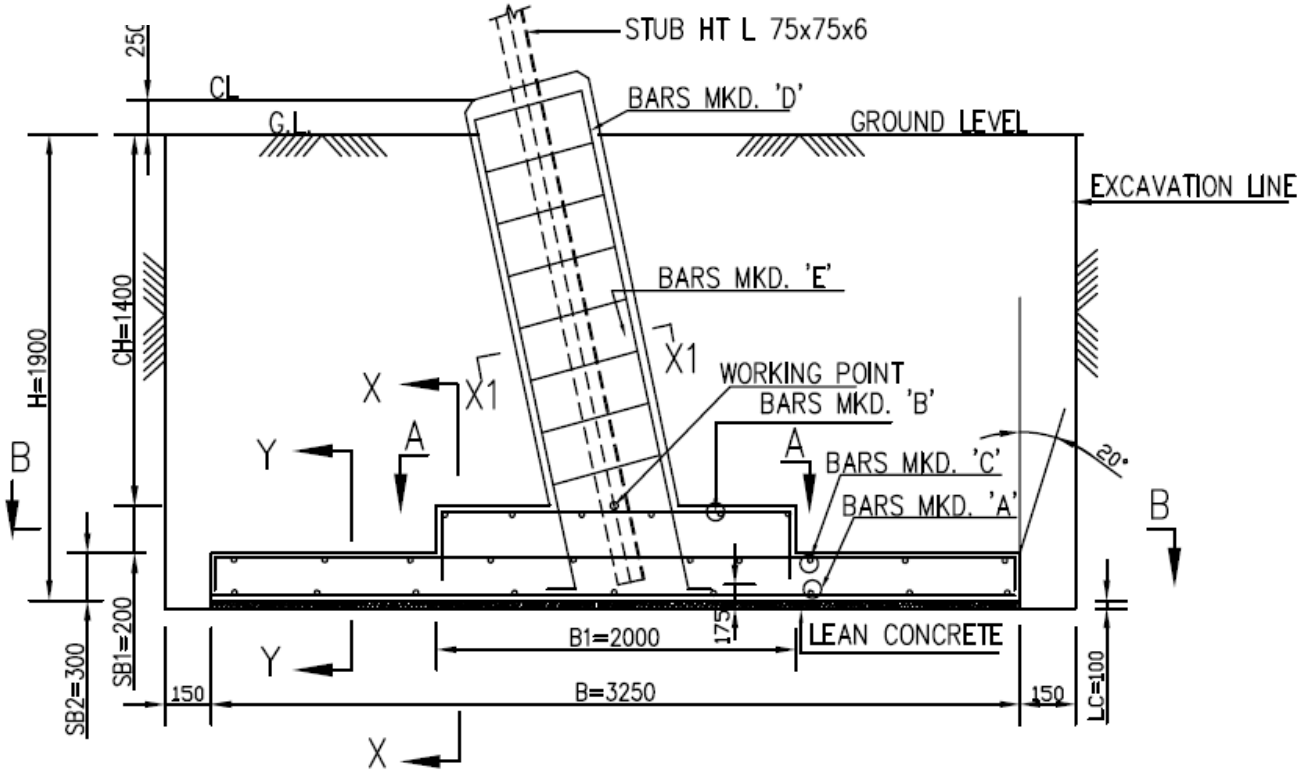
Type of Soil	Poor Soil
Soil Unit Weight	1,400 kg/m^3
Safe Bearing Capacity	100 kN/m^2
Angle of Repose	20 ^{o}



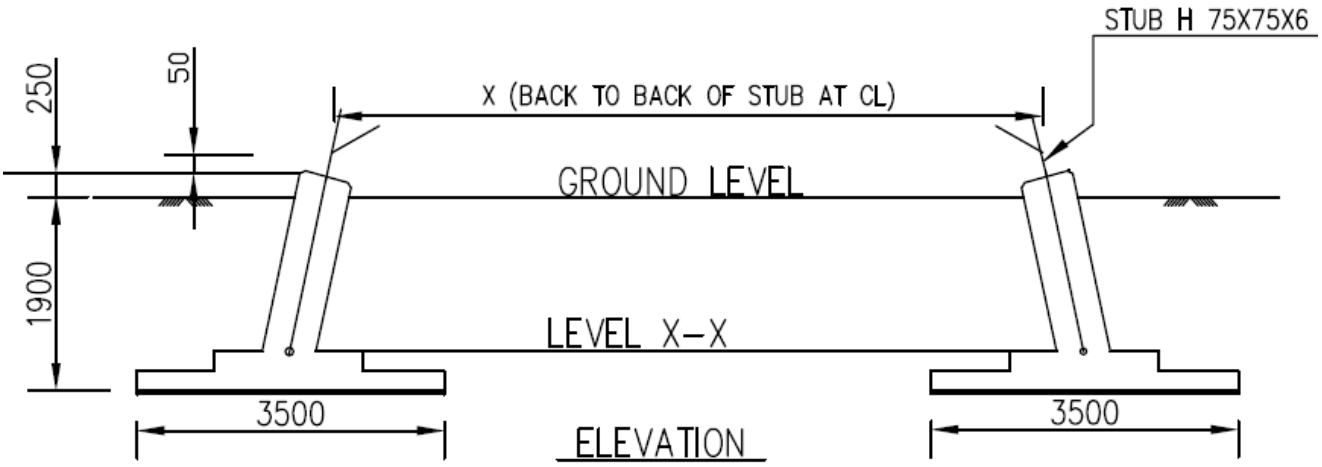


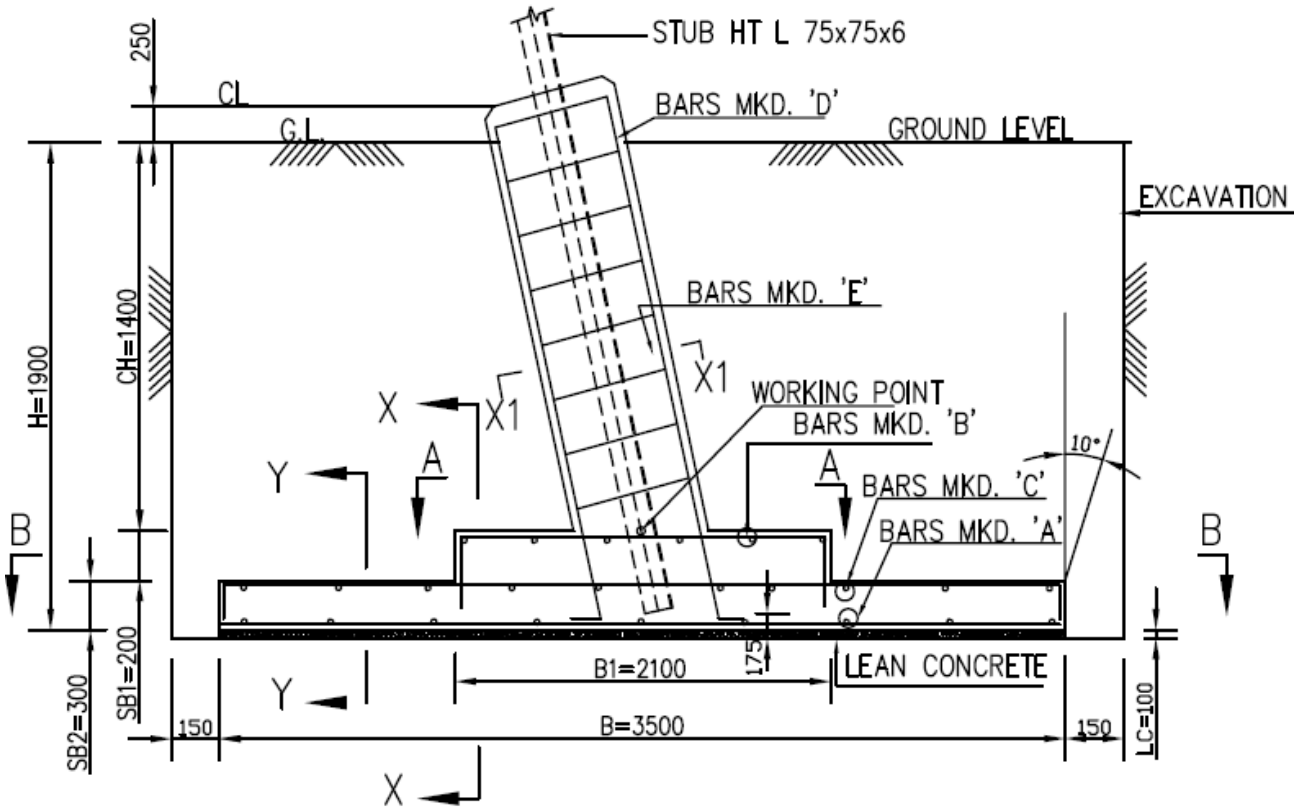
Type of Soil	Submerged Good Soil
Soil Unit Weight	800 kg/m^3
Safe Bearing Capacity	200 kN/m^2
Angle of Repose	20 ^{o}



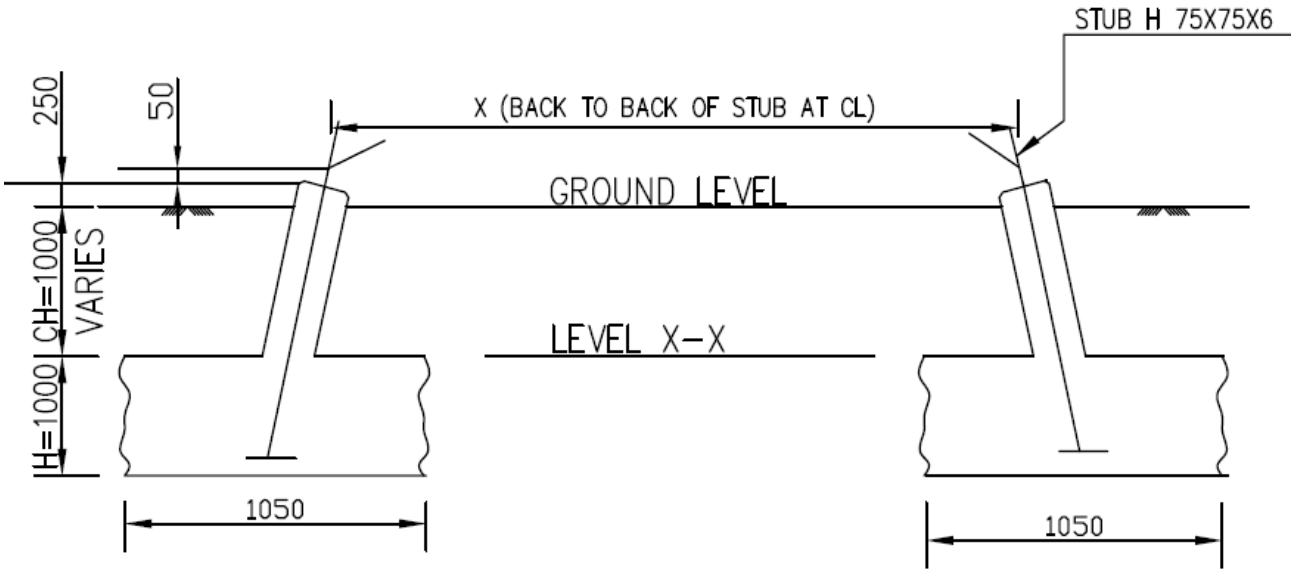


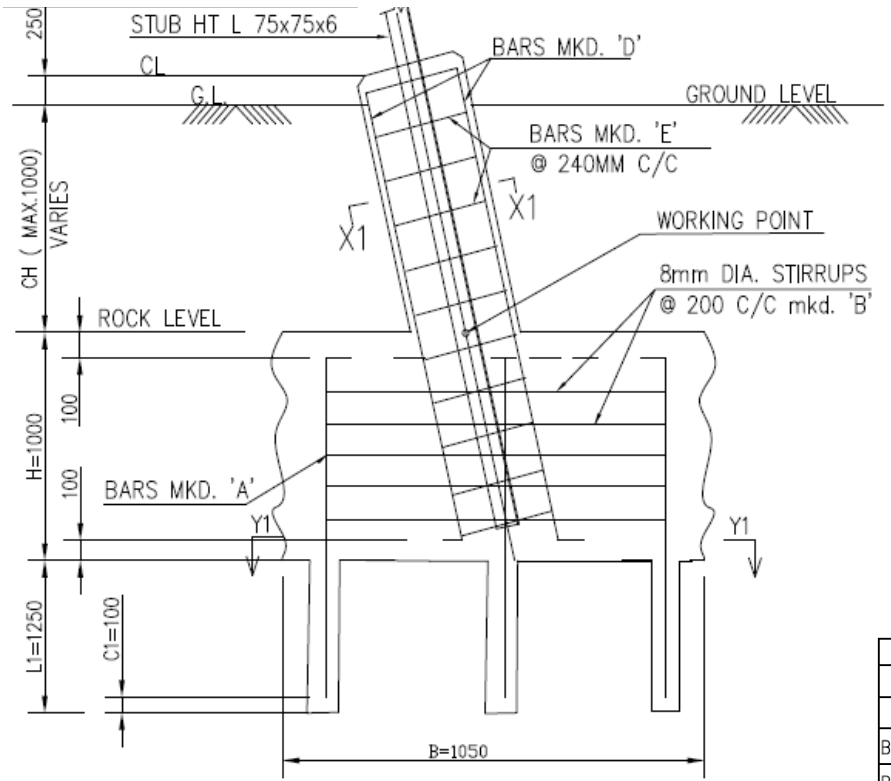
Type of Soil	Submerged Poor Soil
Soil Unit Weight	800 kg/m^3
Safe Bearing Capacity	100 kN/m^2
Angle of Repose	10 ^{o}

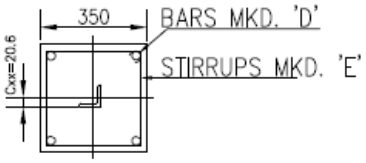




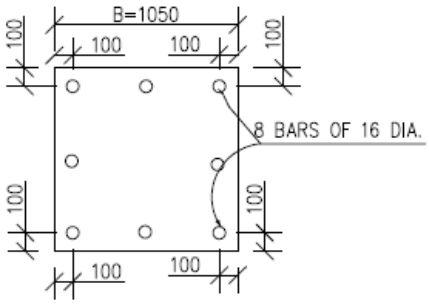
Type of Soil	Rock Foundation





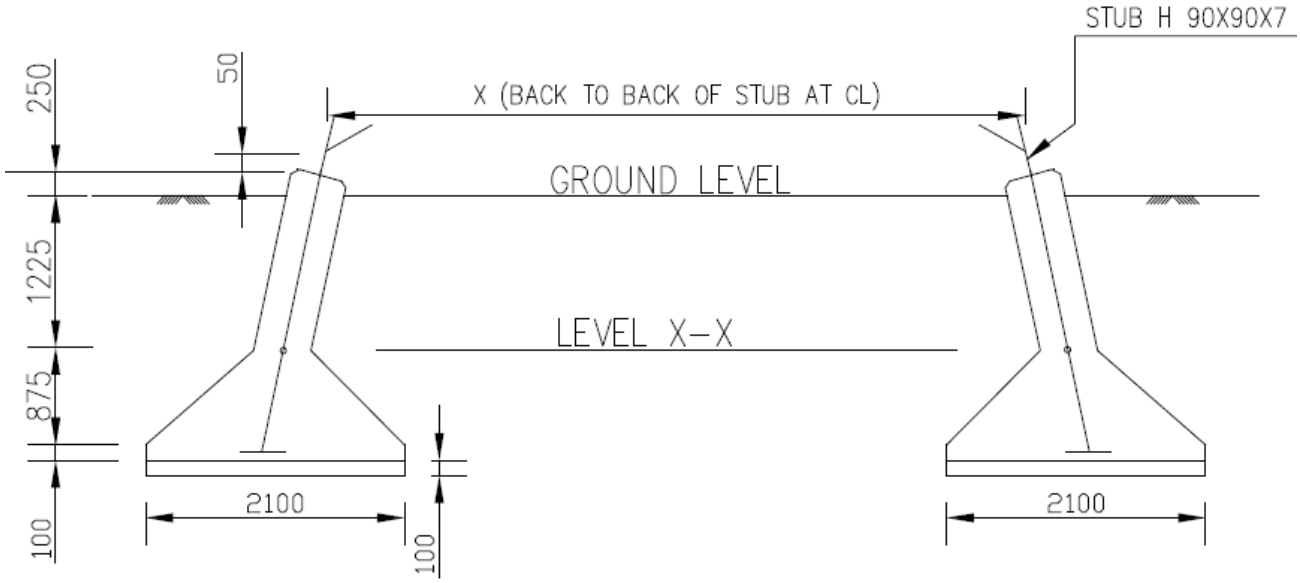


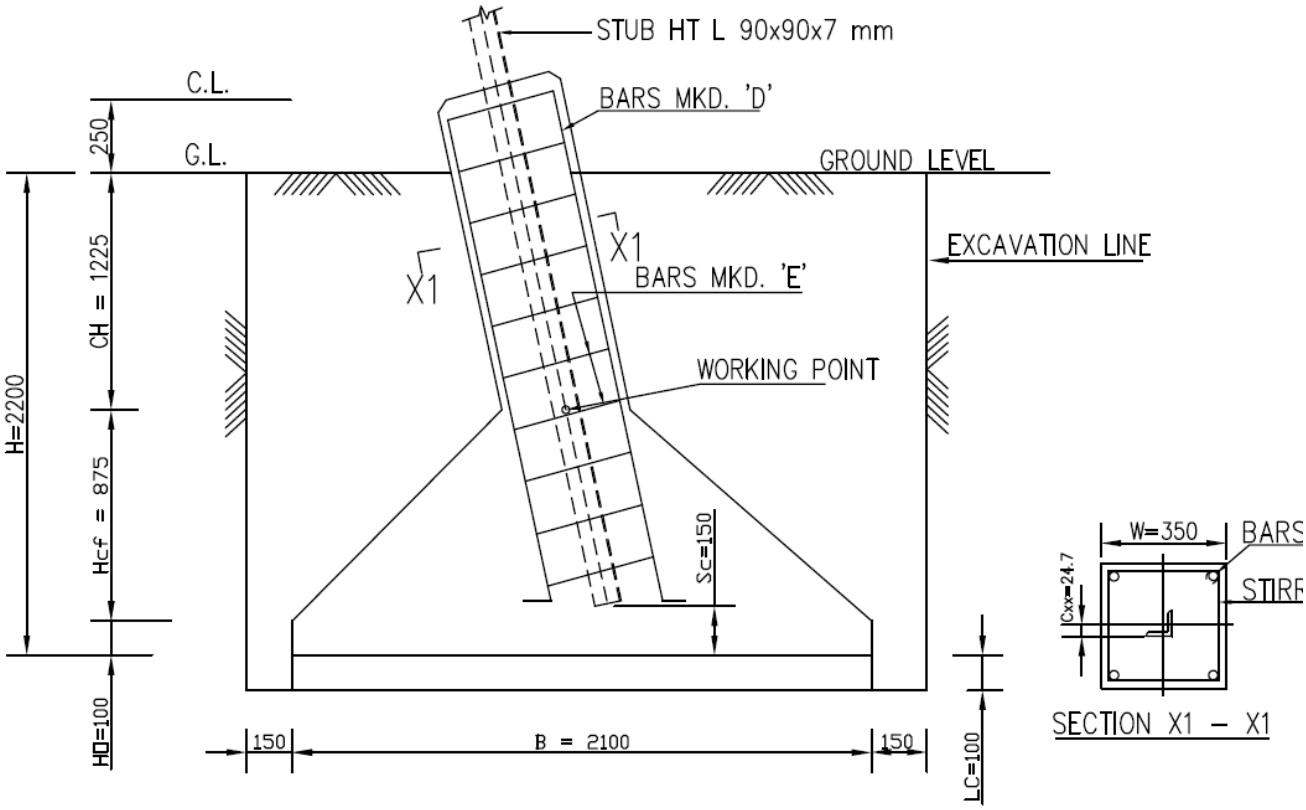
SECTION X1 – X1



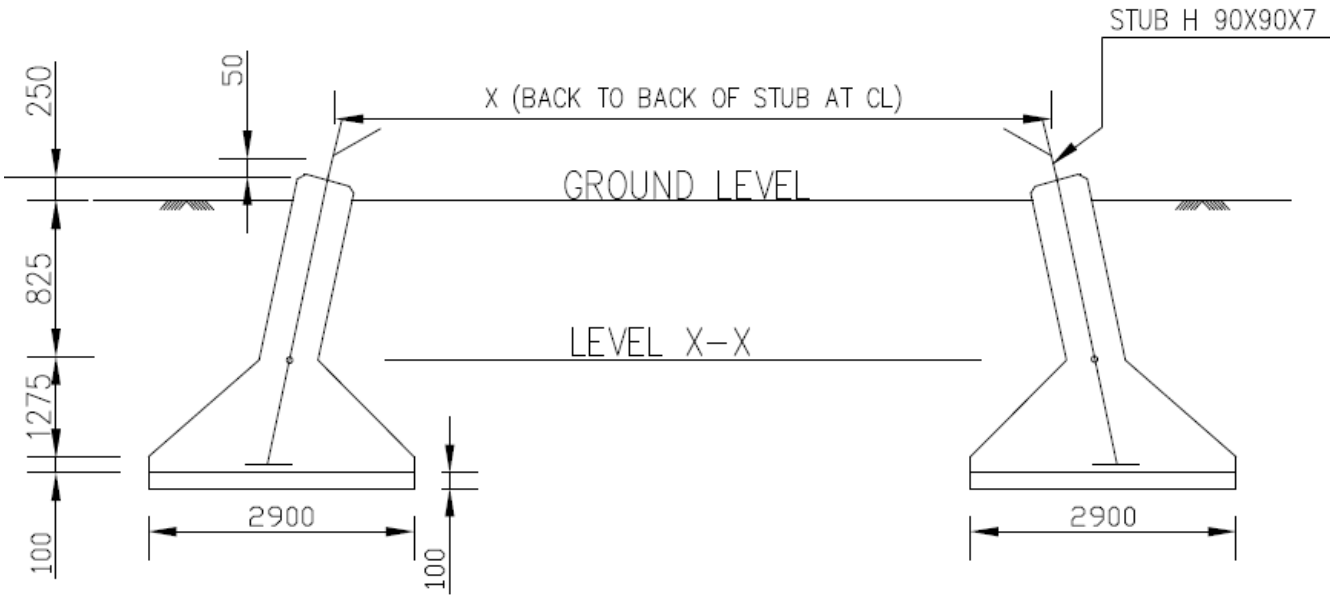
EXCAVATION PLAN DETAIL				
STRUCTURES	X	J	K	C.G OF STUB
	B.T + 1.0M/2.0M/3.0M/4.0M L.E			
B.T+1.0M L.E	4886	5096	7206	20.6
B.T+2.0M L.E	5080	5290	7481	20.6
B.T+3.0M L.E	5274	5484	7755	20.6
B.T+4.0M L.E	5468	5678	8029	20.6

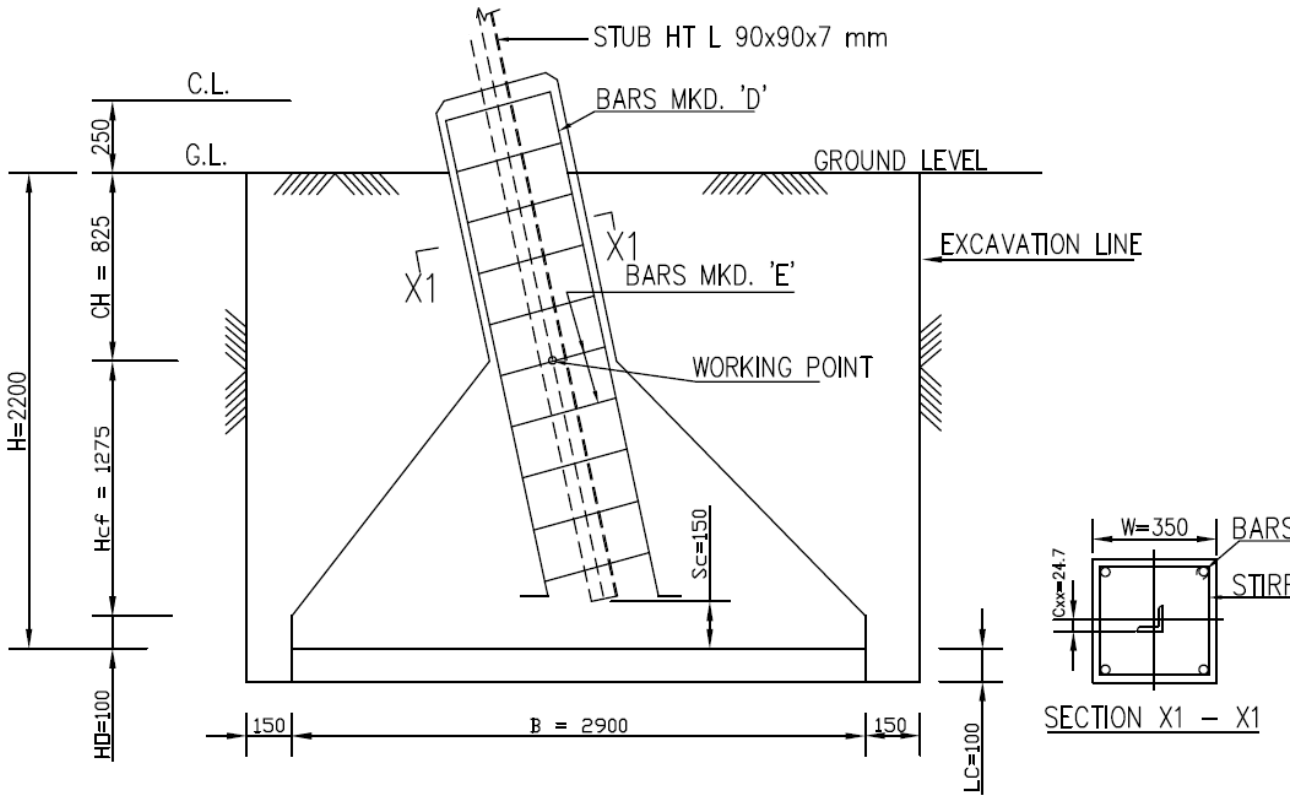
Type of Soil	Good Soil
Soil Unit Weight	1,600 kg/m^3
Safe Bearing Capacity	200 kN/m^2
Angle of Repose	30 ^{o}



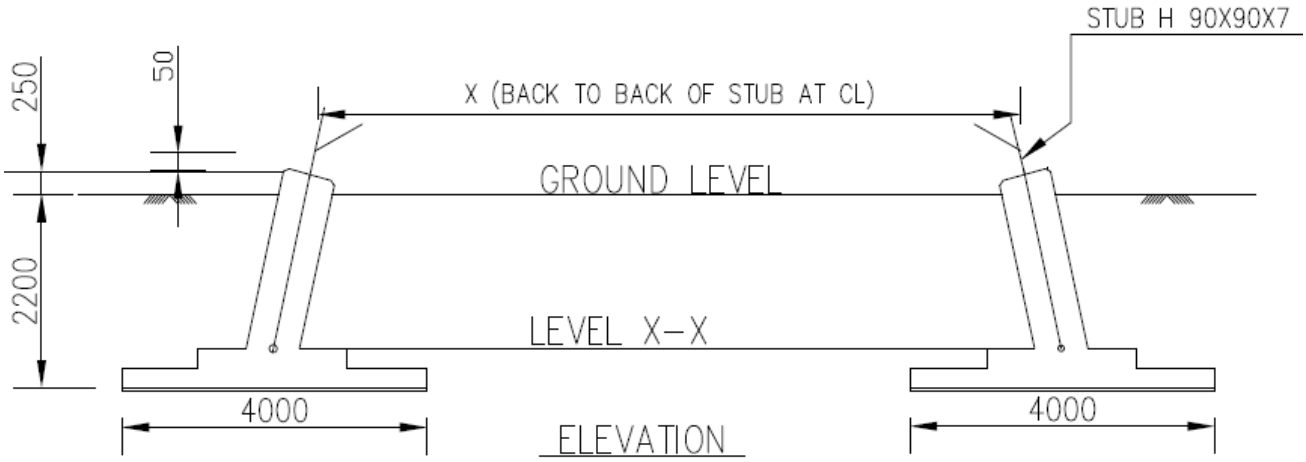


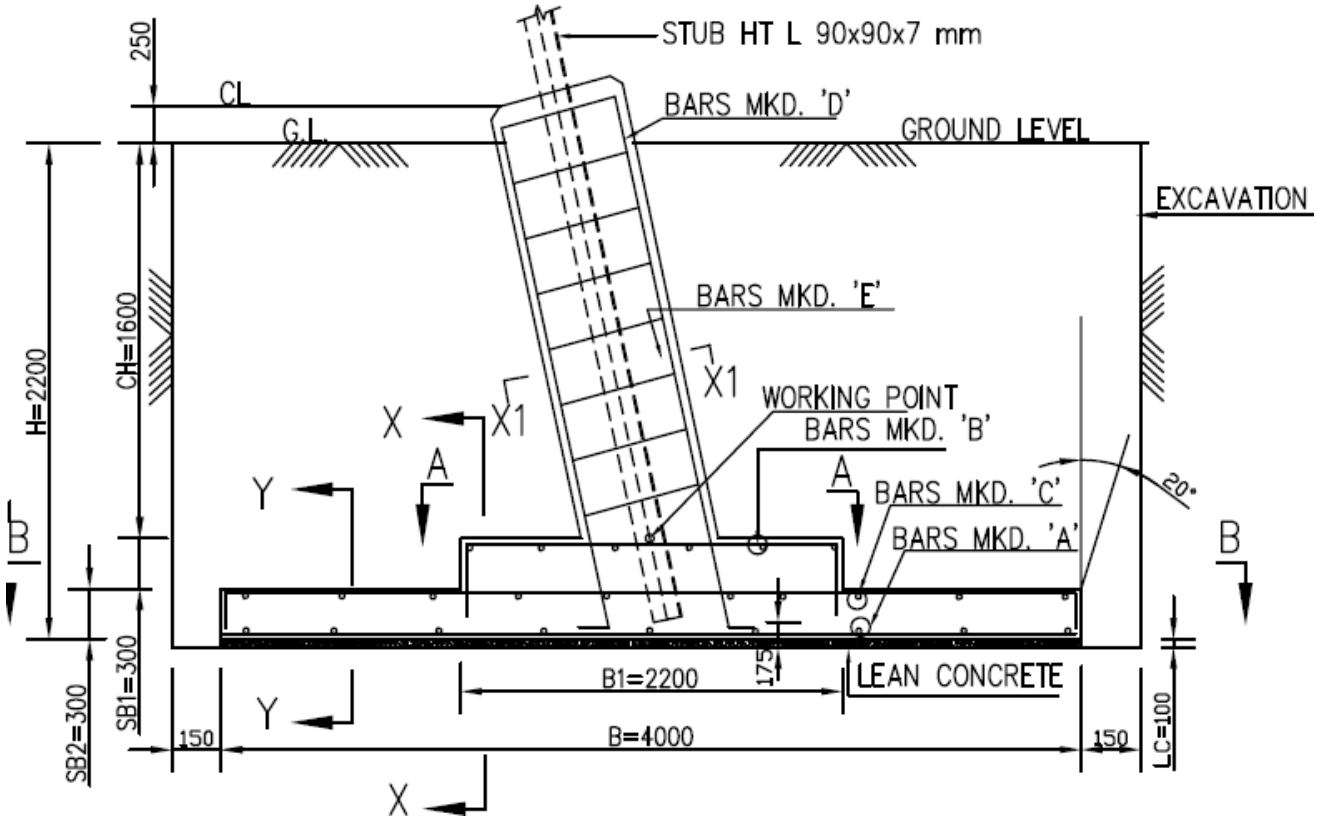
Type of Soil	Poor Soil
Soil Unit Weight	1,400 kg/m^3
Safe Bearing Capacity	100 kN/m^2
Angle of Repose	20 ^{o}



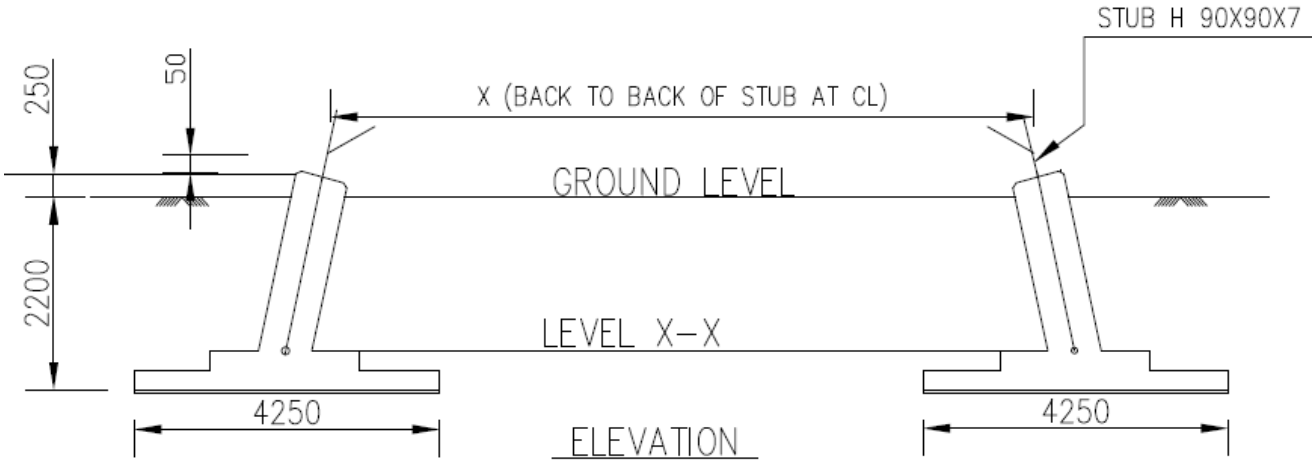


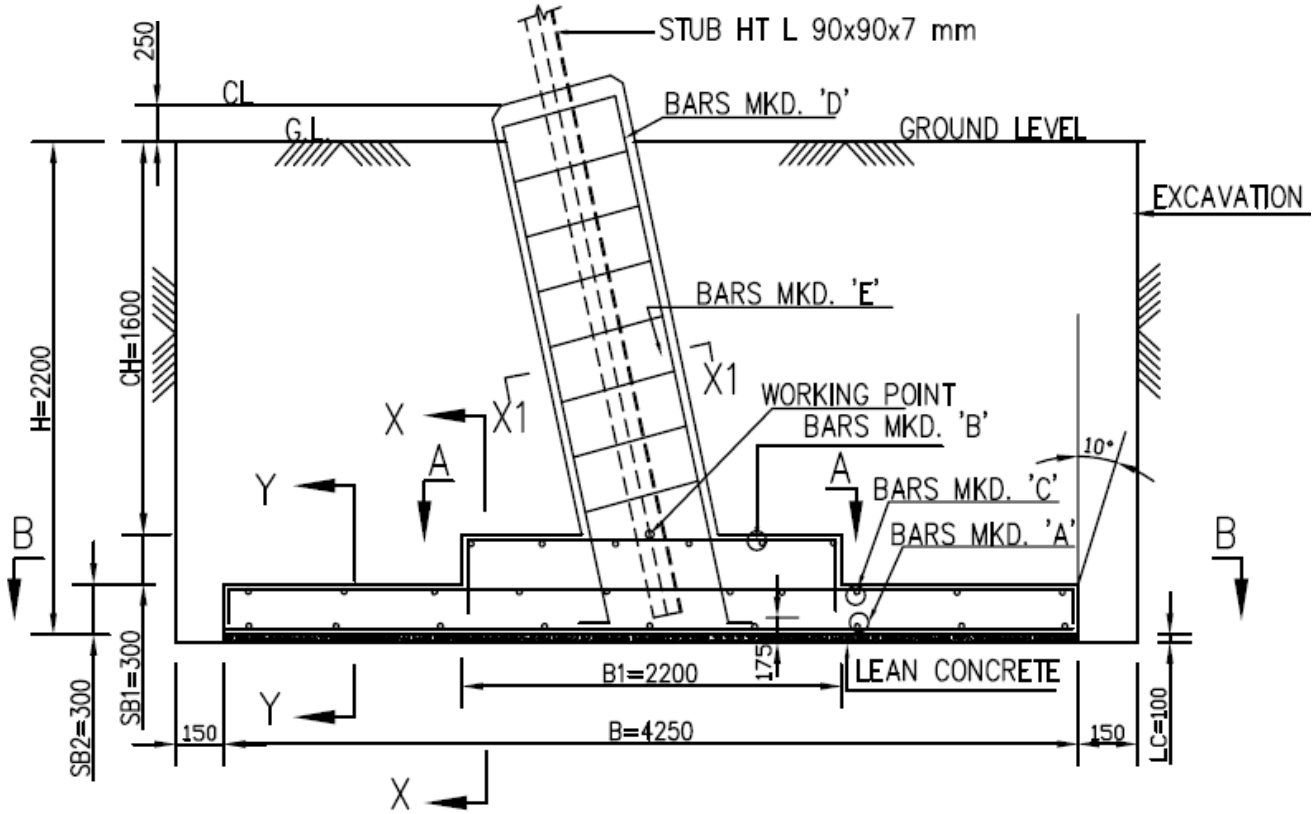
Type of Soil	Submerged Good Soil
Soil Unit Weight	800 kg/m^3
Safe Bearing Capacity	200 kN/m^2
Angle of Repose	20 ^{o}





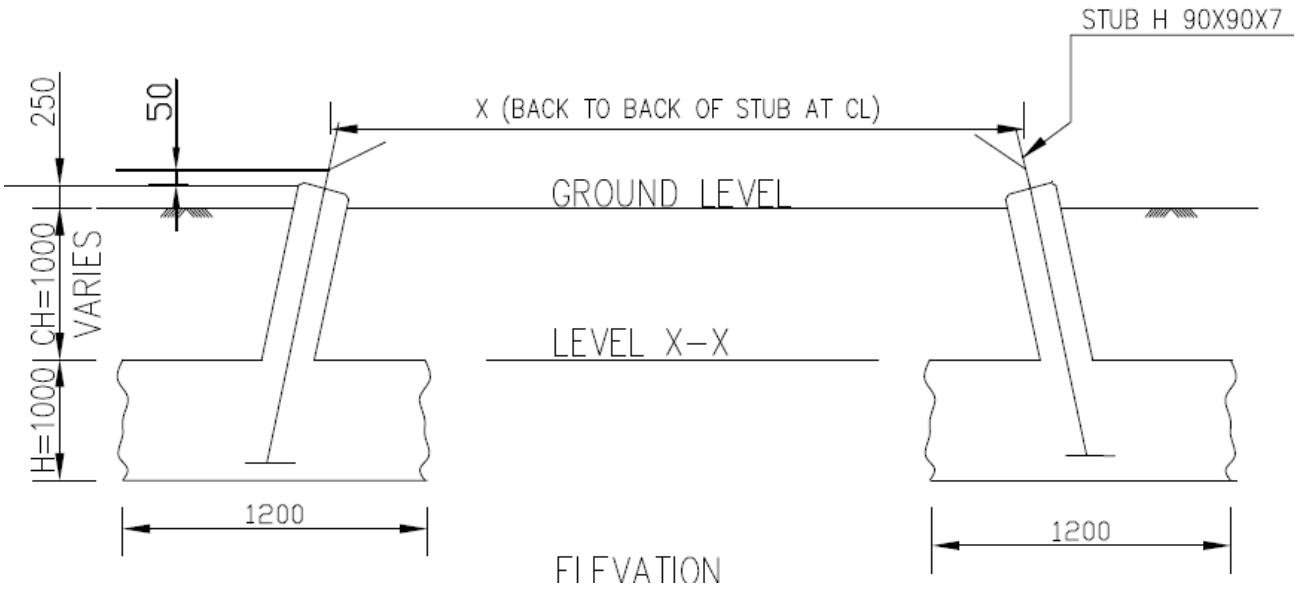
Type of Soil	Submerged Poor Soil
Soil Unit Weight	800 kg/m^3
Safe Bearing Capacity	100 kN/m^2
Angle of Repose	10 ^{o}

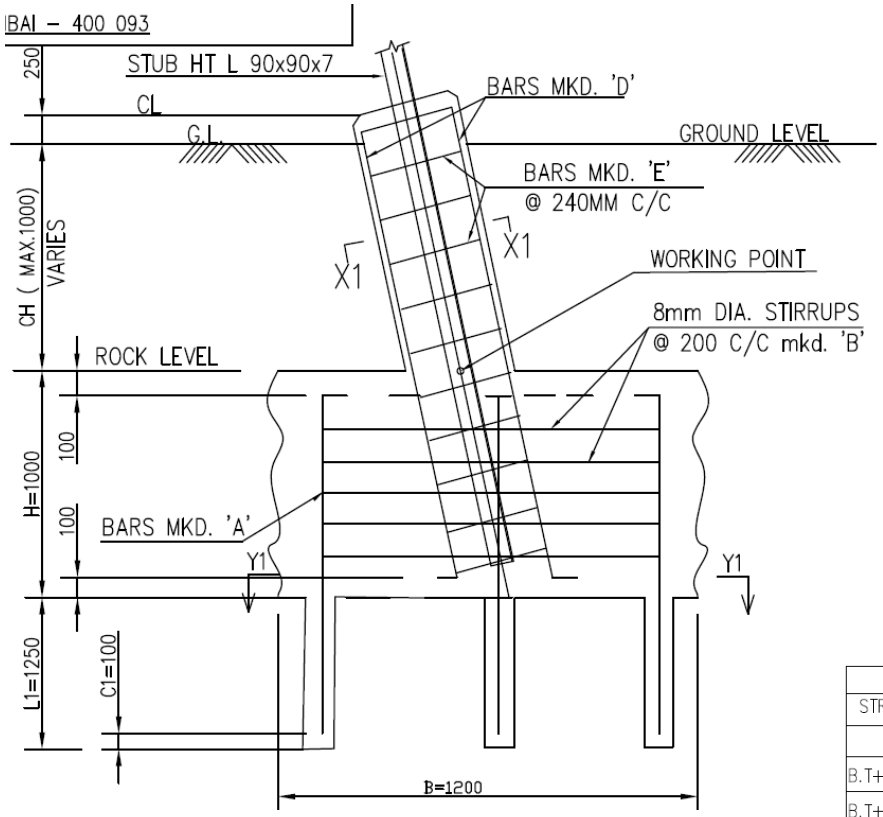


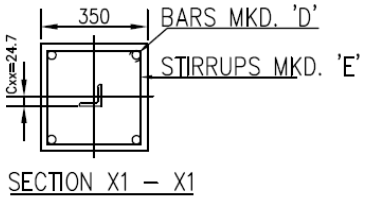


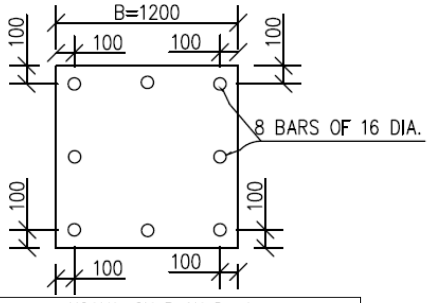
132kV 1cct Overhead Transmission Line
Existing Foundation Design M type (B type) Tension Tower

Type of Soil	Rock Foundation



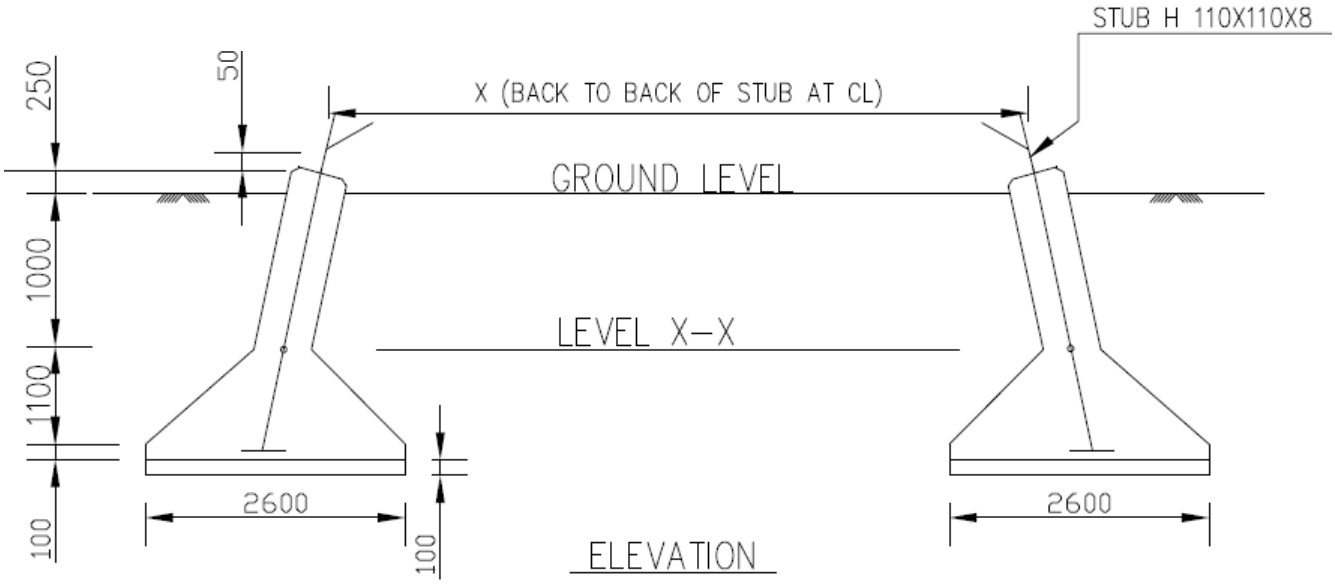


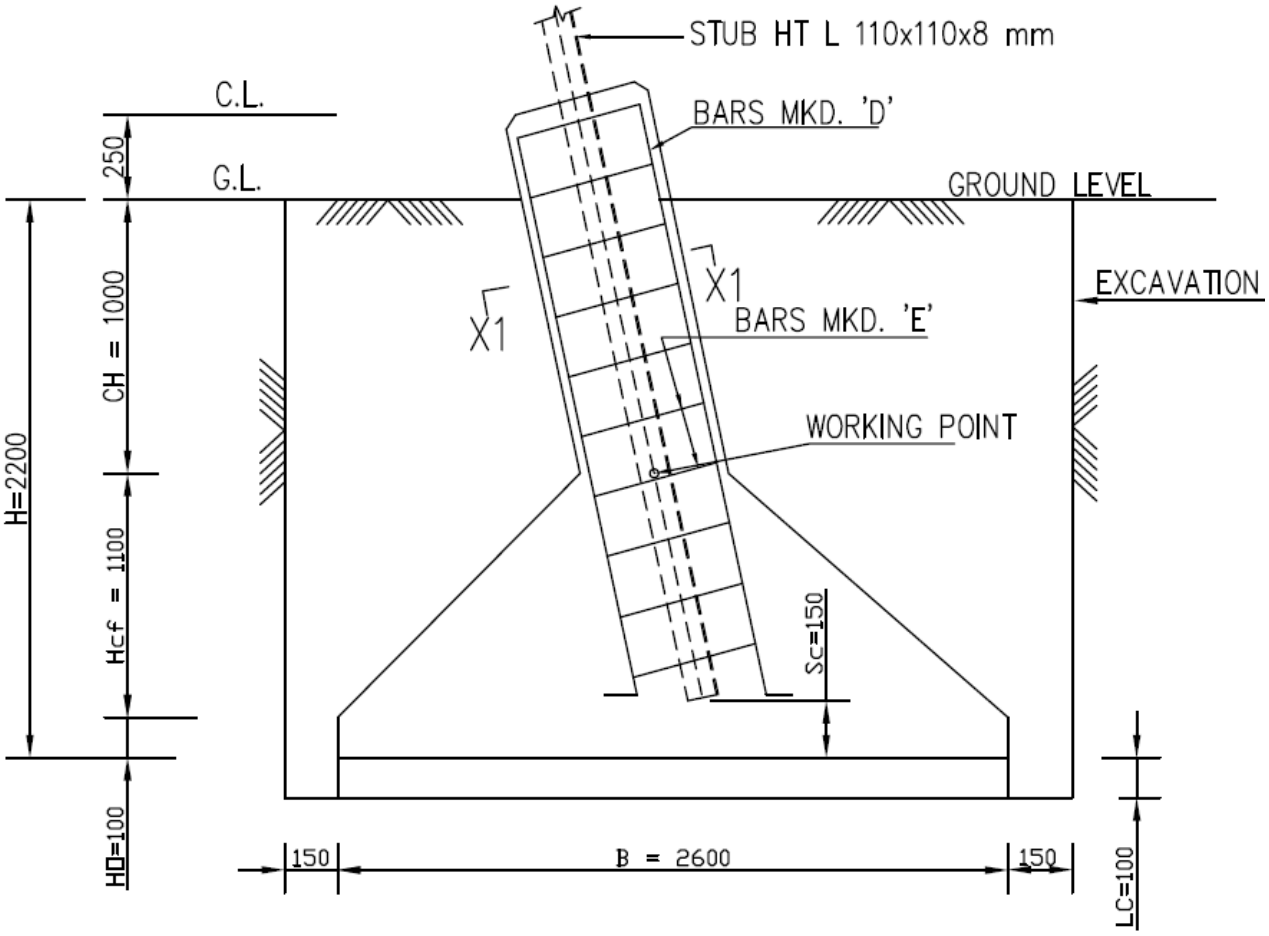




EXCAVATION PLAN DETAIL				
STRUCTURES	X	J	K	C.G OF STUB
	B.T + 1.0M/2.0M/3.0M/4.0M L.E			
B.T+1.0M L.E	4906	5248	7422	24.7
B.T+2.0M L.E	5112	5455	7714	24.7
B.T+3.0M L.E	5319	5661	8006	24.7
B.T+4.0M L.E	5525	5867	8297	24.7

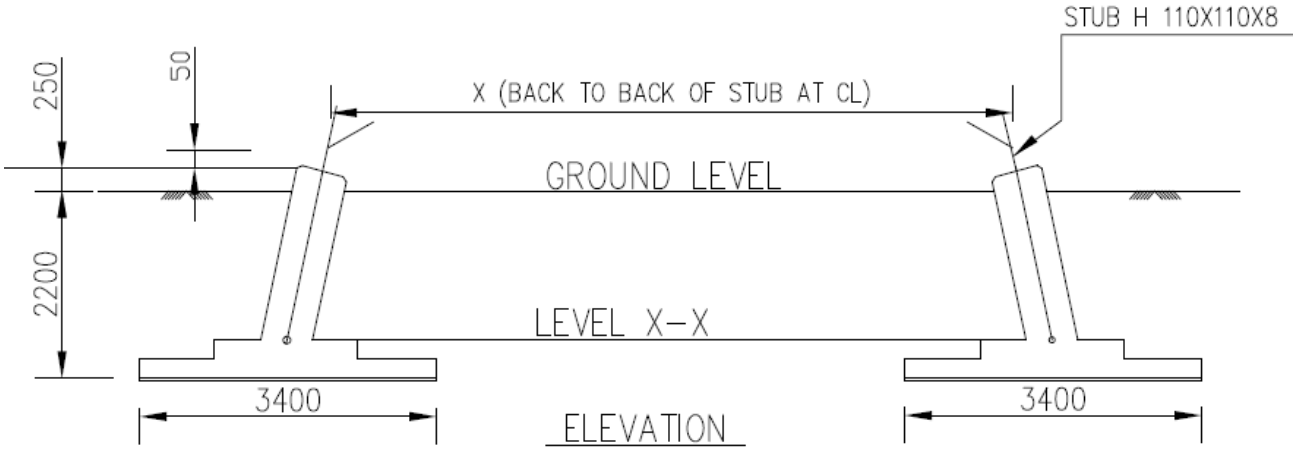
Type of Soil	Good Soil
Soil Unit Weight	1,600 kg/m^3
Safe Bearing Capacity	200 kN/m^2
Angle of Repose	30 ^{o}

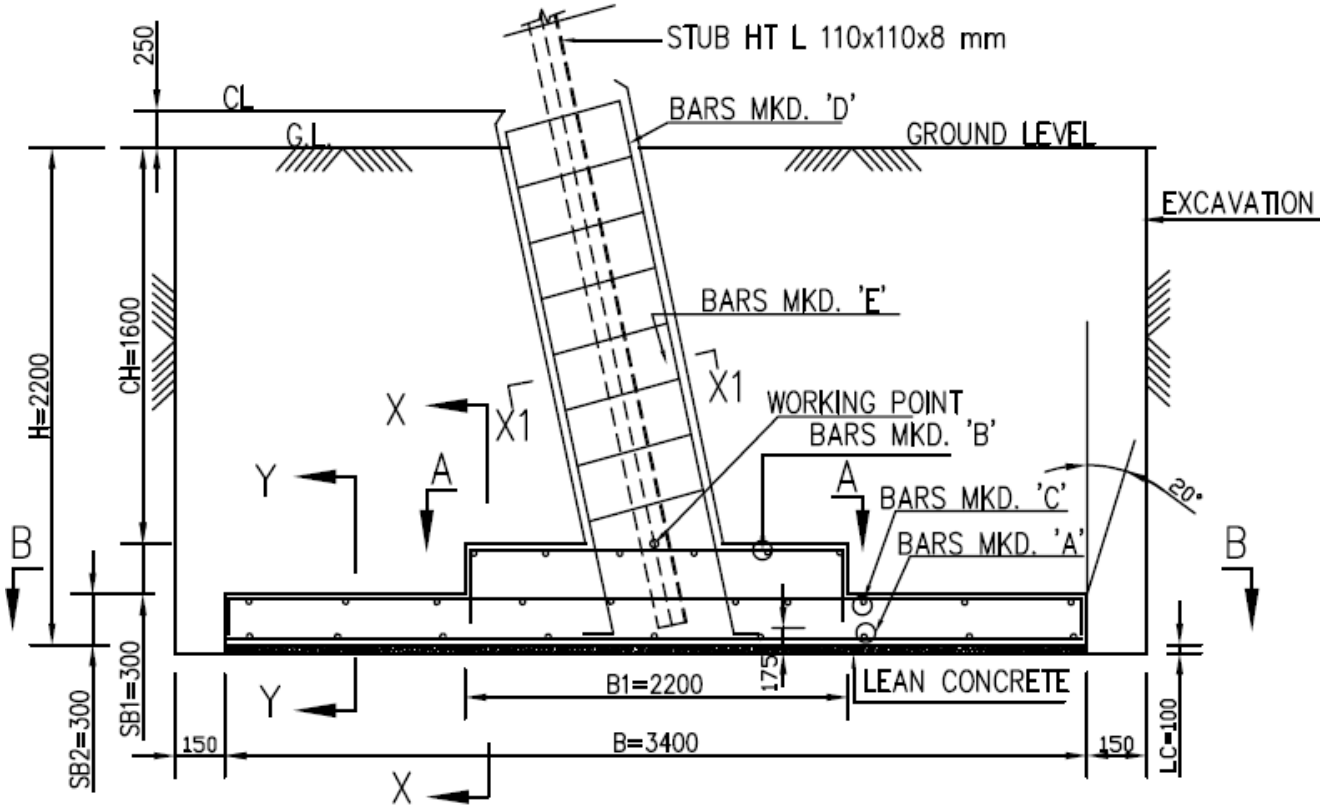




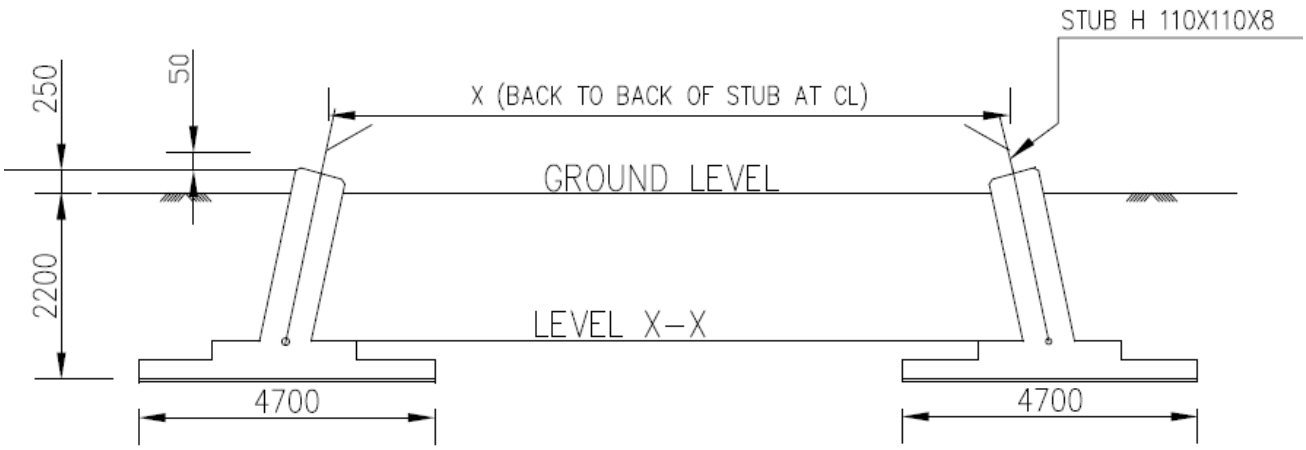
132kV 1cct Overhead Transmission Line
Existing Foundation Design N type (C type) Tension Tower

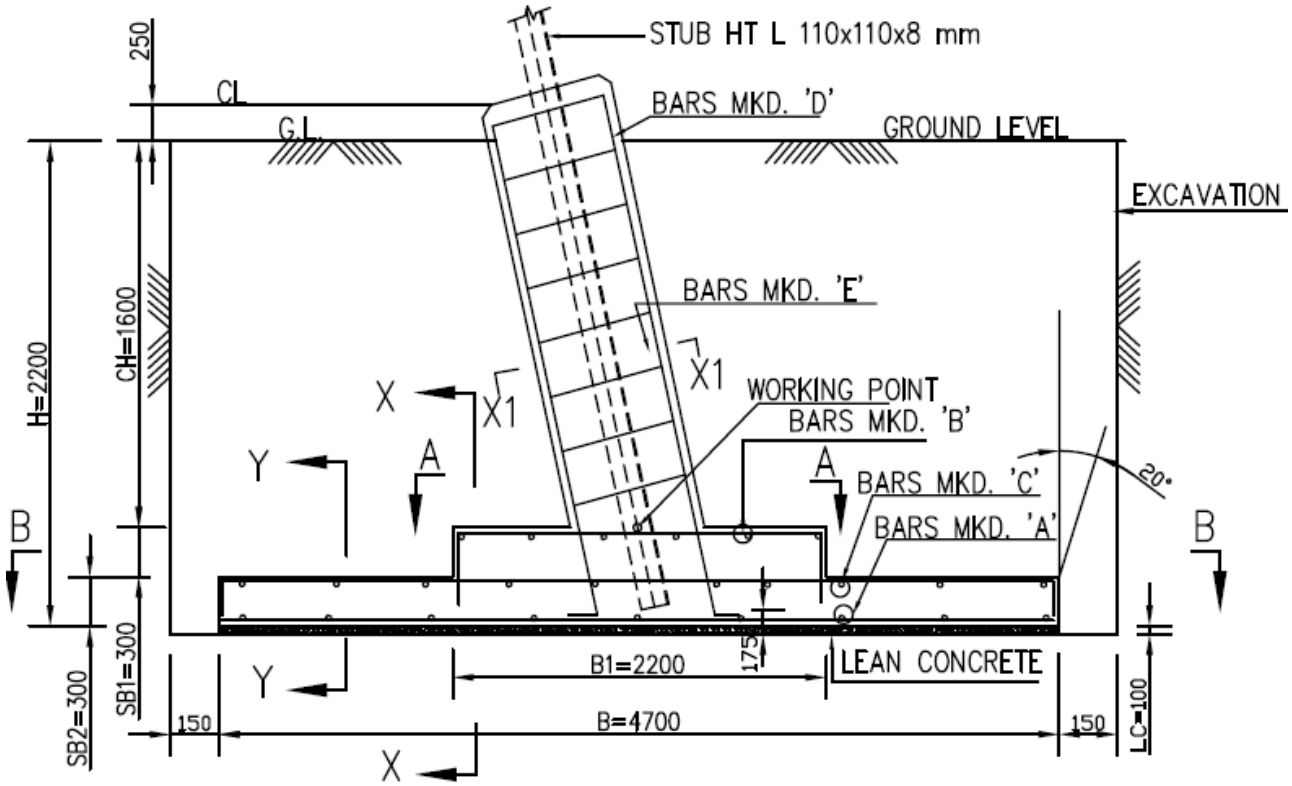
Type of Soil	Poor Soil
Soil Unit Weight	1,400 kg/m^3
Safe Bearing Capacity	100 kN/m^2
Angle of Repose	20 ^{o}



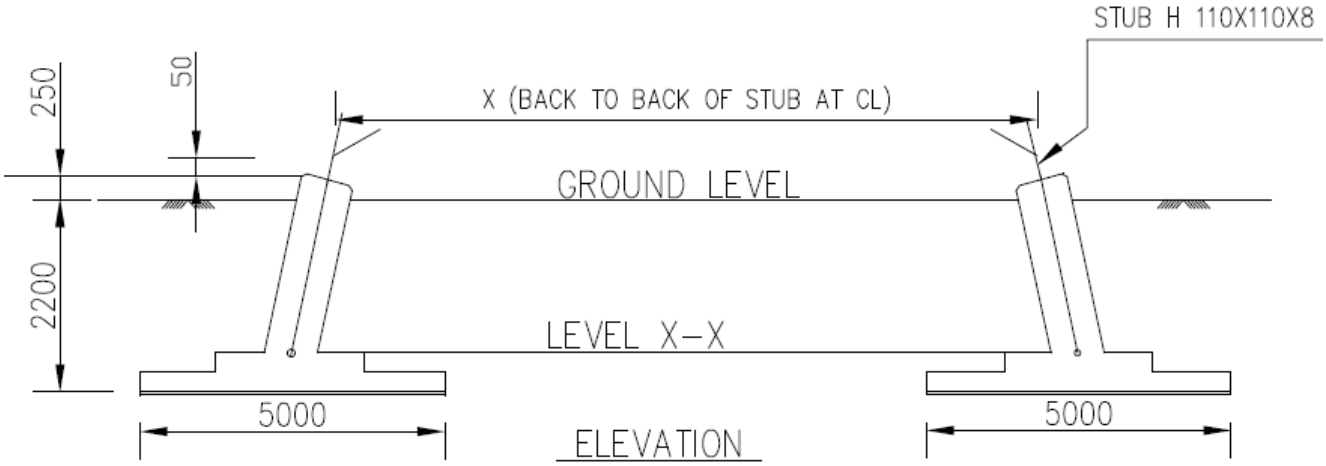


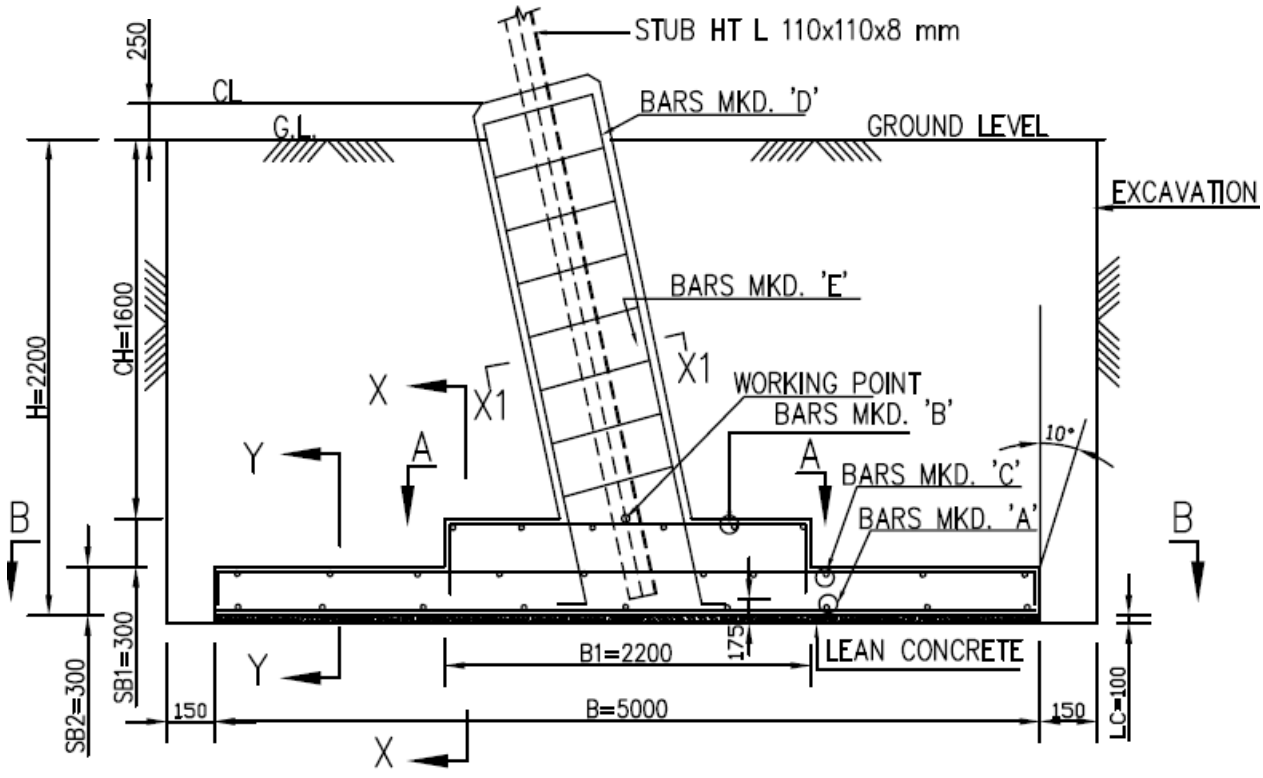
Type of Soil	Submerged Good Soil
Soil Unit Weight	800 kg/m^3
Safe Bearing Capacity	200 kN/m^2
Angle of Repose	20 ^{o}



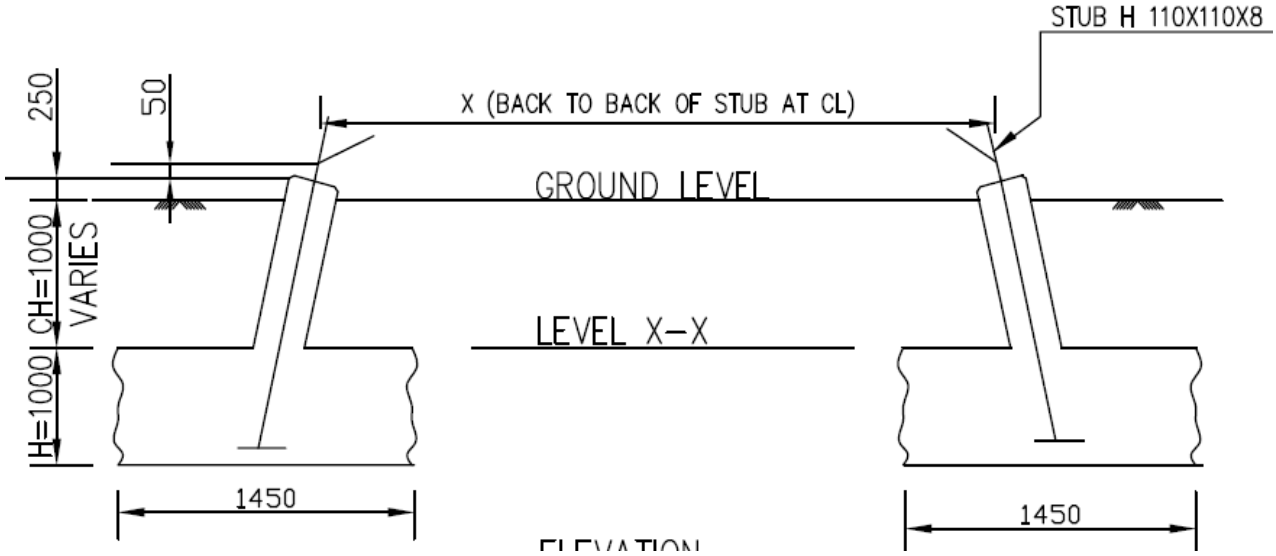


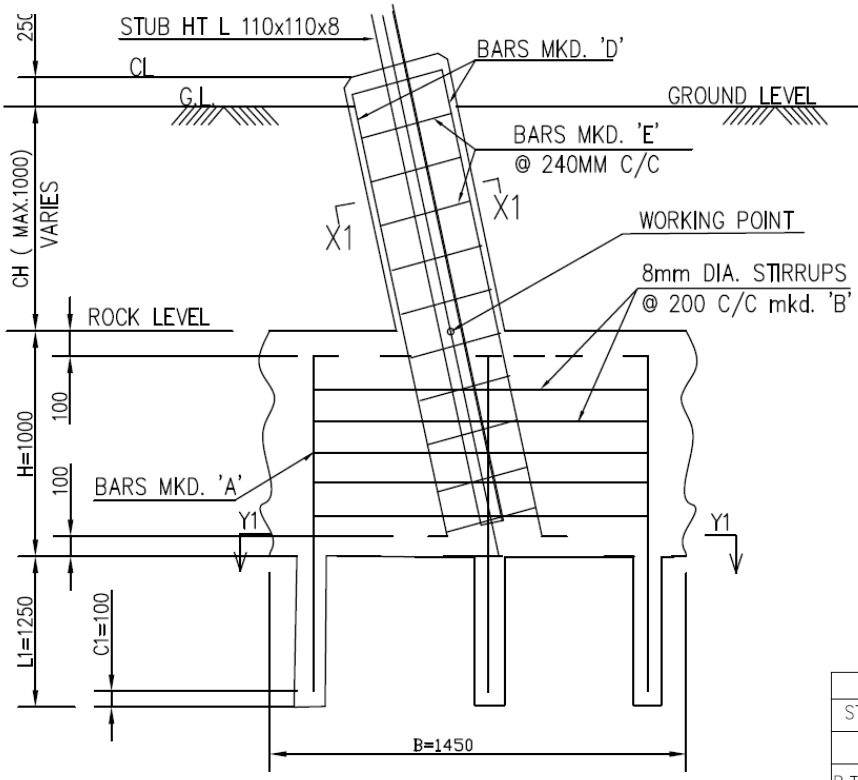
Type of Soil	Submerged Poor Soil
Soil Unit Weight	800 kg/m^3
Safe Bearing Capacity	100 kN/m^2
Angle of Repose	10 ^{o}

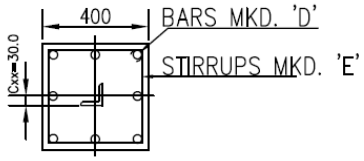


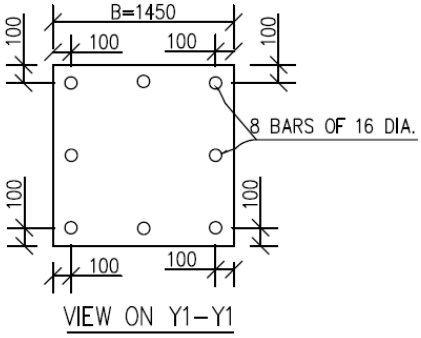


Type of Soil	Rock Foundation









EXCAVATION PLAN DETAIL				
STRUCTURES	X	J	K	C.G OF STUB
	B.T + 1.0M/2.0M/3.0M/4.0M L.E			
B.T+1.0M L.E	6679	7006	9909	30.0
B.T+2.0M L.E	6978	7305	10331	30.0
B.T+3.0M L.E	7276	7604	10754	30.0
B.T+4.0M L.E	7575	7903	11176	30.0

132kV Overhead Transmission Line
Recommended Design Parameter for Tower

Lattice Tower Type in 132kV 2cct Transmission Line

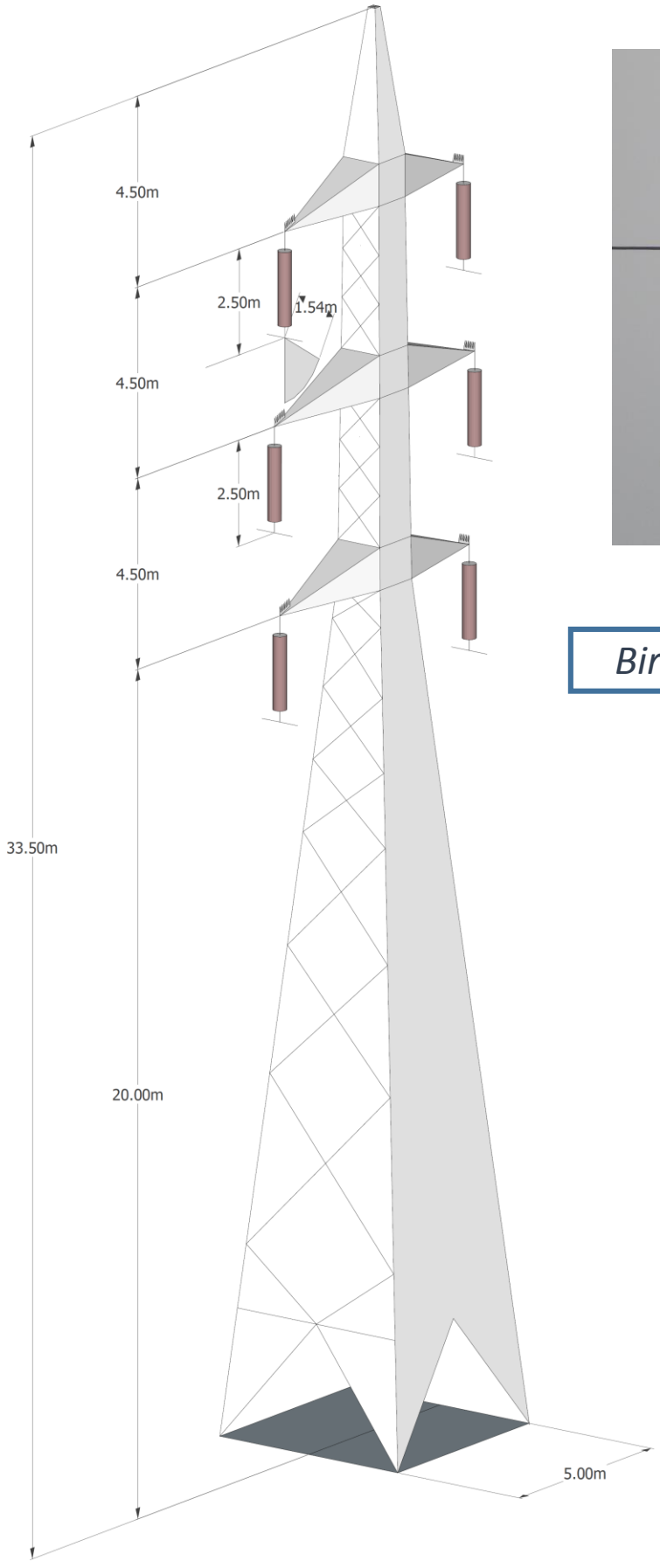
Tower Type	LD	MD	ND	ND
	AA	BB	CC	DD
Deviation Angle	0º-2º	0º-30º	0º-60º	60º-90º
Insulator Strings	Suspension	Tension	Tension	Dead End
Basic Span	350 m	350 m	350 m	350 m
Wind Span	450 m	450 m	450 m	450 m
Weight Span	700 m	700 m	1500 m	700 m
Uplift	- 175m	- 400 m	- 400 m	- 350 m

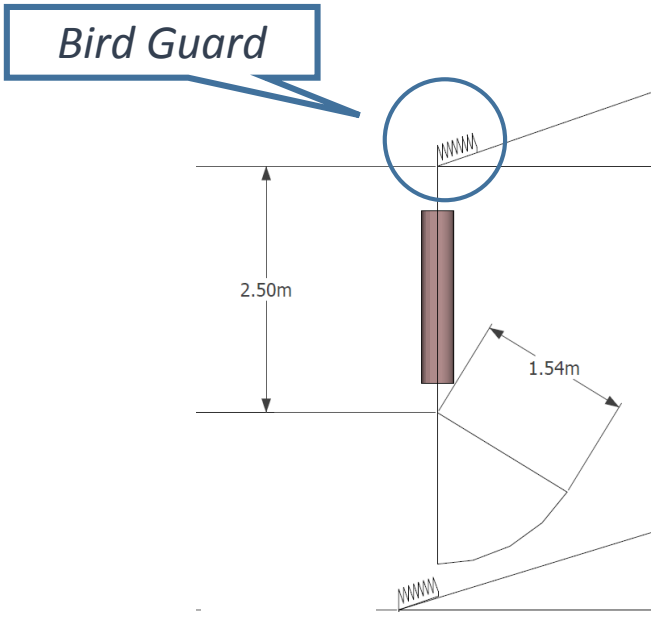
Tubular Monopole Tower Type in 132kV Transmission Line

Tower Type	Tubular 2cct (TAD)		Tubular 1cct (TDS)	
	AA-Mono		D-Mono	
Deviation Angle	0º-2º		0º-5º	
Insulator Strings	Suspension		Tension	
Basic Span	160 m		250 m	
Wind Span	180 m		250 m	
Weight Span	250 m		350 m	
Uplift	N/A		N/A	

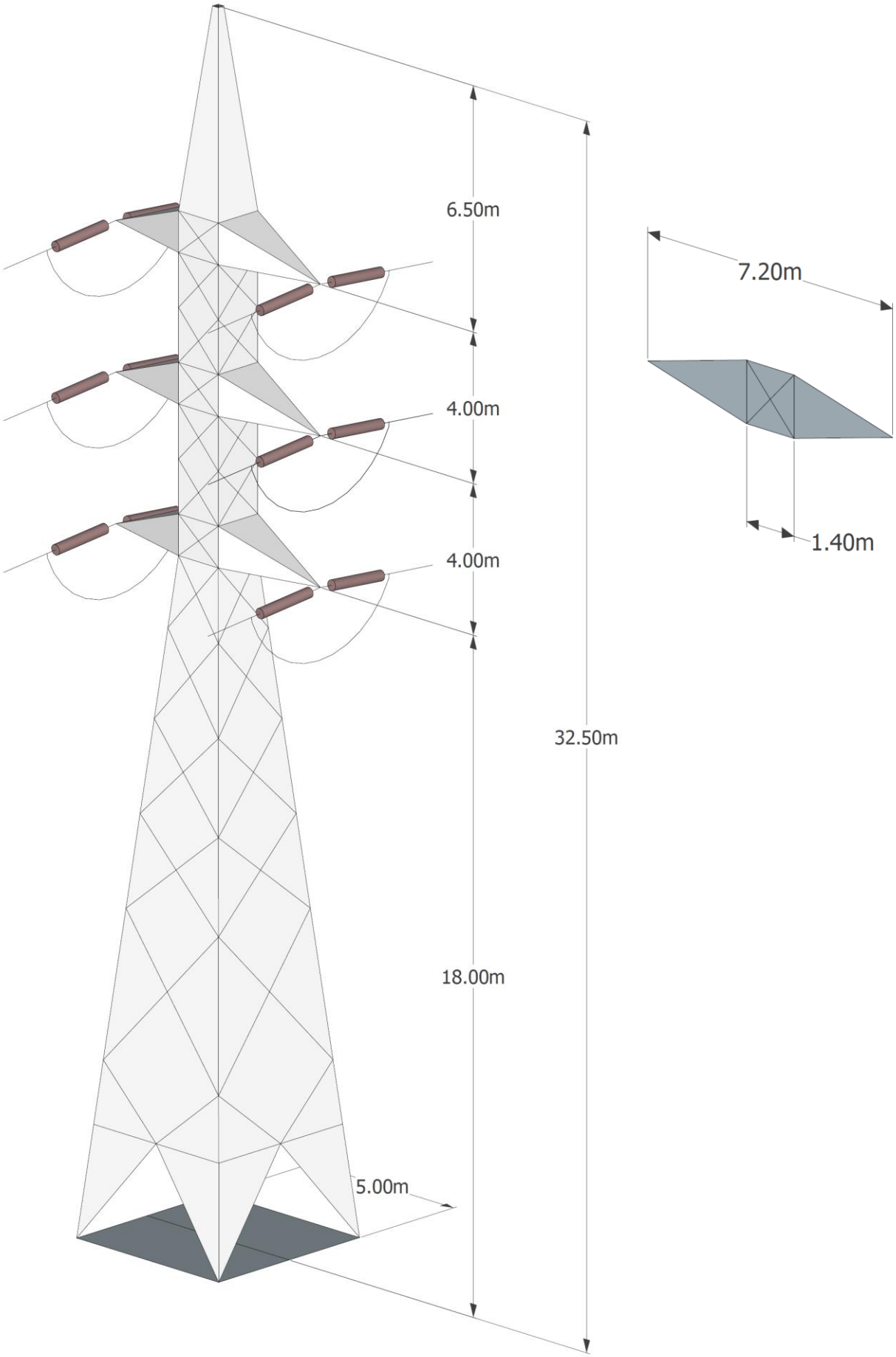
Monopole (Tubular) Tower
Monopoles shall be a constant taper and either circular or polygonal. Polygonal section shall have a minimum of 12 faces.

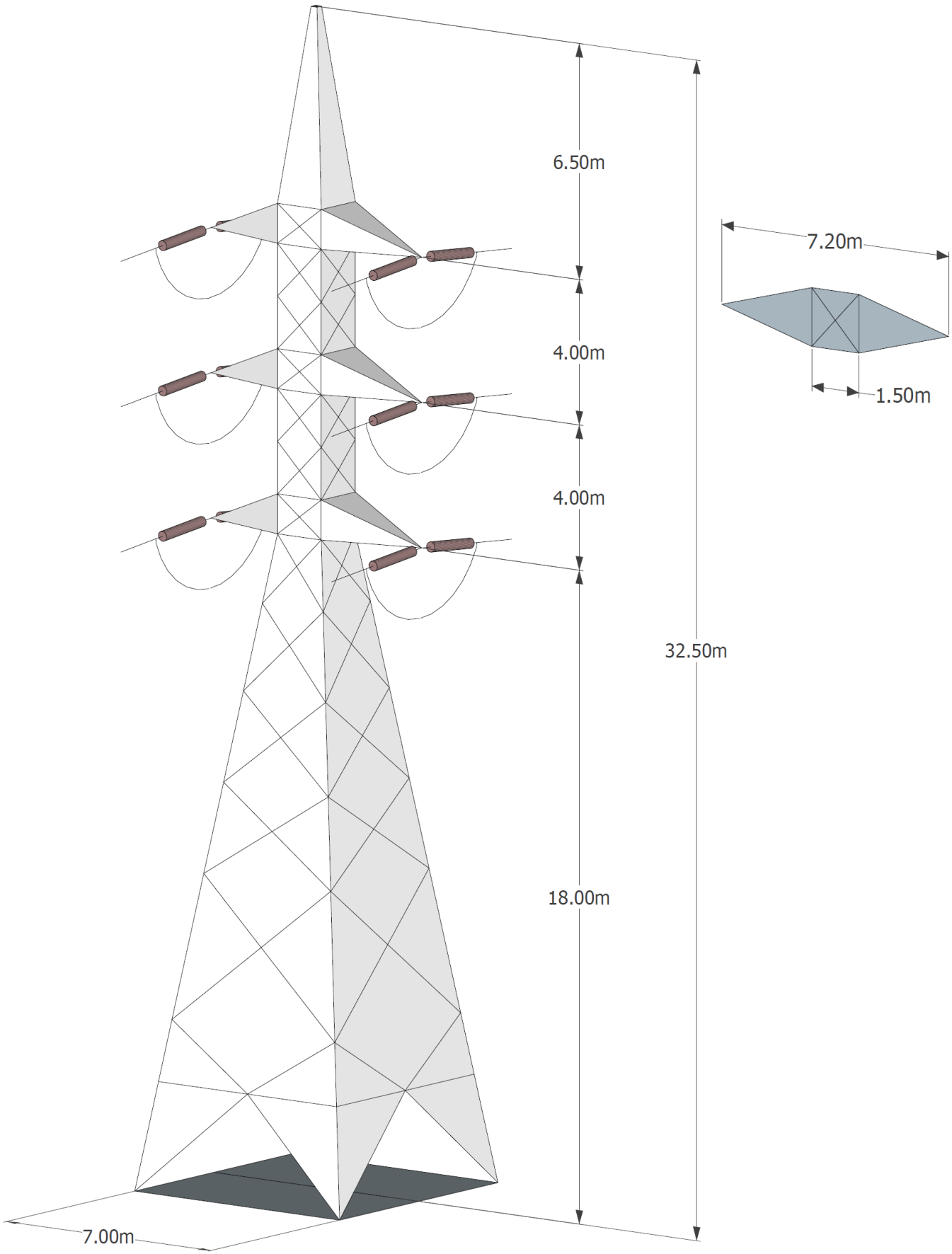
132kV Overhead Transmission Line
Sketch up for Tower Configuration – AD Type (Suspension Double Circuit)



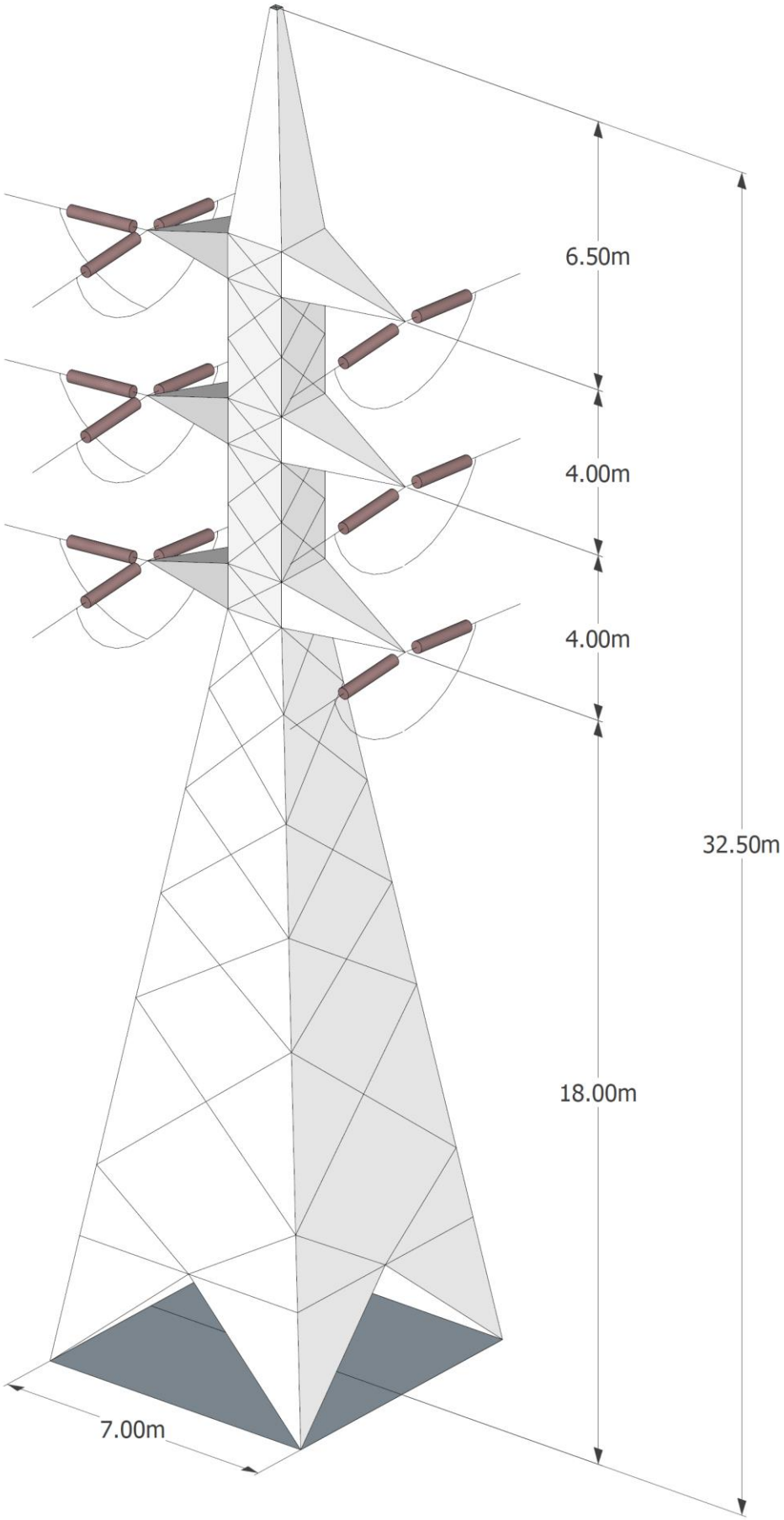


132kV Overhead Transmission Line
Sketch up for Tower Configuration – BD Type (Tension Double Circuit)





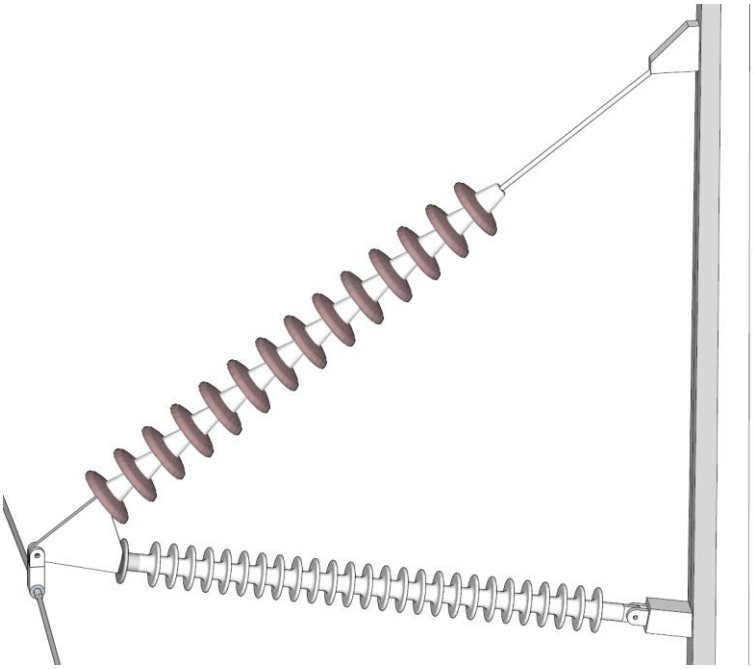
T-53 CD as Section Tower
Side T52 will be full tension and Side T-54 will be slack span

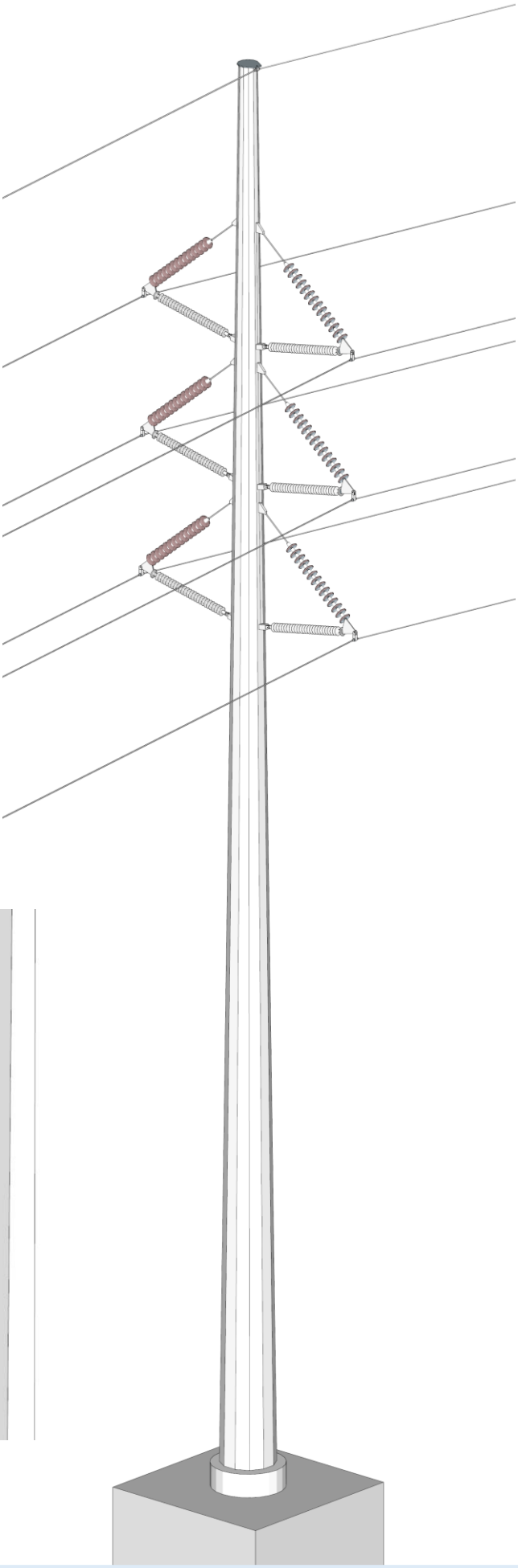


T-22 DD as Branch Tower to Gofa Substation

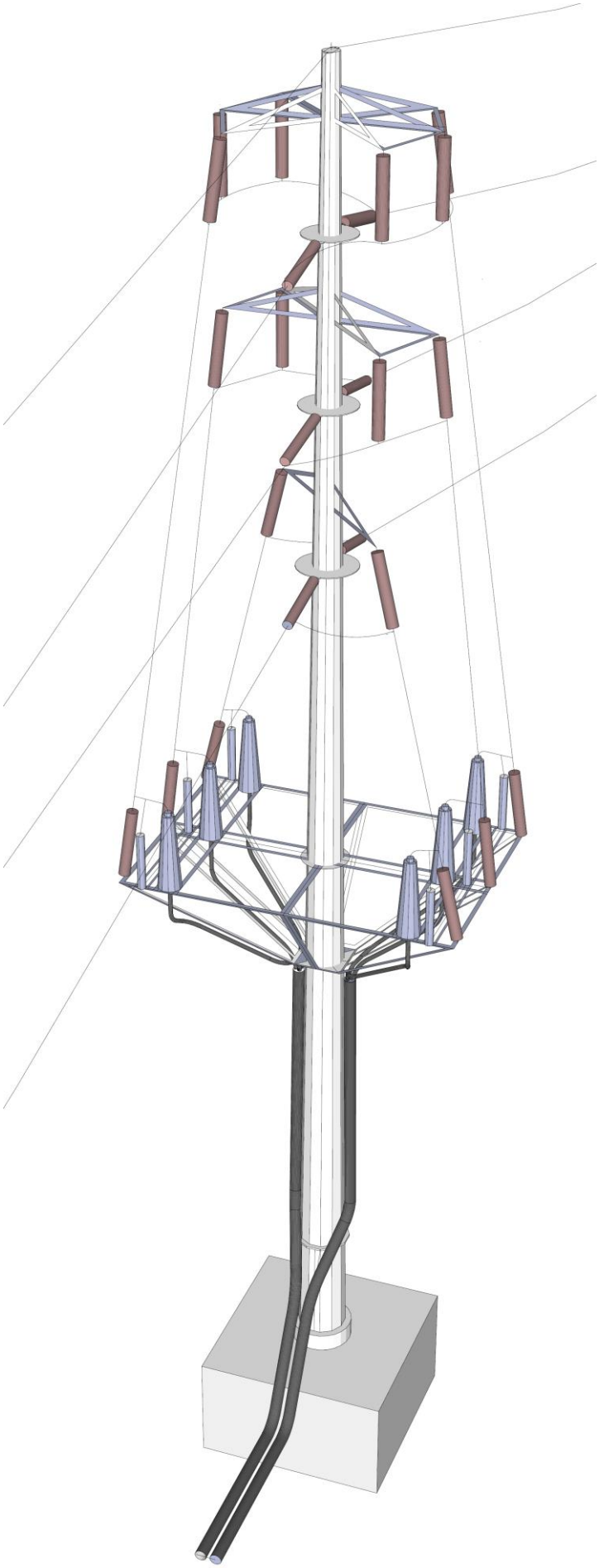
T-21 Under ground termination tower at EEP/EEU Warehouse Store.

T25 – T 33 : New road will be constructed.
132kV monopole tubular tower will be set on median strip of new road.



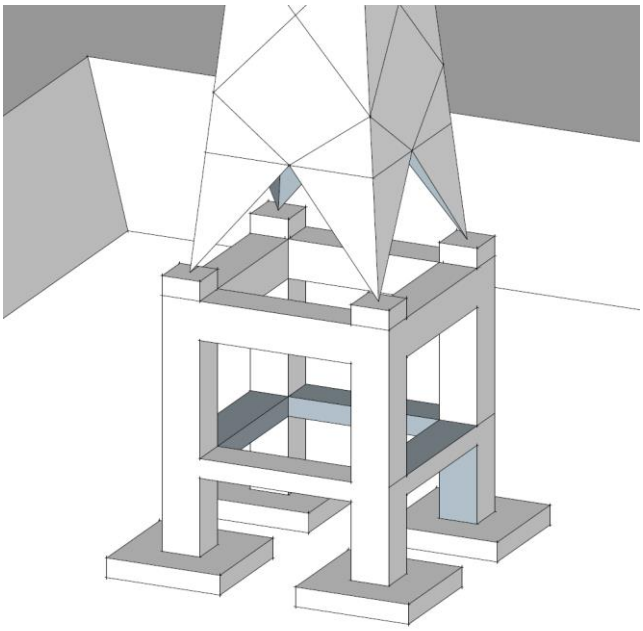


Blaced Post Insulators to keep ROW as 6 meters

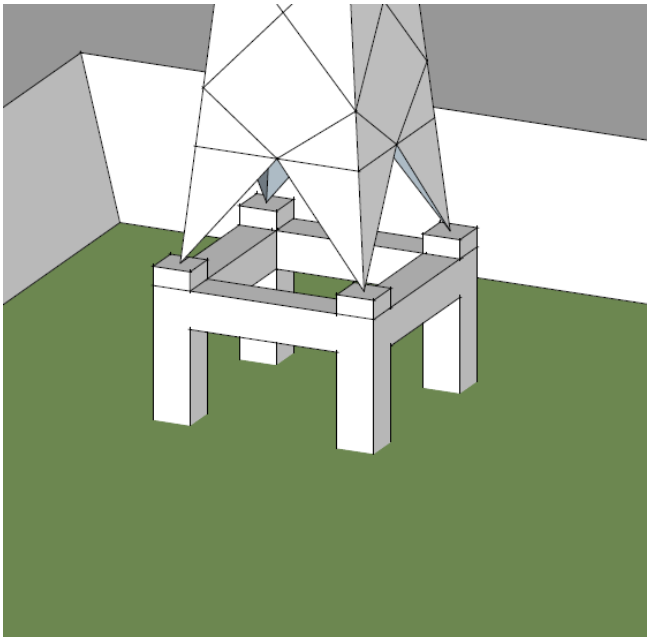


Cable Termination at T67 (Kaliti – Cotobie)
Span will cross at LRT station “Management Institute”

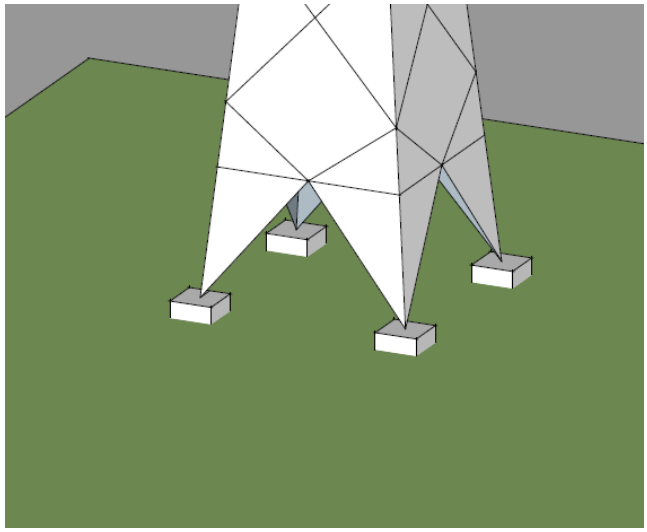
Current Condition at T36



After Construction

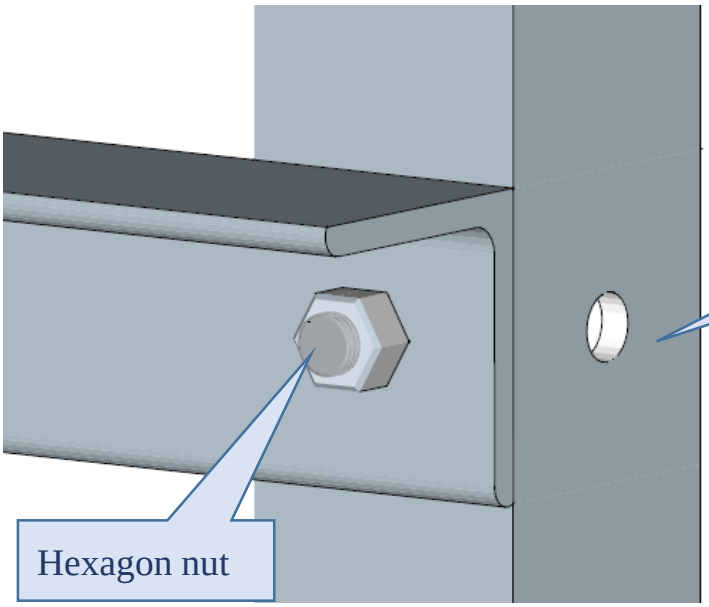


After Embankment works



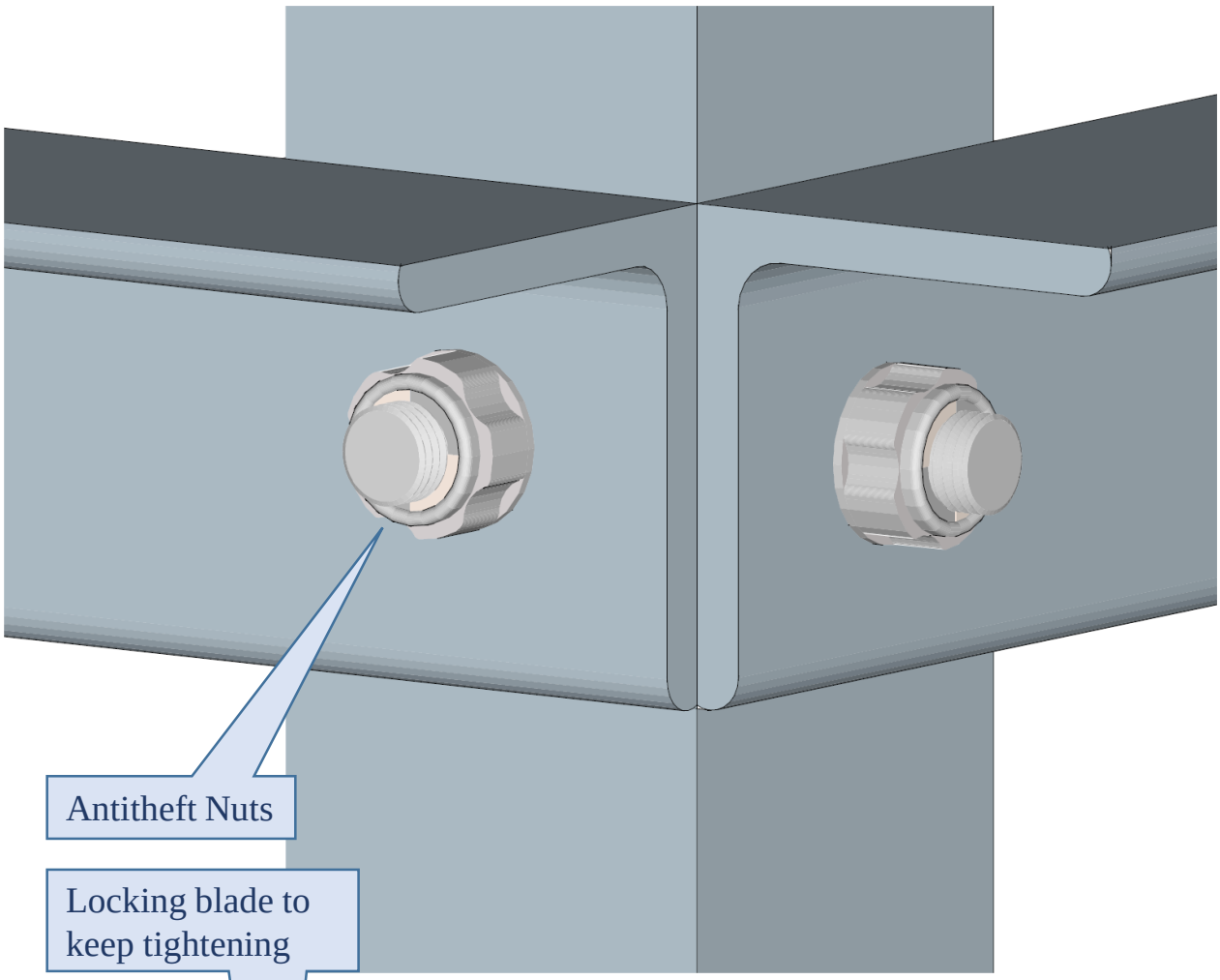
Over 50 bolts & nuts were stolen from this tower

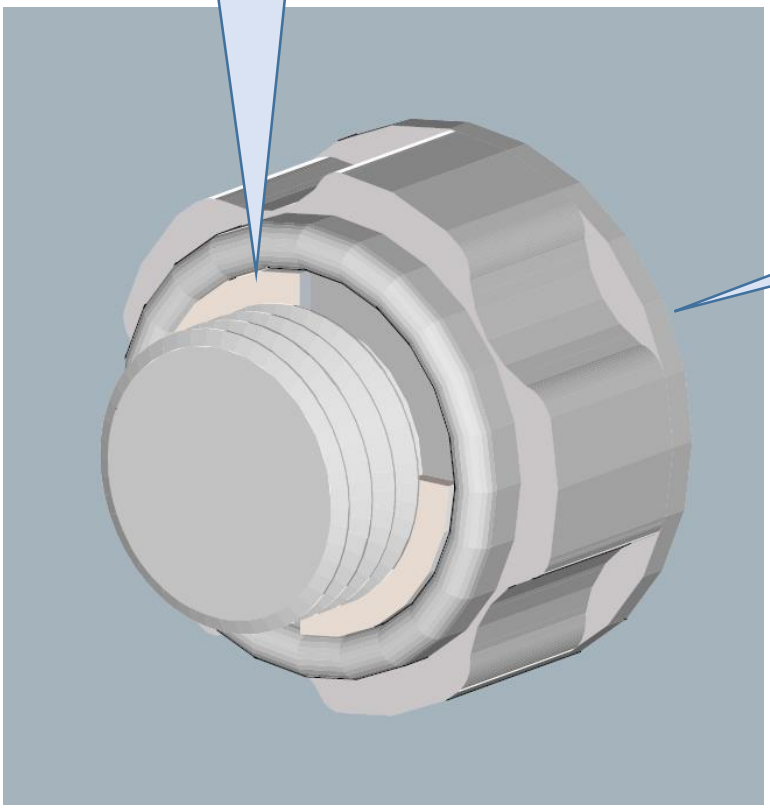
4 main brace steels with bolts & nuts were stolen.



Hexagon nut

Hexagon Nuts were welded, but were forced to remove from tower by ordinary spanner.


Antitheft Nuts
Locking blade to keep tightening


Only special tool can be applied for tightening and removing, ordinary spanner can not remove this nut.

132kV Overhead Transmission Line
Recommended Design Parameter for Tower

Lattice Tower Type in 132kV 2cct Transmission Line

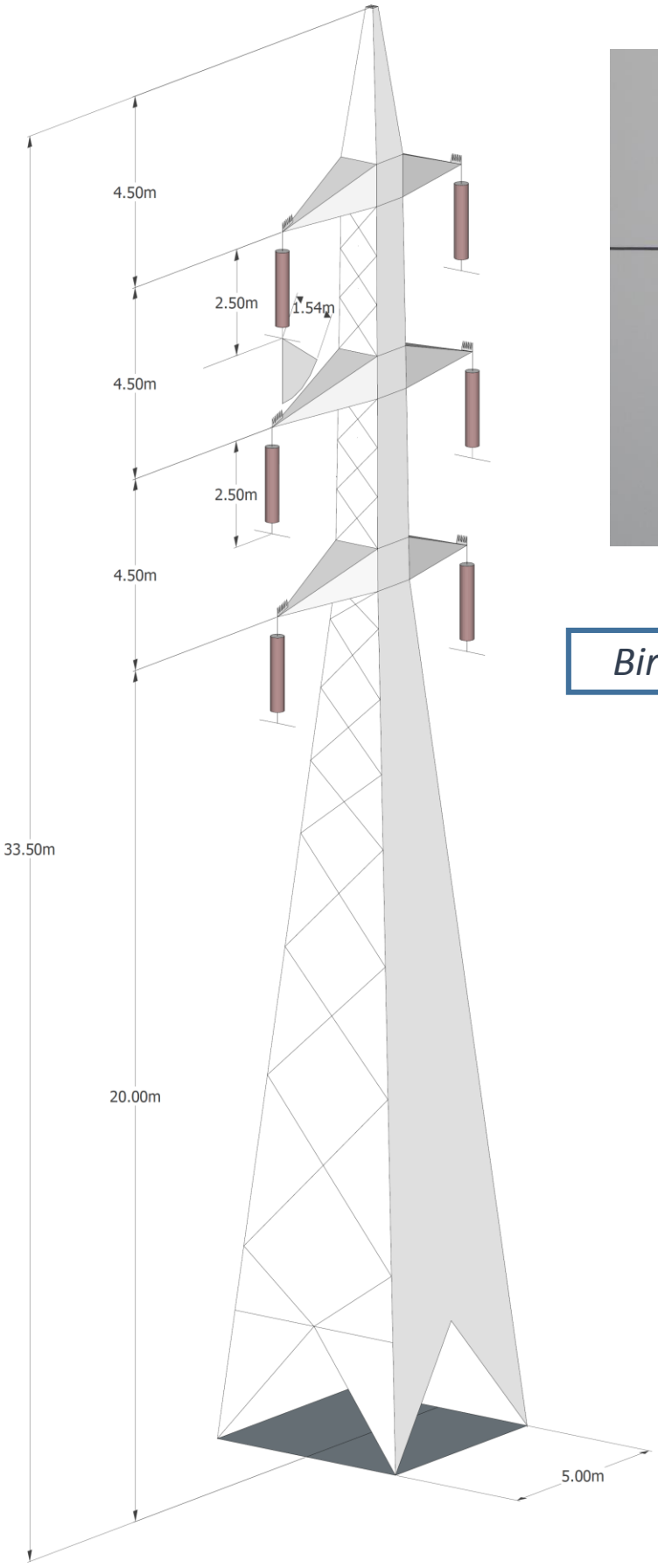
Tower Type	LD	MD	ND	ND
	AA	BB	CC	DD
Deviation Angle	0º-2º	0º-30º	0º-60º	60º-90º
Insulator Strings	Suspension	Tension	Tension	Dead End
Basic Span	350 m	350 m	350 m	350 m
Wind Span	450 m	450 m	450 m	450 m
Weight Span	700 m	700 m	1500 m	700 m
Uplift	- 175m	- 400 m	- 400 m	- 350 m

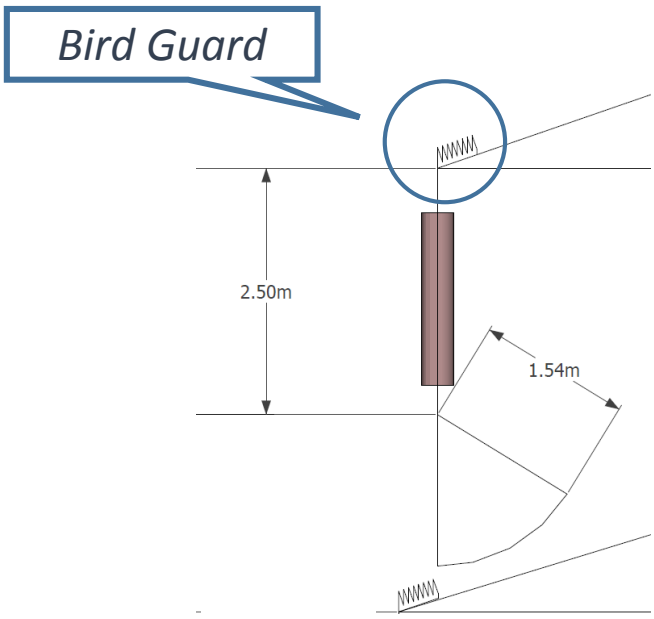
Tubular Monopole Tower Type in 132kV Transmission Line

Tower Type	Tubular 2cct (TAD)		Tubular 1cct (TDS)	
	AA-Mono		D-Mono	
Deviation Angle	0º-2º		0º-5º	
Insulator Strings	Suspension		Tension	
Basic Span	160 m		250 m	
Wind Span	180 m		250 m	
Weight Span	250 m		350 m	
Uplift	N/A		N/A	

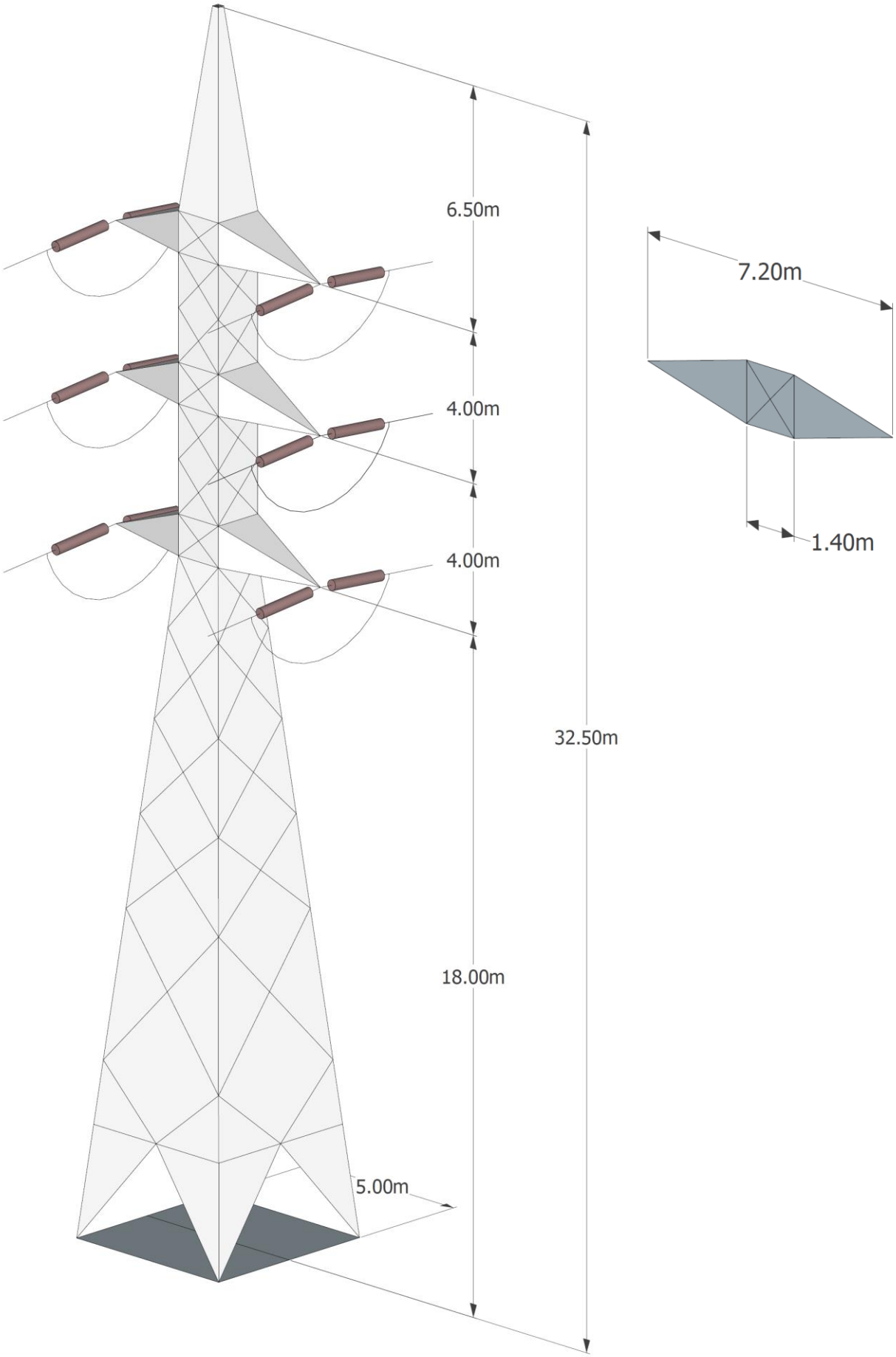
Monopole (Tubular) Tower
Monopoles shall be a constant taper and either circular or polygonal. Polygonal section shall have a minimum of 12 faces.

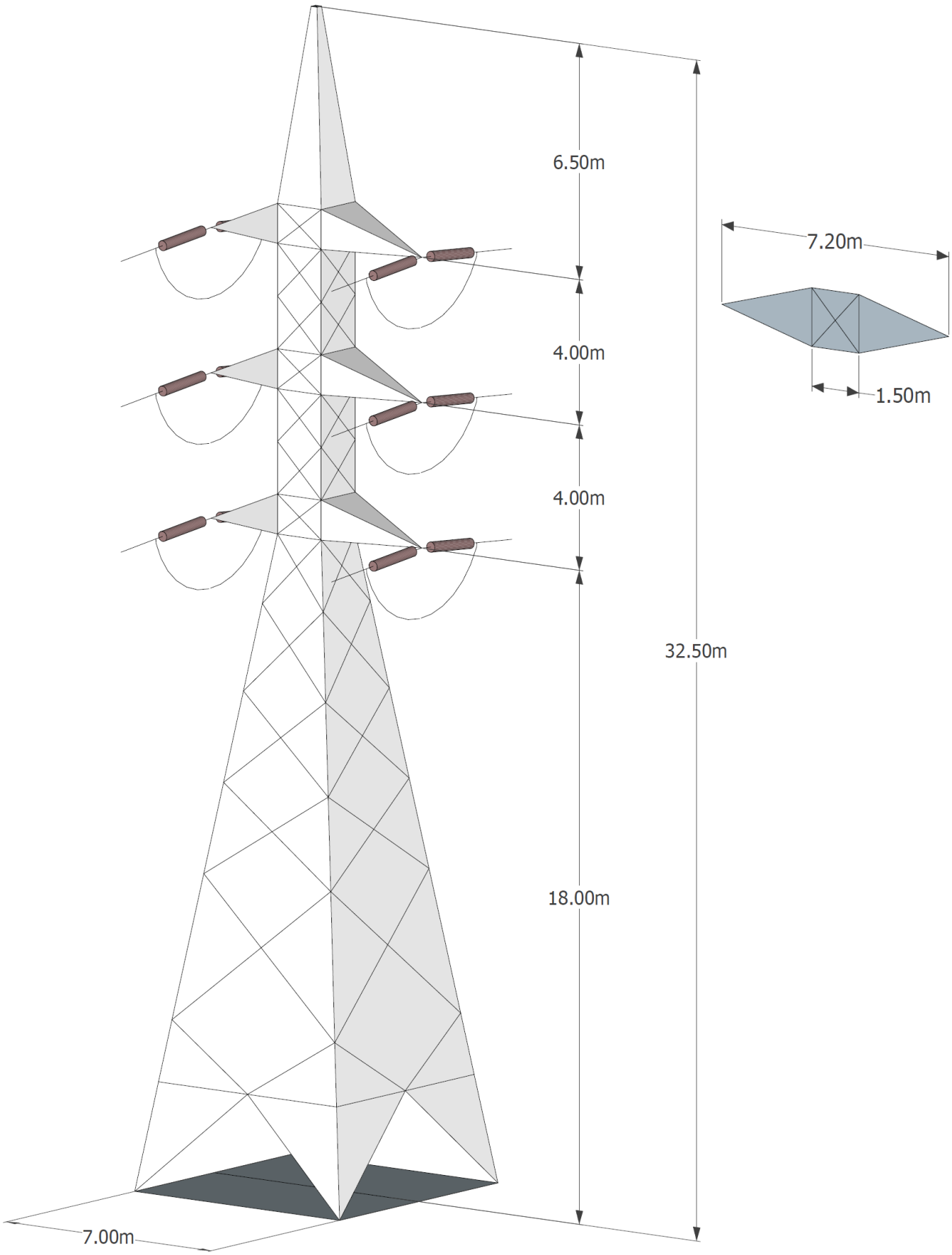
132kV Overhead Transmission Line
Sketch up for Tower Configuration – AD Type (Suspension Double Circuit)



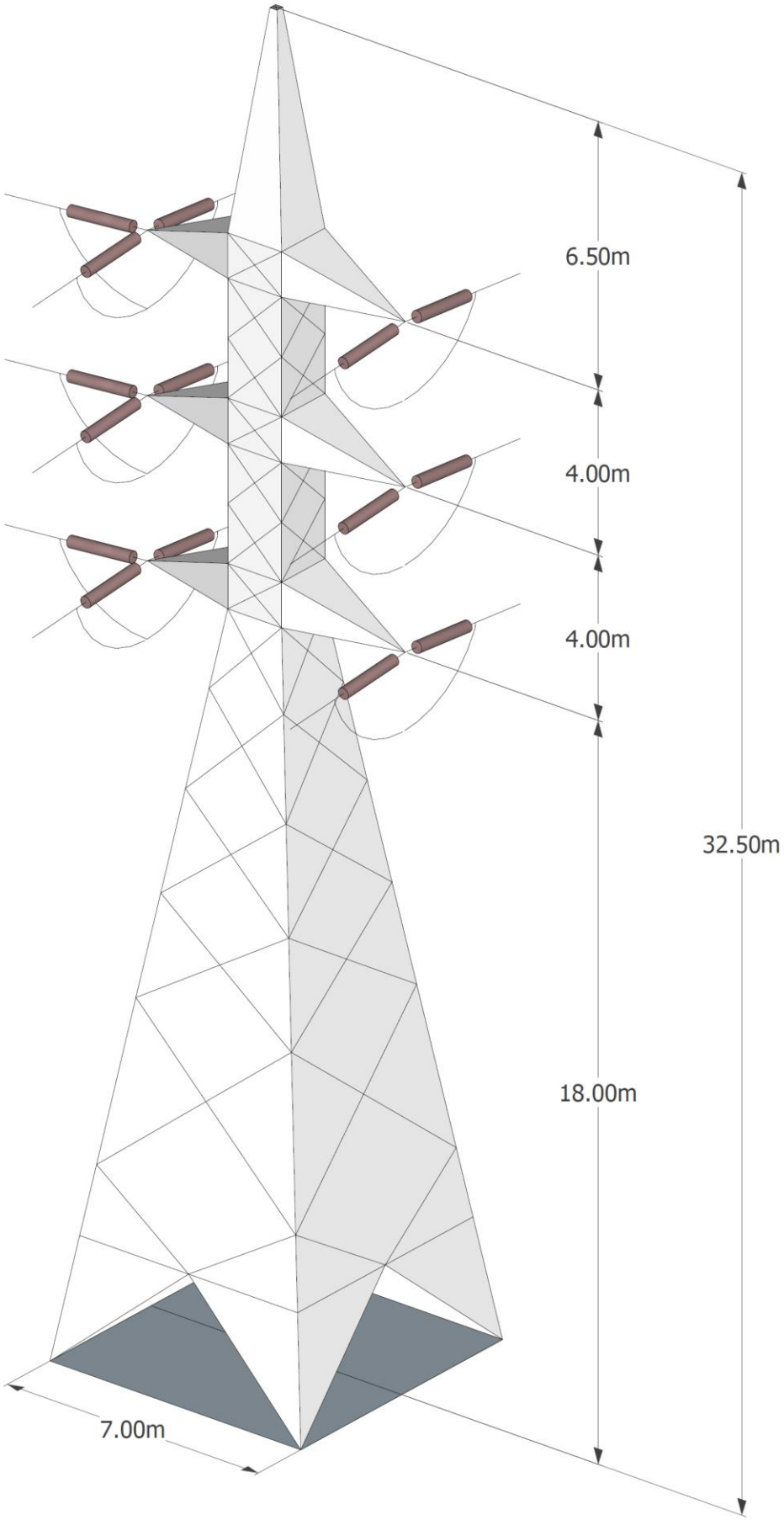


132kV Overhead Transmission Line
Sketch up for Tower Configuration – BD Type (Tension Double Circuit)





T-53 CD as Section Tower
Side T52 will be full tension and Side of T-54 will be slack span

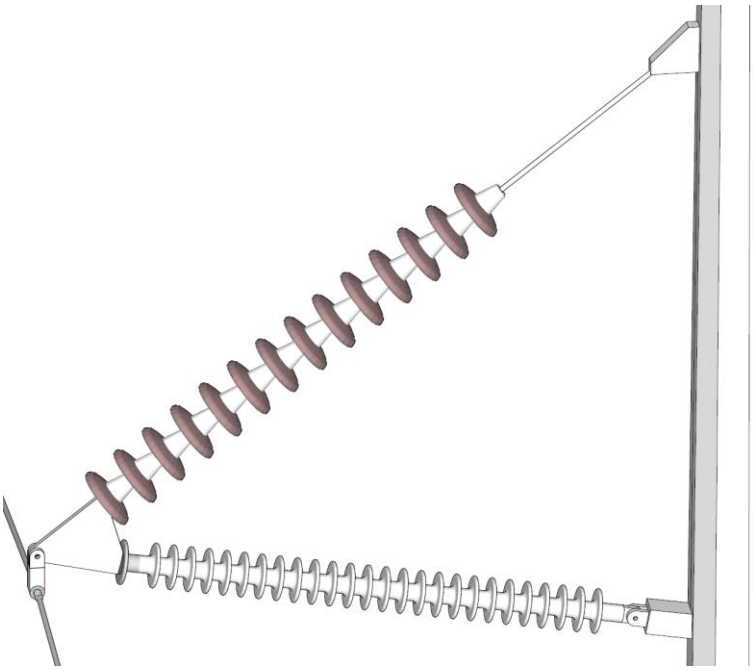


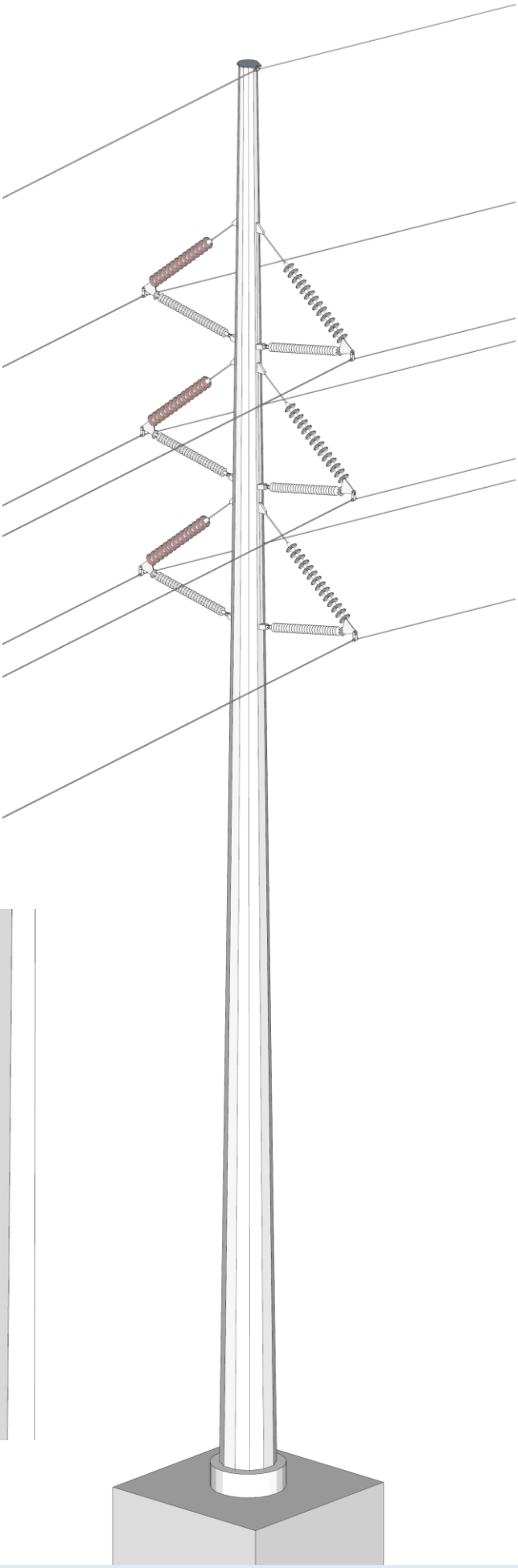
T-22 DD as Branch Tower to Gofa Substation

T-21 Under ground termination tower at EEP/EEU Warehouse Store.

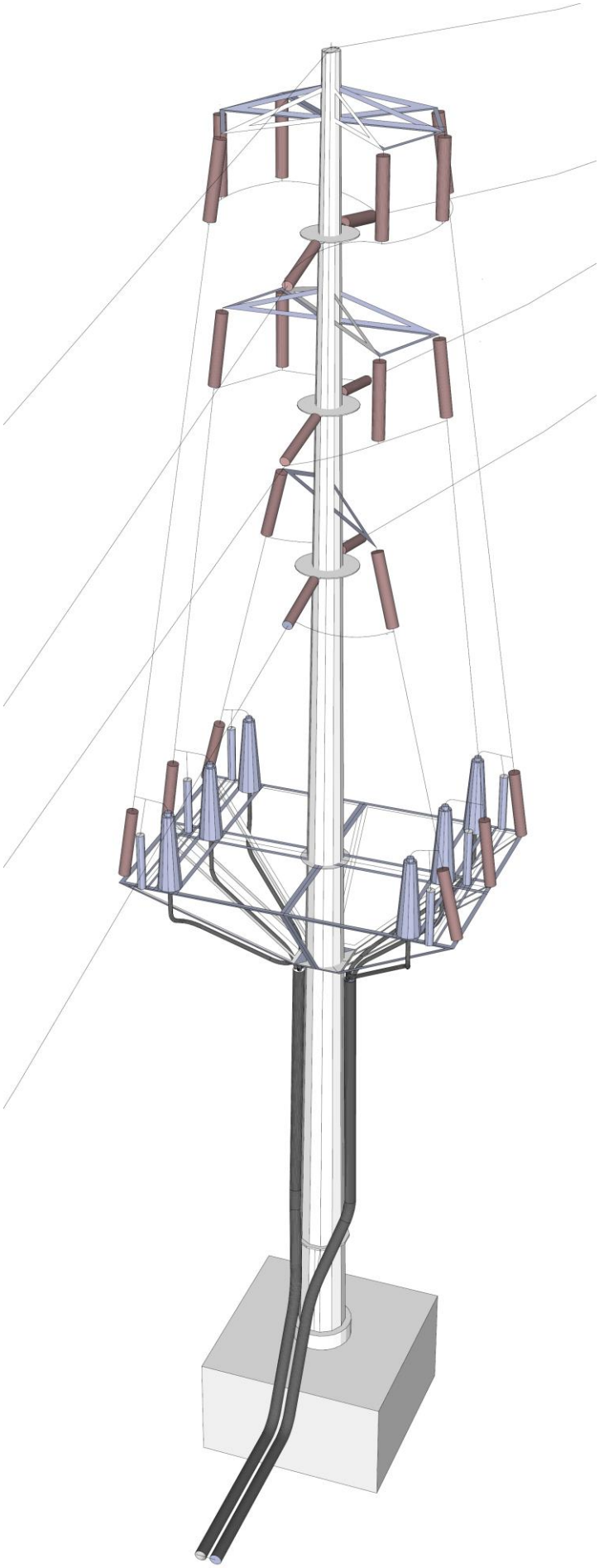
132kV Overhead Transmission Line
Sketch up for Tower Configuration – Monopole Tubular Tower (2cct)

T25 – T 33 : New road will be constructed.
132kV monopole tubular tower will be set on the median strip of the new road.



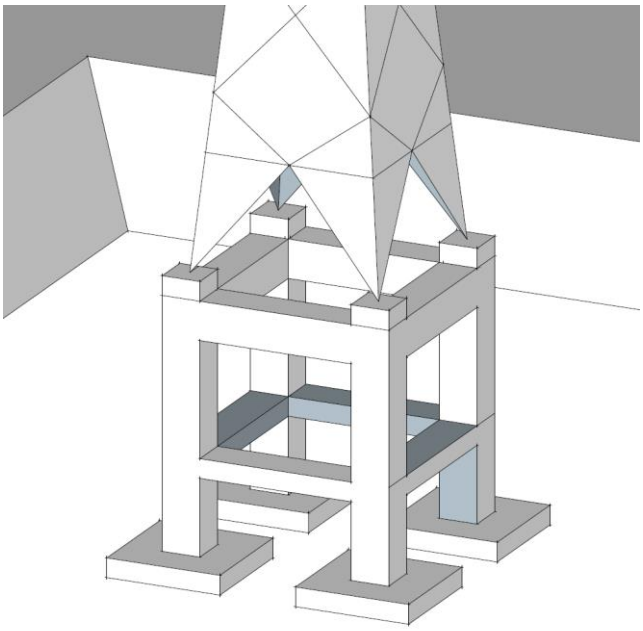


Braced Post Insulators to keep ROW as 6 meters

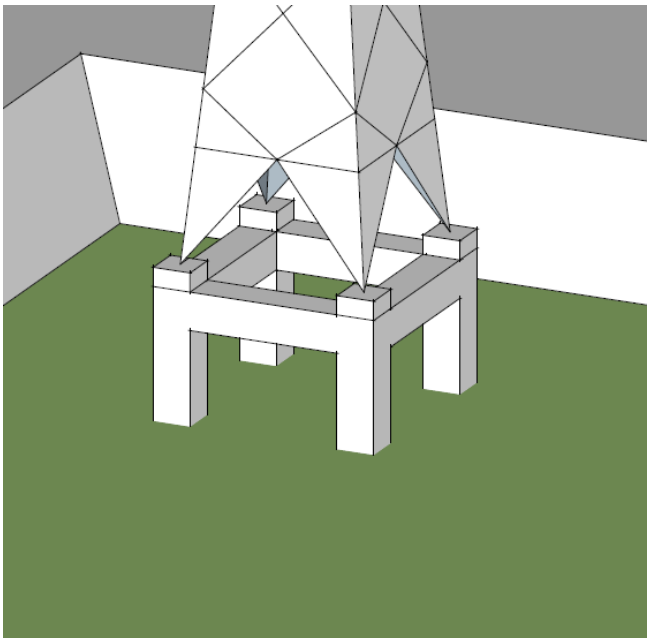


Cable Termination at T67 (Kaliti – Cotobie)
Span will cross at LRT station “Management Institute”

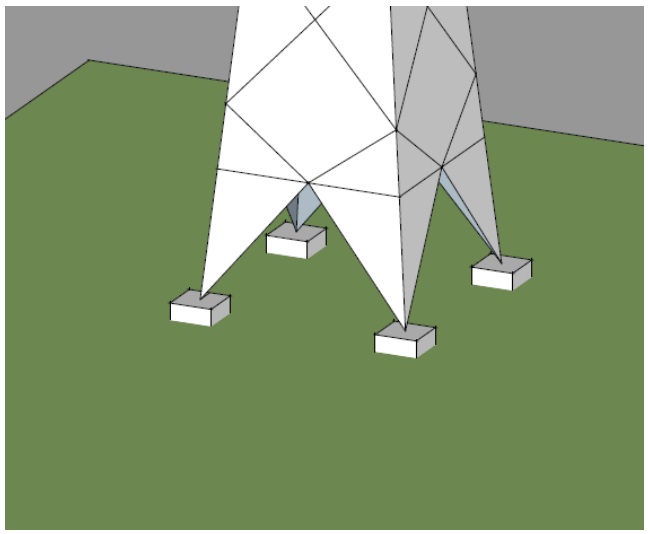
Current Condition at T36



After Construction



After Embankment works



Over 50 bolts & nuts were stolen from this tower

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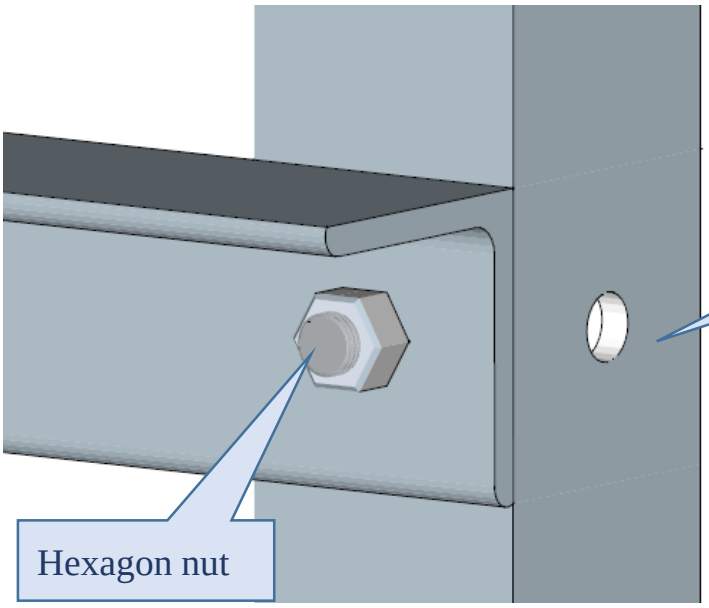
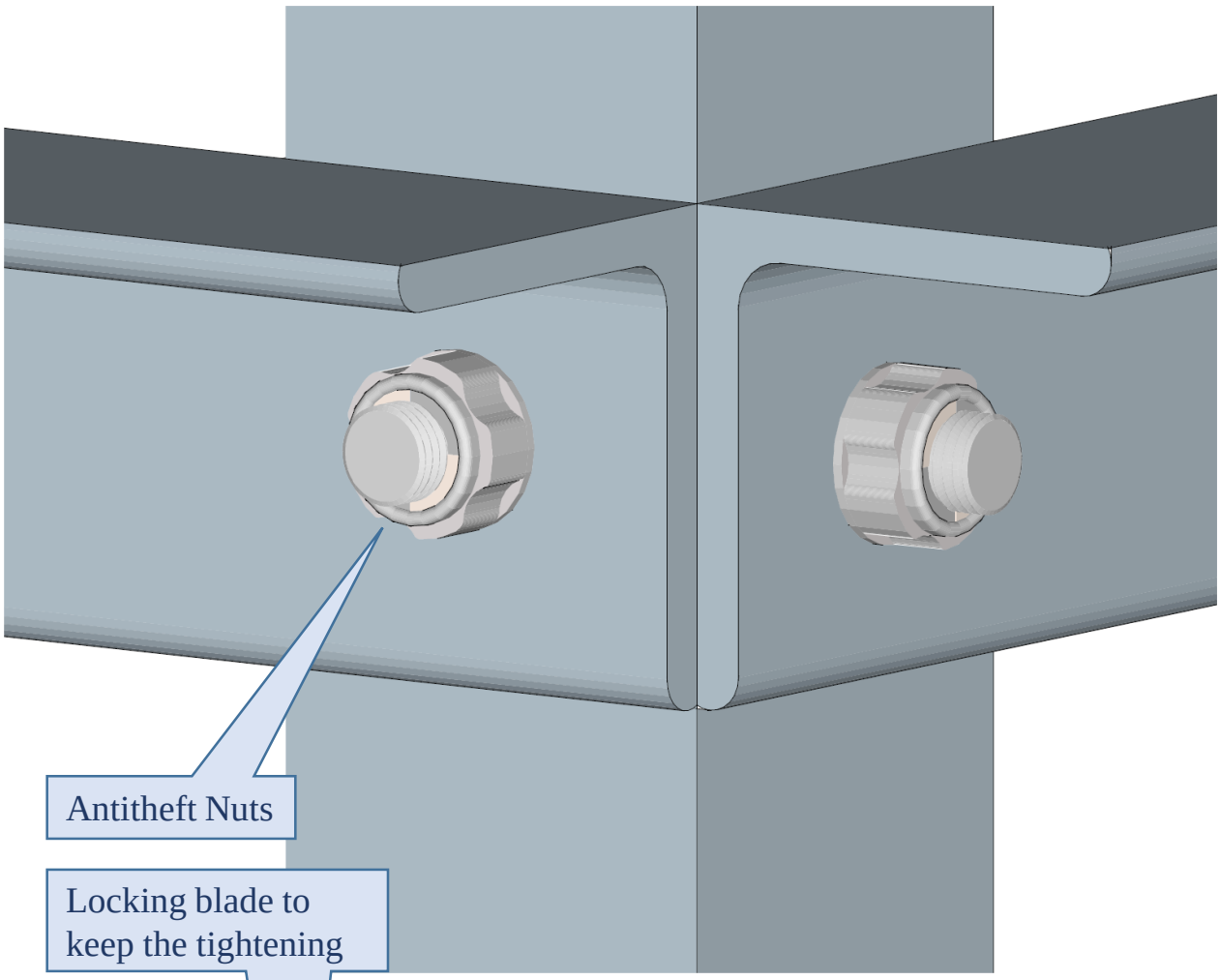


Hexagon nut

Hexagon Nuts were welded, but were forcefully removed from tower by ordinary spanner.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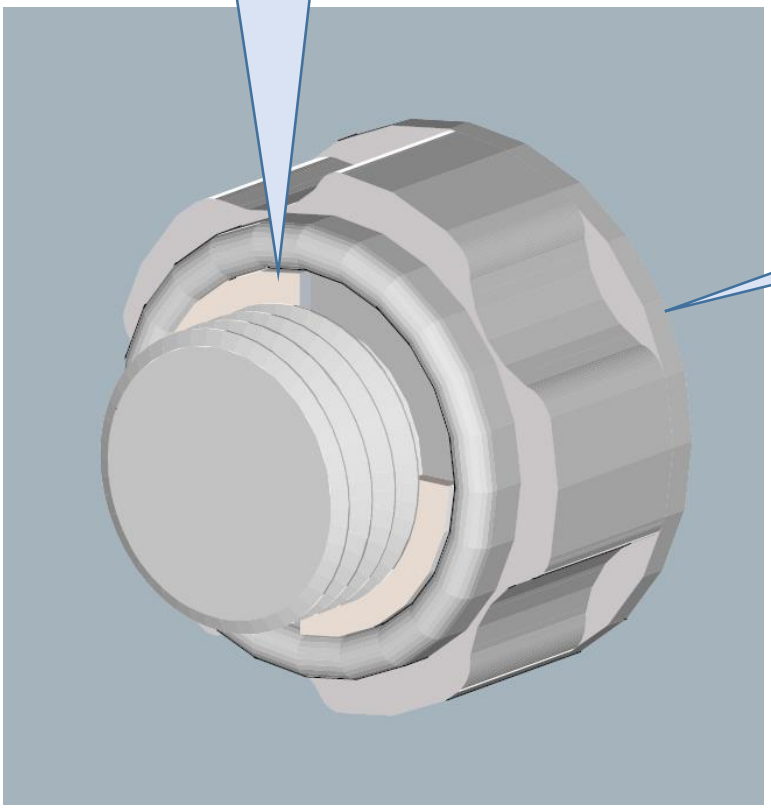
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132kV Overhead Transmission Line
Recommended Design Parameter for Tower

Lattice Tower Type in 132kV 2cct Transmission Line

Tower Type	LD	MD	ND	ND
	AA	BB	CC	DD
Deviation Angle	0º-2º	0º-30º	0º-60º	60º-90º
Insulator Strings	Suspension	Tension	Tension	Dead End
Basic Span	350 m	350 m	350 m	350 m
Wind Span	450 m	450 m	450 m	450 m
Weight Span	700 m	700 m	1500 m	700 m
Uplift	- 175m	- 400 m	- 400 m	- 350 m

Tubular Monopole Tower Type in 132kV Transmission Line

Tower Type	Tubular 2cct (TAD)		Tubular 1cct (TDS)	
	AA-Mono		D-Mono	
Deviation Angle	0º-2º		0º-5º	
Insulator Strings	Suspension		Tension	
Basic Span	160 m		250 m	
Wind Span	180 m		250 m	
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Uplift	N/A		N/A	

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Monopoles shall be a constant taper and either circular or polygonal. Polygonal section shall have a minimum of 12 faces.

132kV Overhead Transmission Line
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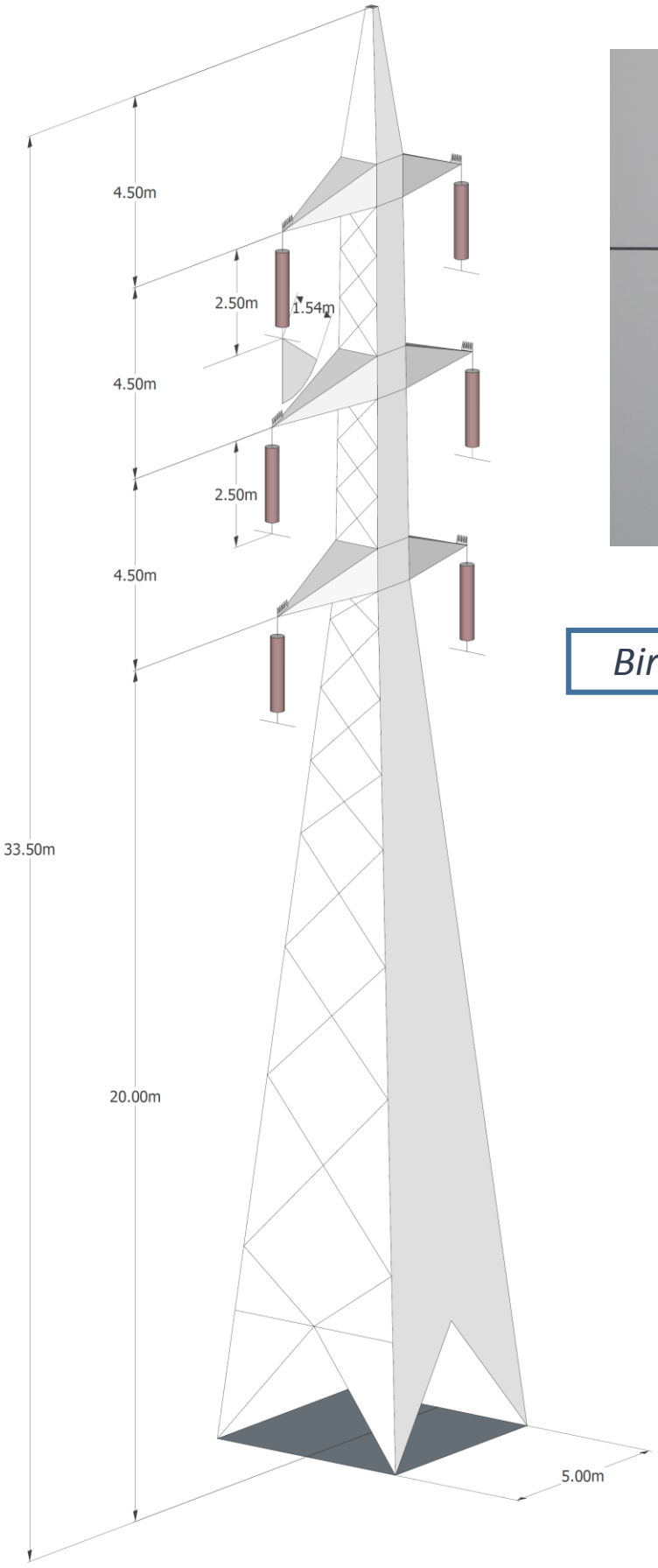
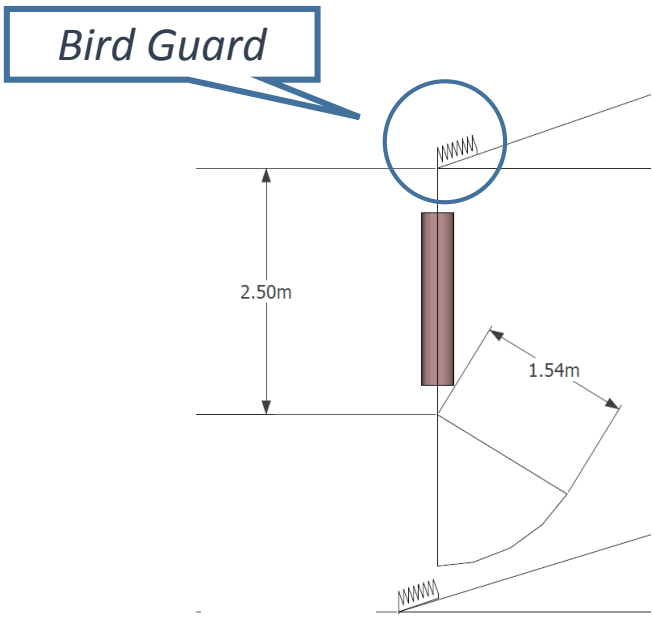
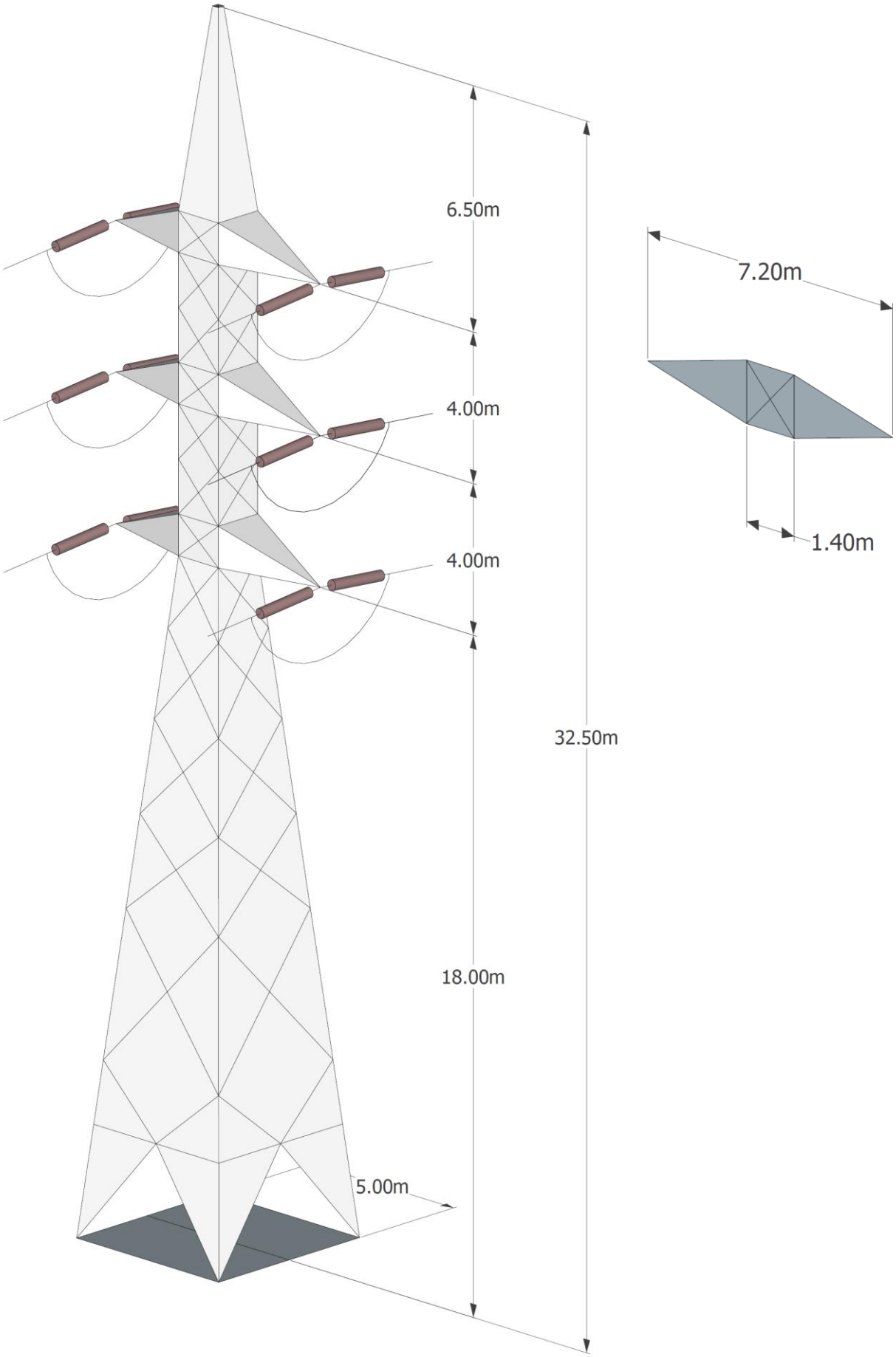
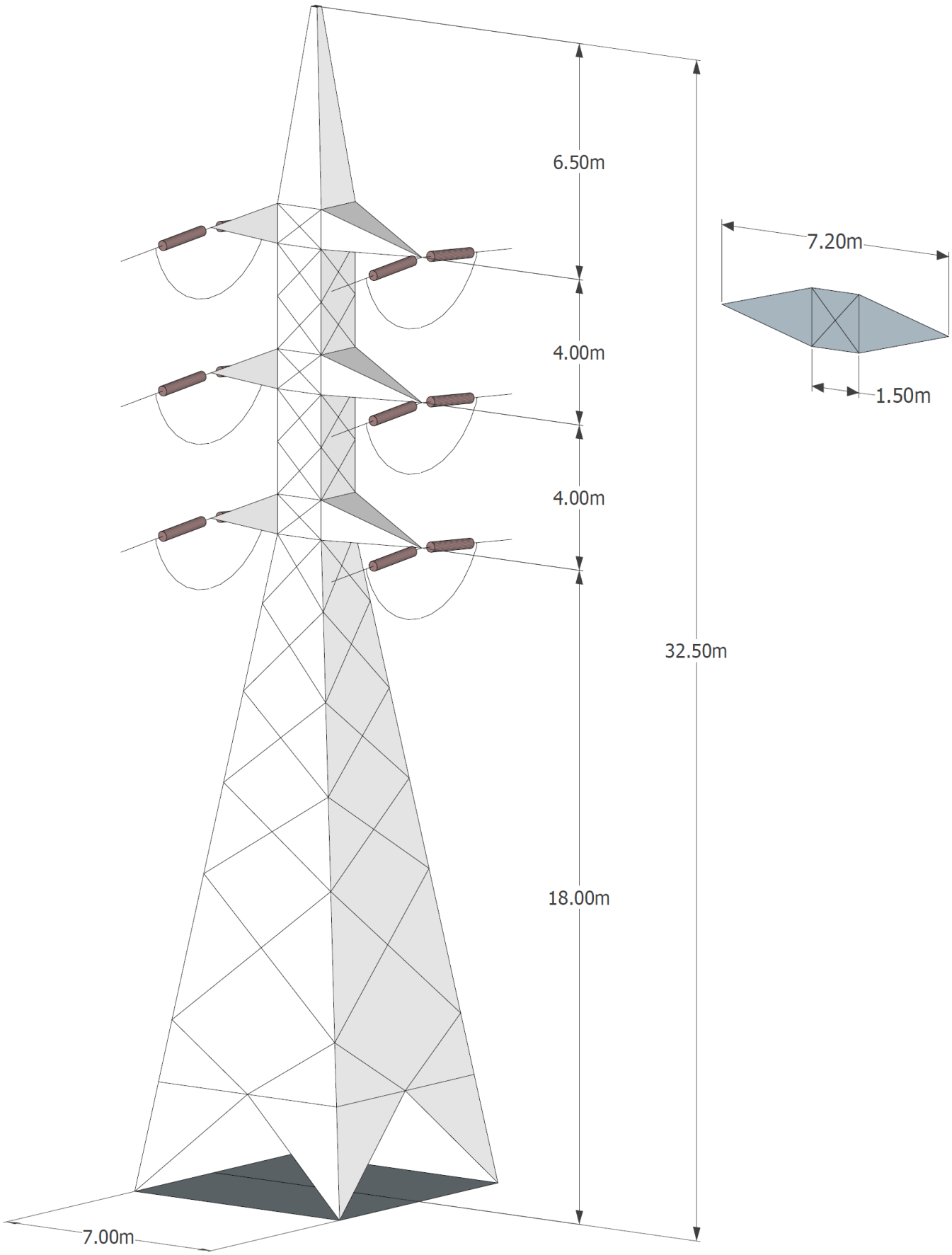




132kV Overhead Transmission Line
Sketch up for Tower Configuration – BD Type (Tension Double Circuit)





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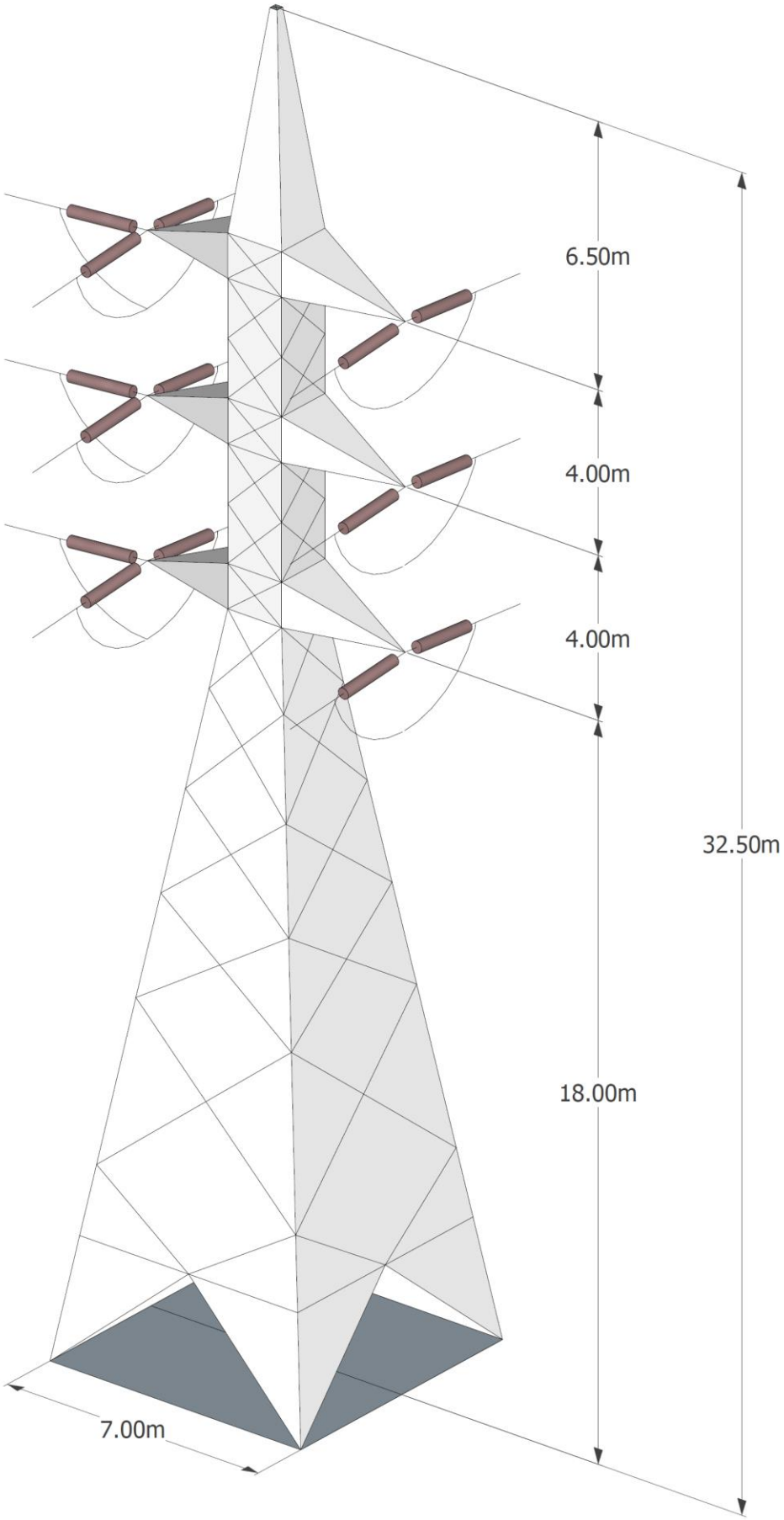

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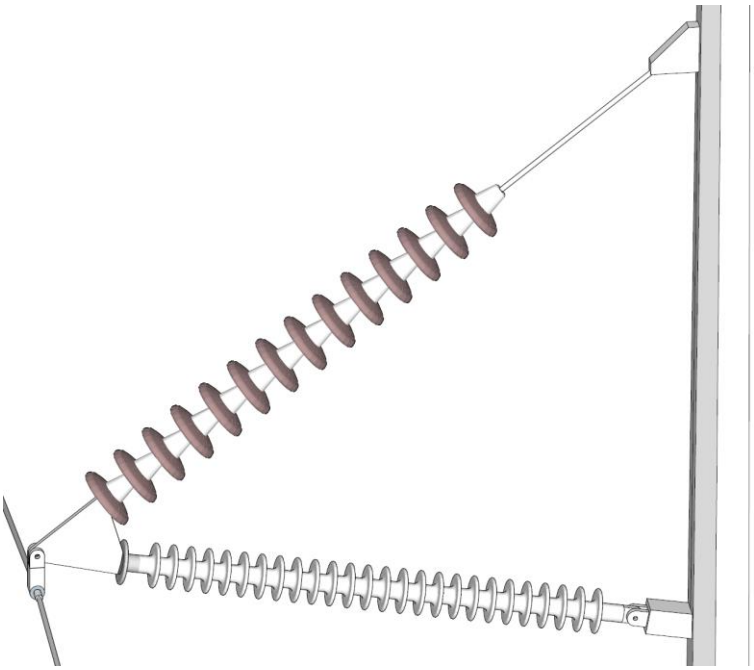

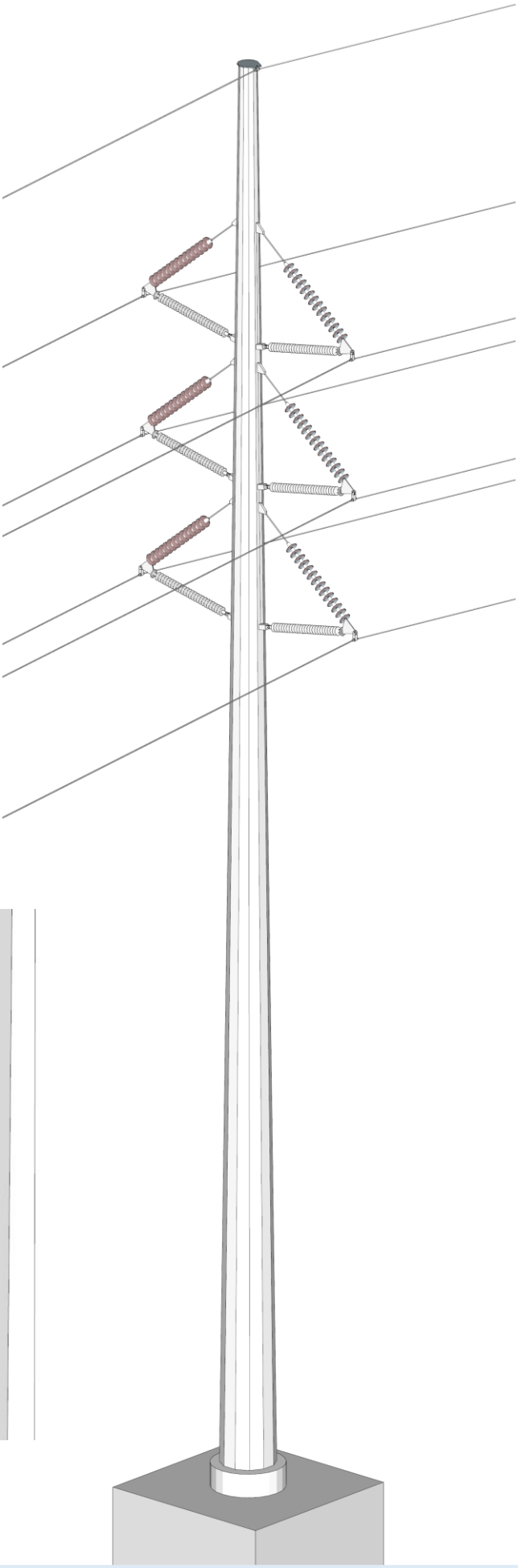

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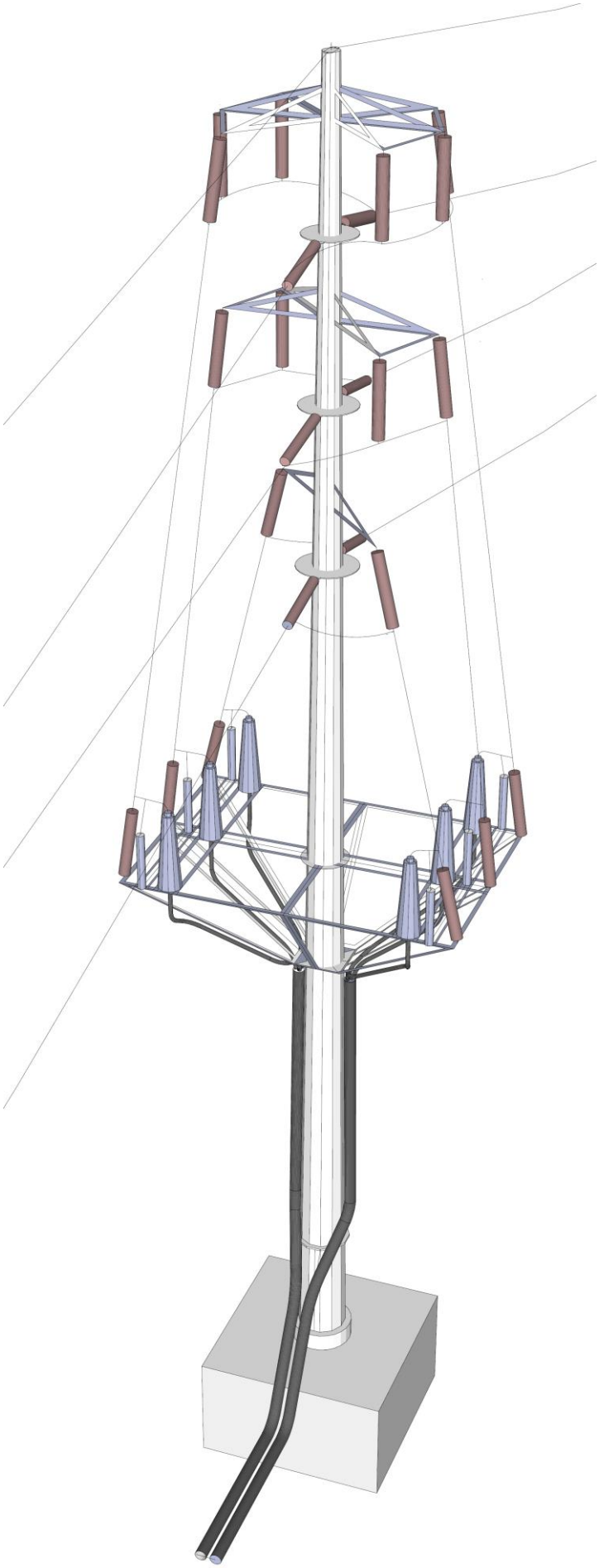

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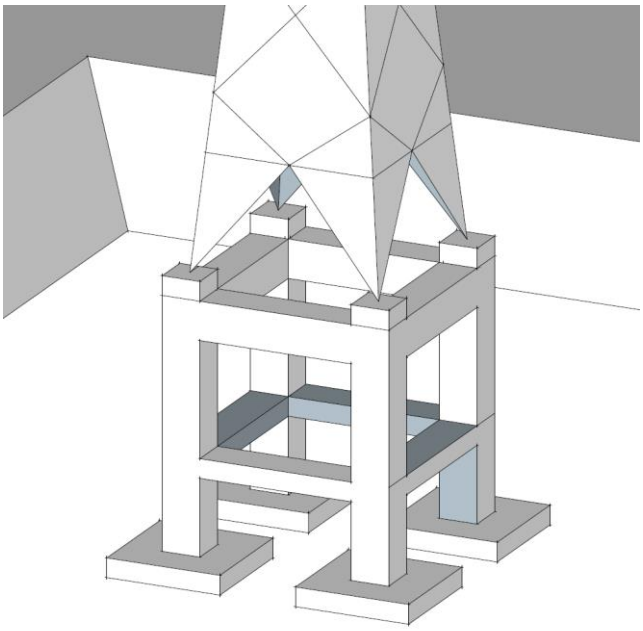
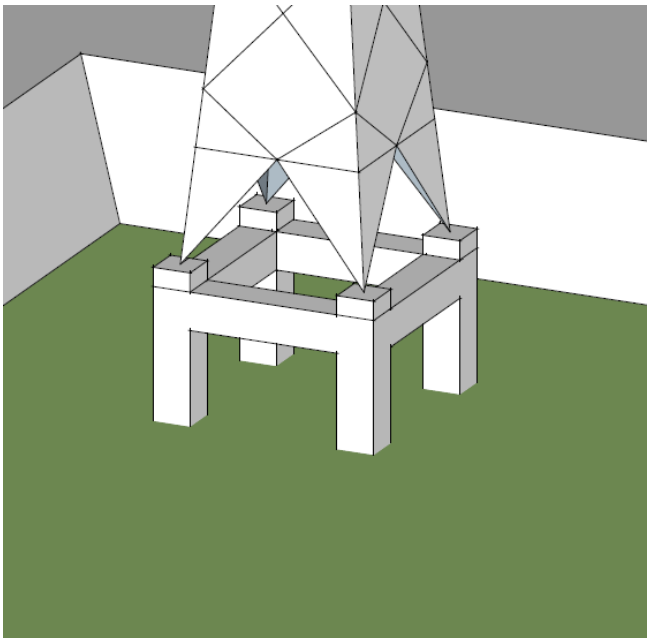


After Construction



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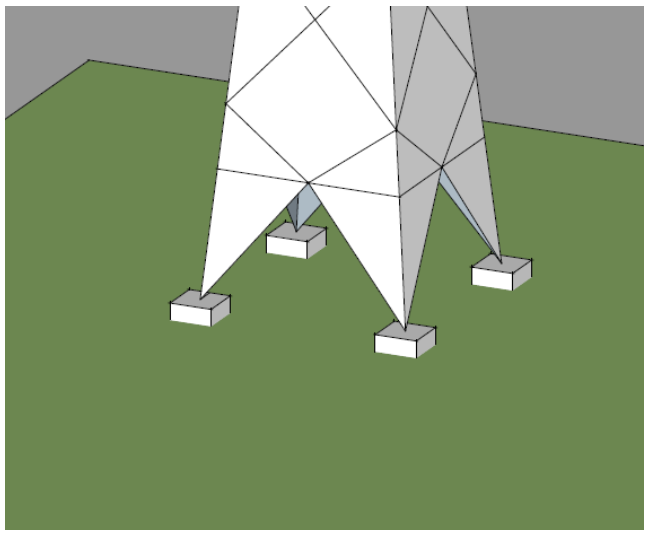

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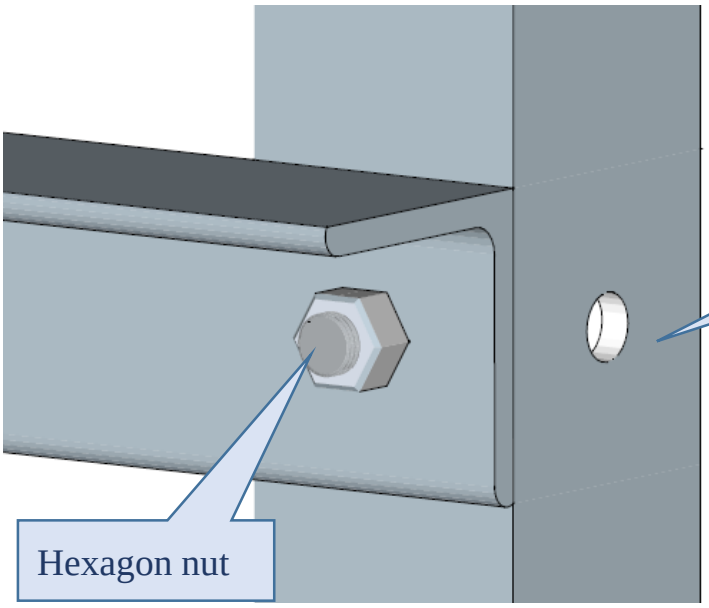

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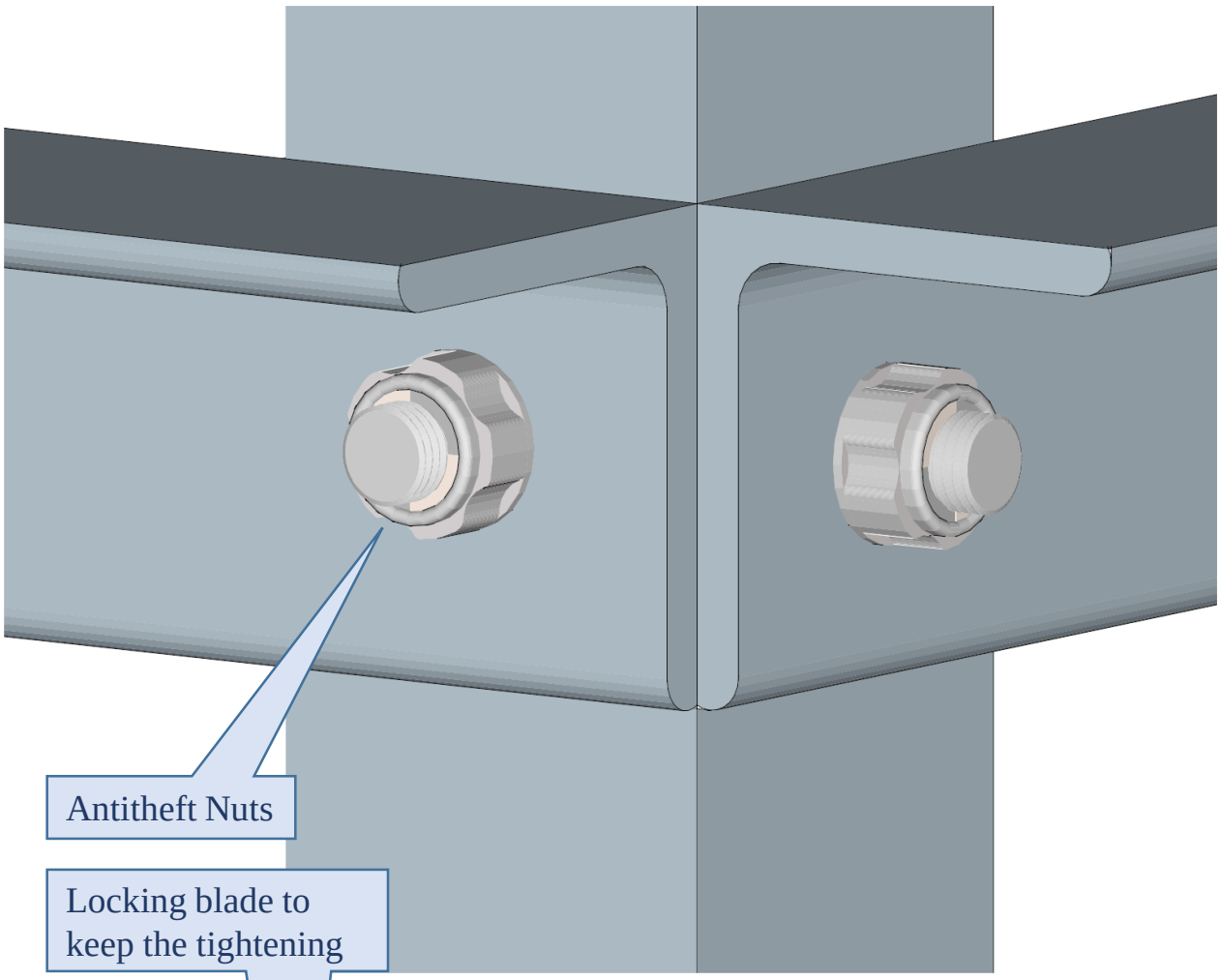
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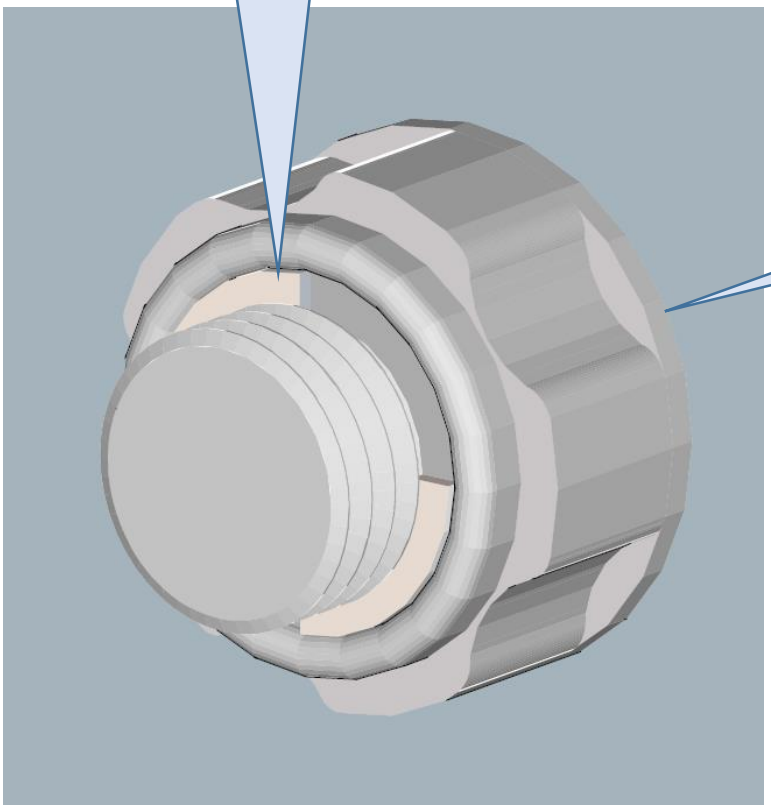
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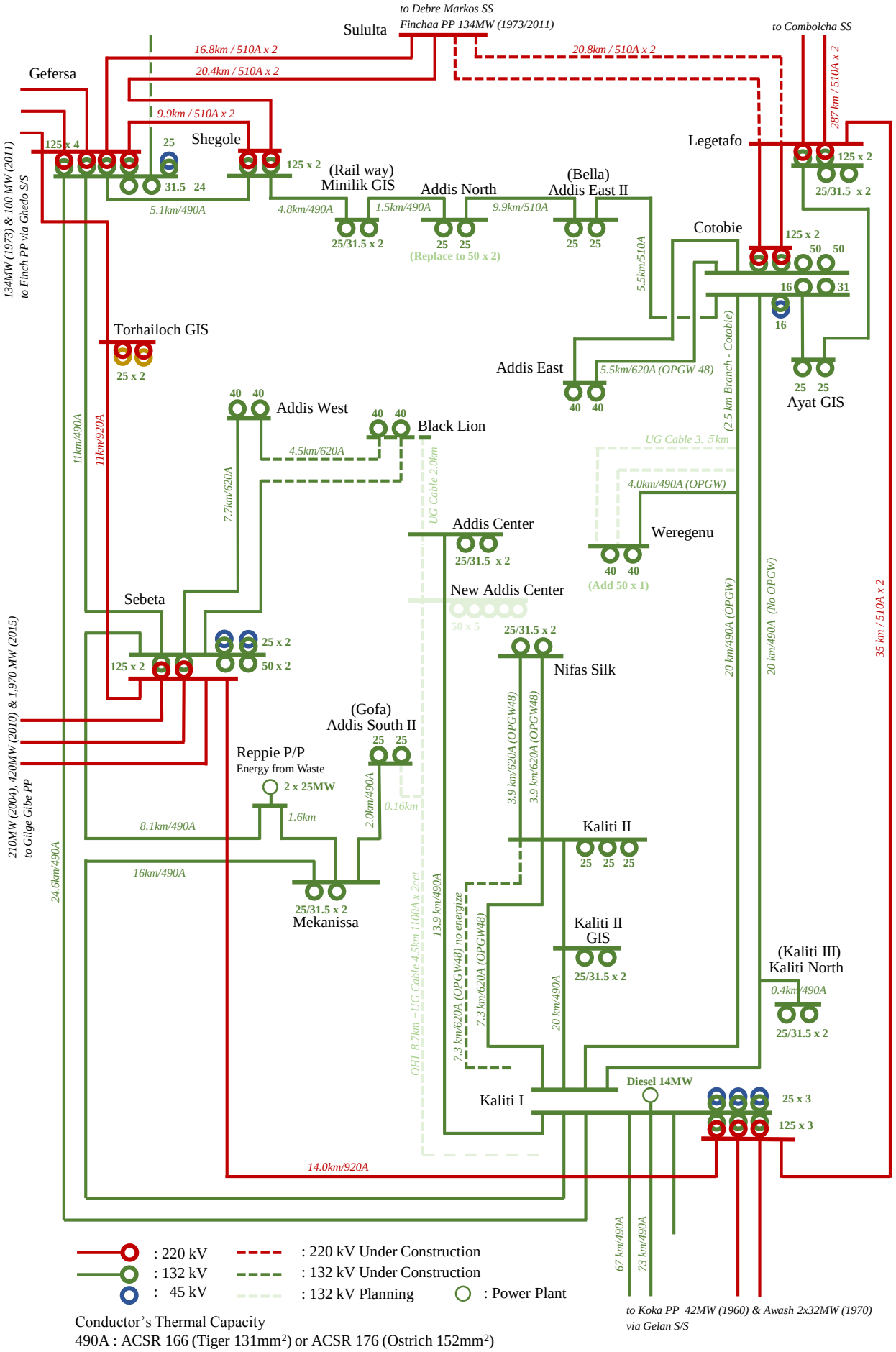
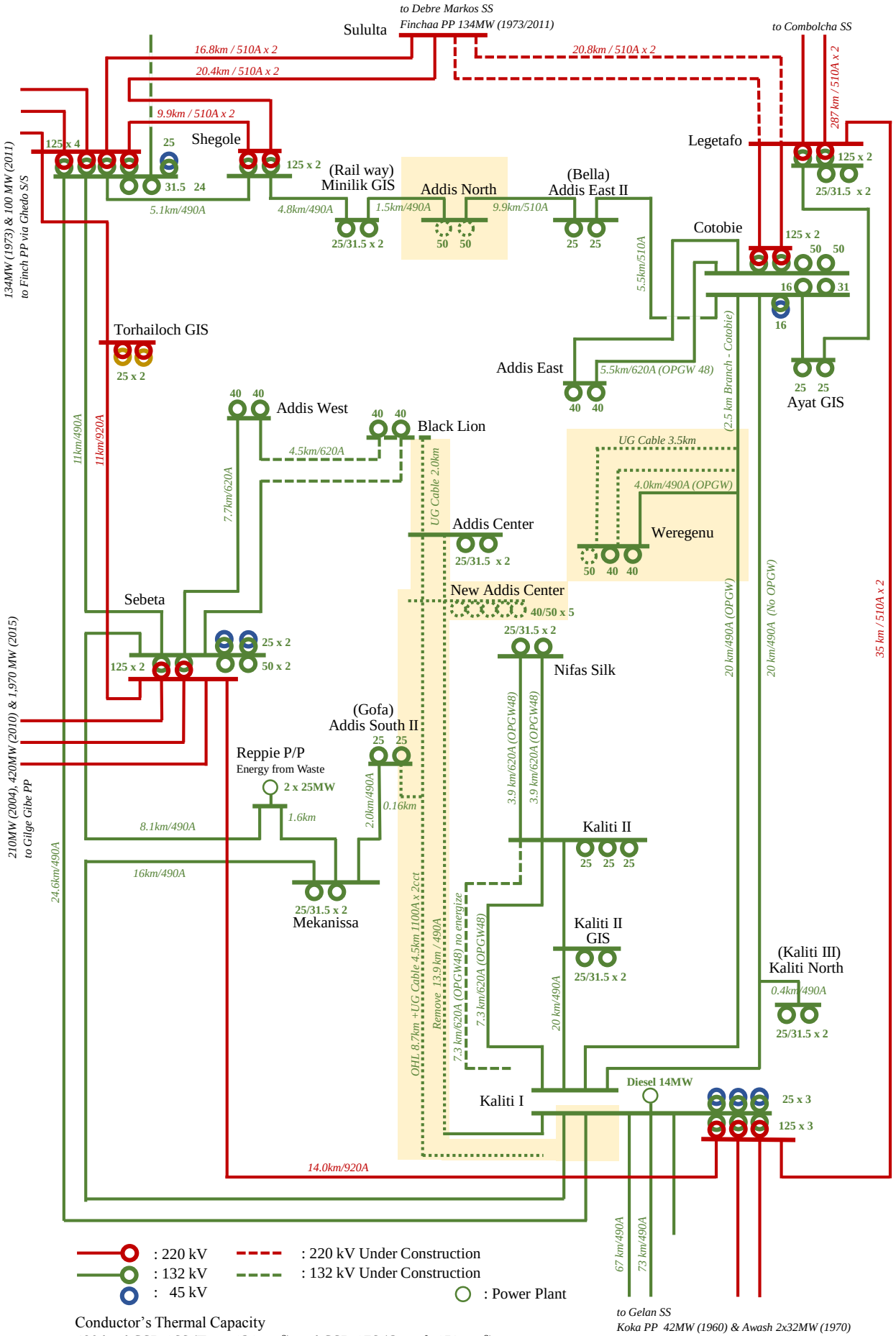
APPENDIX-6

ADDIS ABABA TRANSMISSION NETWORKS



Conductor's Thermal Capacity
490A : ACSR 166 (Tiger 131mm^2) or ACSR 176 (Ostrich 152mm^2)
510A : ASH/AAAC 180 (181.6mm^2)
620A : ACSR 240/30 (Flicker 241.6mm^2)
920A : ACSR 494 (Mallard 403mm^2)

ADDIS ABABA Transmission Network (2018)



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510A : ASH/AAAC 180 (181.6mm²)
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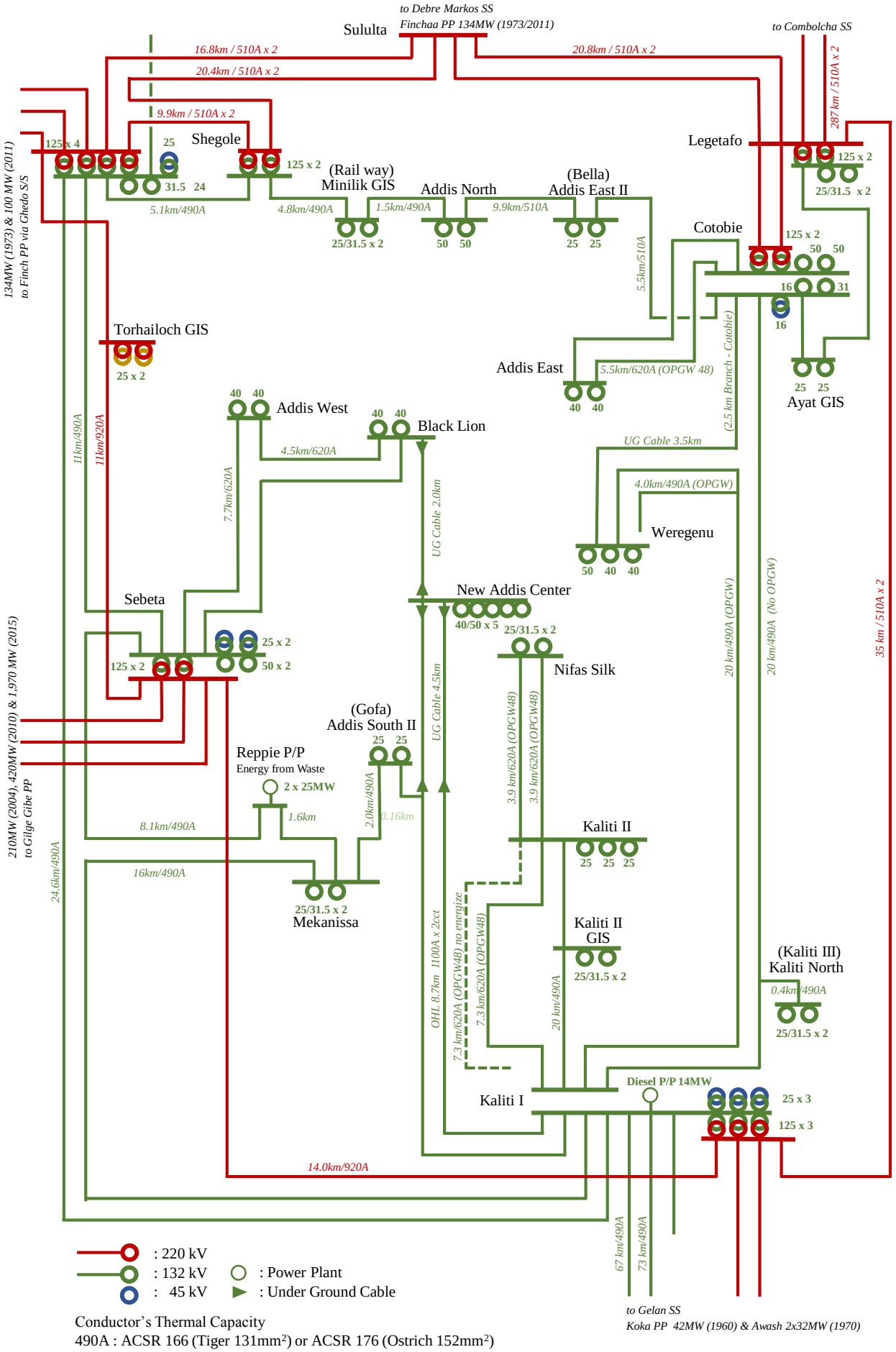
ADDIS ABABA Transmission Network

Scope of Rehabilitation and Upgrading Project



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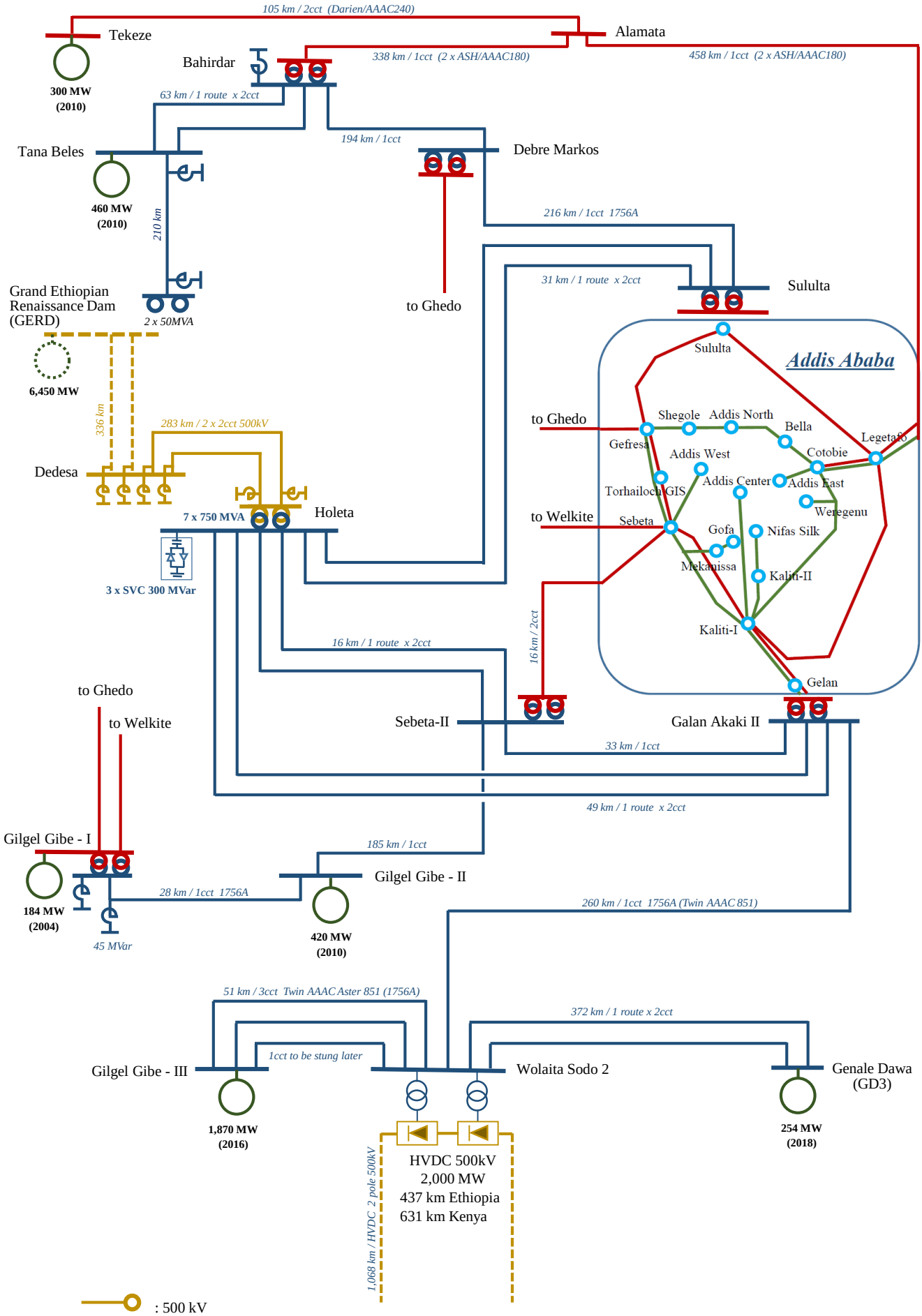
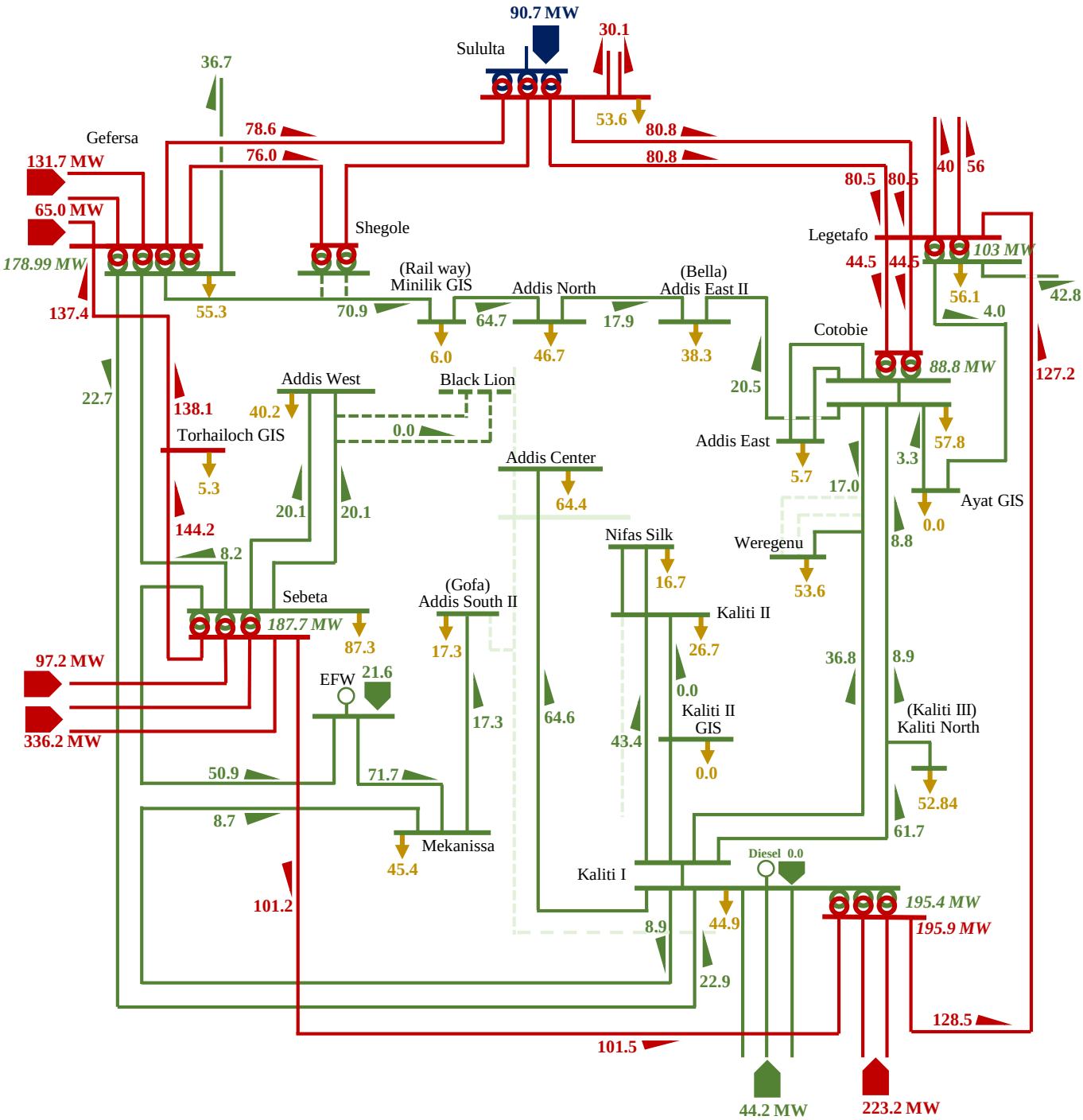
ADDIS ABABA Transmission Network (Expected at 2020)


105 km / 2cct (Darien/AAAC240)
Tekeze
Alamata
338 km / 1cct (2 x ASH/AAAC180)
458 km / 1cct (2 x ASH/AAAC180)
300 MW
(2010)
Bahirdar
63 km / 1 route x 2cct
194 km / 1cct
Tana Beles
Debre Markos
460 MW
(2010)
210 km
216 km / 1cct 1756A
31 km / 1 route x 2cct
Sululta
Grand Ethiopian
Renaissance Dam
(GERD)
2 x 50MVA
to Ghedo
6,450 MW
336 km
283 km / 2 x 2cct 500kV
Dedesa
Holeta
7 x 750 MVA
3 x SVC 300 MVar
Addis Ababa
Sululta
Shegole
Addis North
Bella
Legetafo
Gefresa
Addis West
Cotobie
Addis Center
Addis East
Torhailoch GIS
Weregenu
Sebeta
Gofa
Nifas Silk
Mekanissa
Kaliti-II
Kaliti-I
Gelan
to Welkite
16 km / 2cct
16 km / 1 route x 2cct
to Ghedo
to Welkite
Sebeta-II
Galan Akaki II
33 km / 1cct
49 km / 1 route x 2cct
Gilgel Gibe - I
185 km / 1cct
Gilgel Gibe - II
28 km / 1cct 1756A
260 km / 1cct 1756A (Twin AAAC 851)
184 MW
(2004)
45 MVar
420 MW
(2010)
51 km / 3cct Twin AAAC Aster 851 (1756A)
372 km / 1 route x 2cct
1cct to be stung later
Gilgel Gibe - III
Wolaita Sodo 2
Genale Dawa
(GD3)
1,870 MW
(2016)
254 MW
(2018)
HVDC 500kV
2,000 MW
437 km Ethiopia
631 km Kenya
1,068 km / HVDC 2 pole 500kV
: 500 kV
: 400 kV
: 220 kV
EEP 500kV/400kV Transmission Network
(Including Under Construction)



ADDIS ABABA Transmission Network (2017)

: 400 kV
: 220 kV
: 132 kV
: 220 kV Under Construction
: 132 kV Under Construction
: 132 kV Planning
: Power Plant

図 3.1-4 アジスアベバ系統計画（2018年末）

Detailed facilities of existing 132kV Transmission Line in Addis Ababa

Name of Section	Nos of Circuit	Length	Thermal Capacity	Tower Structure Type
Existing Transmission Line Under Operation				
Kaliti – I to Addis Center	1 cct	13.9 km	490 A	Lattice
Kaliti – I to Kaliti – II (via GIS)	1 cct	6.8 km	490 A	Lattice
Kaliti – I to Kaliti – II 2^{nd} route	2 cct	7.3 km	620 A	Tubular&Lattice
Kaliti – I to Nifas Silk	2 cct	3.9 km	620 A	Tubular
Kaliti – I to Mekanissa	1 cct	16 km	490 A	Lattice
Mekanissa to Sebeta	1 cct	8.1 km	490 A	Lattice
Mekanissa/Sebeta PI to Addice EFW (Energy from Waste)	2 cct	2.6 km	490 A	Lattice
Mekanissa to Kality South II (Gofa)	1 cct	2.0 km	490 A	Lattice
Kaliti - I to Cotobie (via Weregenu)	1 cct	20.0 km	490 A	Lattice
Weregenu to T62 T Branch tower	1 cct	4.0 km	490 A	Lattice
Kaliti - I to Cotobie (via Kaliti III)	1 cct	20.0 km	490 A	Lattice
Kaliti III to T-Branch	1 cct	0.6 km	490 A	Lattice
Cotobie to Addis East	2 cct	5.5 km	620 A	Tubular
Cotobie to Addis East II (Bella)	1 cct	5.5 km	490 A	Lattice
Addis East II (Bella) to Addis North	1 cct	9.9 km	490 A	Lattice
Addis North to Minilik GIS (Railway)	1 cct	1.5 km	490 A	Lattice
Minilik GIS (Railway) to Shegole	1 cct	4.8 km	490 A	Lattice
Shegole to Gefersa	1 cct	5.1 km	490 A	Lattice
Gefresa to Sebeta	1 cct	11.0 km	490 A	Lattice
Gefresa to Kaliti-I	1 cct	24.6 km	490 A	Lattice
Sebeta to Addis West	2 cct	7.7 km	620 A	Tubular
Plan and under construction				
Addis West to Black Lion	2 cct	4.0 km	620 A	Tubular
		185 km		

Ethiopian Electric Power Existing Power Plants Installed Capacity (2017) [MW]

No	Power Plant	Hydro	Diesel	Geothermal	Wind	Total	COD
1	Koka (Awash I)	43.2				43.2	1960
2	Awash II	32.0				32.0	1966
3	Awash III	32.0				32.0	1971
4	Finchaa	134.0				134.0	1973/2003
5	Meleka Wakena	153.0				153.0	1988
6	Tis Abay I	11.4				11.4	1964
7	Tis Abay II	73.0				73.0	2001
8	Gilgei Gibe	184.0				184.0	2004
9	Aluttu Langano			7.3		7.3	1999
10	Kaliti		14.0			14.0	2004
11	Dire Dwa		38.0			38.0	2004
12	Awash 7 Killo		35.0			35.0	2004
13	Tekeze	300.0				300.0	2009
14	Gilget Gibe II	420.0				420.0	2010
15	Tana Beles	460.0				460.0	2010
16	Fincha Amerti Neshi	97.0				97.0	2011
17	Ashegoda (120 wind turbine)				120.0	120.0	2012
18	Adama I (51 wind turbine)				51.0	51.0	2010
19	Adama II (102 wind turbine)				153.0	153.0	2015
20	Gibe III	1,870.0				1,870.0	2015
21	Small diesels		56.0			56.0	
		3,809.6	143.0	7.3	324.0	4,283.9	

22	Genal Dewa (GD3)	254.0				254.0	2018
23	Ground Renaissance (GERD)	6,450.0				6,450.0	

Ministry of Water Irrigation and Electricity
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Generation Planning (Committed Plants)

[MW]

Power Plant	Install Capacity	Capacity in Dry	2014	2015	2016	2017	2018	2019
Existing Power Plant								
Hydro			3,810	3,810	3,810	3,810	3,810	3,810
Diesel			143	143	143	143	143	143
Geothermal			7	7	7	7	7	7
Wind			324	324	324	324	324	324
Hydro Under Construction								
Genal Dawa III	254	254				253	253	253
Grand Renaissance First Phase	500	500					413	413
Grand Renaissance Second Phase	5,500	5,500						4,544
Biomass Planning								
Bio committed 120MW				60	60	60	60	60
Bio committed 137.5MW				60	60	60	60	60
Others Under Construction								
Addis Ababa Energy from Waste				25	25	25	25	25
Generations for Sugar Factories			26	254	354	434	434	434
			4,310	4,683	4,783	5,116	5,529	10,073

Ministry of Water Irrigation and Electricity
Federal Democratic Republic of Ethiopia
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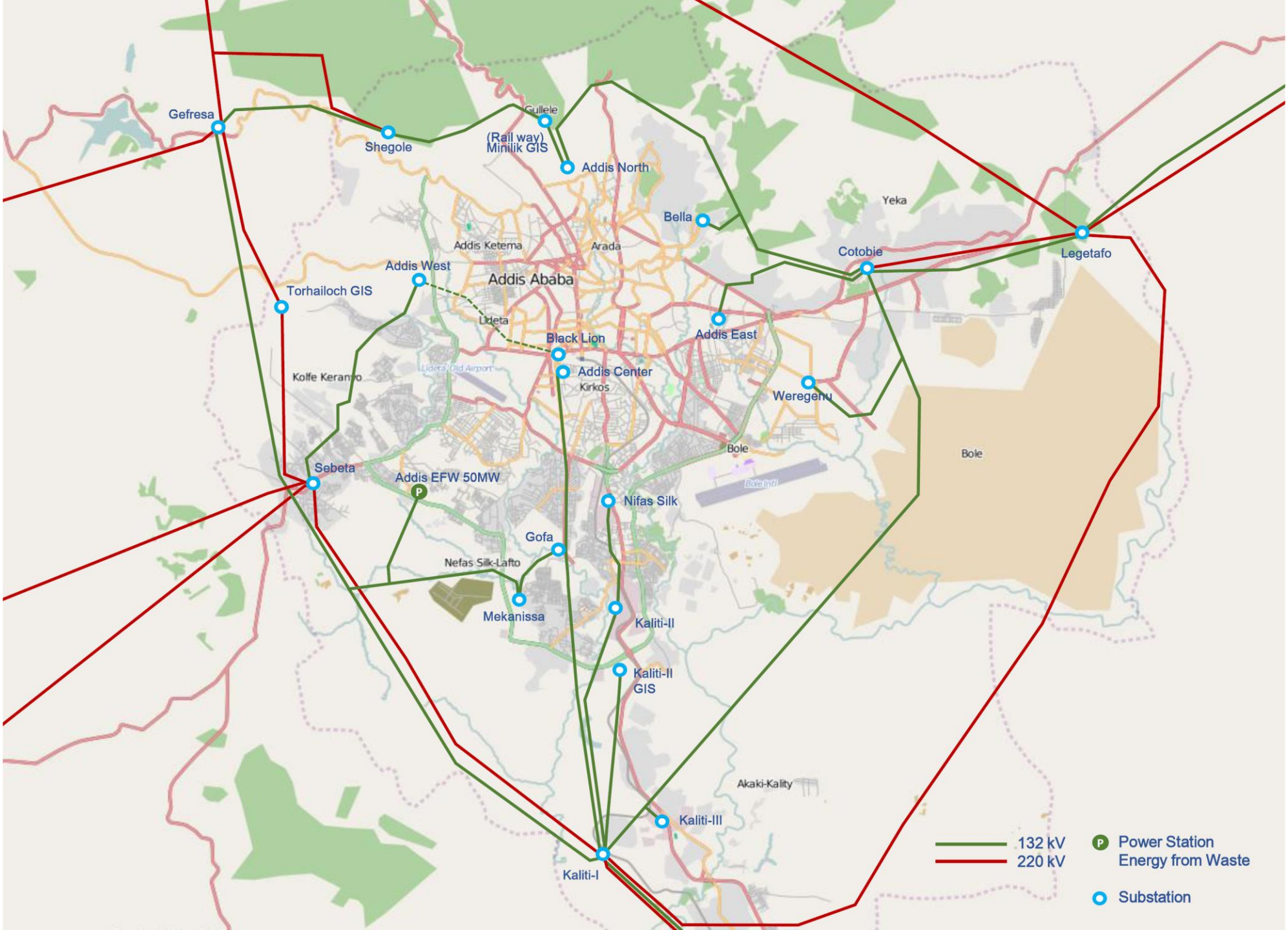
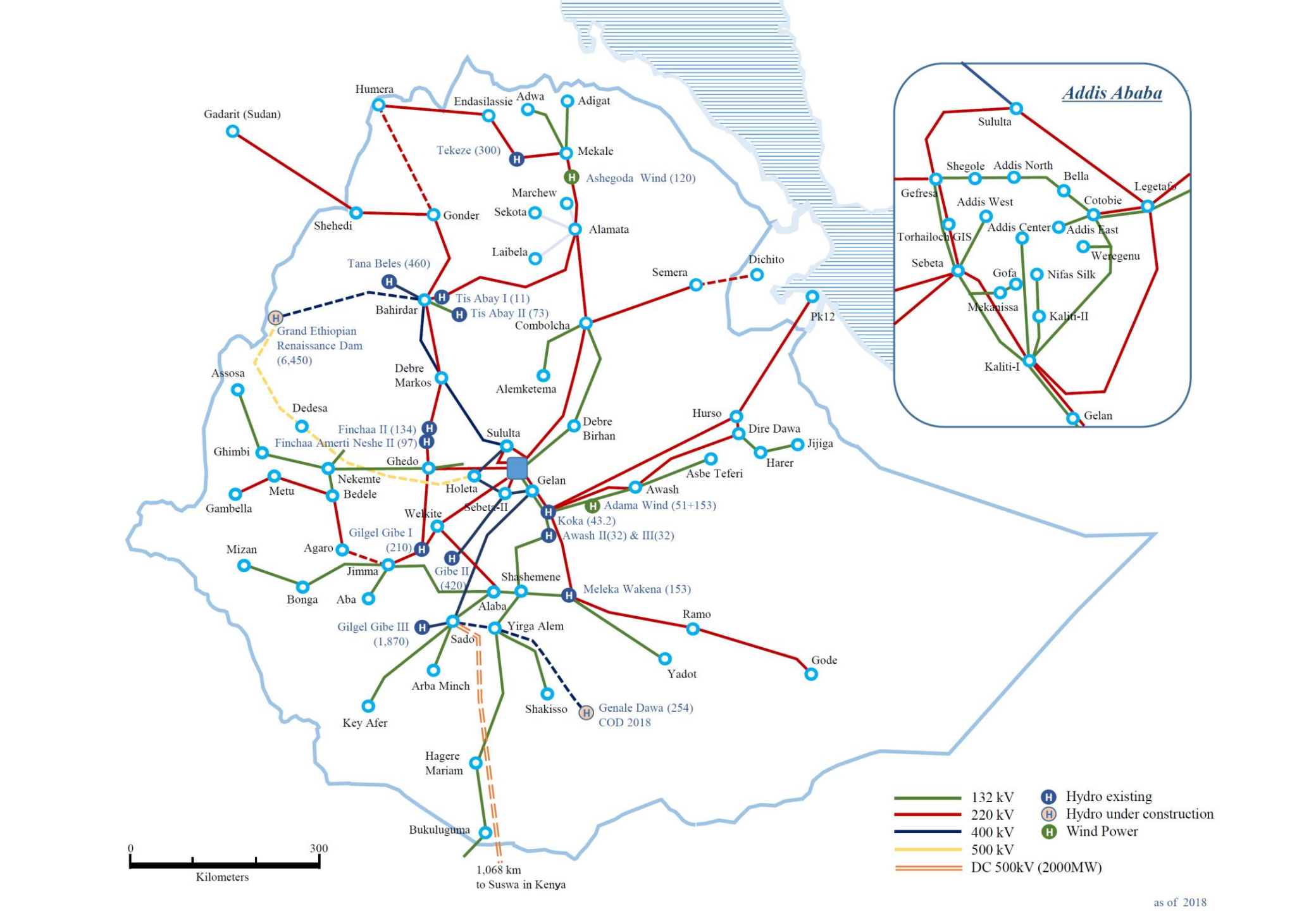
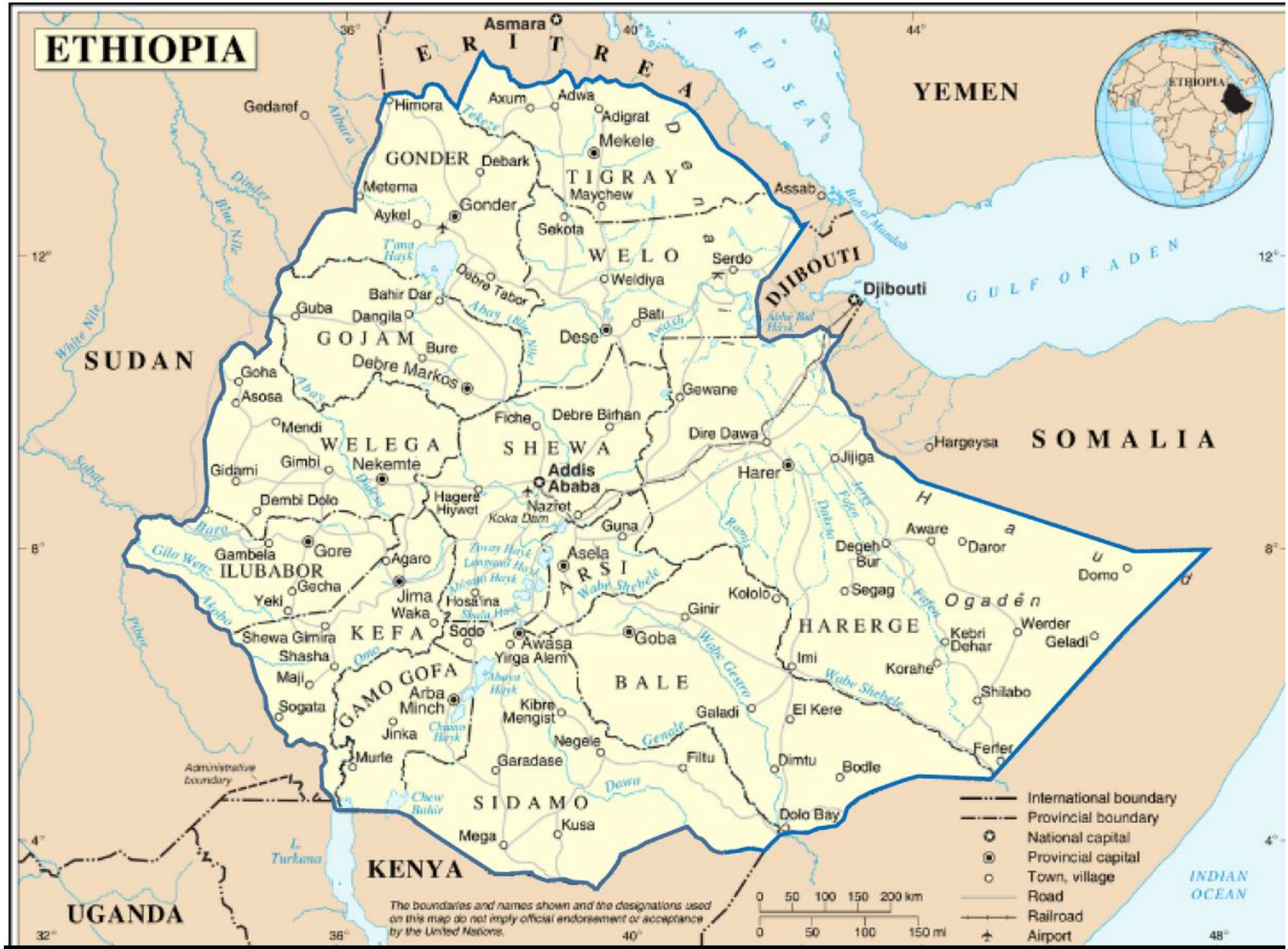

Gefresa
Shegole
Gullele
(Rail way)
Minilik GIS
Addis North
Bella
Yeka
Addis Ketema
Arada
Addis West
Addis Ababa
Cotobie
Legetafo
Torhailoch GIS
Lideta
Addis East
Black Lion
Addis Center
Kirkos
Kolfe Keranio
Weregenu
Bole
Sebeta
Addis EFW 50MW
Nifas Silk
Gofa
Nefas Silk-Lafto
Mekanissa
Kaliti-II
Kaliti-II
GIS
Akaki-Kality
Kaliti-III
Kaliti-I
132 kV
220 kV
Power Station
Energy from Waste
Substation


Addis Ababa
Sululta
Shegole
Addis North
Bella
Legetafo
Gefresa
Addis West
Cotobie
Torhailoch GIS
Addis Center
Addis East
Weregenu
Sebeta
Gofa
Nifas Silk
Mekanissa
Kaliti-II
Kaliti-I
Gelan
Humera
Endasilassie
Adwa
Adigat
Gadarit (Sudan)
Tekeze (300)
Mekale
Ashegoda Wind (120)
Marchew
Sekota
Shehedi
Gonder
Alamata
Laibela
Tana Beles (460)
Dichito
Semera
Tis Abay I (11)
Tis Abay II (73)
Bahirdar
Combolcha
Pk12
Grand Ethiopian Renaissance Dam (6,450)
Debre Markos
Alemketema
Assosa
Dedesa
Hurso
Debre Birhan
Finchaa II (134)
Finchaa Amerti Neshe II (97)
Sululta
Dire Dawa
Jijiga
Ghimbi
Ghedo
Harer
Asbe Teferi
Nekemte
Holeta
Gelan
Awash
Metu
Bedele
Sebeta-II
Adama Wind (51+153)
Gambella
Welkite
Koka (43.2)
Awash II(32) & III(32)
Gilgel Gibe I (210)
Agaro
Mizan
Gibe II (420)
Shashemene
Meleka Wakena (153)
Jimma
Bonga
Aba
Alaba
Ramo
Gilgel Gibe III (1,870)
Yirga Alem
Sado
Yadot
Gode
Arba Minch
Shakisso
Genale Dawa (254)
COD 2018
Key Afer
Hagere Mariam
Bukuluguma
1,068 km
to Suswa in Kenya
0
300
Kilometers
132 kV
220 kV
400 kV
500 kV
DC 500kV (2000MW)
Hydro existing
Hydro under construction
Wind Power
as of 2018


ETHIOPIA
Asmara
ERITREA
Gedaref
Himora
Axum
Adwa
Adigrat
Mekele
GONDER
Debark
TIGRAY
Meterna
Gonder
Maychew
Assab
Aykel
Sekota
WELO
Serdo
Weldiya
DJIBOUTI
Djibouti
Bahir Dar
Debre Tabor
Guba
Dangila
Batı
GOJAM
Bure
Dese
SUDAN
Debre Markos
Goha
Asosa
Gewane
Fiche
Debre Birhan
Mendi
WELEGA
SHEWA
Dire Dawa
Hargeysa
SOMALIA
Jijiga
Gidami
Gimbi
Nekemte
Addis Ababa
Harer
Dembi Dolo
Hagere Hiywet
Nazret
Guna
Aware
Degeh Bur
Daror
Gambela
Gore
Agaro
Asela
ILUBABOR
ARSI
Domo
Gecha
Jima
Kololo
Yeki
Hosa'ina
Segag
Ogadēn
Waka
Ginir
Shewa Gimira
KEFA
Sodo
Awasa
Goba
HARERGE
Kebri Dehar
Werder
Geladi
Shasha
Yirga Alem
Imi
Korahe
Maji
BALE
GAMO GOFA
Arba Minch
Shilabo
Sogata
Kibre Mengist
Galadi
El Kere
Jinka
Negele
Murle
Garadase
Filtu
Dimtu
Bodle
Ferfer
Administrative boundary
SIDAMO
Dolo Bay
Mega
Kusa
KENYA
UGANDA
INDIAN OCEAN
RED SEA
YEMEN
GULF OF ADEN
International boundary
Provincial boundary
National capital
Provincial capital
Town, village
Road
Railroad
Airport
0 50 100 150 200 km
0 50 100 150 mi
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

APPENDIX-7

UNDERGROUND CABLE


S1-1
ALL
Geja Sefer
Black Lion
Lideta
Kirkos
NEW ADC
Kera
Site 1-1
Google Earth
Image © 2018 DigitalGlobe
© 2018 Google
N
1 km


Site 1-2
New ADC
Tower
GOFA
S1-2
ALL
Addis Ababa
Addis Ababa
Google Earth
Image © 2018 DigitalGlobe
© 2018 Google
N
1 km

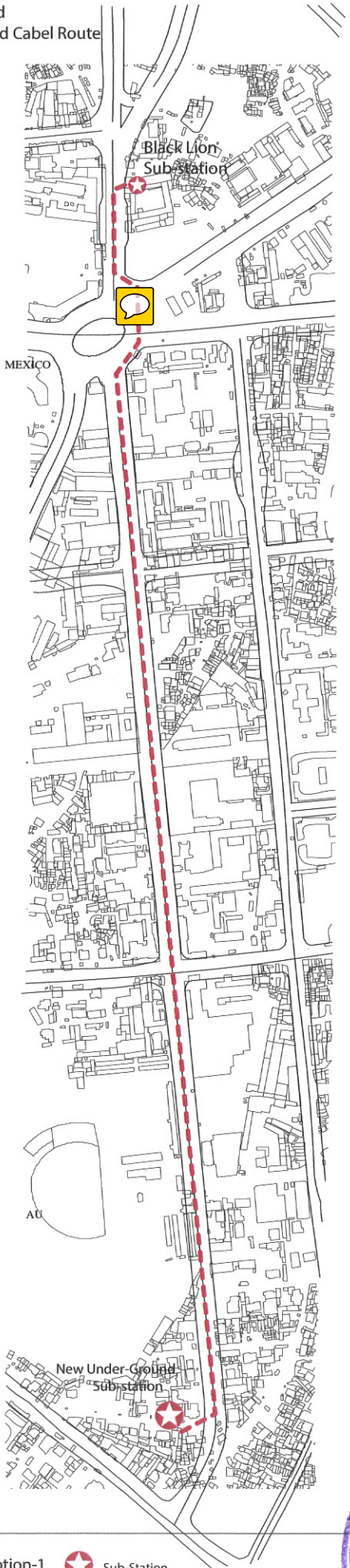

Site 2
Legend
Weregenu
Google Earth
Image © 2018 DigitalGlobe
© 2018 Google
1 km
N

የአዲስ አበባ ከተማ አስተዳደር ፕላን ኮሚሽን
Addis Ababa City Government Plan Commission

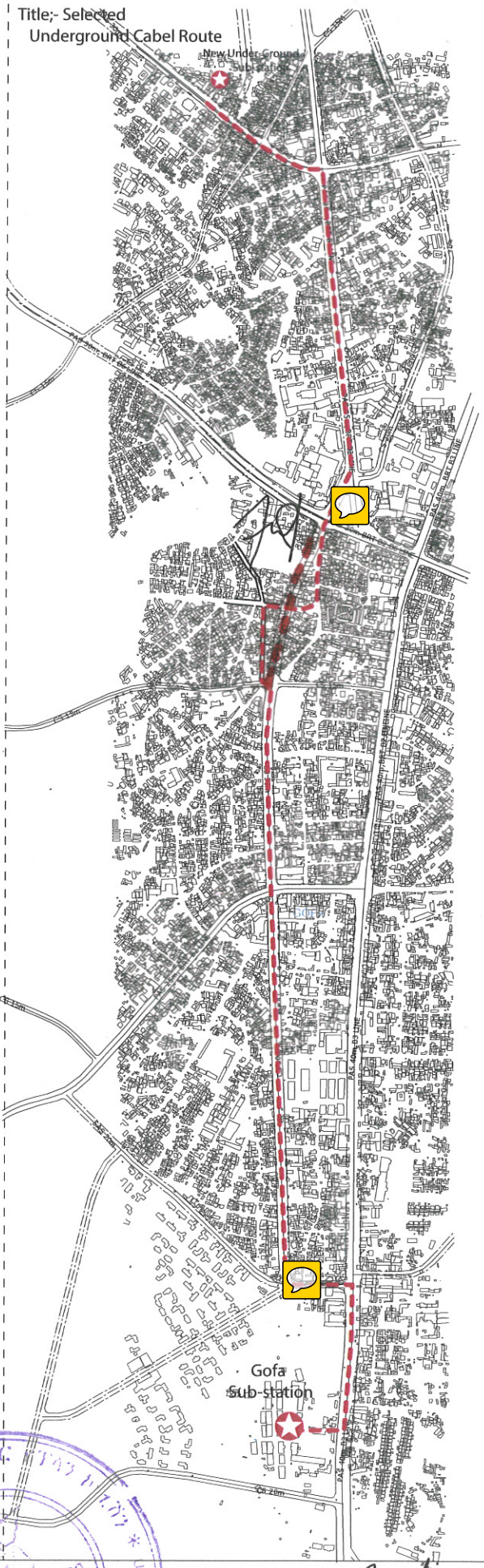
Appendix-7 (B)

Date-08/09/2010

Title;- Selected Underground Cabel Route



Title;- Selected Underground Cabel Route



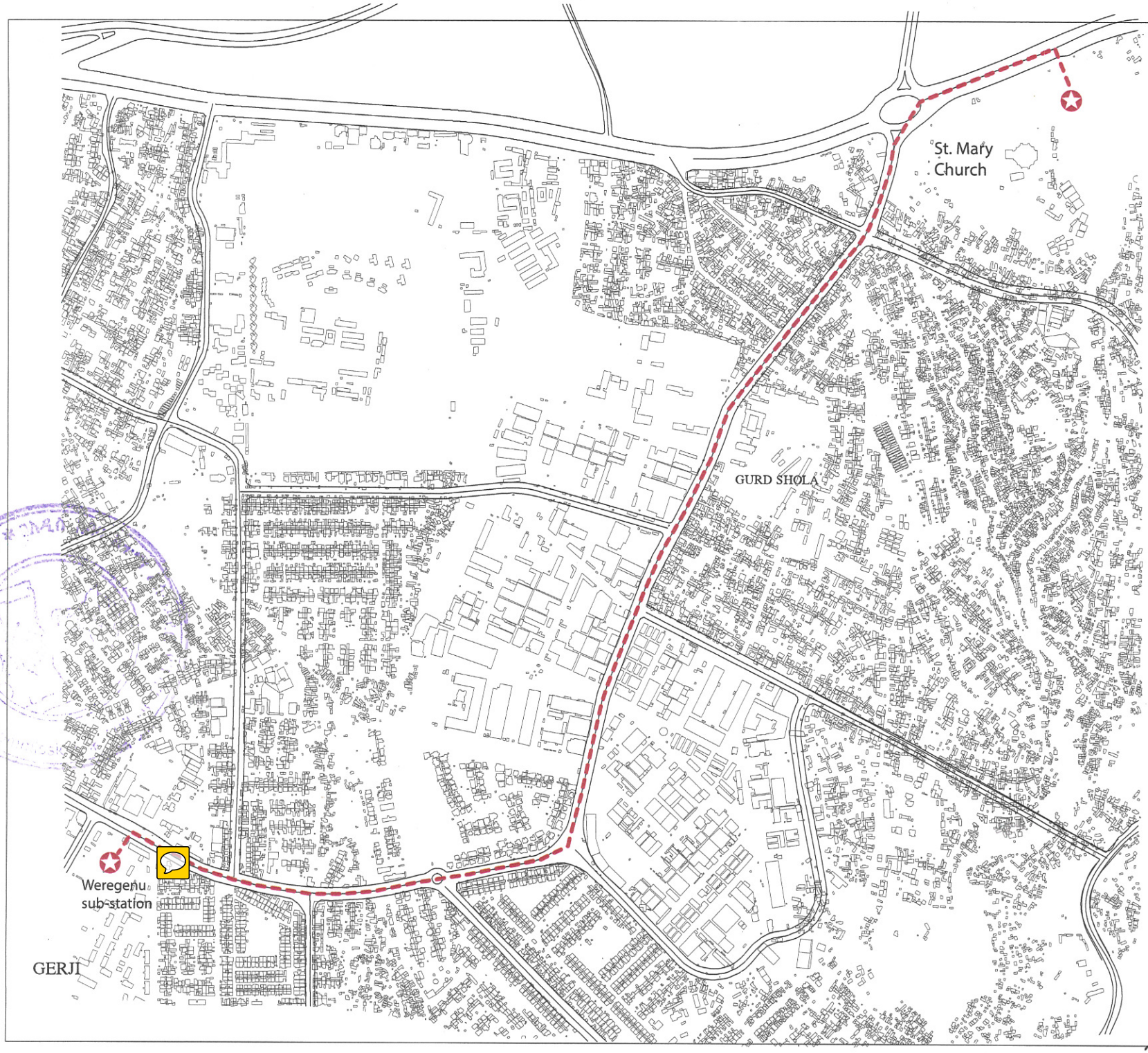
መግለጫ

Option-1 Sub-Station

Option-2 Sub-Station

Scale:- to fit

14/9/10



የአዲስ አበባ ከተማ አስተዳደር ፕላን ኮሚሽን
Addis Ababa City Government Plan Commission

Title;- Selected
Underground Cabel Route

መግለጫ

Option-1or 2

Sub-Station

Date-08/09/2010

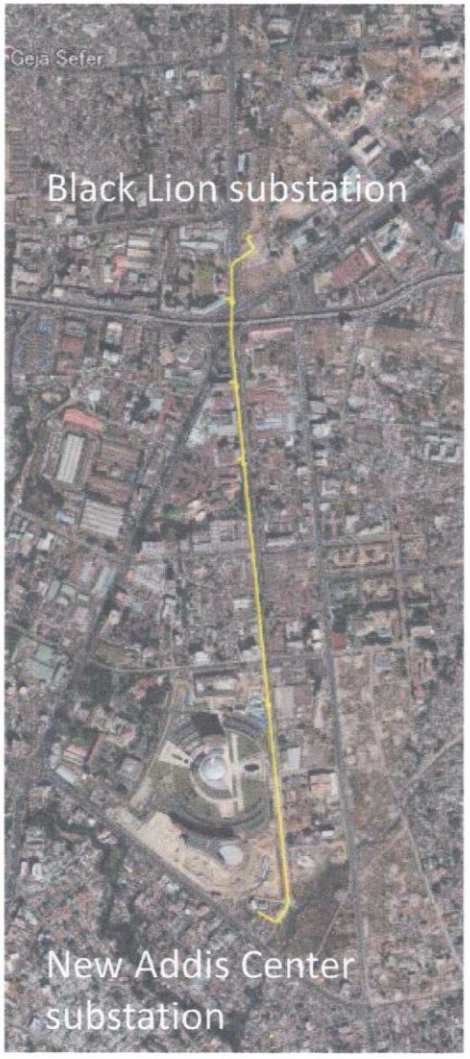
Scale:- to fit

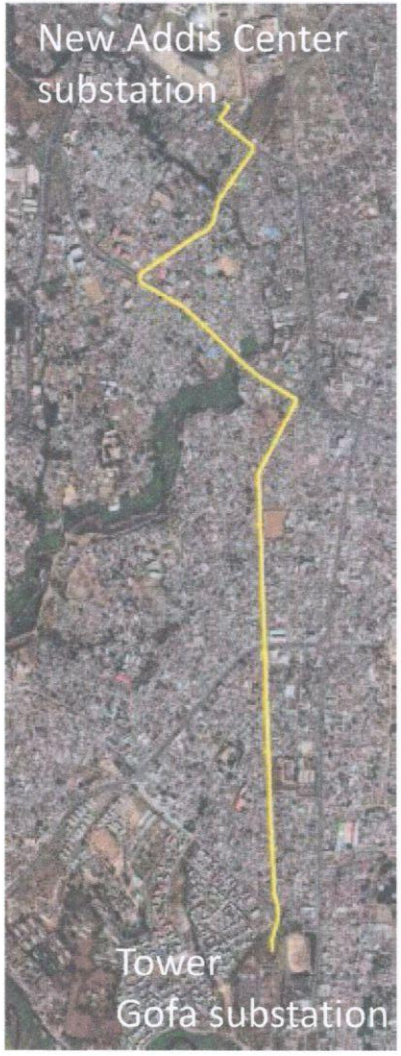
14/9/10

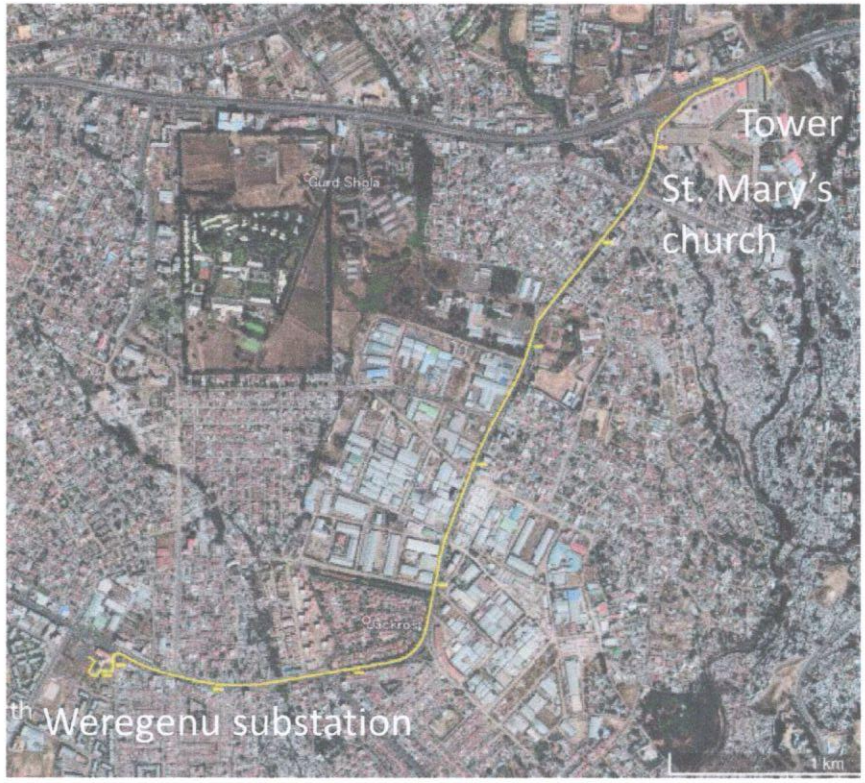
Preparatory Survey on Addis Ababa Transmission and Distribution System

June 2018

Ethiopia Electric Power agrees with the underground cable routes proposed by JICA survey team as the results of the preparatory survey. JICA survey team will prepare the final report based on them.







Ethiopian Electric Power

Project Manager _____

JICA survey team

Team Leader _____

Preparatory Survey on Addis Ababa Transmission and Distribution System

June 2018

Ethiopia Electric Power agrees with the demarcations for the work related to the median strip which are proposed by JICA survey team.

Items	Ethiopian side	Contractor side
Remove obstacles and all trees prior to the installation work of conduit system	✓	
Demolish existing median strips		✓
Recover median strip by a pavement, post the installation work of the conduit system		✓
Restore the median strips structure as the original		✓

Ethiopian Electric Power

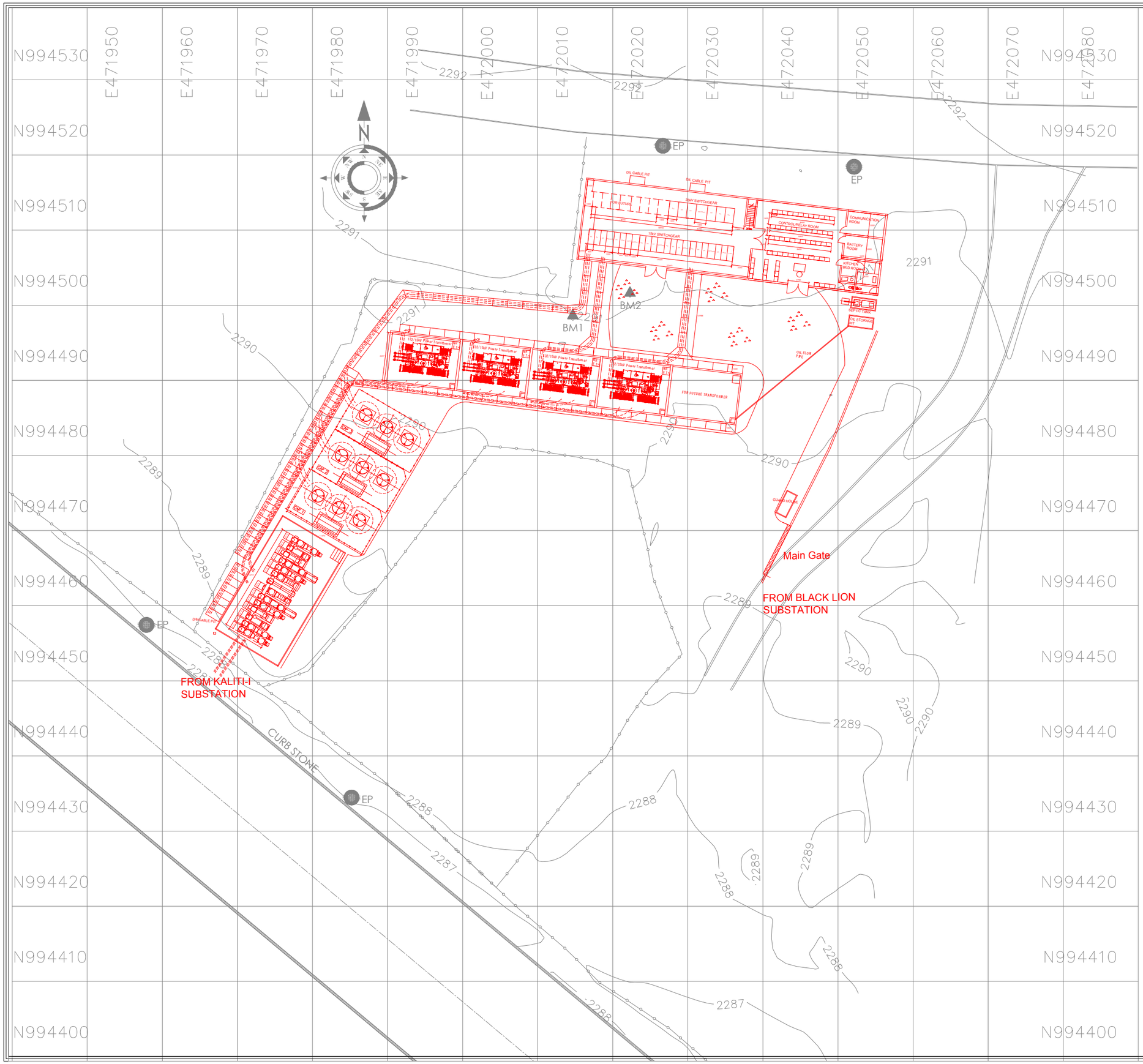
Project Manager _____

JICA survey team

Team Leader _____

APPENDIX-8

E TOPOGRAPHIC DRAWINGS OF SUBSTATION



LEGEND

- MAJOR CONTOUR
- MINOR CONTOUR
- ASPHALT ROAD
- BENCHMARK
- ELECTRIC POLE
- EXISTING HOUSE
- FENCE
- CURB STONE
- ACCESS ROAD

NOTE
Coordinate System
WGS 84

CLIENT:
NEWJEC Inc

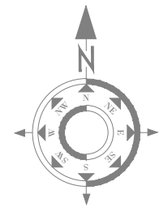
PROJECT:
Addis Ababa Transmission and Distribution System Rehabilitation and Upgrading Project

DRAWING TITLE:	STATUS:
Topographic Map of Project Area Addis Center	FINAL

DRAWING NUMBER:	SCALE:	DATE:
DN AC-1-3	1:500	JUNE 2018

DESIGNED BY:	MS Consultancy
CAD BY:	MS Consultancy
CHECKED BY:	MS Consultancy
APPROVED BY:	MS Consultancy

CONSULTANT:
MS CONSULTANCY



LEGEND

- Major Contour
- Minor Contour
- Walk Way
- Retaining Wall
- Current Transformer (CT)
- Fence
- Bench Mark
- Electric Pole
- Houses
- Boundary
- Gantry Tower (G)
- Box
- Lighting A-resistor
- Insulator (IN)
- Voltag Transformer
- Breaker
- Disconnector
- Rail
- High Voltage transformer (HVT)
- Side Cabinet (K)
- Cable Duct
- Access Road

NOTE
Coordinate System
WGS 84

CLIENT:

NEWJEC Inc

PROJECT:

Addis Ababa Transmission and Distribution System Rehabilitation and Upgrading Project

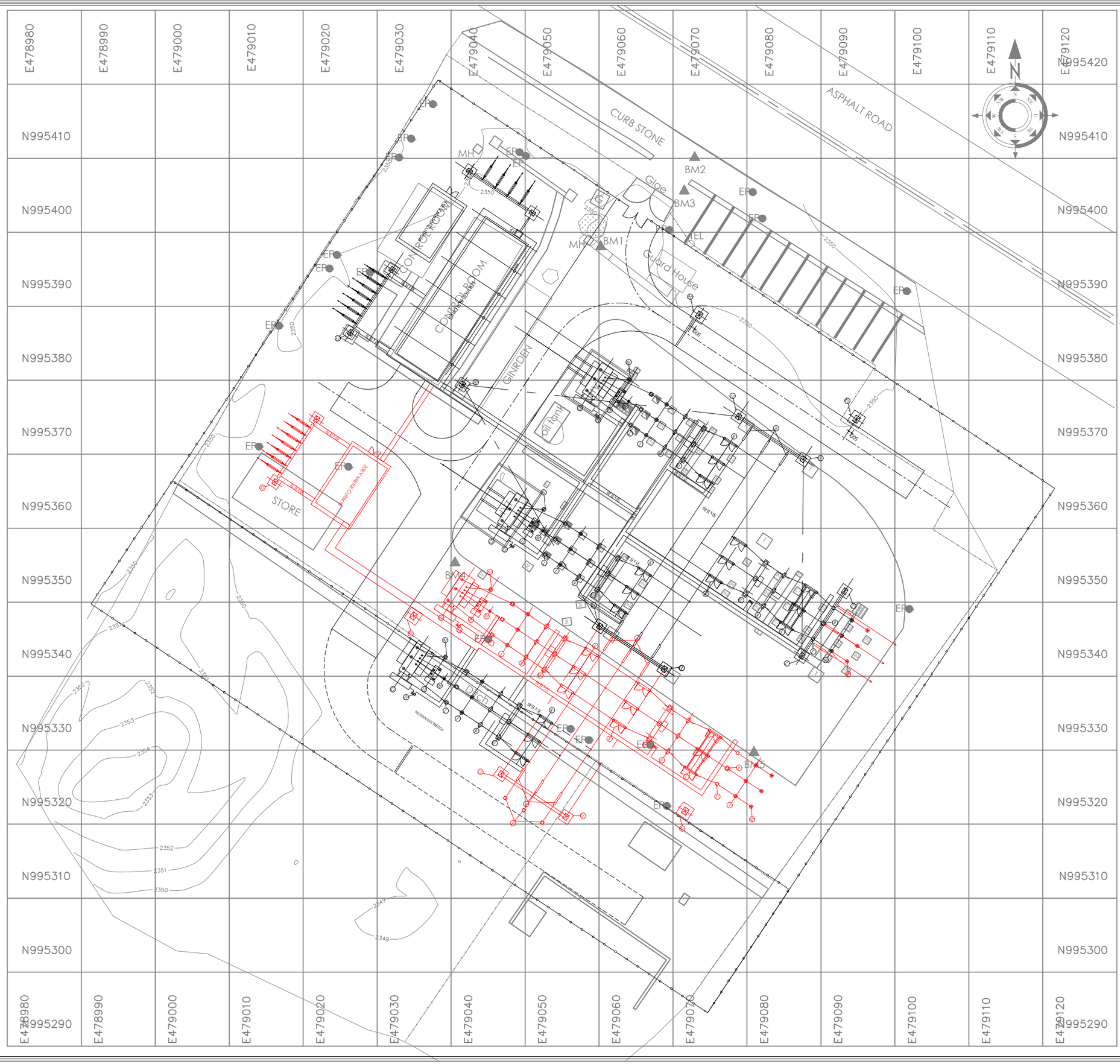
DRAWING TITLE:	STATUS:
Topographic Map of Project Area Addis North	*FINAL*

DRAWING NUMBER:	SCALE:	DATE:
DN AN -1-4	*1:500*	*JUNE 2018*

DESIGNED BY:	MS Consultancy
CAD BY:	MS Consultancy
CHECKED BY:	MS Consultancy
APPROVED BY:	MS Consultancy

CONSULTANT:

MS CONSULTANCY



LEGEND

- Major Contour
- Minor Contour
- Curb Stone
- Manhole (M)
- Current Transformer (CT)
- Fence
- Bench Mark
- Electric Pole
- Houses
- Boundary
- Gantry Tower (G)
- Insulator (IN)
- Tower (T)
- Breaker
- Disconnector
- High Voltage Transformer (HVT)
- Cable Duct
- Ex.Footings
- Asphalt Road

Coordinate System
WGS 84

CLIENT:

NEWJEC Inc

PROJECT:

Addis Ababa Transmission and Distribution System Rehabilitation and Upgrading Project

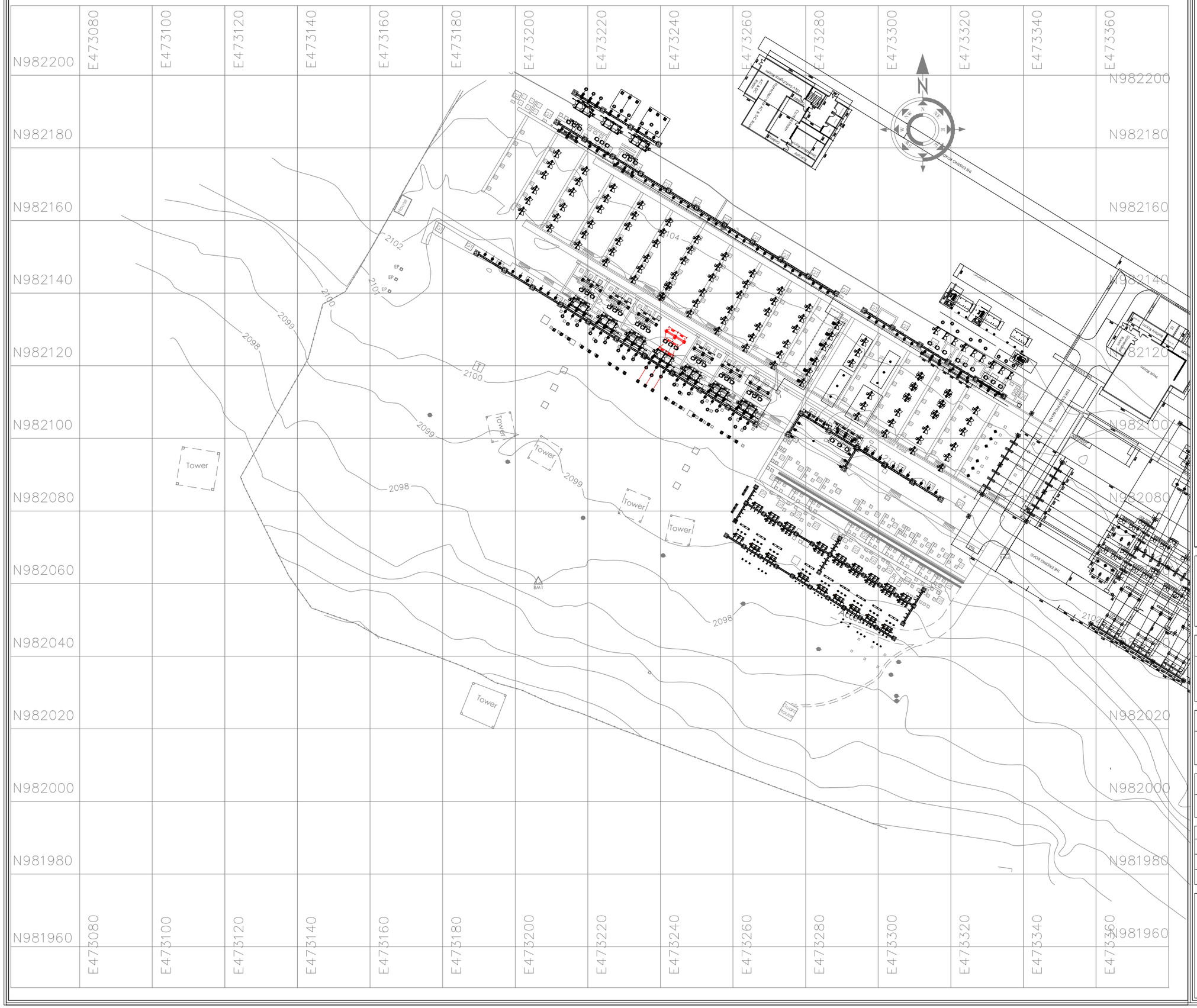
DRAWING TITLE:	**STATUS:**
Topographic Map of Project Area Wereganu	FINAL

DRAWING NUMBER:	**SCALE:**	**DATE:**
DN WE -1	*1:500*	JULY 2018

DESIGNED BY:	MS Consultancy
CAD BY:	MS Consultancy
CHECKED BY:	MS Consultancy
APPROVED BY:	MS Consultancy

CONSULTANT:

MS CONSULTANCY



LEGEND

- Major Contour
- Minor Contour
- Road
- Cable Duct
- Fence
- Bench Mark
- Electric Pole
- Houses
- Boundary
- Gantry Tower (GT)
- Current Transformer (CT)
- Voltag Transfer (VT)
- Arrester (AR)
- Wave Traper (WT)
- Breaker (BR)
- Disconnector (D)
- Basebar Disconnector (BD)
- Marsheling Kiosk (K)

NOTE
Coordinate System
WGS 84

CLIENT:
NEWJEC Inc

PROJECT:
Addis Ababa Transmission and Distribution System Rehabilitation and Upgrading Project

DRAWING TITLE:	**STATUS:**
Topographic Map of Project Area Kality	FINAL

DRAWING NUMBER:	**SCALE:**	**DATE:**
DN KA-2/2	1:1000	JUNE 2018

DESIGNED BY:	MS Consultancy
CAD BY:	MS Consultancy
CHECKED BY:	MS Consultancy
APPROVED BY:	MS Consultancy

CONSULTANT:
MS CONSULTANCY