GENERAL

BUILDING AREA	733.56 m2
TOTAL FLOOR AREA	1,013.37 m2
UNDER GROUND STRUCTURE	REINFORCED CONCRETE CONSTRUCTION
UPPER GROUND STRUCTURE	REINFORCED CONCRETE CONSTRUCTION
ALLOWABLE BEARING CAPACITY	100kN/m2 (assumed)

EXTERIOR FINISHING SCHEDULE

LOCATION	SPECIFICATION
BASEBOARD	CONCRETE STEEL TROWEL + WATER-PROOF COATING PROTECTION CONCRETE t=60mm WITH WIRE MESH
WALL	CONCRETE BLOCK t=200mm PAINT FINISH ON MORTAR
BASEBOARD	EXPOSED CONCRETE
INDUCATION SEAM SEAL	POLYURETHANE 15x10
CONSTRUCTION JOINT SEAL	POLYURETHANE 15x10

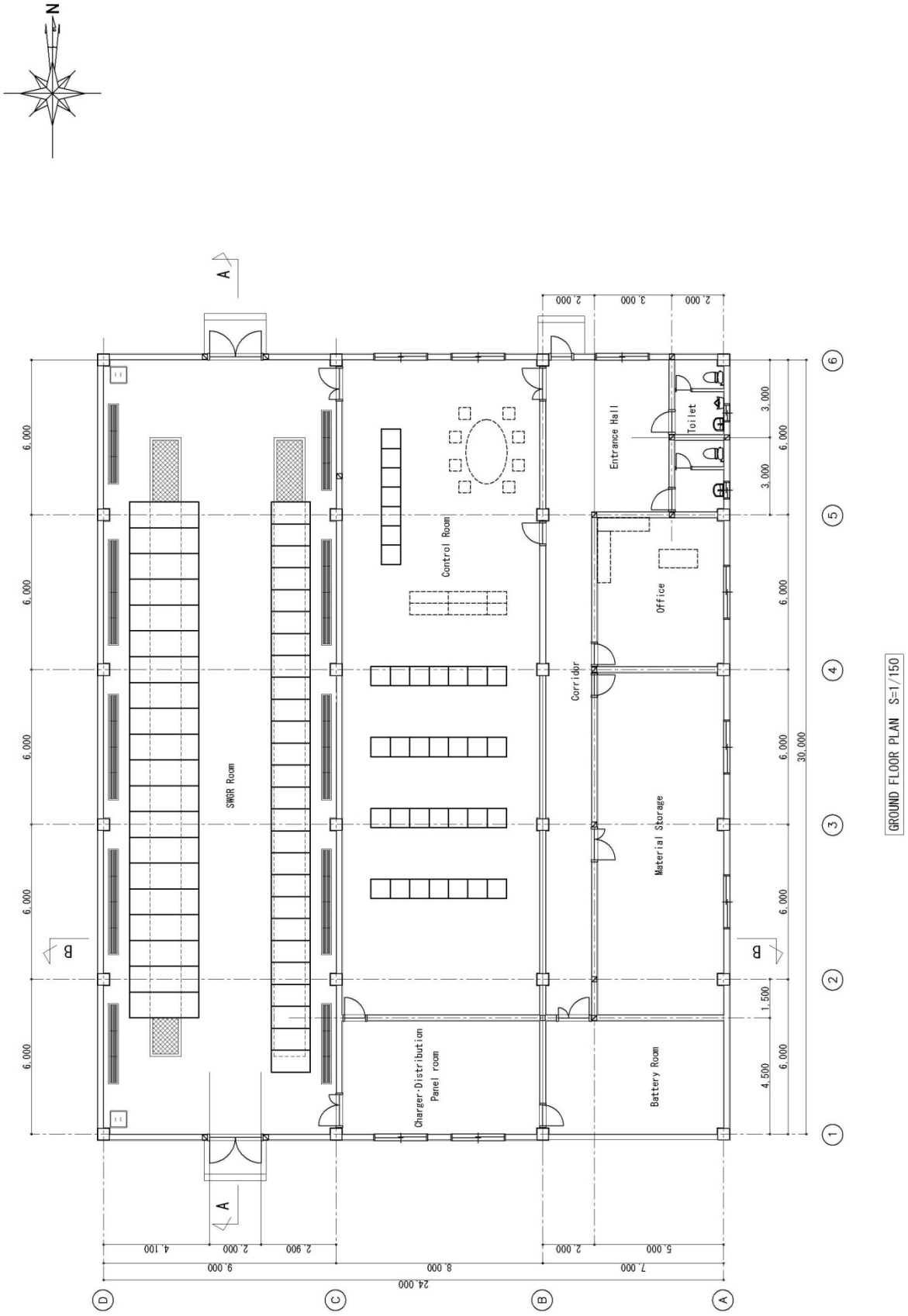
INTERIOR FINISHING SCHEDULE

ROOM NAME	FLOOR	BASEBOARD	WALL	CEILING	CEILING HEIGHT	REMARKS
CABLE PIT ROOM	CONCRETE STEEL TROWEL	EXPOSED CONCRETE H=150	EXPOSED CONCRETE BLOCK t=100 MEAKUP MASONRY	EXPOSED CONCRETE SLAB	2,200	STEEL LADDER
ENTRANCE HALL	PORCELAIN TILE 300 X 300 (NON-SLIP TYPE)	MORTAR FINISH H=100	EP PAITING FINISH ON MORTAR	DECORATED PLASTER BOARD WITH INSULATION	2,800	
CORRIDOR	PORCELAIN TILE 300 X 300 (NON-SLIP TYPE)	MORTAR FINISH H=100	EP PAITING FINISH ON MORTAR	DECORATED PLASTER BOARD WITH INSULATION	2,800	
OFFICE	PORCELAIN TILE 300 X 300 (NON-SLIP TYPE)	MORTAR FINISH H=100	EP PAITING FINISH ON MORTAR	DECORATED PLASTER BOARD WITH INSULATION	2,800	AIR-CONDITINOR.VENTILATION
CONTROL ROOM	FREE ACCESS FLOOR H=300 CHARGING WITH ELECTRICITY PREVENTION VINYL TILE	MORTAR FINISH H=100	EP PAITING FINISH ON MORTAR	DECORATED PLASTER BOARD WITH INSULATION	3,000	AIR-CONDITINOR.VENTILATION
SWGR ROOM	NON-SLIP PAINTING FINSH ON MORTAR	MORTAR FINISH H=100	EP PAITING FINISH ON MORTAR	DECORATED PLASTER BOARD WITH INSULATION	4,000	FLOOR HACTH.AIR-CONDITIONOR.VENTILATION VENTILATION HOLE(GRATING COVER)
PANEL ROOM	NON-SLIP PAINTING FINSH ON MORTAR	MORTAR FINISH H=100	EP PAITING FINISH ON MORTAR	DECORATED PLASTER BOARD WITH INSULATION	3,000	VENTILATION
BATTERY ROOM	ACID RESISTING PAINTING FINSH ON MORTAR	MORTAR FINISH H=100	EP PAITING FINISH ON MORTAR	EXPOSED CONCRETE SLAB PAINTING FINISH	3,550	VENTILATION
MATERIALL STORAGE	MORTAR STEEL TROWEL	MORTAR FINISH H=100	EP PAITING FINISH ON MORTAR	EXPOSED CONCRETE SLAB PAINTING FINISH	3,550	VENTILATION
TOILET	PORCELAIN TILE 300 X 300 (NON-SLIP TYPE)	——	PORCELAIN TILE 300 X 300	DECORATED PLASTER BOARD WITH INSULATION	2,400	STOOL DEVICE (WESTERN-STYLE), URINAL WASHBOWL, VENTILATION

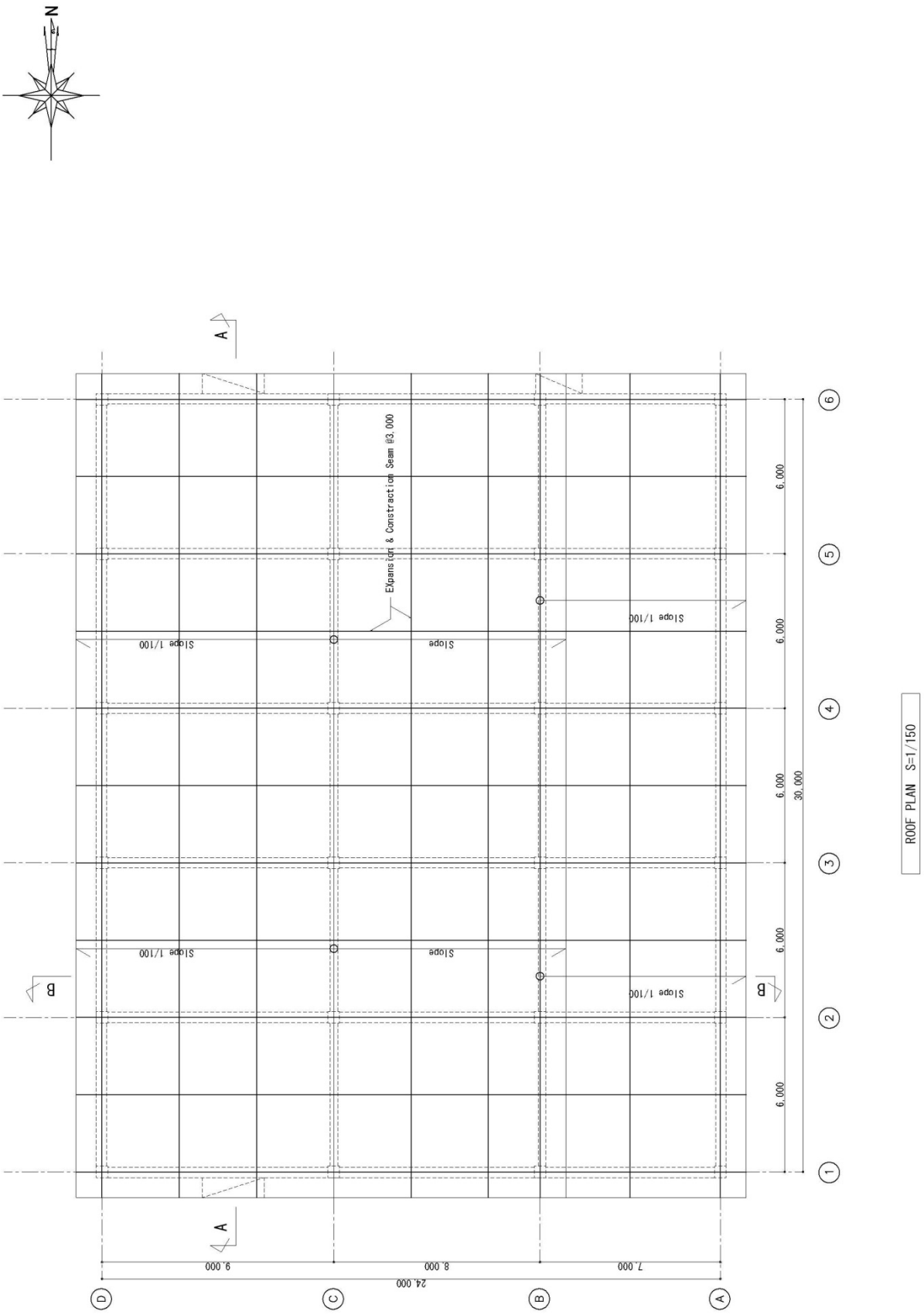
DWG No. SS-A-01

Finishing Schedule for Ilala Substation

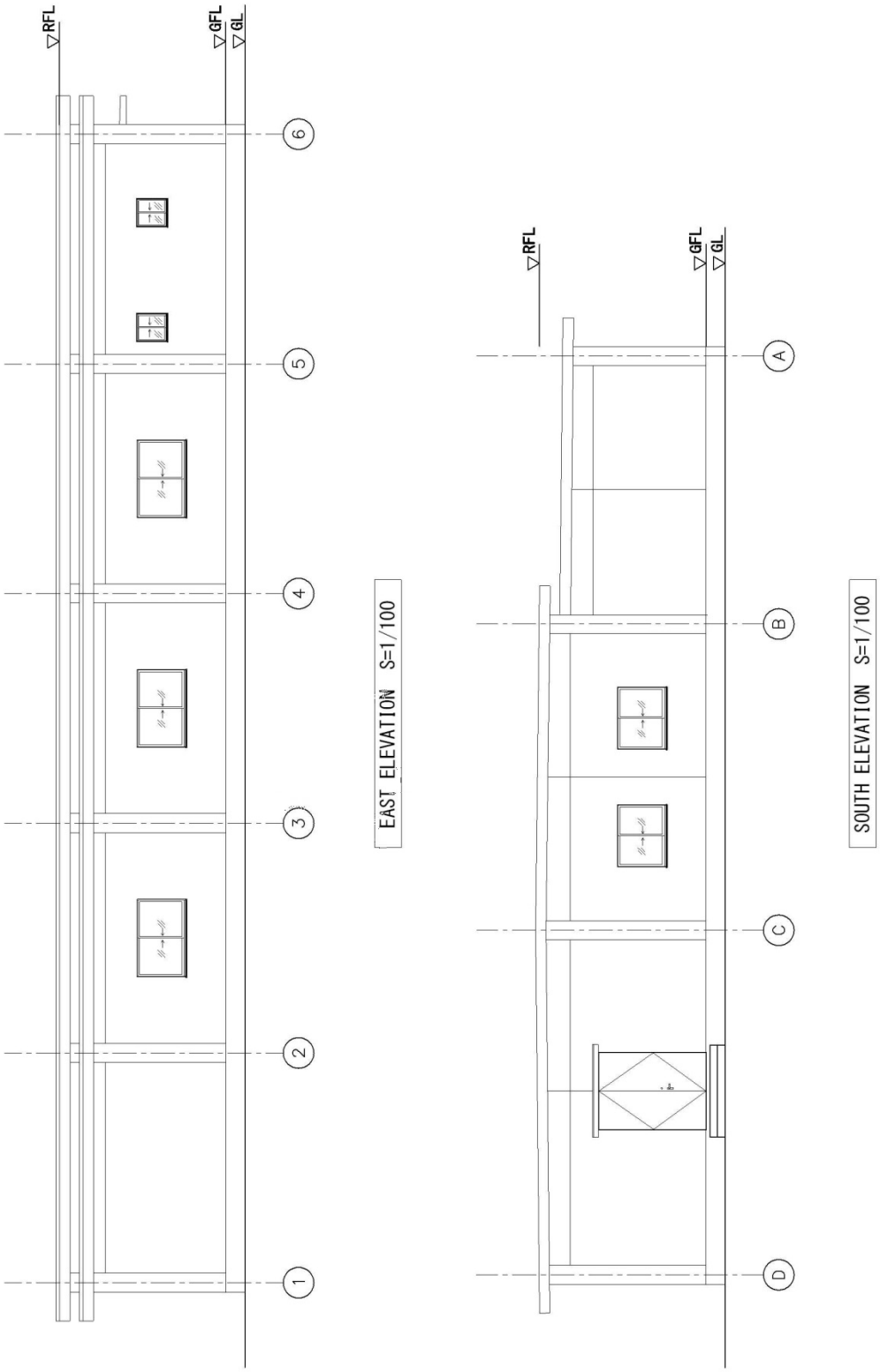
イララ変電所　仕上表



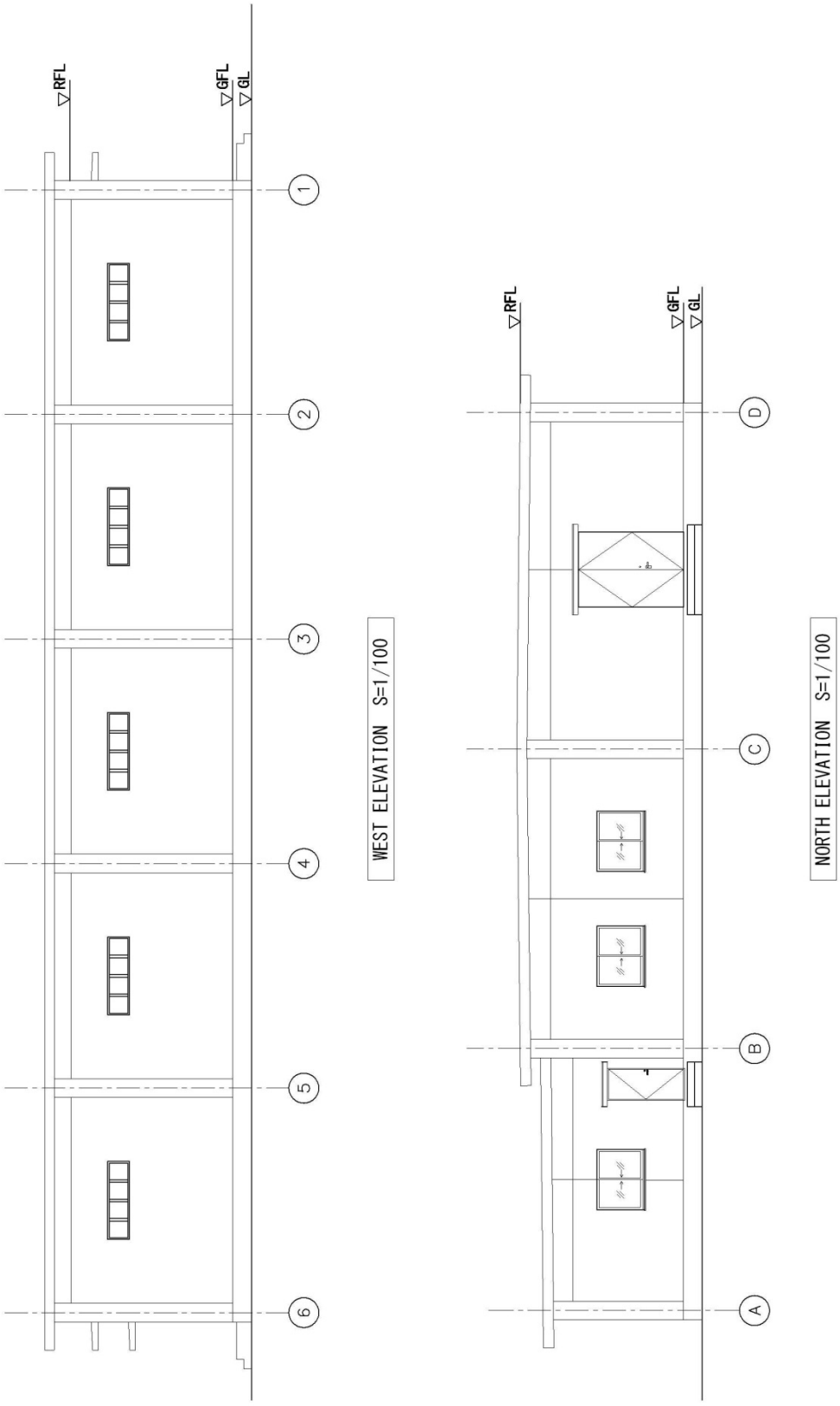
DWG No. SS-A-02
Ground Floor Plan for Ilala Substation
イララ変電所　平面図（Ground Floor Plan）



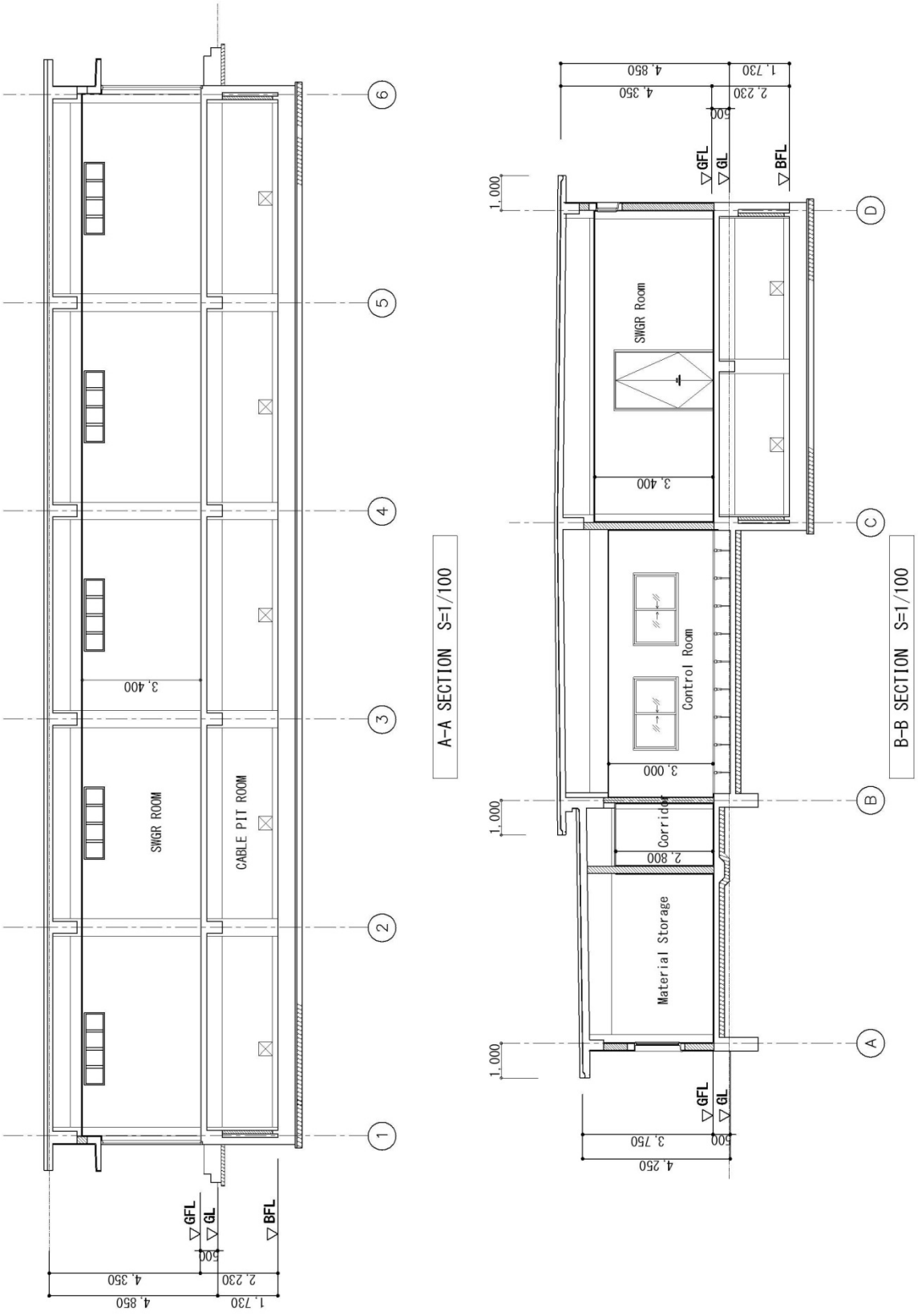
DWG No. SS-A-03
Roof Plan for Ilala Substation
イララ変電所　平面図（Roof Plan）



DWG NO. SS-A-04
Elevation Plan for Ilala Substation
イララ変電所　立面図（1）



DWG NO. SS-A-05
Elevation Plan for Ilala Substation
イララ変電所　立面図（2）



DWG NO. SS-A-06
Sectional Plan for Ilala Substation
イララ変電所　断面図

GENERAL

BUILDING AREA	168.81 m2
TOTAL FLOOR AREA	168.81 m2
UNDER GROUND STRUCTURE	REINFORCED CONCRETE CONSTRUCTION
UPPER GROUND STRUCTURE	REINFORCED CONCRETE CONSTRUCTION
ALLOWABLE BEARING CAPACITY	90kN/m2 (assumed)

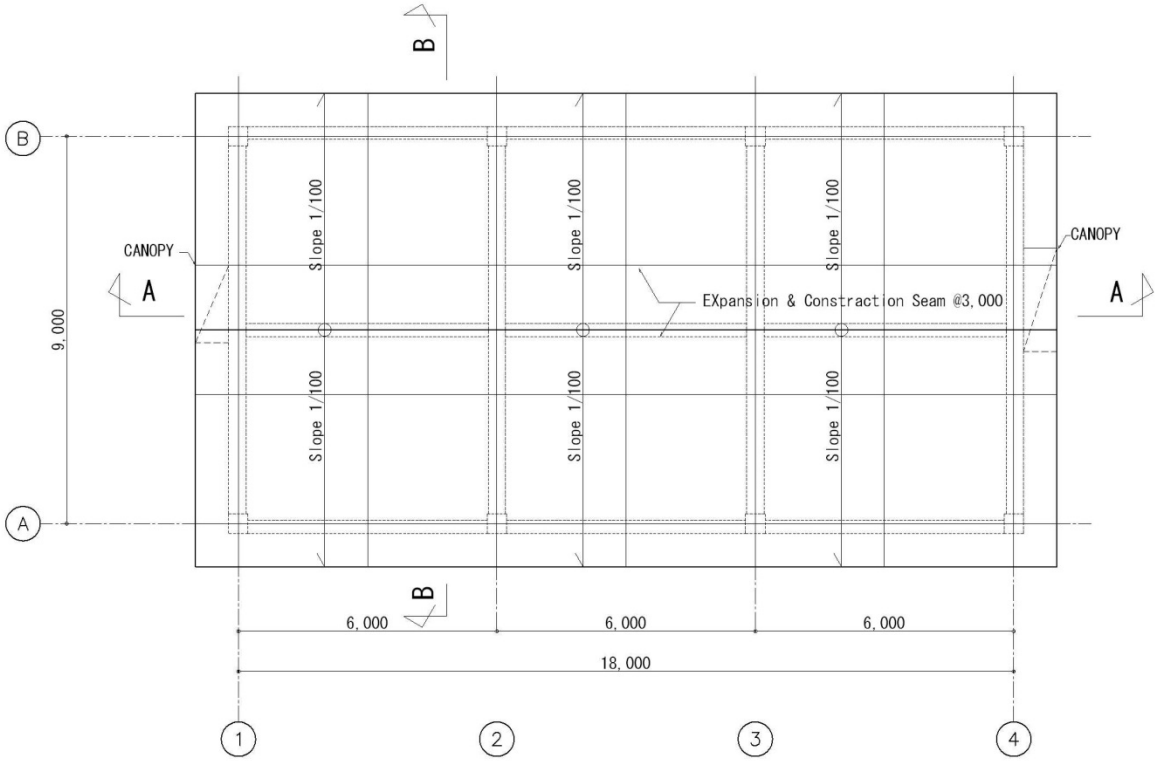
EXTERIOR FINISHING SCHEDULE

LOCATION	SPECIFICATION
BASEBOARD	CONCRETE STEEL TROWEL + WATER-PROOF COATING PROTECTION CONCRETE t=80mm WITH WIRE MESH
WALL	CONCRETE BLOCK t=200mm PAINT FINISH ON MORTAR
BASEBOARD	EXPOSED CONCRETE
INDUCATION SEAM SEAL	POLYURETHANE 15x10
CONSTRUCTION JOINT SEAL	POLYURETHANE 15x10

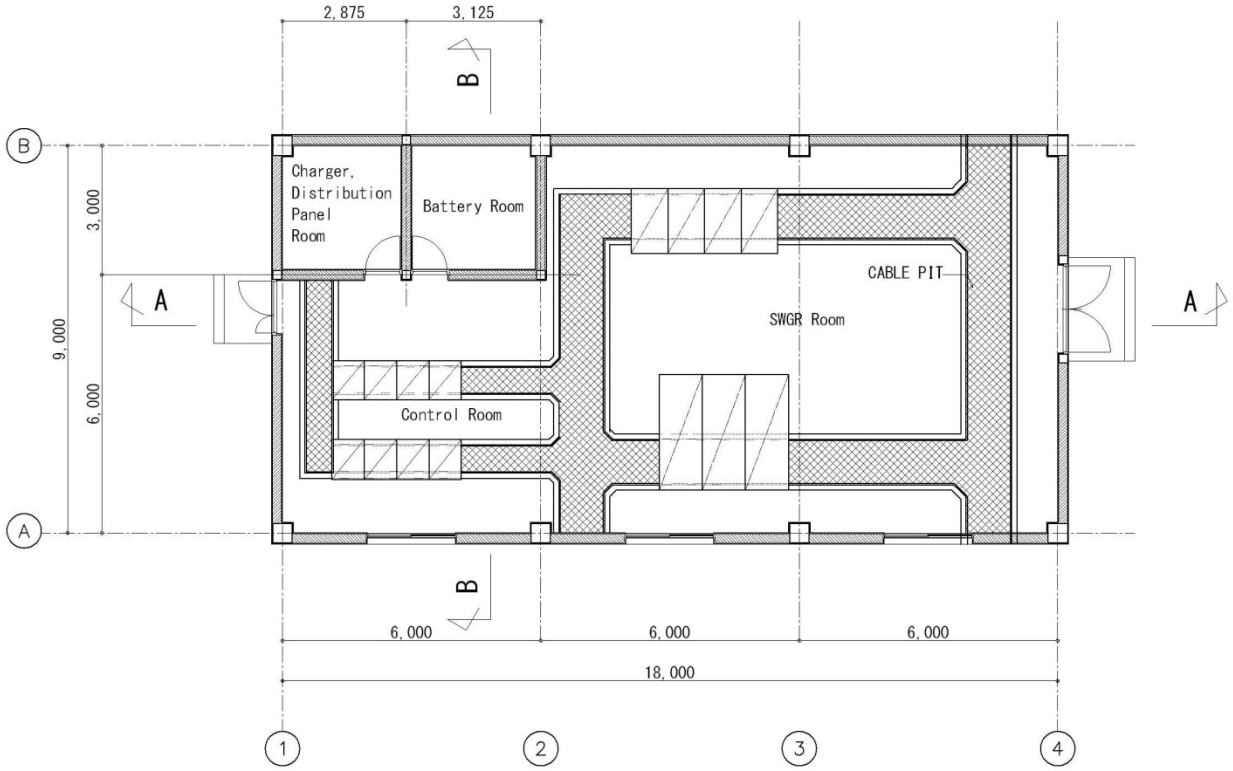
INTERIOR FINISHING SCHEDULE

ROOM NAME	FLOOR	BASEBOARD	WALL	CEILING	CEILING HEIGHT	REMARKS
CONTROL ROOM	NON-SLIP PAINTING FINSH ON MORTAR	MORTAR FINISH H=100	EP PAITING FINISH ON MORTAR	DECORATED PLASTER BOARD WITH INSULATION	3,400	AIR-CONDITINOR, VENTILATION CABLE PIT
SWGR ROOM	NON-SLIP PAINTING FINSH ON MORTAR	MORTAR FINISH H=100	EP PAITING FINISH ON MORTAR	DECORATED PLASTER BOARD WITH INSULATION	3,400	AIR-CONDITINOR, VENTILATION CABLE PIT
PANEL ROOM	NON-SLIP PAINTING FINSH ON MORTAR	MORTAR FINISH H=100	EP PAITING FINISH ON MORTAR	DECORATED PLASTER BOARD WITH INSULATION	3,000	VENTILATION
BATTERY ROOM	ACID RESISTING PAINTING FINSH ON MORTAR	MORTAR FINISH H=100	EP PAITING FINISH ON MORTAR	DECORATED PLASTER BOARD WITH INSULATION	3,000	VENTILATION

DWG No. SS-A-07
Finishing Schedule for 33/11kV Substation
33/11kV 変電所　仕上表

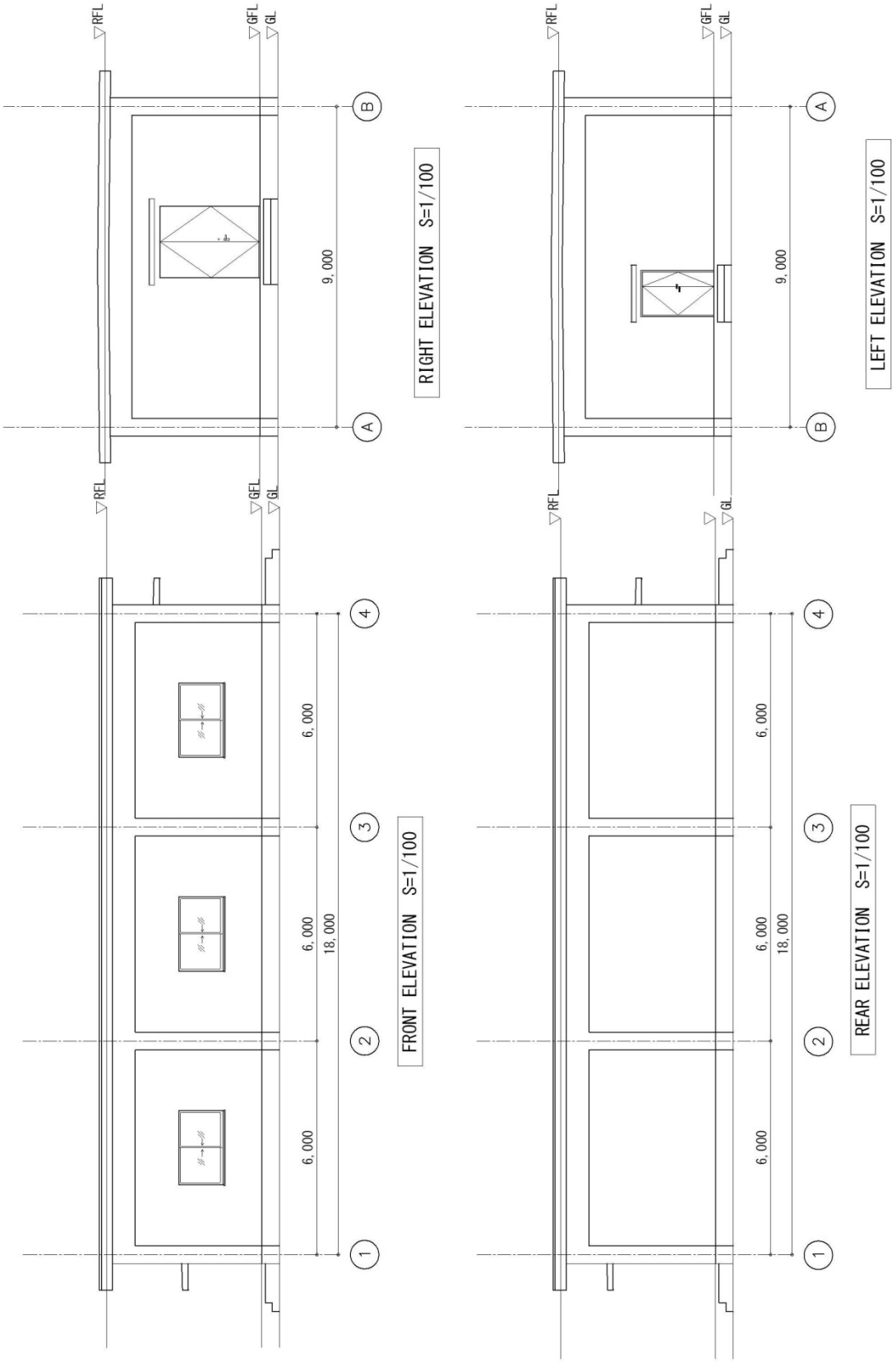


ROOF PLAN S=1/100

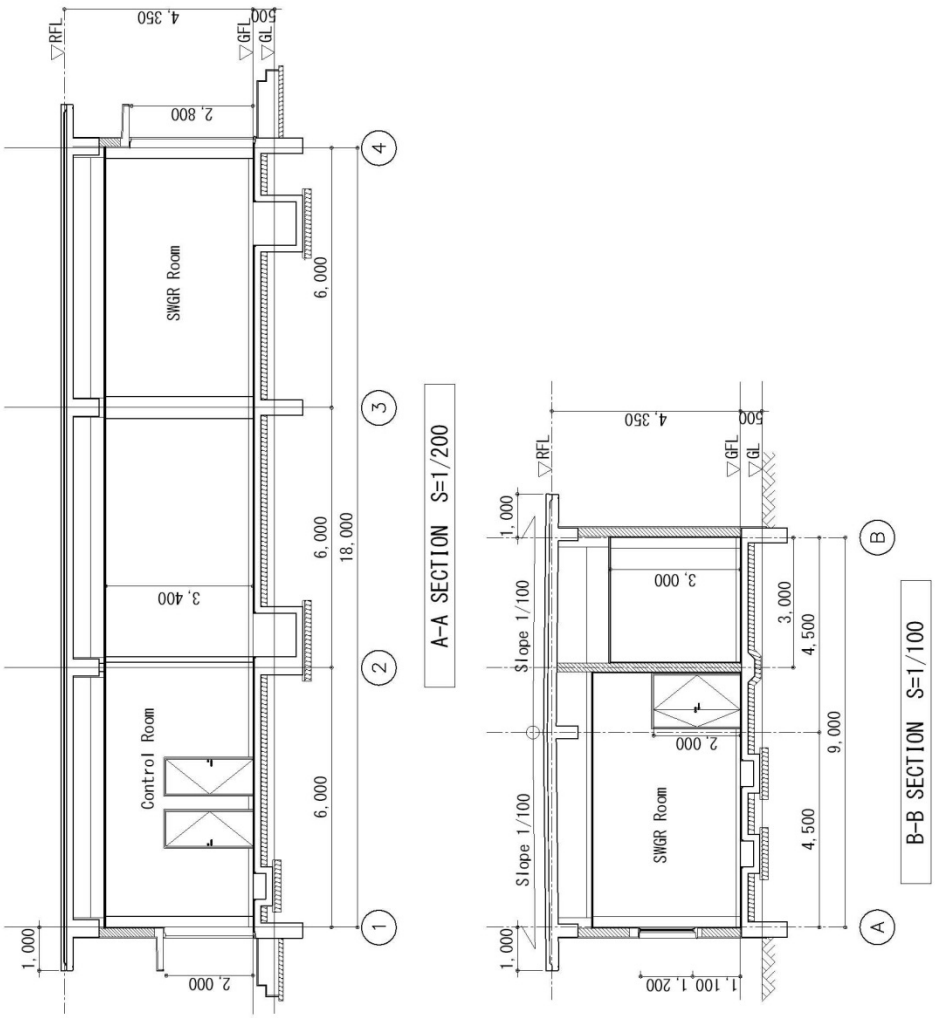


GROUND FLOOR PLAN S=1/100

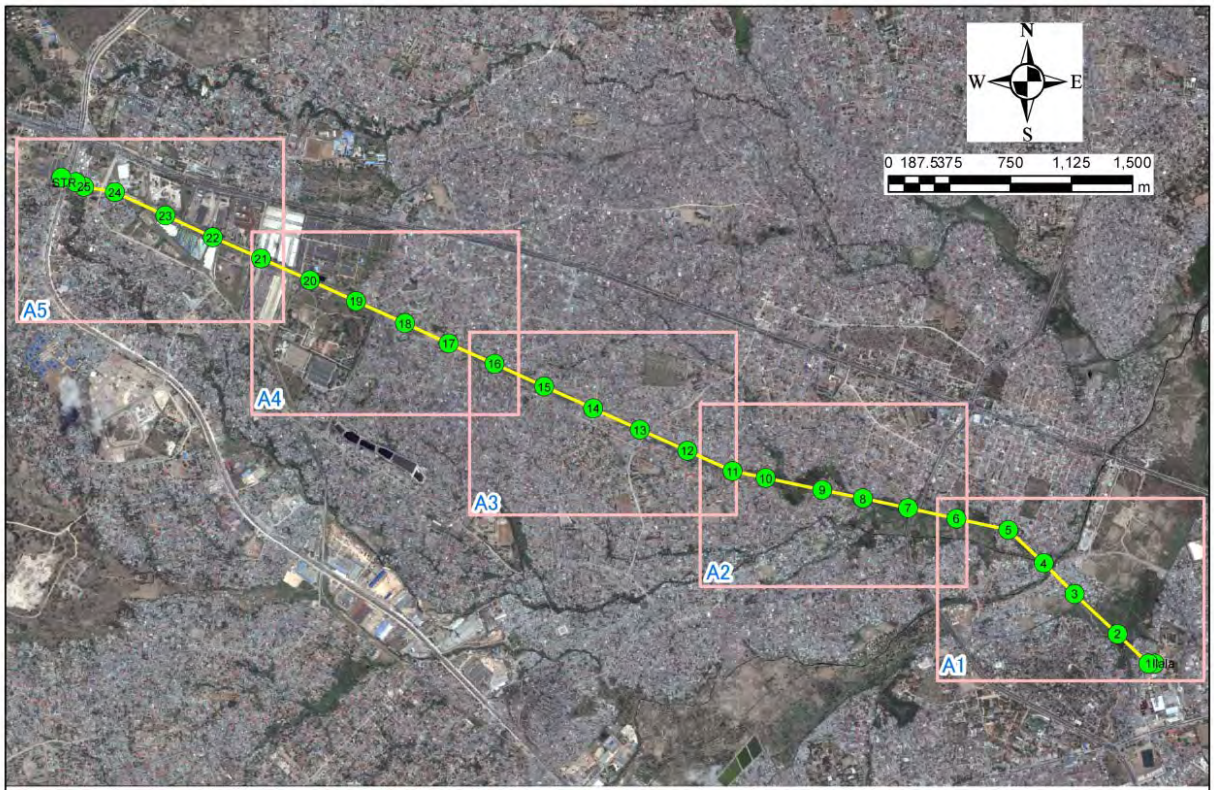
DWG No. SS-A-08
Ground Floor and Roof Plan for 33/11kV Substation
33/11kV 変電所　平面図



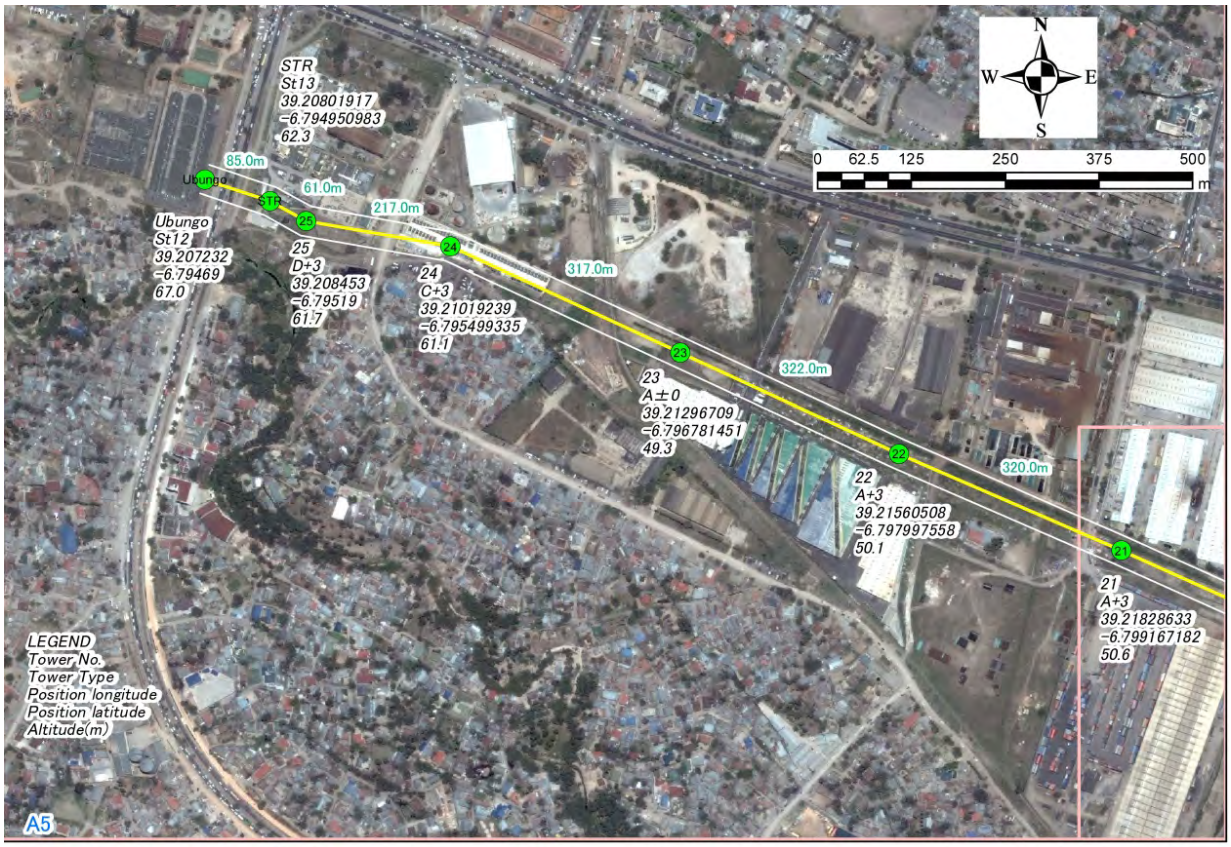
DWG No. SS-A-09
Elevation Plan for 33/11kV Substation
33/11kV 変電所　立面図



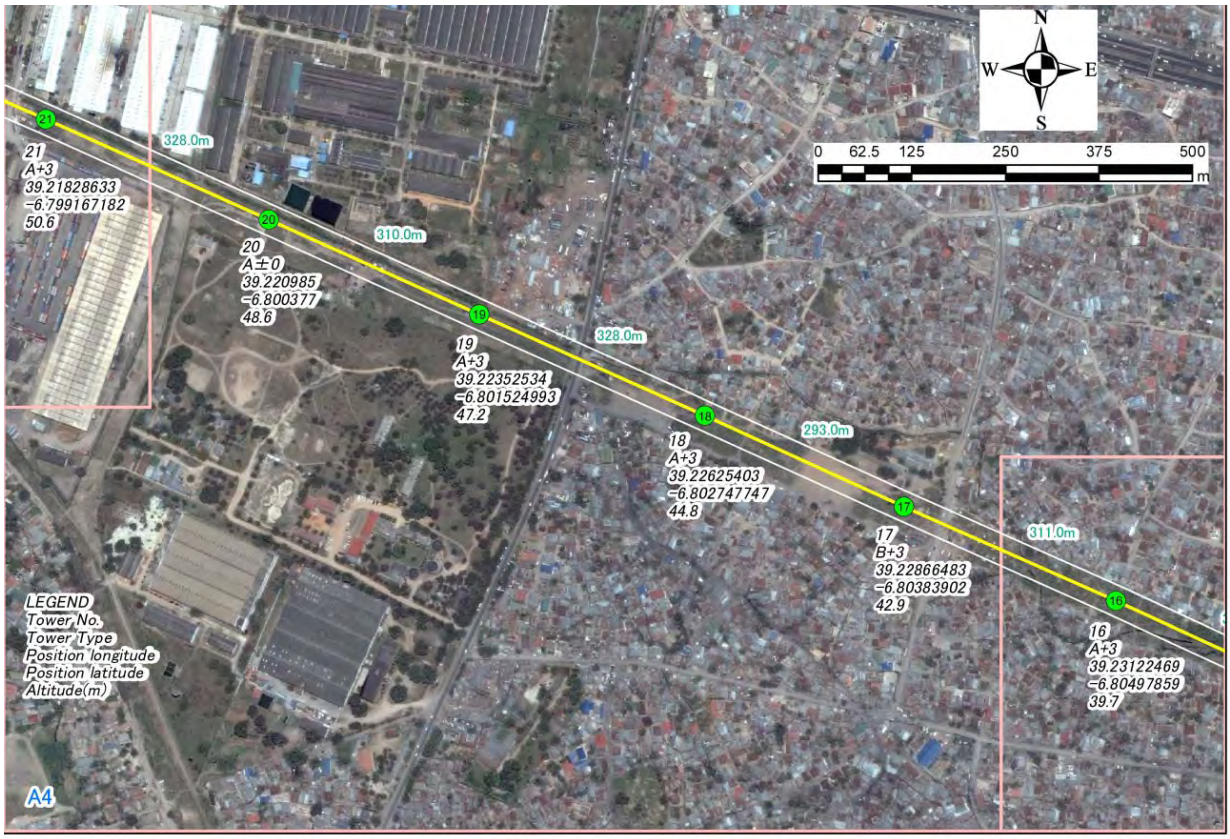
DWG No. SS-A-10
Sectional Plan for 33/11kV Substation
33/11kV 変電所　断面図



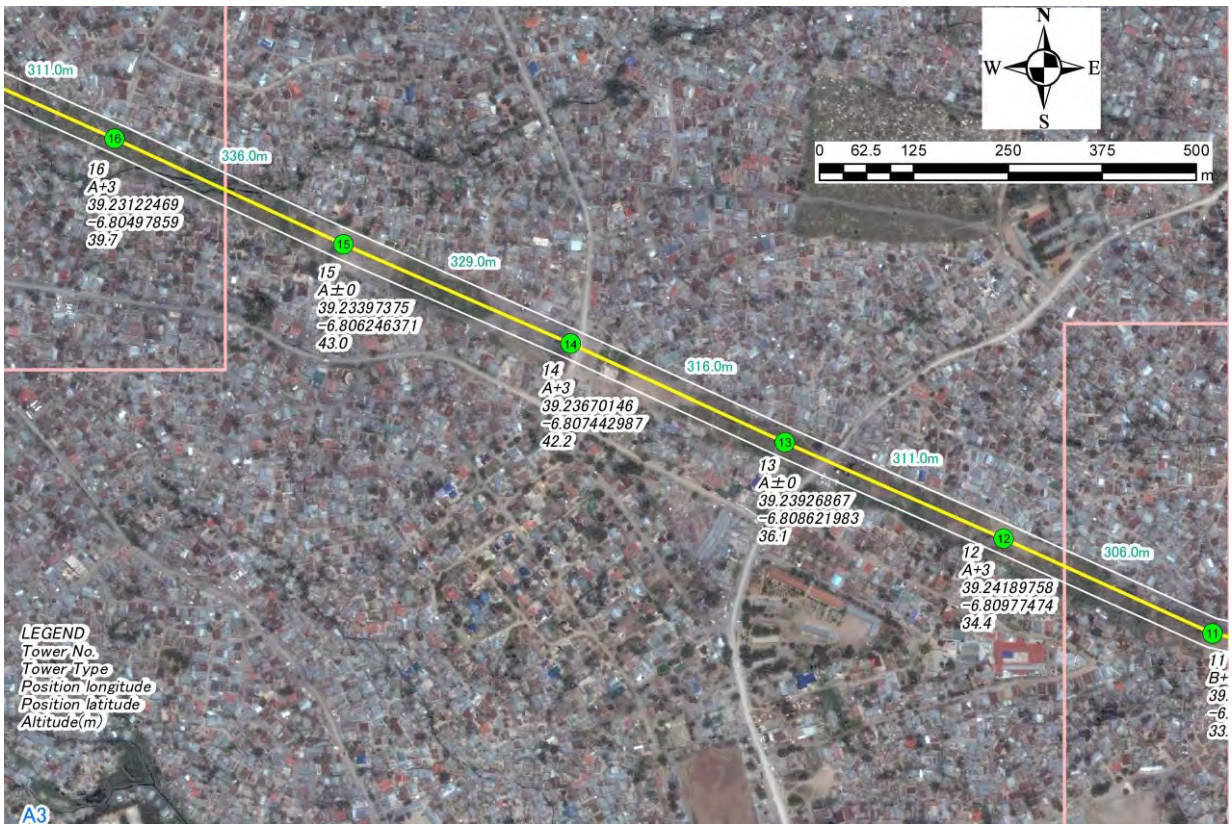
DWG No. TL-01
Route Map of Transmission Line (Key Plan)
送電線ルート図 (Key Plan)



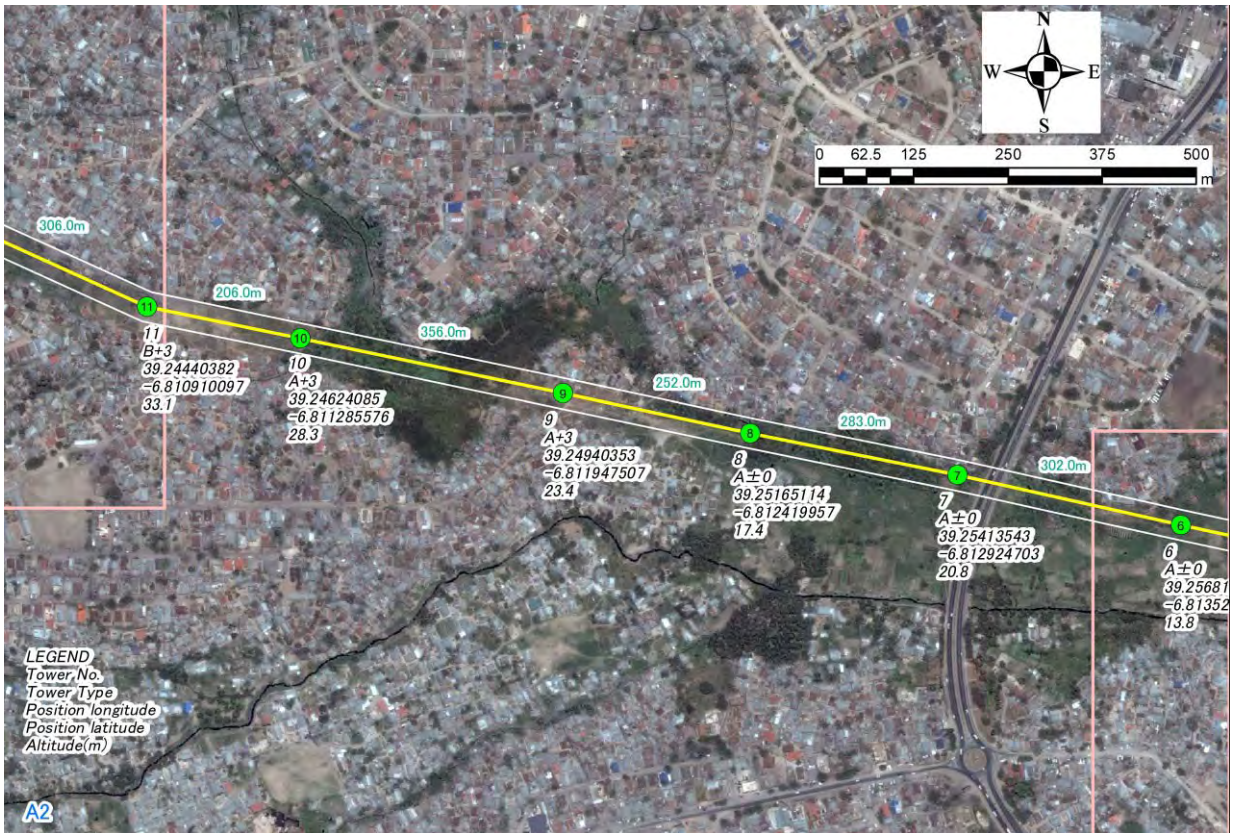
DWG No. TL-01-01
Route Map of Transmission Line -1
送電線ルート図-1



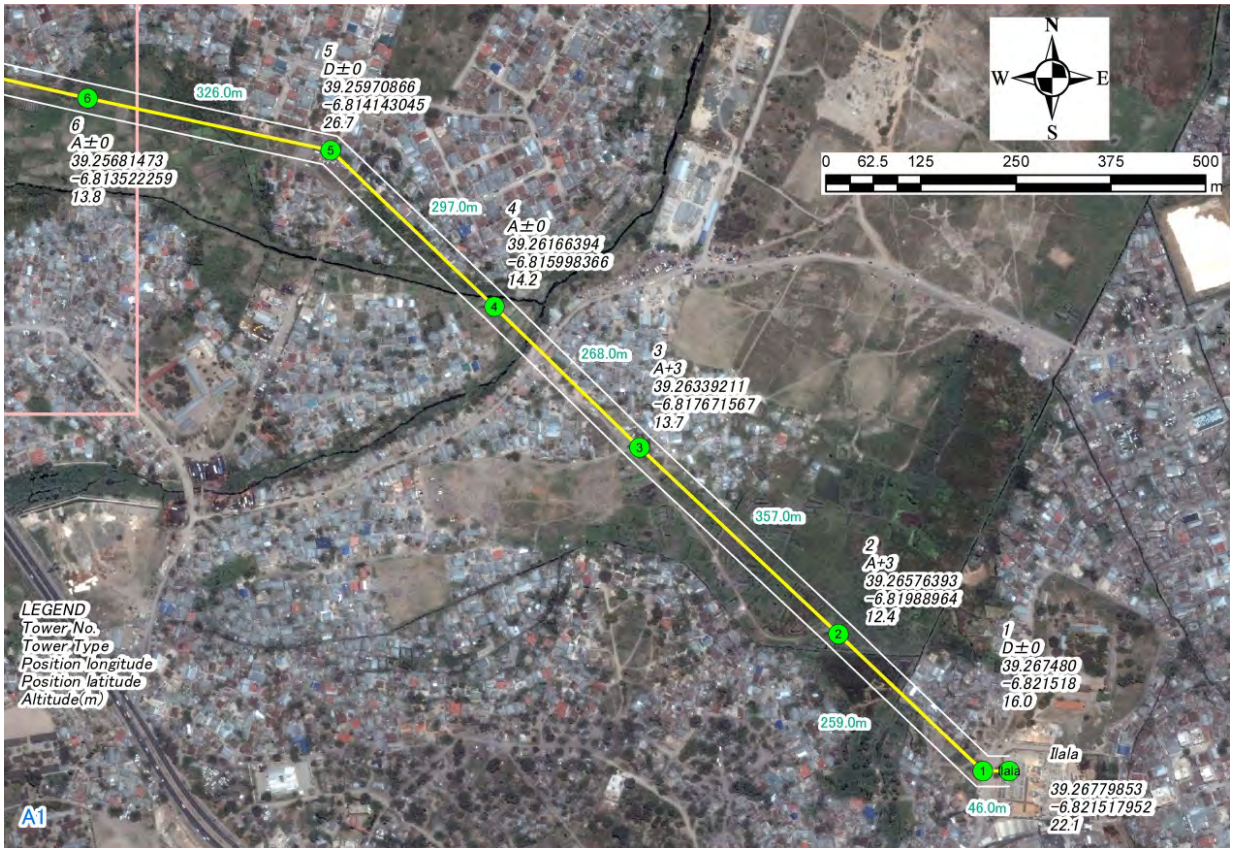
DWG No. TL-01-02
Route Map of Transmission Line -2
送電線ルート図-2



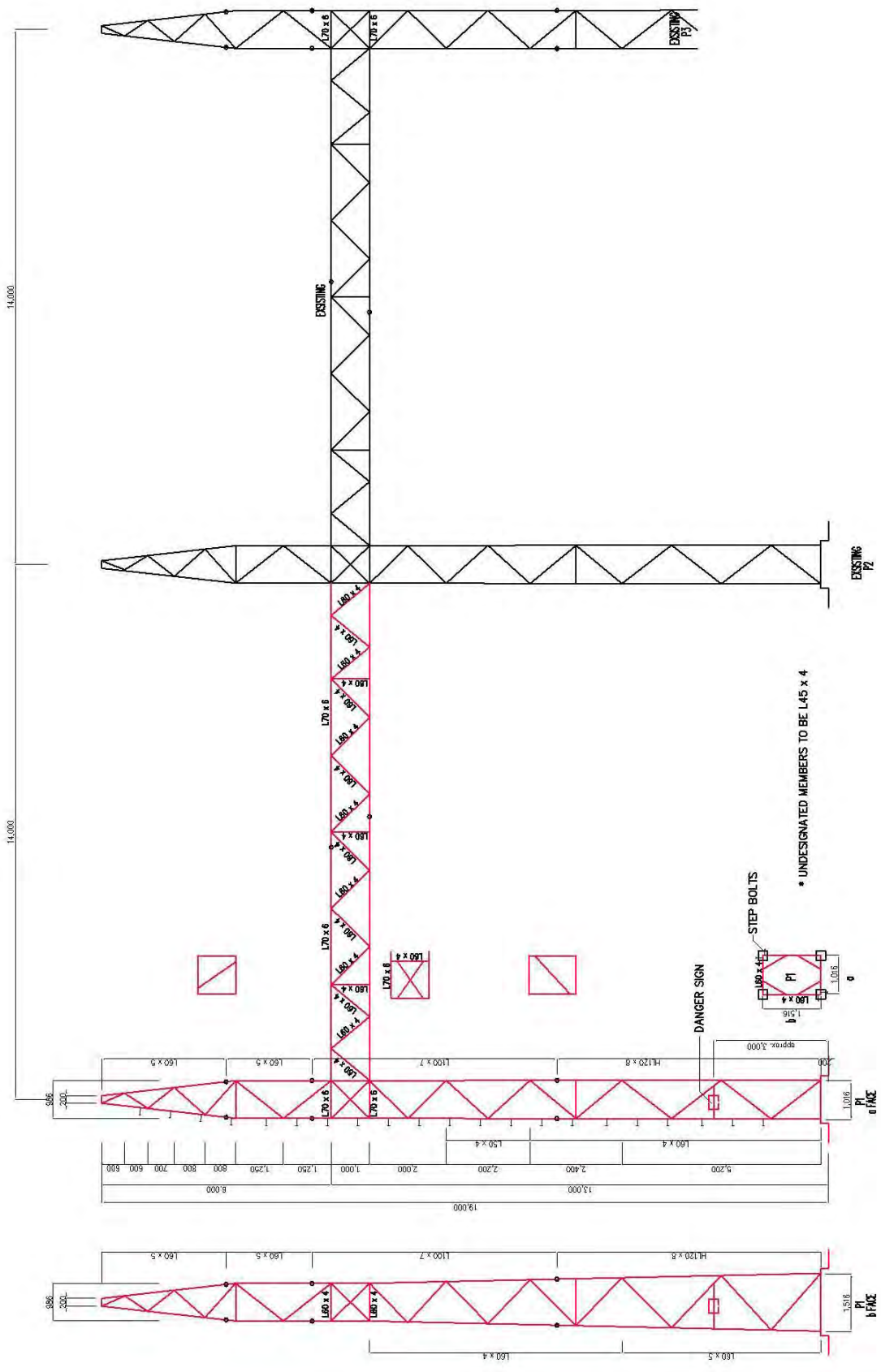
DWG No. TL-01-03
Route Map of Transmission Line -3
送電線ルート図-3



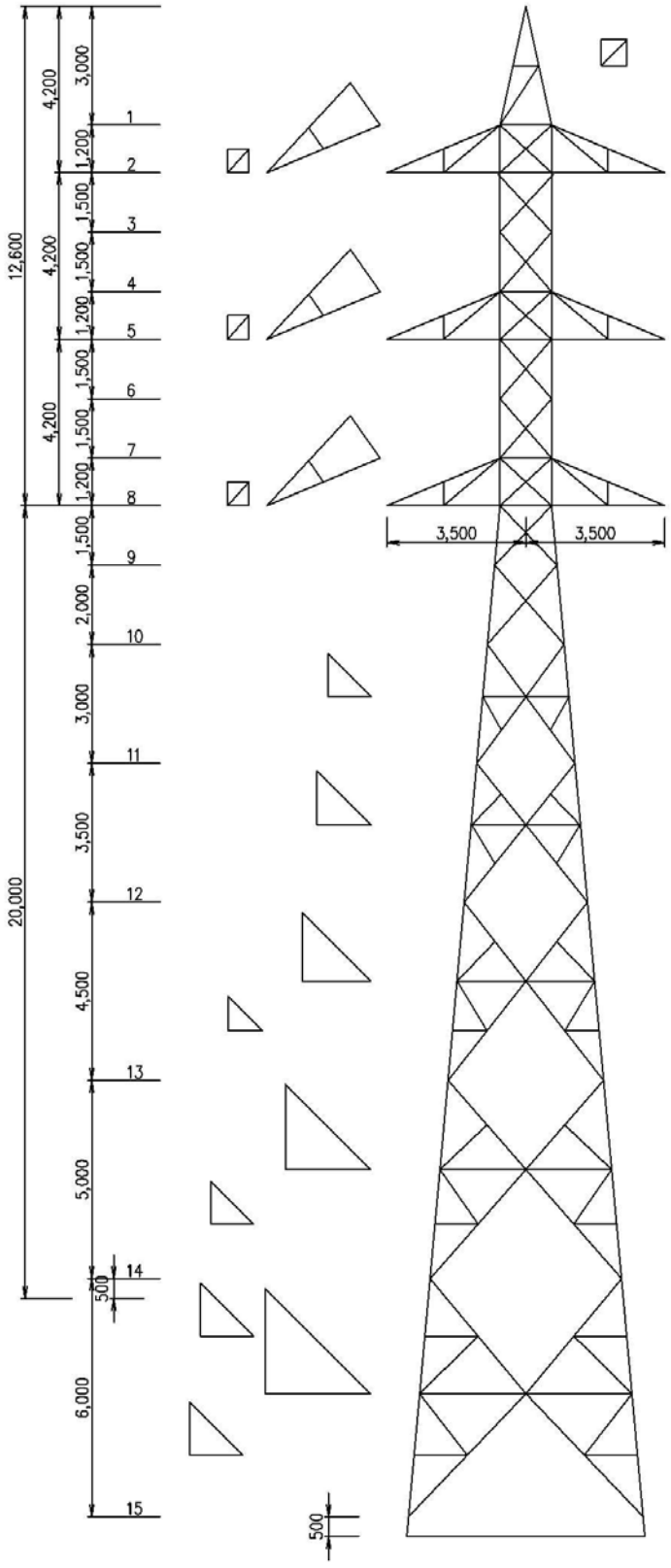
DWG No. TL-01-04
Route Map of Transmission Line -4
送電線ルート図-4



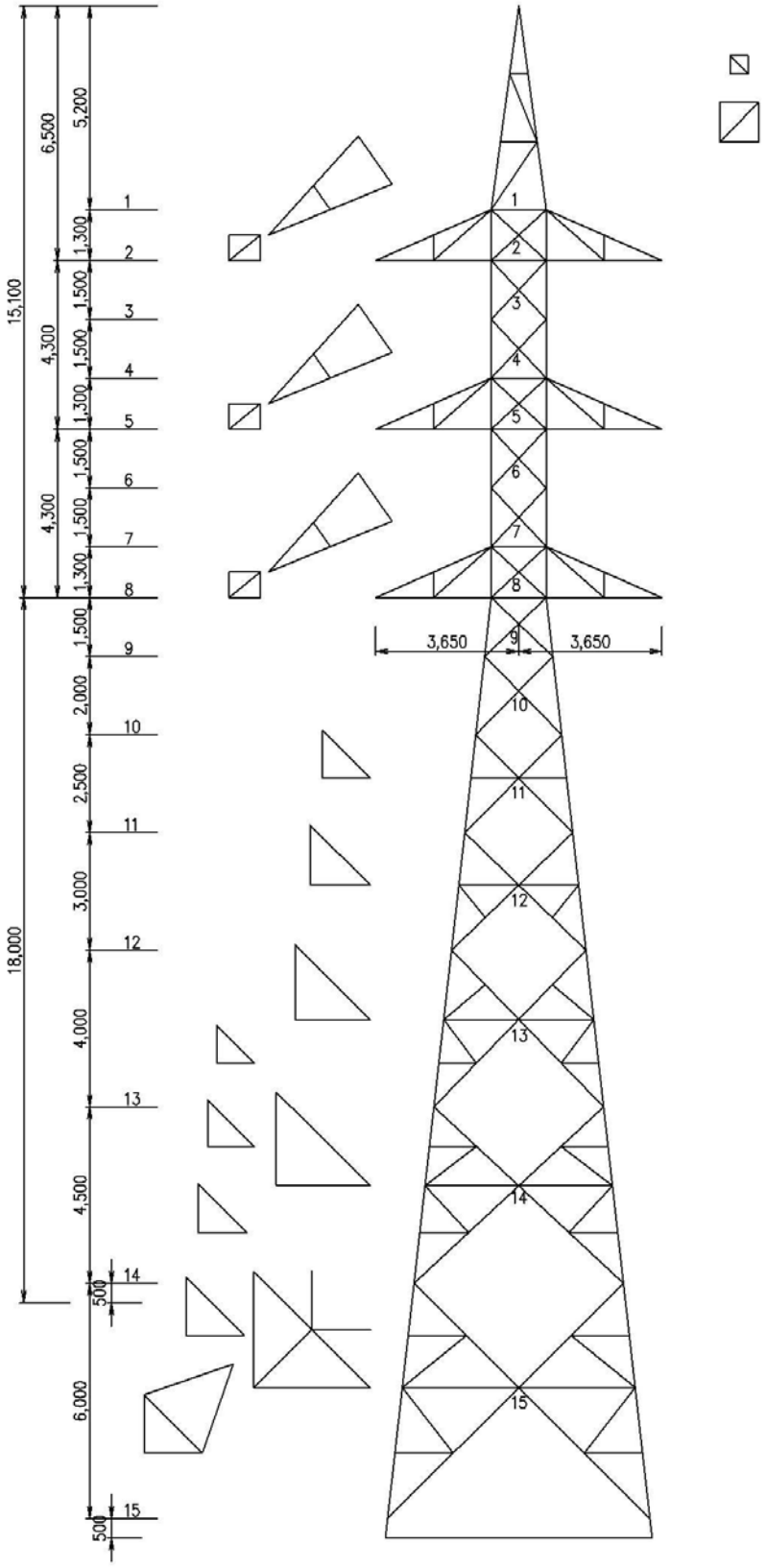
DWG No. TL-01-05
Route Map of Transmission Line -5
送電線ルート図-5



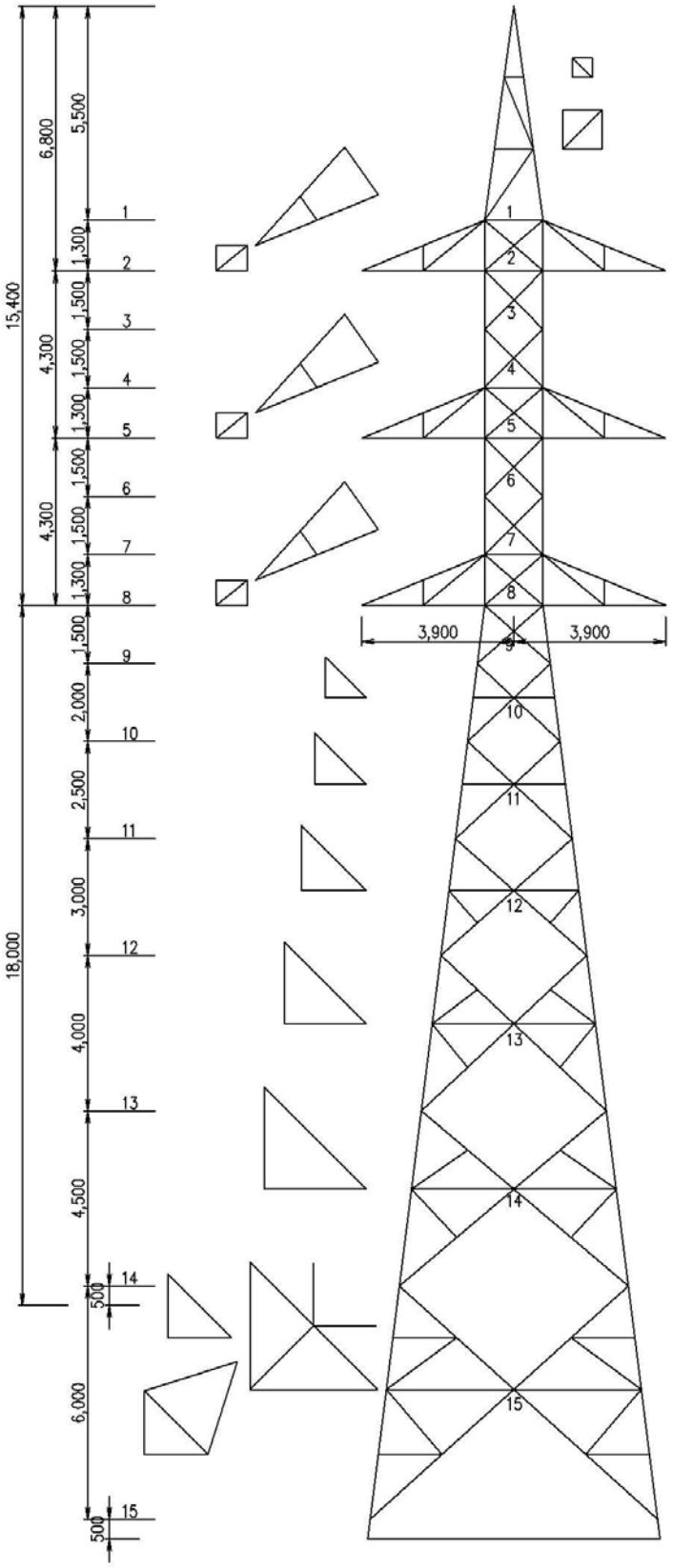
DWG No. TL-E-01
Gantry (Expansion)
ガントリー姿図（増設）



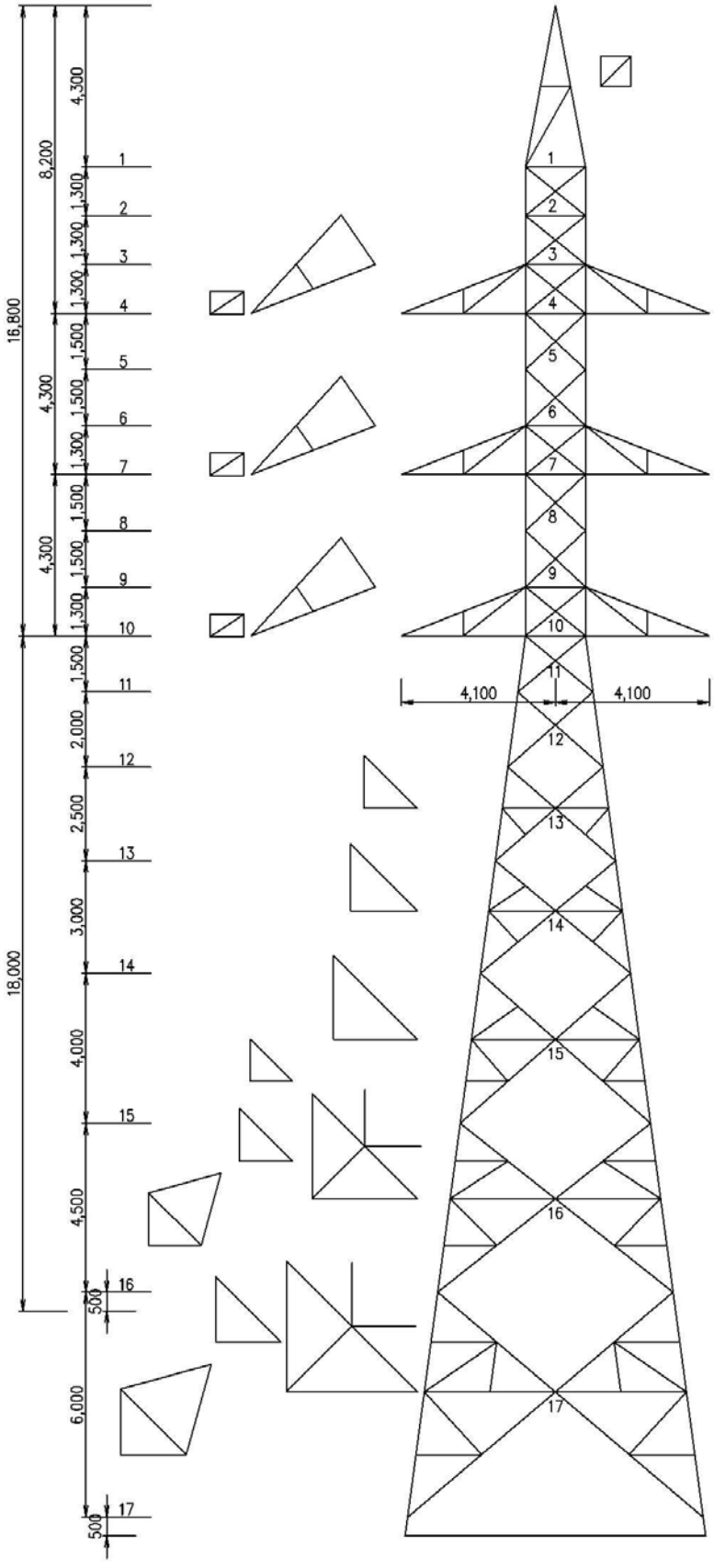
DWG No. TL-S-01
Steel Tower (Type A)
既設送電鉄塔姿図（Type A）



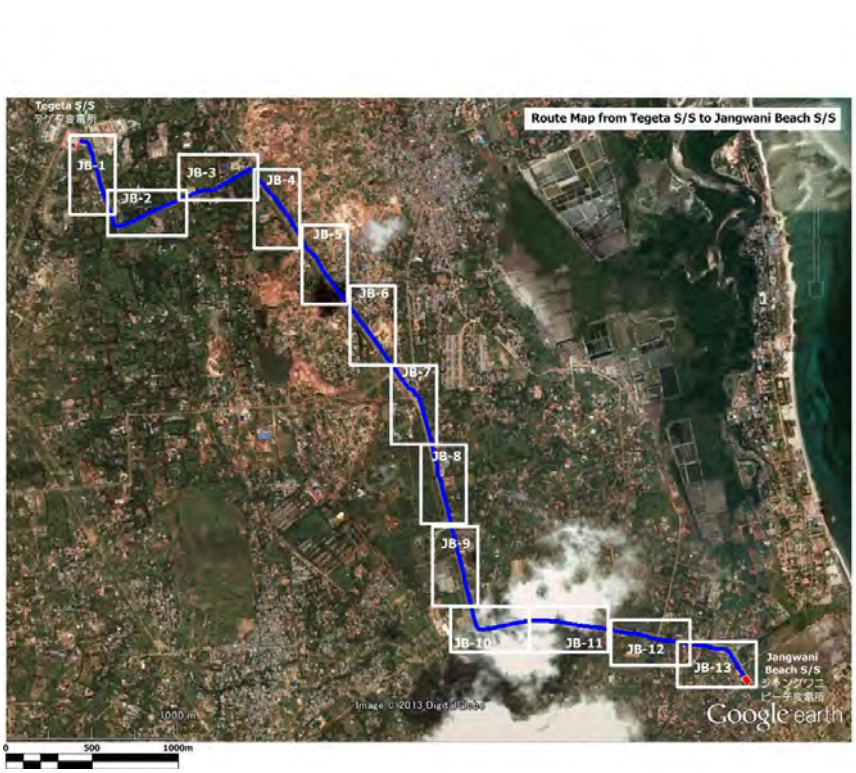
DWG No. TL-S-02
Steel Tower (Type B)
既設送電鉄塔姿図（Type B）



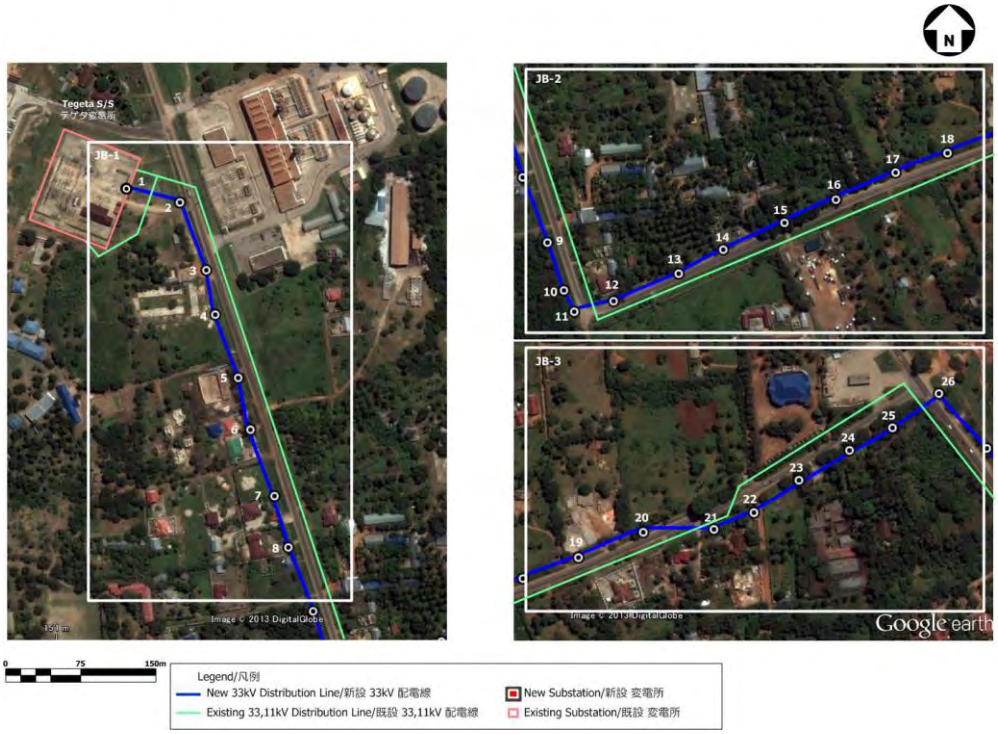
DWG No. TL-S-03
Steel Tower (Type C)
既設送電鉄塔姿図（Type C）



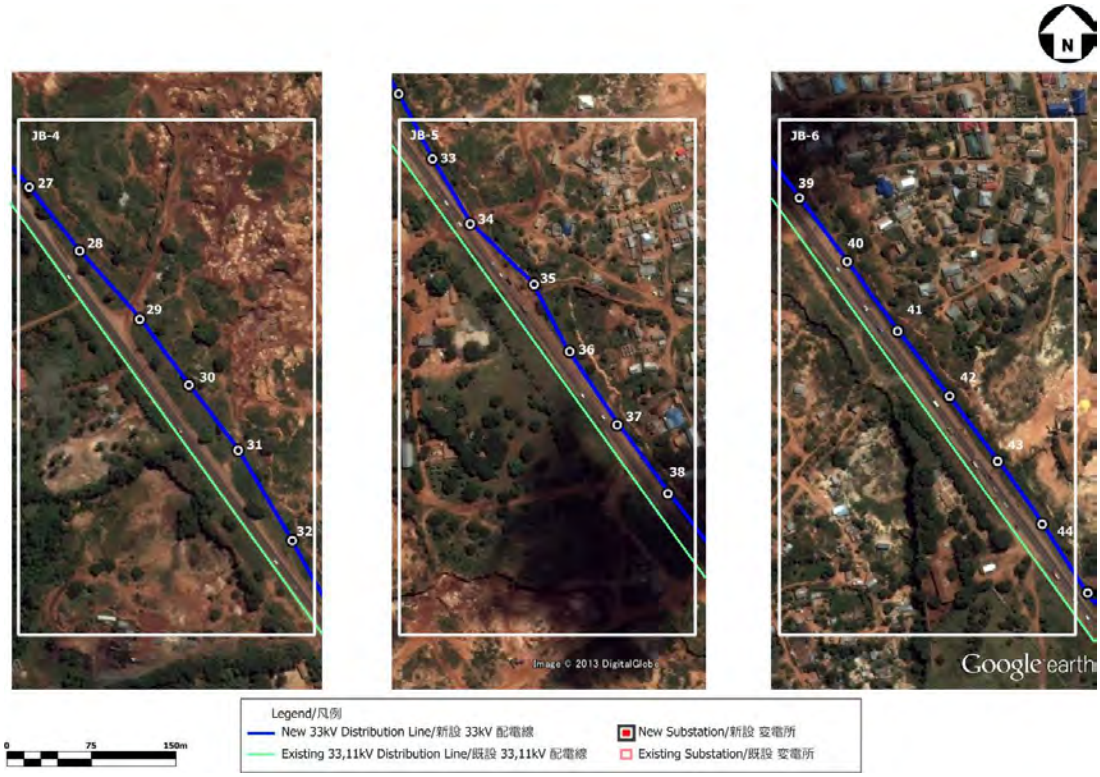
DWG No. TL-S-04
Steel Tower (Type D)
既設送電鉄塔姿図（Type D）



DWG No. DL-R-01
Route Map of Distribution Line (Key Plan)
Jangwani Beach Substation – Tegeta Substation (6.5km)
33kV 配電線ルート図(Key Plan)
テゲタ変電所 - ジャングワニビーチ変電所間（6.5km）



DWG No. DL-R-01-01
Route Map of Distribution Line-1
Jangwani Beach Substation – Tegeta Substation (6.5km)
33kV 配電線ルート図-1
テゲタ変電所 - ジャングワニビーチ変電所間（6.5km）



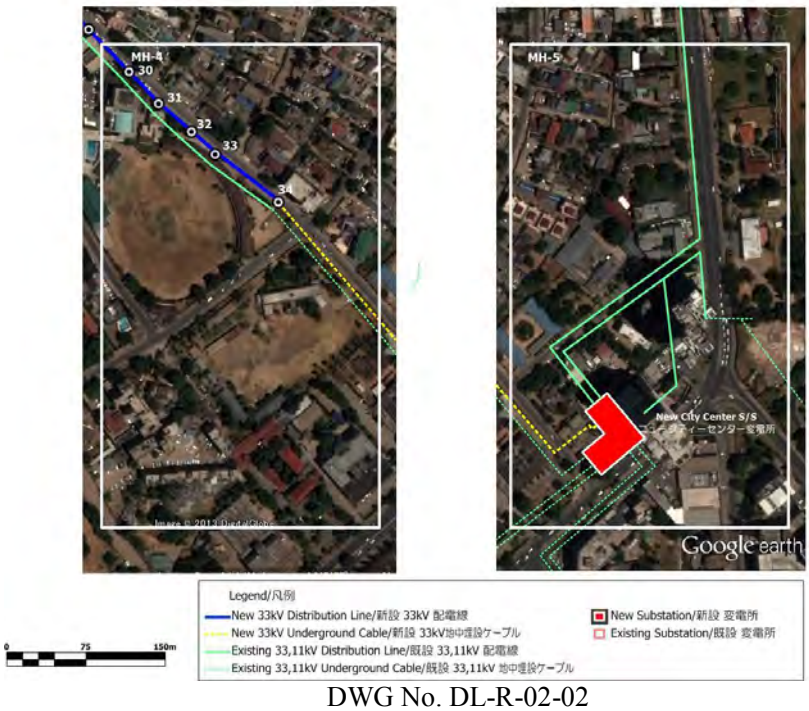
DWG No. DL-R-01-02
Route Map of Distribution Line-2
Jangwani Beach Substation – Tegeta Substation (6.5km)
33kV 配電線ルート図-2
テゲタ変電所 - ジャングワニビーチ変電所間（6.5km）

DWG No. DL-R-01-03
Route Map of Distribution Line-3
Jangwani Beach Substation – Tegeta Substation (6.5km)
33kV 配電線ルート図-3
テゲタ変電所 - ジャングワニビーチ変電所間（6.5km）

DWG No. DL-R-01-04
Route Map of Distribution Line-4
Jangwani Beach Substation – Tegeta Substation (6.5km)
33kV 配電線ルート図-4
テゲタ変電所 - ジャングワニビーチ変電所間（6.5km）

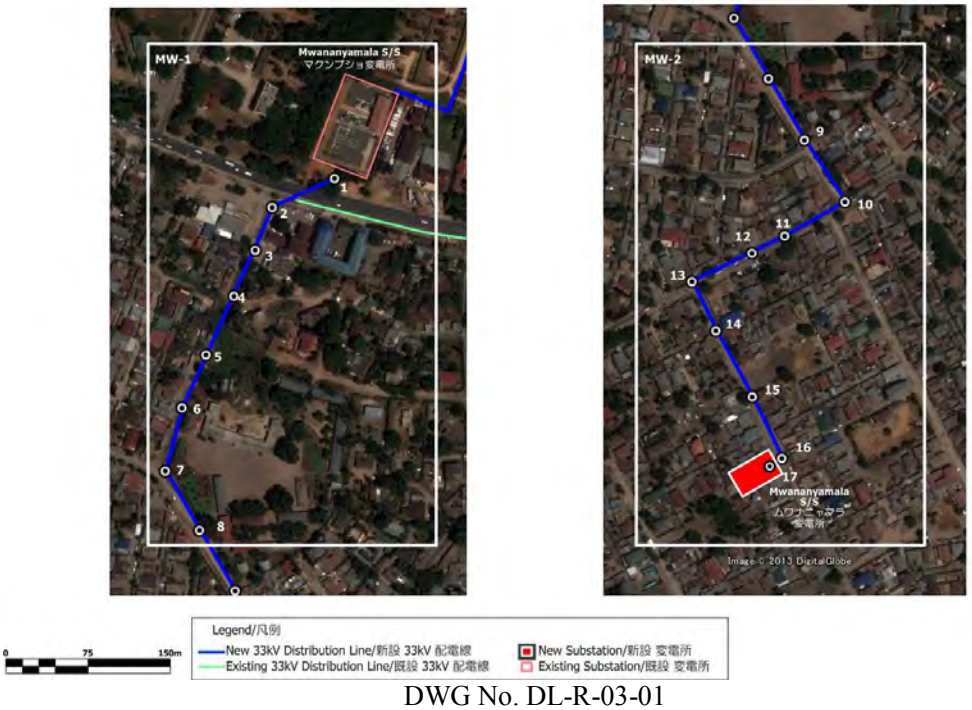
DWG No. DL-R-02
Route Map of Distribution Line (Key Plan)
Muhimbili Substation – New City Center Substation (2.0km)
33kV 配電線ルート図(Key Plan)
ニューシティーセンター変電所 - ムヒンビリ変電所間（2.0km）

DWG No. DL-R-02-01
Route Map of Distribution Line-1
Muhimbili Substation – New City Center Substation (2.0km)
33kV 配電線ルート図-1
ニューシティーセンター変電所 - ムヒンビリ変電所間（2.0km）



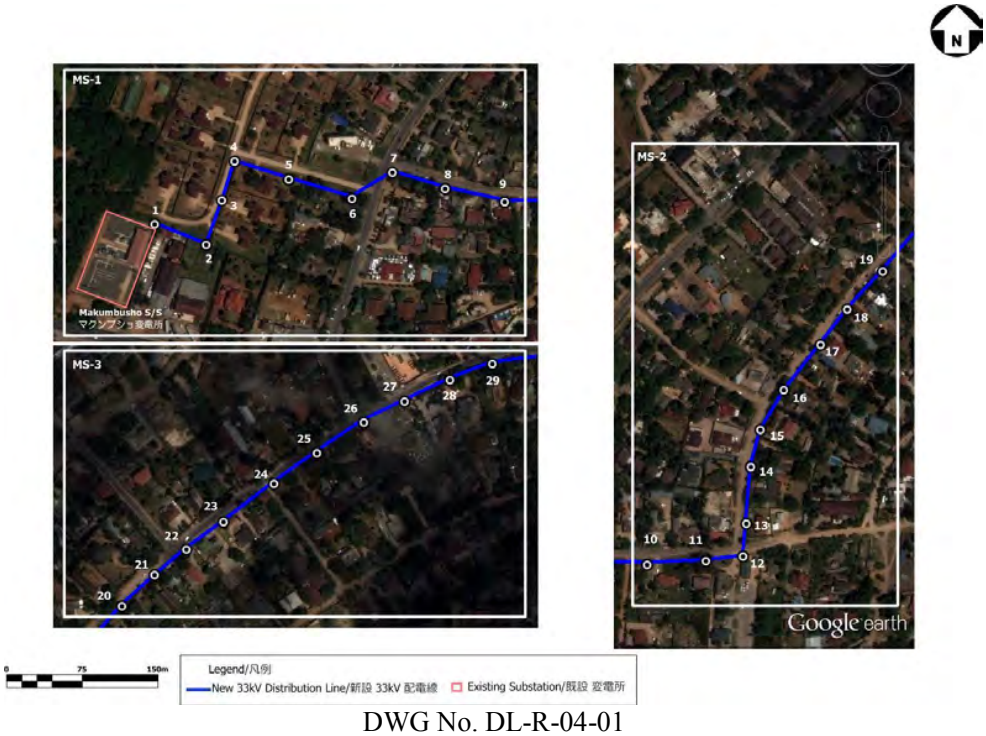
DWG No. DL-R-02-02
Route Map of Distribution Line-2
Muhimbili Substation – New City Center Substation (2.0km)
33kV 配電線ルート図-2
ニューシティーセンター変電所 - ムヒンビリ変電所間（2.0km）

DWG No. DL-R-03
Route Map of Distribution Line (Key Plan)
Mwananyamala Substation – Makumbusho Substation (1.1km)
33kV 配電線ルート図(Key Plan)
マクンブショ変電所 - ムワナニャマラ変電所間（1.1km）

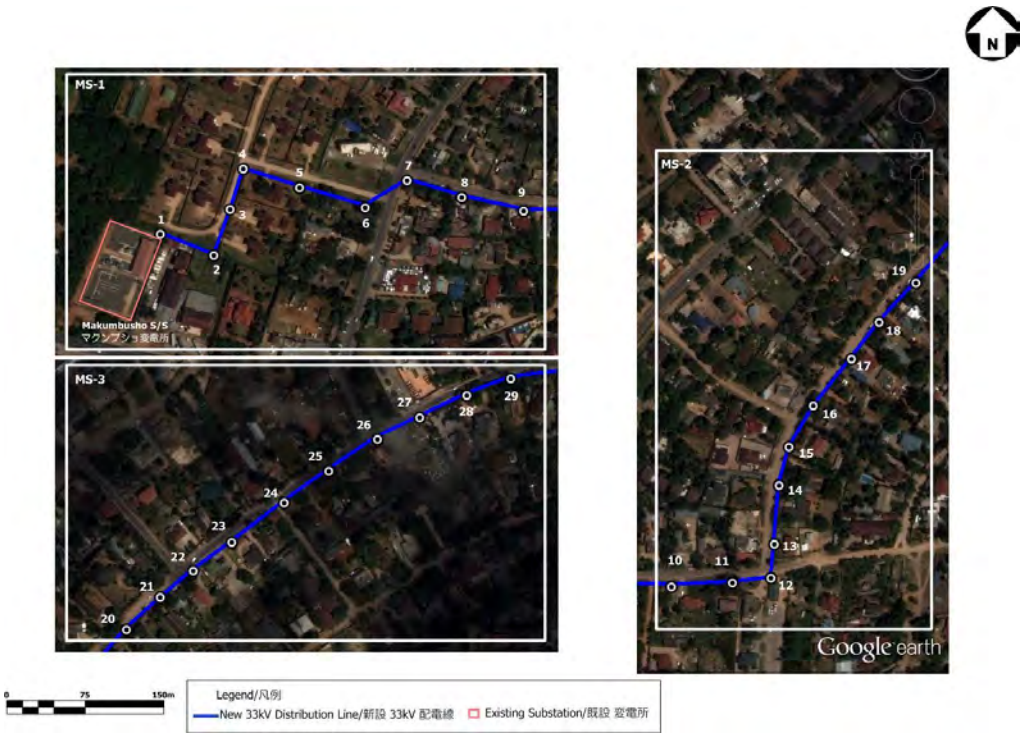


DWG No. DL-R-03-01
Route Map of Distribution Line-1
Mwananyamala Substation – Makumbusho Substation (1.1km)
33kV 配電線ルート図-1
マクンブショ変電所 - ムワナニャマラ変電所間（1.1km）

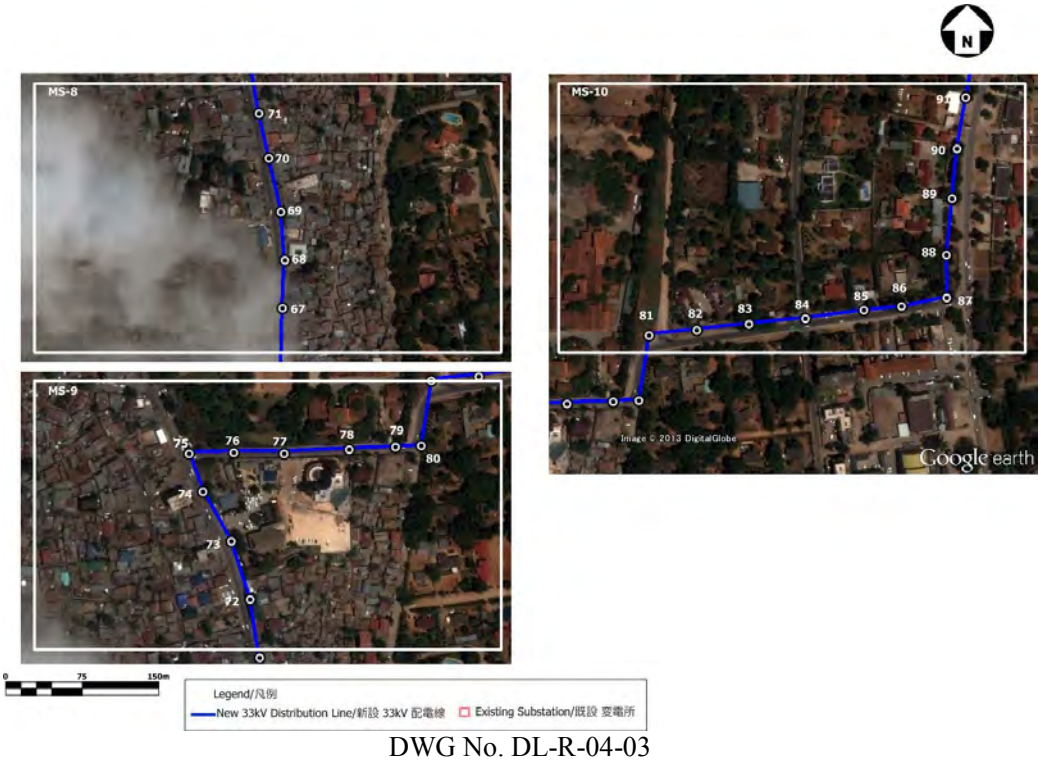
DWG No. DL-R-04
Route Map of Distribution Line (Key Plan)
Msasani Substation – Makumbusho Substation (7.6km)
33kV 配電線ルート図(Key Plan)
マクンブショ変電所 - ムササニ変電所間（7.6km）



DWG No. DL-R-04-01
Route Map of Distribution Line-1
Msasani Substation – Makumbusho Substation (7.6km)
33kV 配電線ルート図-1
マクンブショ変電所 - ムササニ変電所間（7.6km）



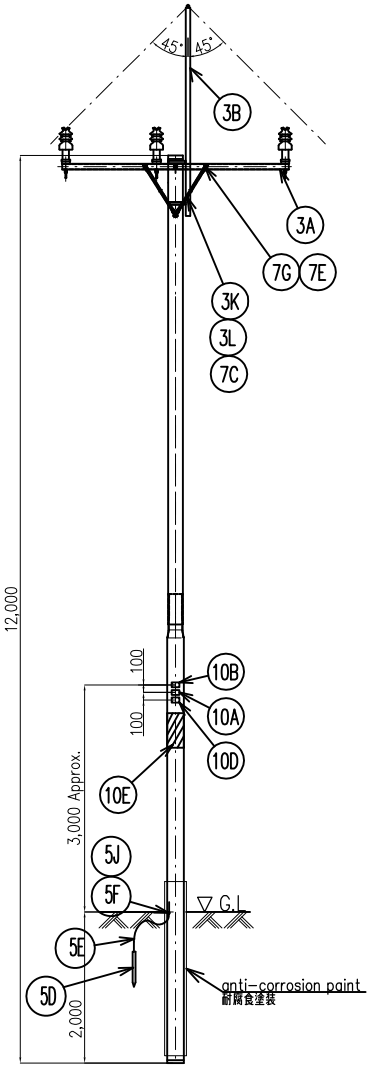
DWG No. DL-R-04-02
Route Map of Distribution Line-2
Msasani Substation – Makumbusho Substation (7.6km)
33kV 配電線ルート図-2
マクンブショ変電所 - ムササニ変電所間（7.6km）



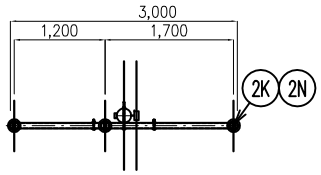
DWG No. DL-R-04-03
Route Map of Distribution Line-3
Msasani Substation – Makumbusho Substation (7.6km)
33kV 配電線ルート図-3
マクンブショ変電所 - ムササニ変電所間（7.6km）

DWG No. DL-R-04-04
Route Map of Distribution Line-4
Msasani Substation – Makumbusho Substation (7.6km)
33kV 配電線ルート図-4
マクンブショ変電所 - ムササニ変電所間（7.6km）

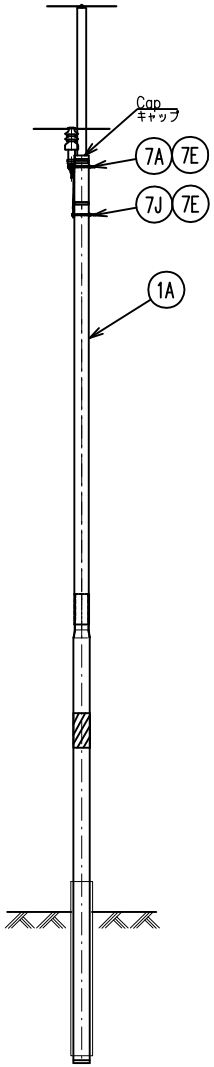
DWG No. DL-R-04-05
Route Map of Distribution Line-5
Msasani Substation – Makumbusho Substation (7.6km)
33kV 配電線ルート図-5
マクンブショ変電所 - ムササニ変電所間（7.6km）



Elevation−1



Top



Elevation−2

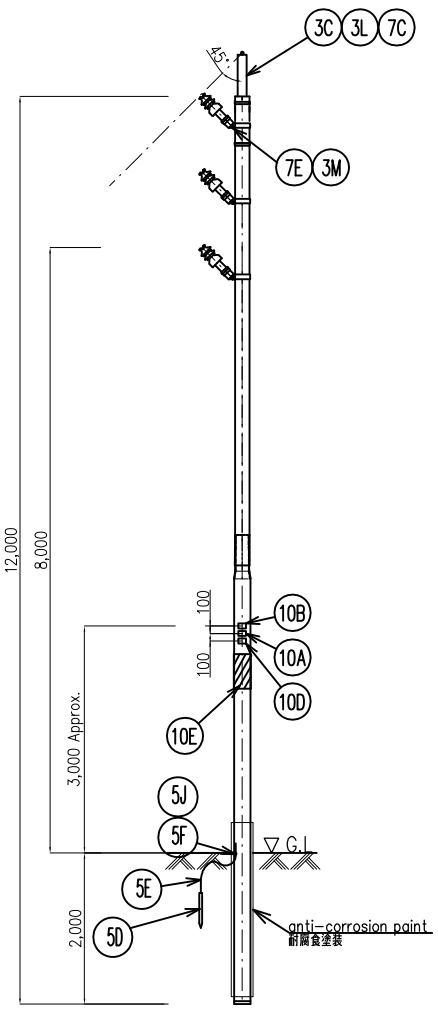
PART NO.	DESCRIPTION	Q'TY	項目
1A	Steel Pole 12m with Pole Cap	1	鋼管柱 12m キャップ付
2K	33kV Post Insulator	3	33kV ポスト碍子
2N	Preformed Top Tie for ACSR150	3	頂部タイACSR150
3A	Crossarm 75x75x3.2x3000	1	腕金 (75x75x3.2x3000)
3B	Crossarm 45x75x3.2x3000	1	架空地線用腕金 (45x75x3.2x3000)
3K	Crossarm Brace Pipe type	2	腕金支持金物
3L	Crossarm Support	2	腕金支持金物 (架空地線用)
5D	Ground Rod 14x1500	1	接地棒 14x1500
5E	Lead Wire Terminal	1	引出し端子
5F	Compression Connector (38−22)	1	圧着端子 (38−22)
5J	Grounding Wire (IV38sq.mm)	18m	接地線 (IV38sq.mm)
7A	Bolt&Nut M16x400(Pole/Crossarm)	1	ボルトナット M16x400(電柱/腕金)
7C	Bolt&Nut M16x350(Pole/Crossarm)	2	ボルトナット M16x350(電柱/腕金)
7E	Square Washer	8	角座金
7G	Bolt&Nut M16x120(Crossarm/Brace)	2	ボルトナット M16x120(腕金/支持金物)
7J	Bolt&Nut M16x350(Pole/Brace)	1	ボルトナット M16x350(電柱/支持金物)
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti−climbing	5m	昇降防止用有刺鉄線

(S=1/100)

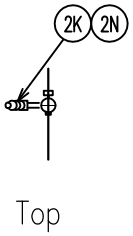
DWG No. DL-E-01

Intermediate Pole [Angle 0 to 5 deg] Pole Type A-1

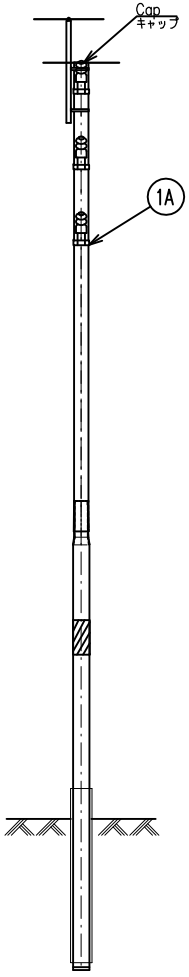
33kV引通し柱 [0 度 ～ 5 度] 電柱の種別 A-1



Elevation－1



Top



Elevation－2

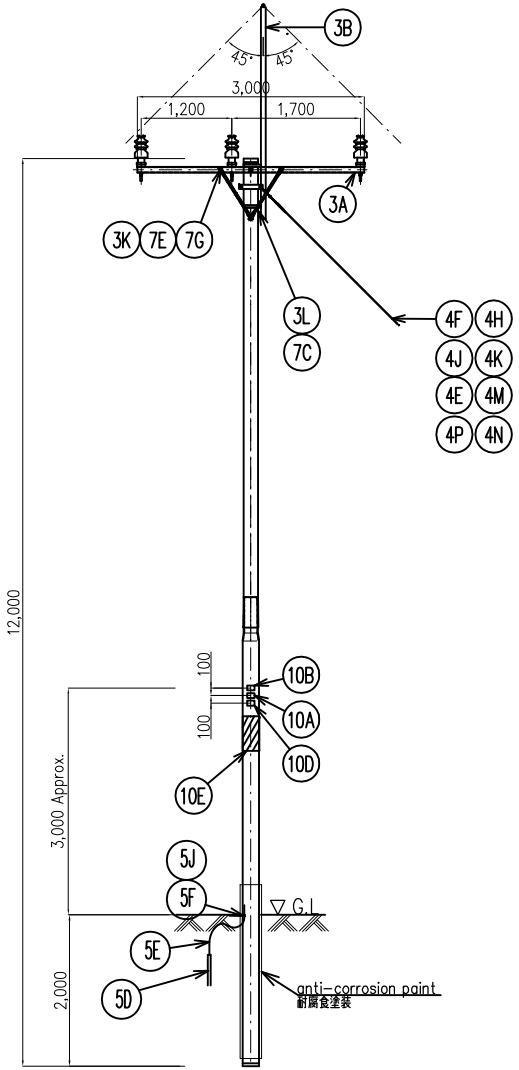
PART NO.	DESCRIPTION	Q'TY	項目
1A	Steel Pole 12m with Pole Cap	1	鋼管柱 12m キャップ付
2K	33kV Post Insulator	3	33kV ポスト碍子
2N	Preformed Top Tie for ACSR150	3	頂部タイACSR150
3C	Crossarm 45x75x3.2x1500	1	架空地線用腕金 (45x75x3.2x1500)
3L	Crossarm Support	2	腕金支持金物(架空地線用)
3M	Insulator Support	3	碍子取付用金具
5D	Ground Rod 14x1500	1	接地棒 14x1500
5E	Lead Wire Terminal	1	引出し端子
5F	Compression Connector (38-22)	1	圧着端子 (38-22)
5J	Grounding Wire (IV38sq.mm)	18m	接地線 (IV38sq.mm)
7C	Bolt&Nut M16x350(Pole/Crossarm)	2	ボルトナット M16x350(電柱/腕金)
7E	Square Washer	5	角座金
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti-climbing	5m	昇降防止用有刺鉄線

(S=1/100)

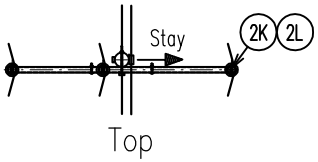
DWG No. DL-E-02

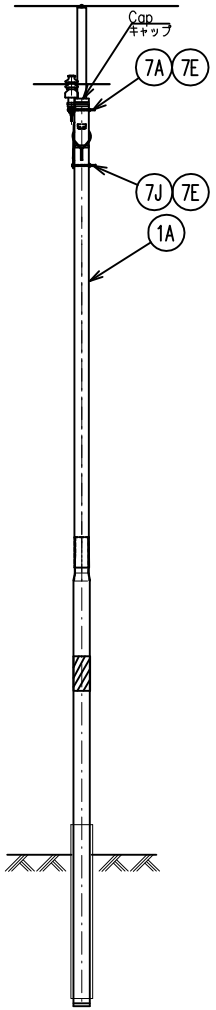
Intermediate Pole [Angle 0 to 5 deg] Pole Type A-2

33kV引通し柱 [0 度 ～ 5 度] 電柱の種別 A-2



Elevation−1





Elevation−2

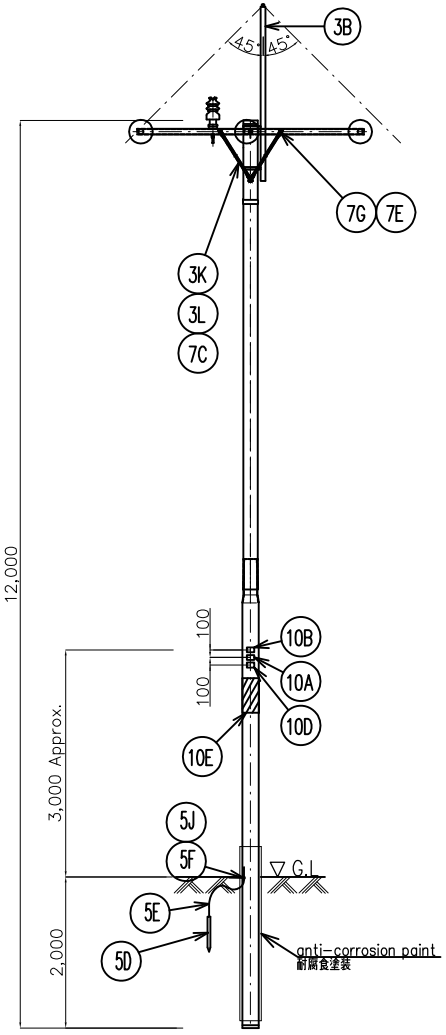
PART NO.	DESCRIPTION	Q'TY	項目
1A	Steel Pole 12m with Pole Cap	1	鋼管柱 12m キャップ付
2K	33kV Post Insulator	3	33kV ポスト碍子
2L	Preformed Side Tie for ACSR150	3	側部タイ ACSR150
3A	Crossarm 75x75x3.2x3000	1	腕金 (75x75x3.2x3000)
3B	Crossarm 45x75x3.2x3000	1	架空地線用腕金 (45x75x3.2x3000)
3K	Crossarm Brace Pipe type	2	腕金支持金物
3L	Crossarm Support	2	腕金支持金物 (架空地線用)
4E	Stay Band	1	支線バンド(シングル)
4F	Stay Wire	15m	支線
4H	Dead End Grip for Insulator	2	巻付グリップ碍子用
4J	Dead End Grip for Thimble	4	巻付グリップシンブル用
4K	Stay Insulator 33kV	1	支線用碍子 33kV
4M	Turnbuckle	1	ターンバックル
4N	Stay Rod	1	支線棒
4P	Stay Plate	1	支線プレート
5D	Ground Rod 14x1500	1	接地棒 14x1500
5E	Lead Wire Terminal	1	引出し端子
5F	Compression Connector (38−22)	1	圧着端子 (38−22)
5J	Grounding Wire (IV38sq.mm)	18m	接地線 (IV38sq.mm)
7A	Bolt&Nut M16x400(Pole/Crossarm)	1	ボルトナット M16x400(電柱/腕金)
7C	Bolt&Nut M16x350(Pole/Crossarm)	2	ボルトナット M16x350(電柱/腕金)
7E	Square Washer	9	角座金
7G	Bolt&Nut M16x120(Crossarm/Brace)	2	ボルトナット M16x120(腕金/支持金物)
7J	Bolt&Nut M16x350(Pole/Brace)	1	ボルトナット M16x350(電柱/支持金物)
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti-climbing	5m	昇降防止用有刺鉄線

(S=1/100)

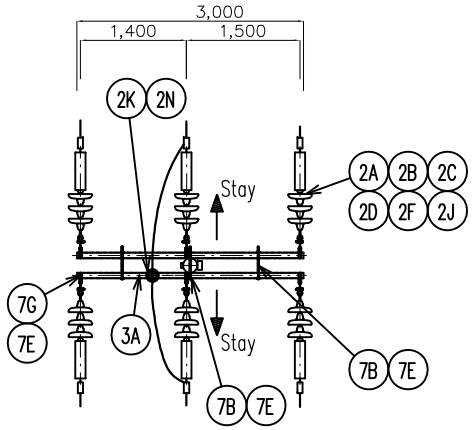
DWG No. DL-E-03

Light Angle Pole up to 30° Pole Type B

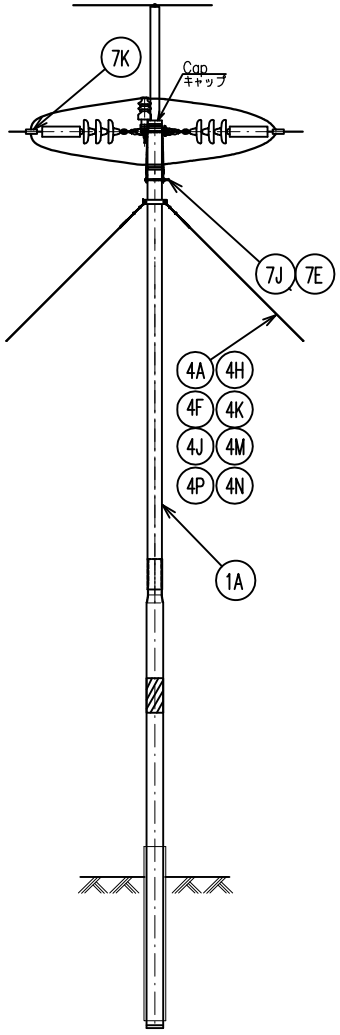
角度柱 [5 度 ～ 30 度] 電柱の種別 B



Elevation－1



Top



Elevation－2

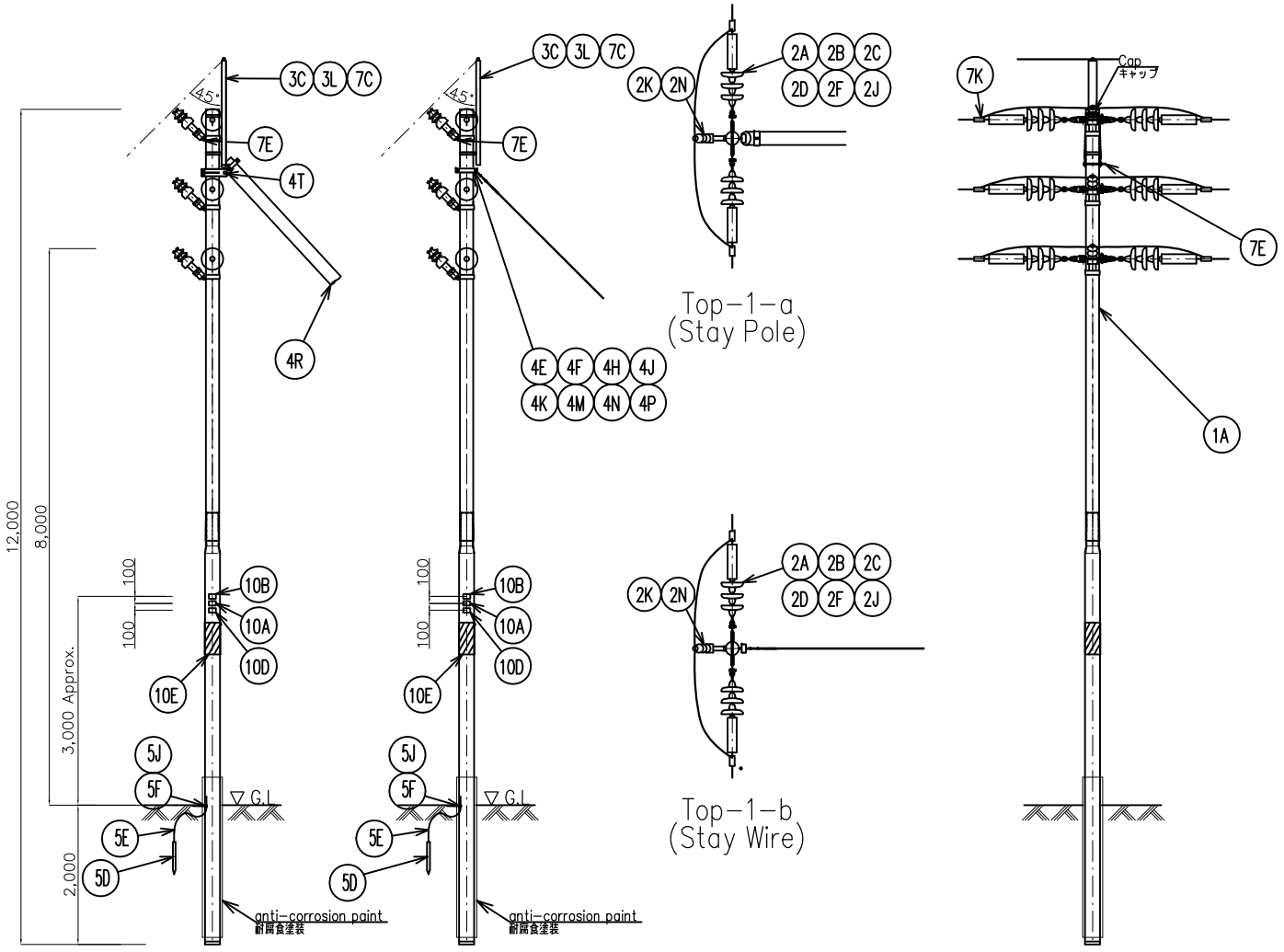
PART NO.	DESCRIPTION	Q'TY	項目
1A	Steel Pole 12m with Pole Cap,Nail	1	鋼管柱 12m キャップ付
2A	Disc Insulator	18	皿碍子
2B	Anchor Shackle	6	アンカーシャックル
2C	Ball Eye	6	ボールアイ
2D	Socket Eye	6	ソケットアイ
2F	Dead End Clamp for 33kV(ACSR150)	6	33kV 引留クランプ(ACSR150)
2J	Twist Strap	6	ねじりストラップセット
2K	33kV Post Insulator	3	33kV ポスト碍子
2N	Preformed Top Tie for ACSR150	3	頂部タイACSR150
3A	Crossarm 75x75x3.2x3000	2	腕金 (75x75x3.2x3000)
3B	Crossarm 45x75x3.2x3000	1	架空地線用腕金 (45x75x3.2x3000)
3K	Crossarm Brace Pipe type	4	腕金支持金物
3L	Crossarm Support	2	腕金支持金物 (架空地線用)
4A	Stay Band (Double)	1	支線バンド(ダブル)
4F	Stay Wire	30m	支線
4H	Dead End Grip for Insulator	4	巻付グリップ碍子用
4J	Dead End Grip for Thimble	8	巻付グリップシンブル用
4K	Stay Insulator 33kV	4	支線用碍子 33kV
4M	Turnbuckle	2	ターンバックル
4N	Stay Rod	2	支線棒
4P	Stay Plate	2	支線プレート
5D	Ground Rod 14x1500	1	接地棒 14x1500
5E	Lead Wire Terminal	1	引出し端子
5F	Compression Connector (38-22)	1	圧着端子 (38-22)
5J	Grounding Wire (IV38sq.mm)	18m	接地線 (IV38sq.mm)
7B	Double Arming Bolt M16x400(Pole/W-Crossarm)	3	ダブルボルト M16x400(電柱/二重腕金)
7C	Bolt&Nut M16x350(Pole/Crossarm)	2	ボルトナット M16x350(電柱/腕金)
7E	Square Washer	19	角座金
7G	Bolt&Nut M16x120(Crossarm/Brace)	2	ボルトナット M16x120(腕金/支持金物)
7J	Bolt&Nut M16x300(Pole/Brace)	1	ボルトナット M16x300(電柱/支持金物)
7K	Bolt type Connector for 33kV(ACSR150/ACSR150)	6	33kV ボルトタイプコネクター(ACSR150/ACSR150)
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti-climbing	5m	昇降防止用有刺鉄線

(S=1/100)

DWG No. DL-E-04

Section Pole Pole Type C-1

両引留柱 電柱の種別 C-1



Elevation-1-a (Stay Pole)　Elevation-1-b (Stay Wire)　Elevation-2 (Common)

(Stay Pole)

PART NO.	DESCRIPTION	Q'TY	項目
1A	Steel Pole 12m with Pole Cap,Nail	1	鋼管柱 12m キャップ付
2A	Disc Insulator	18	皿碍子
2B	Anchor Shackle	6	アンカーシャックル
2C	Ball Eye	6	ボールアイ
2D	Socket Eye	6	ソケットアイ
2F	Dead End Clamp for 33kV(ACSR150)	6	33kV 引留クランプ(ACSR150)
2J	Twist Strap	6	ねじりストラップセット
2K	33kV Post Insulator	3	33kV ポスト碍子
2N	Preformed Top Tie for ACSR150	3	頂部タイACSR150
3C	Crossarm 45x75x3.2x1500	1	架空地線用腕金 (45x75x3.2x1500)
3L	Crossarm Support	2	腕金支持金物 (架空地線用)
4R	Stay Pole	1	支柱
4T	Stay Pole Bracket	1	支柱取付金物
5D	Ground Rod 14x1500	1	接地棒 14x1500
5E	Lead Wire Terminal	1	引出し端子
5F	Compression Connector (38-22)	1	圧着端子 (38-22)
5J	Grounding Wire (IV38sq.mm)	18m	接地線 (IV38sq.mm)
7C	Bolt&Nut M16x350(Pole/Crossarm)	2	ボルトナット M16x350(電柱/腕金)
7E	Square Washer	20	角座金
7K	Bolt type Connector for 33kV(ACSR150/ACSR150)	6	33kV ボルトタイプコネクター(ACSR150/ACSR150)
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti-climbing	5m	昇降防止用有刺鉄線

(Stay Wire)

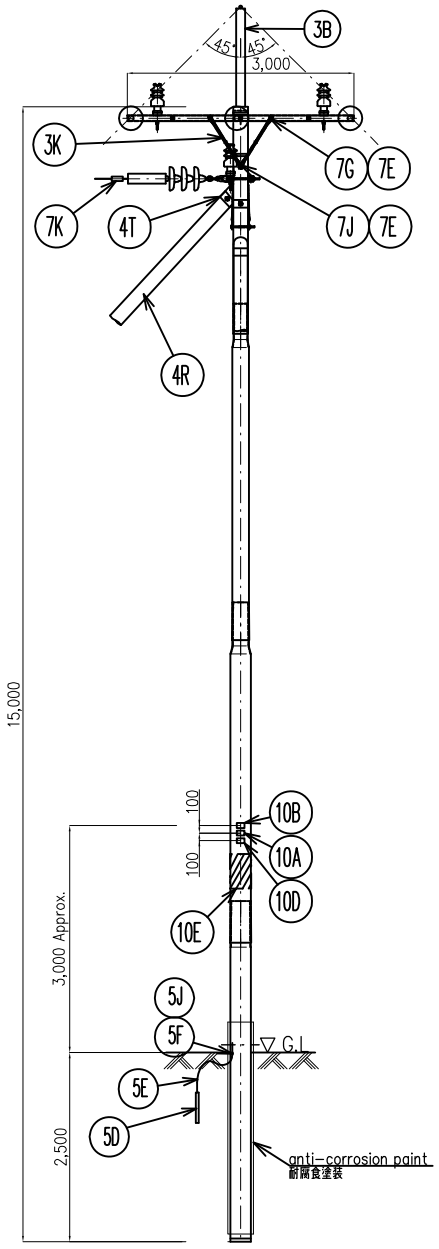
PART NO.	DESCRIPTION	Q'TY	項目
1A	Steel Pole 12m with Pole Cap,Nail	1	鋼管柱 12m キャップ付
2A	Disc Insulator	18	皿碍子
2B	Anchor Shackle	6	アンカーシャックル
2C	Ball Eye	6	ボールアイ
2D	Socket Eye	6	ソケットアイ
2F	Dead End Clamp for 33kV(ACSR150)	6	33kV 引留クランプ(ACSR150)
2J	Twist Strap	6	ねじりストラップセット
2K	33kV Post Insulator	3	33kV ポスト碍子
2N	Preformed Top Tie for ACSR150	3	頂部タイACSR150
3C	Crossarm 45x75x3.2x1500	1	架空地線用腕金 (45x75x3.2x1500)
3L	Crossarm Support	2	腕金支持金物 (架空地線用)
4E	Stay Band	1	支線バンド (シングル)
4F	Stay Wire	30m	支線 45
4H	Dead End Grip for Insulator	2	巻付グリップ碍子用
4J	Dead End Grip for Thimble	4	巻付グリップシンブル用
4K	Stay Insulator 33kV	1	支線用碍子 33kV
4M	Turnbuckle	1	ターンバックル
4N	Stay Rod	1	支線棒
4P	Stay Plate	1	支線プレート
5D	Ground Rod 14x1500	1	接地棒 14x1500
5E	Lead Wire Terminal	1	引出し端子
5F	Compression Connector (38-22)	1	圧着端子 (38-22)
5J	Grounding Wire (IV38sq.mm)	18m	接地線 (IV38sq.mm)
7C	Bolt&Nut M16x350(Pole/Crossarm)	2	ボルトナット M16x350(電柱/腕金)
7E	Square Washer	20	角座金
7K	Bolt type Connector for 33kV(ACSR150/ACSR150)	6	33kV ボルトタイプコネクター(ACSR150/ACSR150)
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti-climbing	5m	昇降防止用有刺鉄線

(S=1/100)

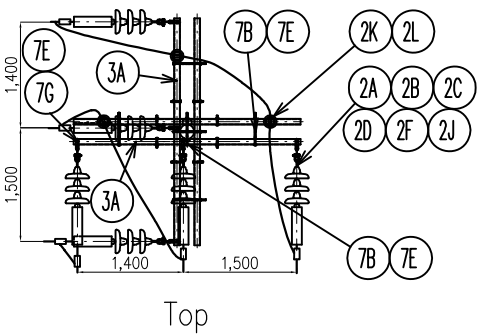
DWG No. DL-E-05

Section Pole Pole Type C-2

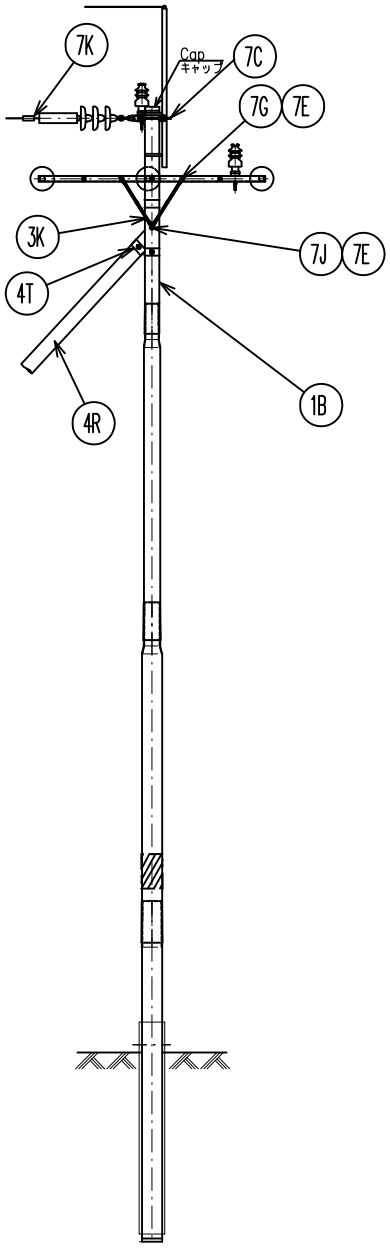
両引留柱 電柱の種別 C-2



Elevation−1



Top



Elevation−2

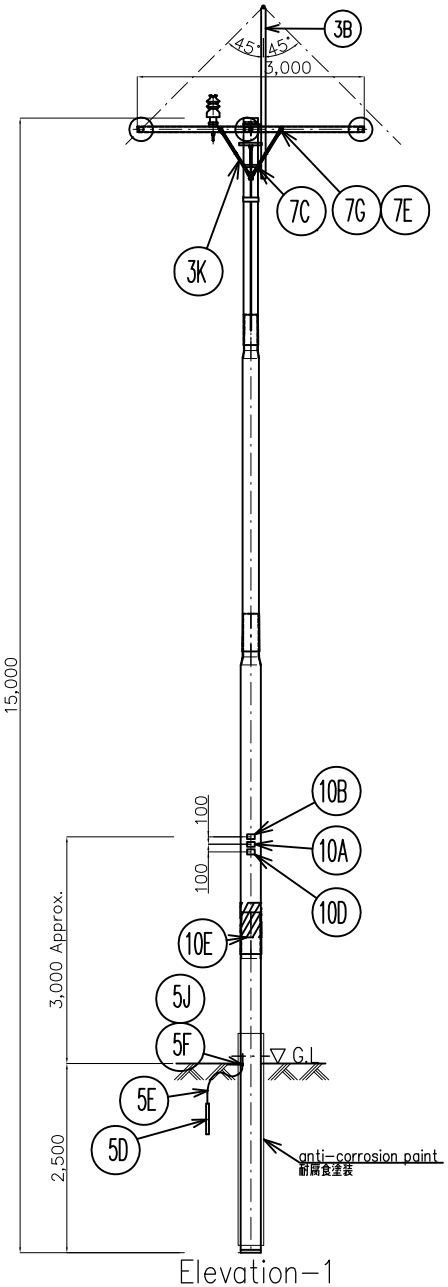
PART NO.	DESCRIPTION	Q'TY	項目
1B	Steel Pole 15m with Pole Cap	1	鋼管柱 15m キャップ付
2A	Disc Insulator	18	皿碍子
2B	Anchor Shackle	6	アンカーシャックル
2C	Ball Eye	6	ボールアイ
2D	Socket Eye	6	ソケットアイ
2F	Dead End Clamp for 33kV(ACSR150)	6	33kV 引留クランプ(ACSR150)
2J	Twist Strap	6	ねじりストラップセット
2K	33kV Post Insulator	3	33kV ポスト碍子
2L	Preformed Side Tie for ACSR150	3	側部タイ ACSR150
3A	Crossarm 75x75x3.2x3000	4	腕金 (75x75x3.2x3000)
3B	Crossarm 45x75x3.2x3000	1	架空地線用腕金 (45x75x3.2x3000)
3K	Crossarm Brace Pipe type	8	腕金支持金物
3L	Crossarm Support	2	腕金支持金物 (架空地線用)
4R	Stay Pole	1	支柱
4T	Stay Pole Bracket	1	支柱取付金物
5D	Ground Rod 14x1500	1	接地棒 14x1500
5E	Lead Wire Terminal	1	引出し端子
5F	Compression Connector (38-22)	1	圧着端子 (38-22)
5J	Grounding Wire (1V38sq.mm)	18m	接地線 (1V38sq.mm)
7B	Double Arming Bolt M16x400(Pole/W-Crossarm)	4	ダブルボルト M16x400(電柱/二重腕金)
7C	Bolt&Nut M16x350(Pole/Crossarm)	2	ボルトナット M16x350(電柱/腕金)
7E	Square Washer	18	角座金
7G	Bolt&Nut M16x120(Crossarm/Brace)	8	ボルトナット M16x120(腕金/支持金物)
7J	Bolt&Nut M16x350(Pole/Brace)	2	ボルトナット M16x350(電柱/支持金物)
7K	Bolt type Connector for 33kV(ACSR150/ACSR150)	6	33kV ボルトタイプコネクター(ACSR150/ACSR150)
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti-climbing	5m	昇降防止用有刺鉄線

(S=1/100)

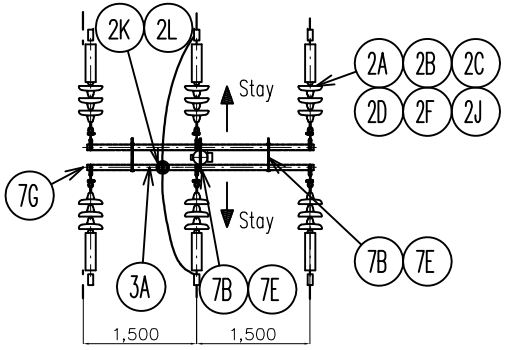
DWG No. DL-E-06

Heavy Angle [Line Angle 90 deg] Pole Type D

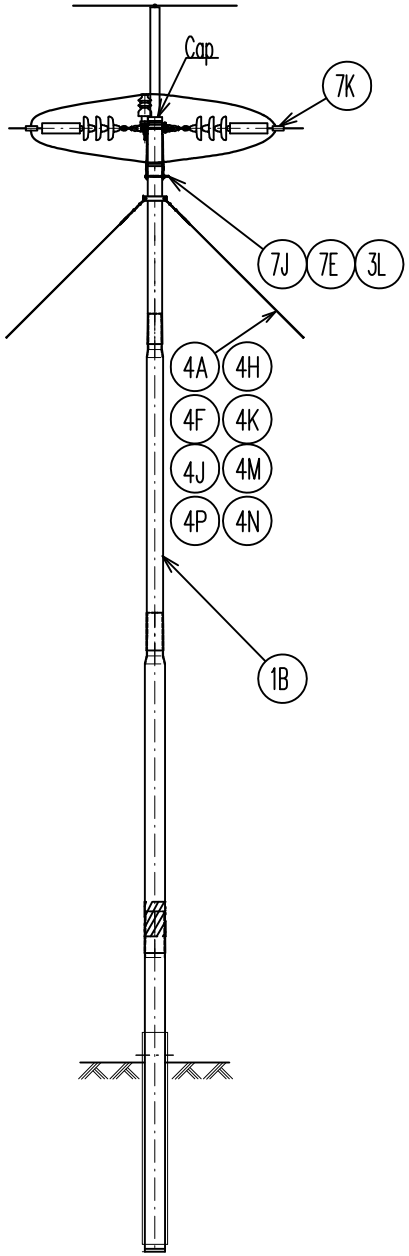
強角度柱 [90 度] 電柱の種別 D



Elevation-1



Top



Elevation-

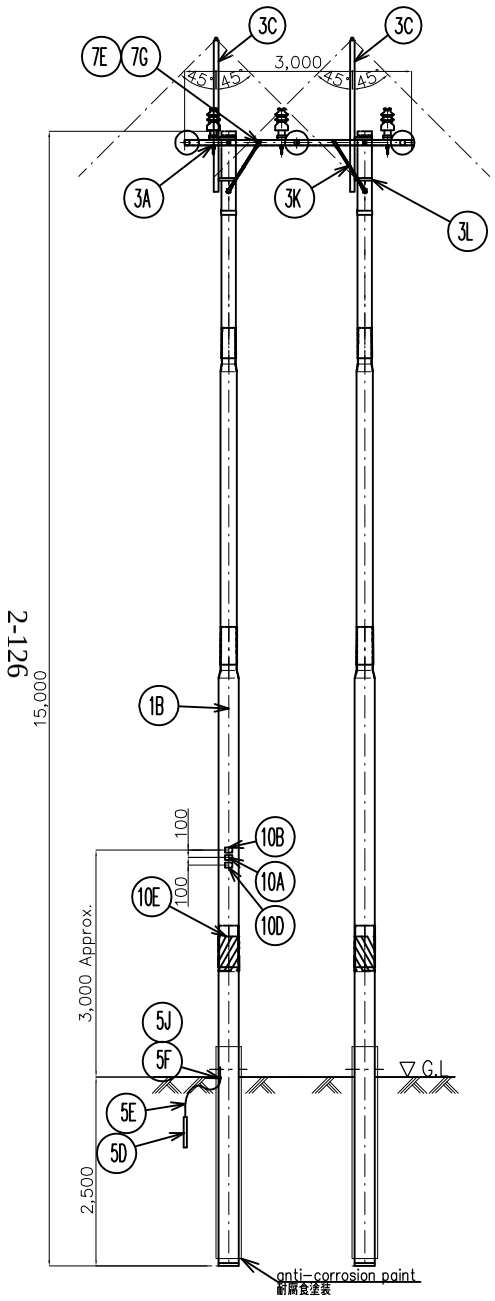
PART NO.	DESCRIPTION	Q'TY	項目
1B	Steel Pole 15m with Pole Cap	1	鋼管柱 15m キャップ付
2A	Disc Insulator	18	皿碍子
2B	Anchor Shackle	6	アンカーシャックル
2C	Ball Eye	6	ボールアイ
2D	Socket Eye	6	ソケットアイ
2F	Dead End Clamp for 33kV(ACSR150)	6	33kV 引留クランプ(ACSR150)
2J	Twist Strap	6	ねじりストラップセット
2K	33kV Post Insulator	3	33kV ポスト碍子
2L	Preformed Side Tie for ACSR150	3	側部タイ ACSR150
3A	Crossarm 75x75x3.2x3000	2	腕金 (75x75x3.2x3000)
3B	Crossarm 45x75x3.2x3000	1	架空地線用腕金 (45x75x3.2x3000)
3K	Crossarm Brace Pipe type	4	腕金支持金物
3L	Crossarm Support	2	腕金支持金物 (架空地線用)
4A	Stay Band (Double)	2	支持バンド(ダブル)
4F	Stay Wire	40m	支線
4H	Dead End Grip for Insulator	4	巻付グリップ碍子用
4J	Dead End Grip for Thimble	8	巻付グリップシンブル用
4K	Stay Insulator 33kV	2	支線用碍子 33kV
4M	Turnbuckle	2	ターンバックル
4N	Stay Rod	2	支線棒
4P	Stay Plate	2	支線プレート
5B	Stainless Band L=1200mm	3	ステンレスバンド L=1200mm
5D	Ground Rod 14x1500	1	接地棒 14x1500
5E	Lead Wire Terminal	1	引出し端子
5F	Compression Connector (38-22)	1	圧着端子 (38-22)
5J	Grounding Wire (IV38sq.mm)	18m	接地線 (IV38sq.mm)
7B	Double Arming Bolt M16x400(Pole/W-Crossarm)	2	ダブルボルト M16x400(電柱/二重腕金)
7C	Bolt&Nut M16x350(Pole/Crossarm)	2	ボルトナット M16x350(電柱/腕金)
7E	Square Washer	11	角座金
7G	Bolt&Nut M16x120(Crossarm/Brace)	4	ボルトナット M16x120(腕金/支持金物)
7J	Bolt&Nut M16x350(Pole/Brace)	1	ボルトナット M16x350(電柱/支持金物)
7K	Bolt type Connector for 33kV(ACSR150/ACSR150)	2	33kV ボルトタイプコネクター(ACSR150/ACSR150)
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti-climbing	5m	昇降防止用有刺鉄線

(S=1/100)

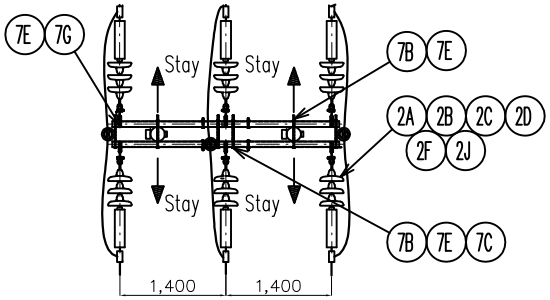
DWG No. DL-E-07

Overcross Pole Type E

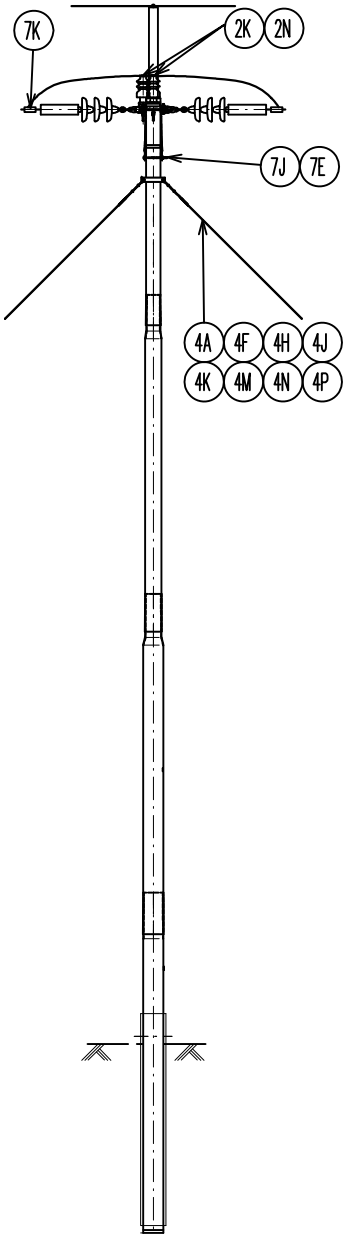
横断柱 電柱の種別 E



Elevation－1



Top



Elevation－2

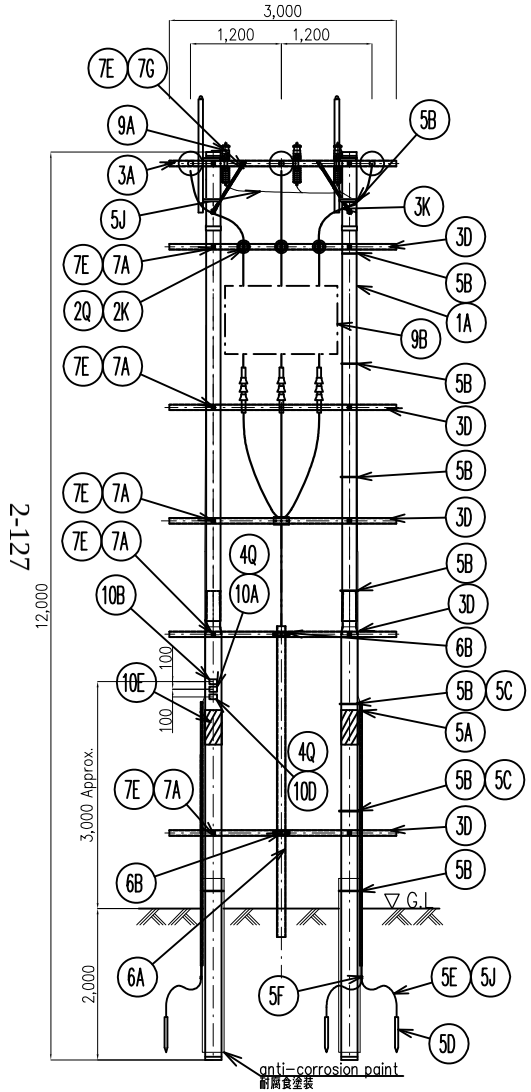
PART NO.	DESCRIPTION	Q'TY	項目
1B	Steel Pole 15m with Pole Cap	2	鋼管柱 15m キャップ付
2A	Disc Insulator	18	皿碍子
2B	Anchor Shackle	6	アンカーシャックル
2C	Ball Eye	6	ボールアイ
2D	Socket Eye	6	ソケットアイ
2F	Dead End Clamp for 33kV(ACSR150)	6	33kV 引留クランプ(ACSR150)
2J	Twist Strap	6	ねじりストラップセット
2K	33kV Post Insulator	3	33kV ポスト碍子
2N	Preformed Top Tie for ACSR150	3	頂部タイACSR150
3A	Crossarm 75x75x3.2x3000	2	腕金 (75x75x3.2x3000)
3C	Crossarm 45x75x3.2x1500	2	架空地線用腕金 (45x75x3.2x1500)
3K	Crossarm Brace Pipe type	4	腕金支持金物
3L	Crossarm Support	4	腕金支持金物(架空地線用)
4A	Stay Band (Double)	1	支持バンド(ダブル)
4F	Stay Wire	60m	支線
4H	Dead End Grip for Insulator	8	巻付グリップ碍子用
4J	Dead End Grip for Thimble	16	巻付グリップシンブル用
4K	Stay Insulator 33kV	4	支線用碍子 33kV
4M	Turnbuckle	4	ターンバックル
4N	Stay Rod	4	支線棒
4P	Stay Plate	4	支線プレート
5D	Ground Rod 14x1500	1	接地棒 14x1500
5E	Lead Wire Terminal	1	引出し端子
5F	Compression Connector (38-22)	1	圧着端子 (38-22)
5J	Grounding Wire (IV38sq.mm)	18m	接地線 (IV38sq.mm)
7B	Double Arming Bolt M16x400(Pole/W-Crossarm)	2	ダブルボルト M16x400(電柱/二重腕金)
7C	Bolt&Nut M16x350(Pole/Crossarm)	2	ボルトナット M16x350(電柱/腕金)
7E	Square Washer	19	角座金
7G	Bolt&Nut M16x120(Crossarm/Brace)	4	ボルトナット M16x120(腕金/支持金物)
7J	Bolt&Nut M16x350(Pole/Brace)	2	ボルトナット M16x350(電柱/支持金物)
7K	Bolt type Connector for 33kV(ACSR150/ACSR150)	6	33kV ボルトタイプコネクター(ACSR150/ACSR150)
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti-climbing	10m	昇降防止用有刺鉄線

(S=1/100)

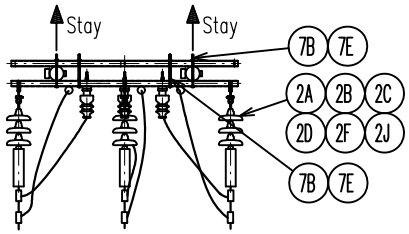
DWG No. DL-E-08

Overcross Section Pole Type F

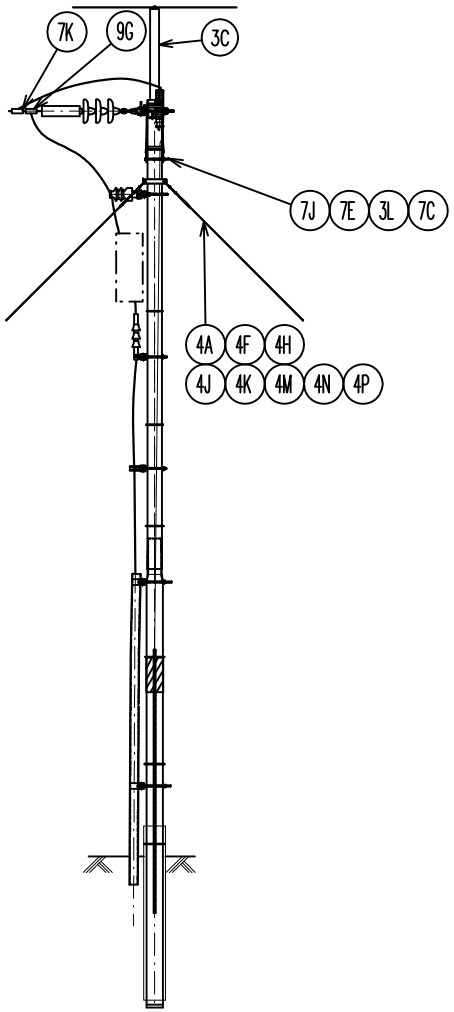
横断引留柱 電柱の種別 F



Elevation−1



Top



Elevation−2

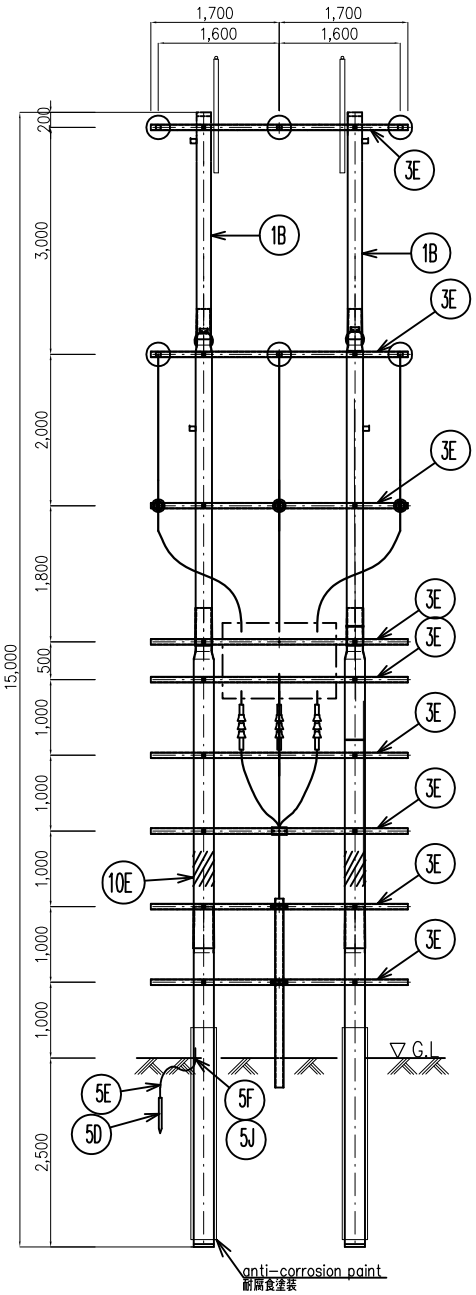
PART NO.	DESCRIPTION	Q'TY	項目
1A	Steel Pole 12m with Pole Cap	2	鋼管柱 12m キャップ付
2A	Disc Insulator	9	皿碍子
2B	Anchor Shackle	3	アンカーシャックル
2C	Ball Eye	3	ボールアイ
2D	Socket Eye	3	ソケットアイ
2F	Dead End Clamp for 33kV(ACSR150)	3	33kV 引留クランプ(ACSR150)
2J	Twist Strap	3	ねじりストラップセット
2K	33kV Post Insulator	3	33kV ポスト碍子
2Q	Aluminum Bind Wire 4.0mm	9m	アルミニウム結束線 4.0mm
3A	Crossarm 75x75x3.2x3000	2	腕金 (75x75x3.2x3000)
3C	Crossarm 45x75x3.2x1500	2	架空地線用腕金 (45x75x3.2x1500)
3D	Crossarm 75x75x3.2x3000 for Terminal	5	引留用 腕金 (75x75x3.2x3000)
3K	Crossarm Brace Pipe type	4	腕金支持金物
3L	Crossarm Support	2	腕金支持金物(架空地線用)
4A	Stay Band (Double)	1	支持バンド(ダブル)
4F	Stay Wire	30m	支線
4H	Dead End Grip for Insulator	8	巻付グリップ碍子用
4J	Dead End Grip for Thimble	16	巻付グリップシンブル用
4K	Stay Insulator 33kV	4	支線用碍子 33kV
4M	Turnbuckle	4	ターンバックル
4N	Stay Rod	4	支線棒
4P	Stay Plate	4	支線プレート
5A	PVC Protection Pipe L=4.0m	2	PVC 保護管 L=4.0m
5B	Stainless Band	16	ステンレスバンドセット
5D	Ground Rod 14x1500	3	接地棒 14x1500
5E	Lead Wire Terminal	3	引出し端子
5F	Compression Connector (38−22)	3	圧着端子 (38−22)
5J	Grounding Wire (IV38sq.mm)	40m	接地線 (IV38sq.mm)
6A	Protection Pipe for Cable (PVC150)	4m	ケーブル保護管 (PVC150)
6B	Pipe Saddle	2	管止め具
7A	Bolt&Nut M16x400(Pole/Crossarm)	10	ボルトナット M16x400(電柱/腕金)
7B	Double Arming Bolt M16x400(Pole/W-Crossarm)	2	ダブルボルト M16x400(電柱/二重腕金)
7C	Bolt&Nut M16x350(Pole/Crossarm)	12	ボルトナット M16x350(電柱/腕金)
7E	Square Washer	45	角座金
7G	Bolt&Nut M16x120(Crossarm/Brace)	4	ボルトナット M16x120(腕金/支持金物)
7J	Bolt&Nut M16x350(Pole/Brace)	2	ボルトナット M16x350(電柱/支持金物)
7K	Bolt type Connector for 33kV(ACSR150/ACSR150)	6	33kV ボルトタイプコネクター(ACSR150/ACSR150)
9A	33kV Lightning Arrester	3	33kV 避雷器
9B	33kV Line Switch	1	33kV ラインスイッチ
9G	Bolt type Connector (ACSR150 / Cu 38)	3	ボルトタイプコネクター (ACSR150 / Cu 38)
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti-climbing	10m	昇降防止用有刺鉄線

(S=1/100)

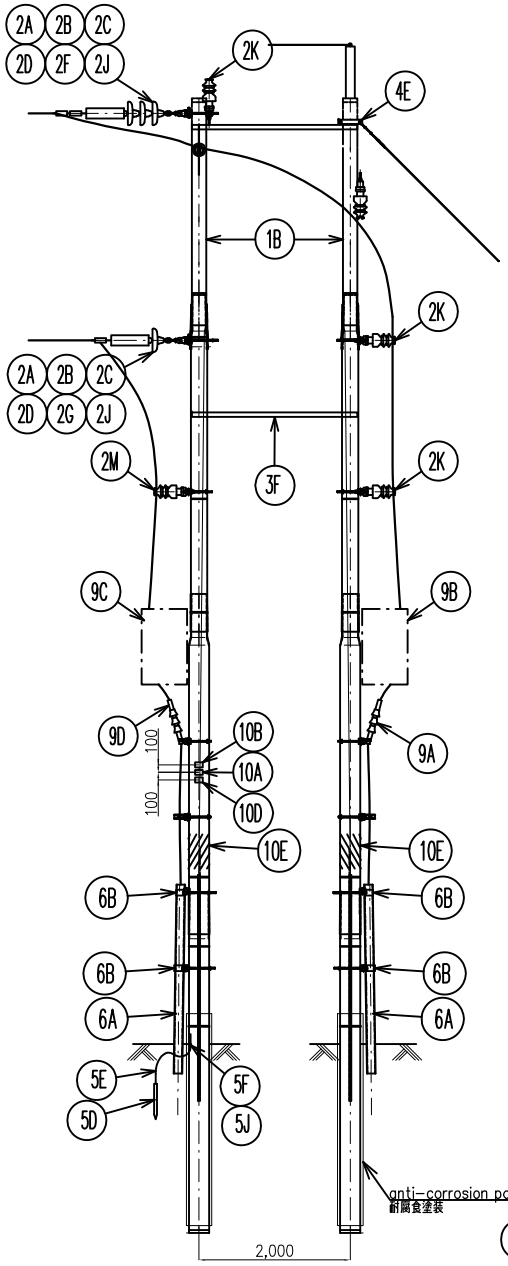
DWG No. DL-E-09

Terminal Pole (33kV) Type G

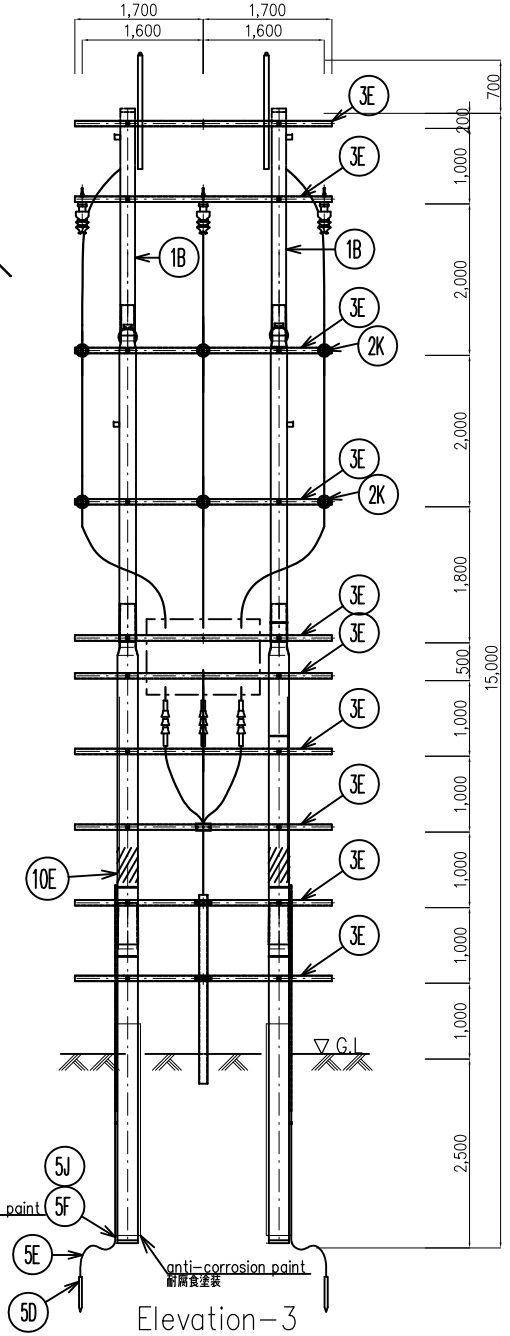
引留柱 (33kV) 電柱の種別 G



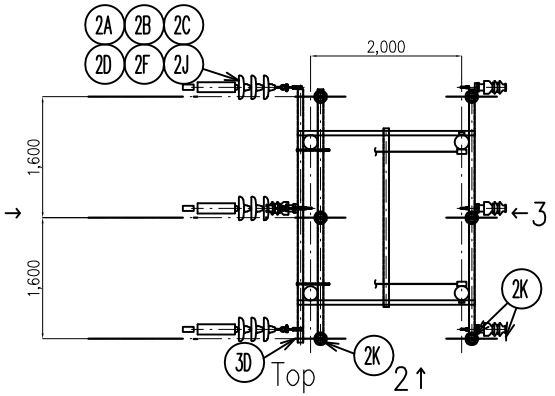
Elevation−1



Elevation−2



Elevation−3



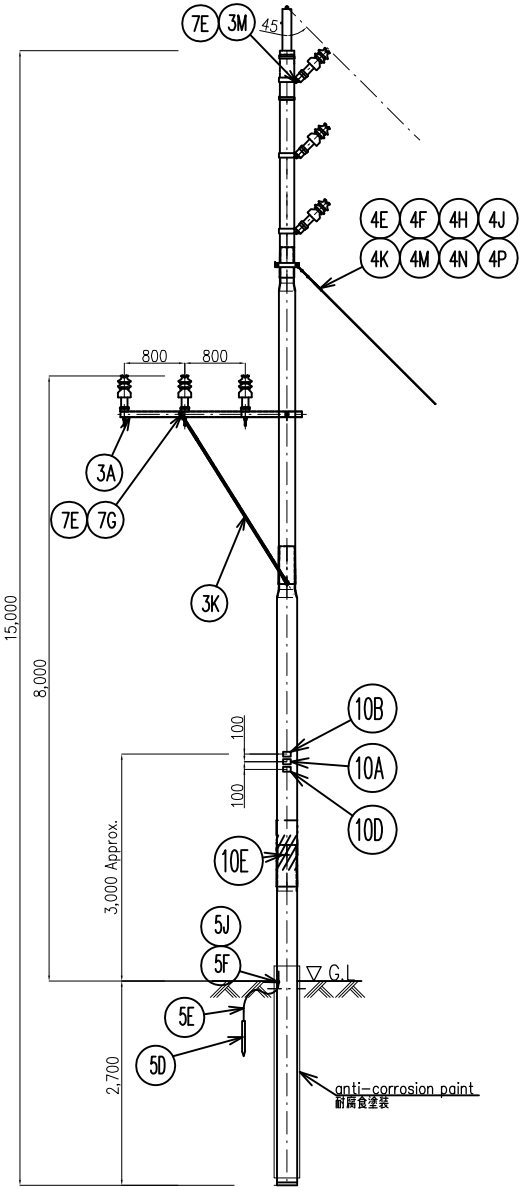
PART NO.	DESCRIPTION	Q'TY	項目
1B	Steel Pole 15m with Pole Cap	4	鋼管柱 15m キャップ付
2A	Disc Insulator	12	皿碍子
2B	Anchor Shackle	6	アンカーシャックル
2C	Ball Eye	6	ボールアイ
2D	Socket Eye	6	ソケットアイ
2F	Dead End Clamp for 33kV	6	33kV 引留クランプ
2G	Dead End Clamp for 11kV	6	11kV 引留クランプ
2J	Twist Strap	6	ねじりストラップセット
2K	Post Insulator for 33kV	18	33kV ポスト碍子
2M	Pin Insulator for 11kV	18	11kV ピン碍子
3C	Crossarm 45x75x3.2x1500	2	架空地線用腕金 (45x75x3.2x1500)
3D	Crossarm 75x75x3.2x3000 for Terminal	2	引留用 腕金 (75x75x3.2x3000)
3E	Crossarm 75x75x3.2x3400	20	腕金 (75x75x3.2x3400)
3F	Crossarm 75x75x3.2x2400	4	腕金 (75x75x3.2x2400)
3K	Crossarm Brace Pipe type	4	腕金支持金物
3L	Crossarm Support	4	腕金支持金物 (架空地線用)
4E	Stay Band	2	支線バンド (シングル)
4F	Stay Wire	60m	支線
4H	Dead End Grip for Insulator	4	巻付グリップ碍子用
4J	Dead End Grip for Thimble	8	巻付グリップシンブル用
4K	Stay Insulator 33kV	2	支線用碍子 33kV
4M	Turnbuckle	2	ターンバックル
4N	Stay Rod	2	支線棒
4P	Stay Plate	2	支線プレート
5D	Ground Rod 14x1500	1	接地棒 14x1500
5E	Lead Wire Terminal	1	引出し端子
5F	Compression Connector (38−22)	1	圧着端子 (38−22)
5J	Grounding Wire (IV38sq.mm)	40m	接地線 (IV38sq.mm)
6A	Protection Pipe for Cable (PVC150)	8m	ケーブル保護管 (PVC150)
6B	Pipe Saddle	2	管止め具
7C	Bolt&Nut M16x350(Pole/Crossarm)	18	ボルトナット M16x350(電柱/腕金)
9A	33kV Lightning Arrester	3	33kV 避雷器
9B	33kV Line Switch	1	33kV ラインスイッチ
9C	11kV Line Switch	1	11kV ラインスイッチ
9D	11kV Lightning Arrester	3	11kV 避雷器
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti−climbing	20m	昇降防止用有刺鉄線

(S=1/100)

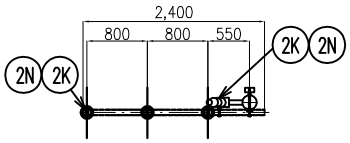
DWG No. DL-E-10

Terminal Pole (33kV-11kV Shared) Type H

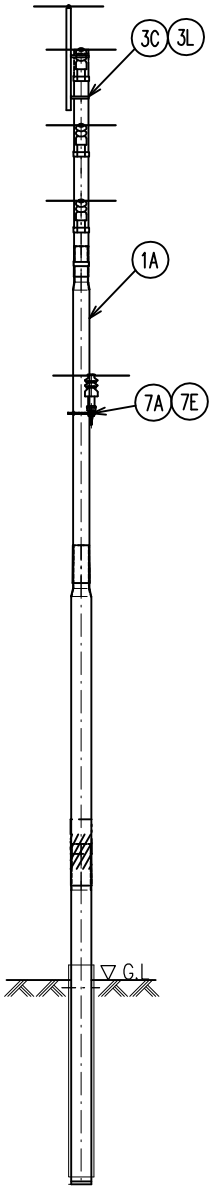
共架引留柱 (33kV-11kV) 電柱の種別 H



Elevation－1



Top



Elevation－2

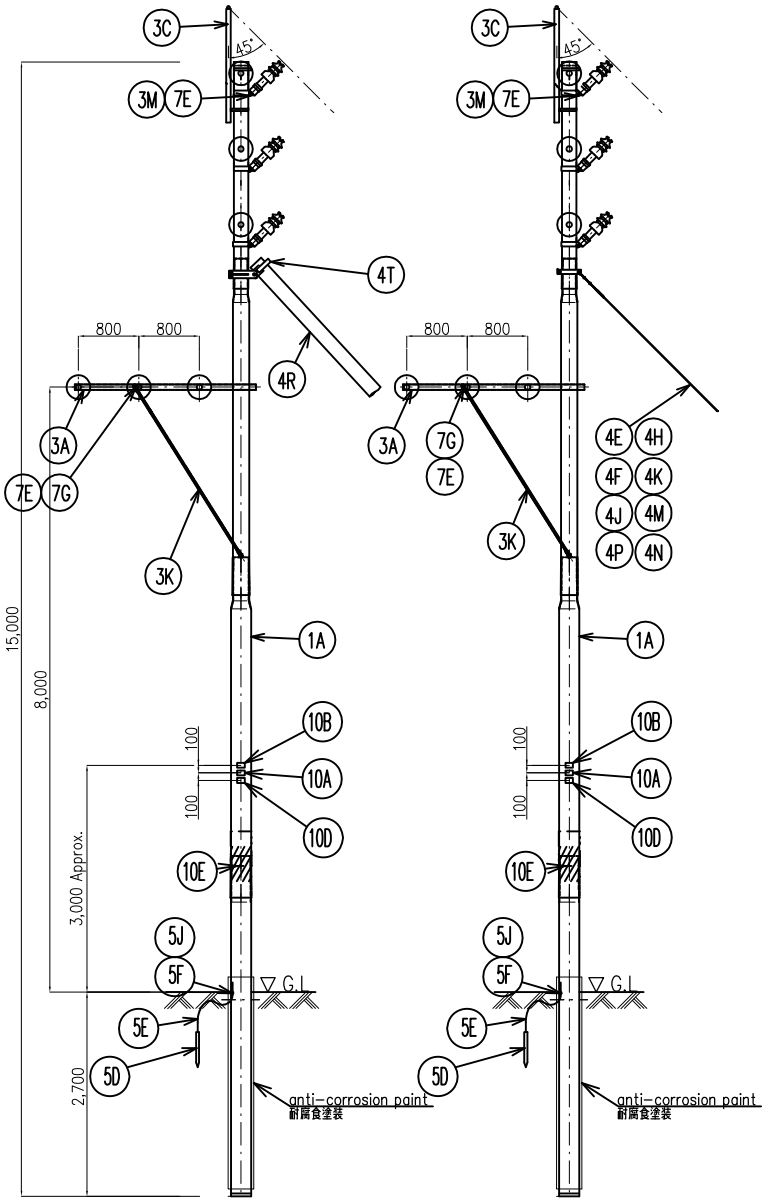
PART.NO.	DESCRIPTION	Q'TY	項目
1A	Steel Pole 15m with Pole Cap	1	鋼管柱 15m キャップ付
2K	33kV Post Insulator	3	33kV ポスト碍子
2N	Preformed Top Tie for ACSR150	3	頂部タイACSR150
3A	Crossarm 75x75x3.2x3000	1	腕金 (75x75x3.2x3000)
3C	Crossarm 45x75x3.2x1500	1	架空地線用腕金 (45x75x3.2x1500)
3K	Crossarm Brace Pipe type	2	腕金支持金物
3L	Crossarm Support	2	腕金支持金物(架空地線用)
3M	Insulator Support	3	碍子取付用金具
4E	Stay Band	1	支線バンド(シングル)
4F	Stay Wire	30m	支線
4H	Dead End Grip for Insulator	2	巻付グリップ碍子用
4J	Dead End Grip for Thimble	4	巻付グリップシンブル用
4K	Stay Insulator 33kV	1	支線用碍子 33kV
4M	Turnbuckle	1	ターンバックル
4N	Stay Rod	1	支線棒
4P	Stay Plate	1	支線プレート
5D	Ground Rod 14x1500	1	接地棒 14x1500
5E	Lead Wire Terminal	1	引出し端子
5F	Compression Connector (38-22)	1	圧着端子 (38-22)
5J	Grounding Wire (IV38sq.mm)	18m	接地線 (IV38sq.mm)
7A	Bolt&Nut M16x400(Pole/Crossarm)	1	ボルトナット M16x400(電柱/腕金)
7E	Square Washer	6	角座金
7G	Bolt&Nut M16x120(Crossarm/Brace)	1	ボルトナット M16x120(腕金/支持金物)
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti-climbing	5m	昇降防止用有刺鉄線

(S=1/100)

DWG No. DL-E-11

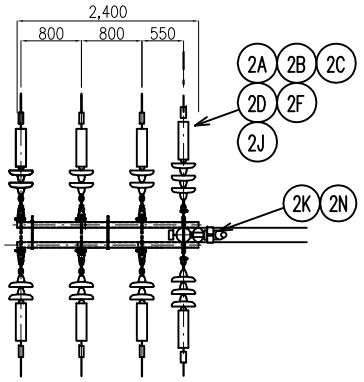
Combination Pole (33.11kV) Type I-1

共架引通し柱 (33.11kV) 電柱の種別 I-1

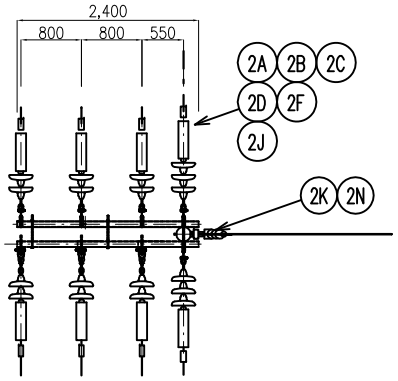


Elevation−1−a
(Stay Pole)

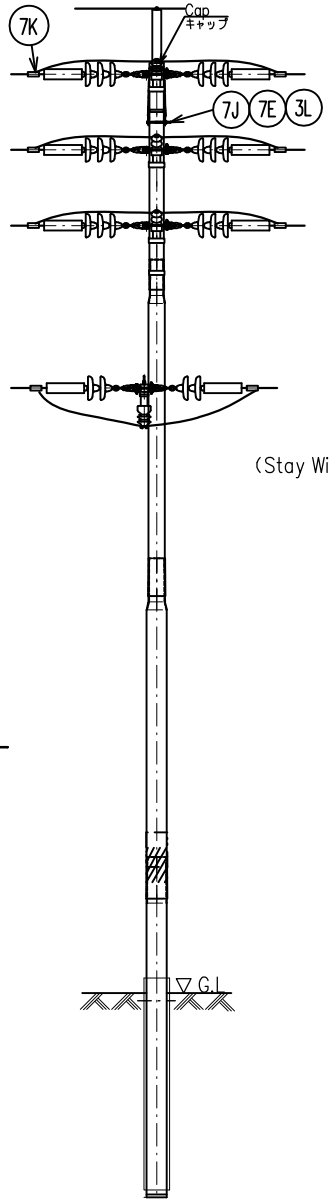
Elevation−1−b
(Stay Wire)



Top−1−a
(Stay Pole)



Top−1−b
(Stay Pole)



Elevation−2
(Common)

(Stay Pole)

PART.NO.	DESCRIPTION	Q'TY	項目
1A	Steel Pole 15m with Pole Cap,Nail	1	鋼管柱 15m キャップ付
2A	Disc Insulator	18	皿碍子
2B	Anchor Shackle	6	アンカーシャックル
2C	Ball Eye	6	ボールアイ
2D	Socket Eye	6	ソケットアイ
2F	Dead End Clamp for 33kV(ACSR150)	6	3.3kV 引留クランプ(ACSR150)
2J	Twist Strap	6	ねじりストラップセット
2K	33kV Post Insulator	3	3.3kV ポスト碍子
2N	Preformed Top Tie for ACSR150	3	頂部タイACSR150
3A	Crossarm 75x75x3.2x3000	3	腕金 (75x75x3.2x3000)
3C	Crossarm 45x75x3.2x1500	1	架空地線用腕金 (45x75x3.2x1500)
3K	Crossarm Brace Pipe type	2	腕金支持金物
3L	Crossarm Support	2	腕金支持金物(架空地線用)
3M	Insulator Support	3	碍子取付用金具
4R	Stay Pole	1	支柱
4T	Stay Pole Bracket	1	支柱取付金物
5D	Ground Rod 14x1500	1	接地棒 14x1500
5E	Lead Wire Terminal	1	引出し端子
5F	Compression Connector (38−22)	1	圧着端子 (38−22)
5J	Grounding Wire (IV38sq.mm)	18m	接地線 (IV38sq.mm)
7B	Double Arming Bolt M16x400(Pole/W-Crossarm)	3	ダブルボルト M16x400(電柱/二重腕金)
7G	Bolt&Nut M16x120(Crossarm/Brace)	2	ボルトナット M16x120(腕金/支持金物)
7J	Bolt&Nut M16x350(Pole/Brace)	2	ボルトナット M16x350(電柱/支持金物)
7E	Square Washer	20	角座金
7K	Bolt type Connector for 33kV(ACSR150/ACSR150)	12	33kV ボルトタイプコネクター(ACSR150/ACSR150)
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti−climbing	5m	昇降防止用有刺鉄線

(Stay Wire)

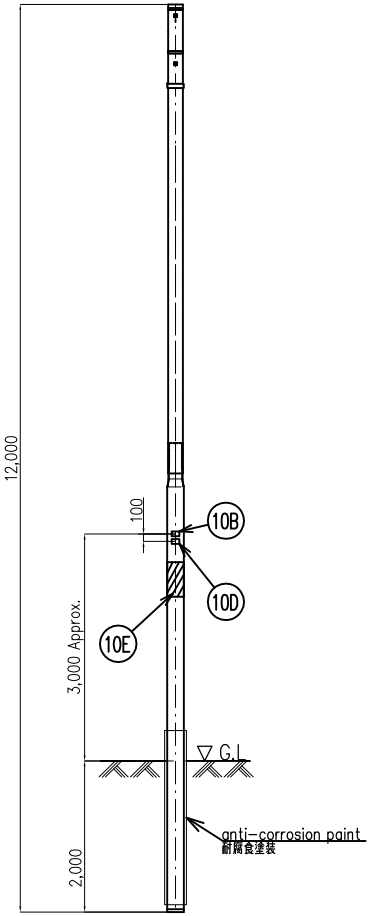
PART.NO.	DESCRIPTION	Q'TY	項目
1A	Steel Pole 15m with Pole Cap,Nail	1	鋼管柱 15m キャップ付
2A	Disc Insulator	18	皿碍子
2B	Anchor Shackle	6	アンカーシャックル
2C	Ball Eye	6	ボールアイ
2D	Socket Eye	6	ソケットアイ
2F	Dead End Clamp for 33kV(ACSR150)	6	3.3kV 引留クランプ(ACSR150)
2J	Twist Strap	6	ねじりストラップセット
2K	33kV Post Insulator	3	3.3kV ポスト碍子
2N	Preformed Top Tie for ACSR150	3	頂部タイACSR150
3A	Crossarm 75x75x3.2x3000	3	腕金 (75x75x3.2x3000)
3C	Crossarm 45x75x3.2x1500	1	架空地線用腕金 (45x75x3.2x1500)
3K	Crossarm Brace Pipe type	2	腕金支持金物
3L	Crossarm Support	2	腕金支持金物(架空地線用)
3M	Insulator Support	3	碍子取付用金具
4E	Stay Band	1	支線バンド(シングル)
4F	Stay Wire	30m	支線
4H	Dead End Grip for Insulator	2	巻付グリップ碍子用
4J	Dead End Grip for Thimble	4	巻付グリップシンブル用
4K	Stay Insulator 33kV	1	支線用碍子 33kV
4M	Turnbuckle	1	ターンバックル
4N	Stay Rod	1	支線棒
4P	Stay Plate	1	支線プレート
5D	Ground Rod 14x1500	1	接地棒 14x1500
5E	Lead Wire Terminal	1	引出し端子
5F	Compression Connector (38−22)	1	圧着端子 (38−22)
5J	Grounding Wire (IV38sq.mm)	18m	接地線 (IV38sq.mm)
7B	Double Arming Bolt M16x400(Pole/W-Crossarm)	2	ダブルボルト M16x400(電柱/二重腕金)
7J	Bolt&Nut M16x350(Pole/Brace)	2	ボルトナット M16x350(電柱/支持金物)
7E	Square Washer	20	角座金
7G	Bolt&Nut M16x120(Crossarm/Brace)	2	ボルトナット M16x120(腕金/支持金物)
7K	Bolt type Connector for 33kV(ACSR150/ACSR150)	12	33kV ボルトタイプコネクター(ACSR150/ACSR150)
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti−climbing	5m	昇降防止用有刺鉄線

(S=1/100)

DWG No. DL-E-12

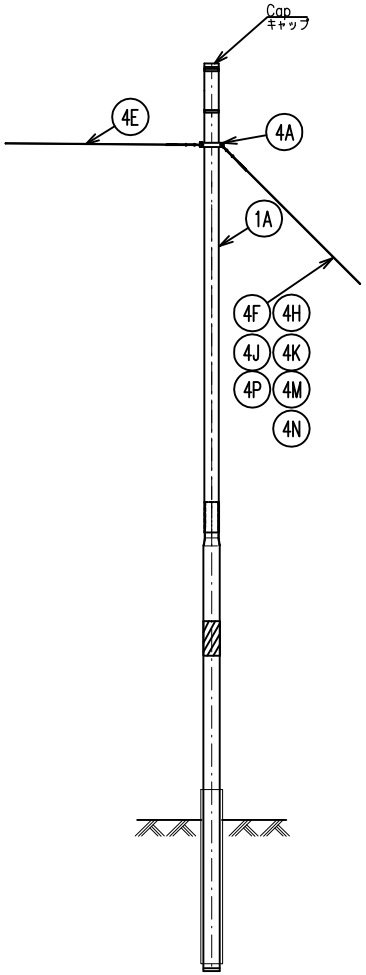
Combination Section Pole (33.11kV) Type I-2

共架両引留柱 (33.11kV) 電柱の種別 I-2



Elevation−1

Top



Elevation−2

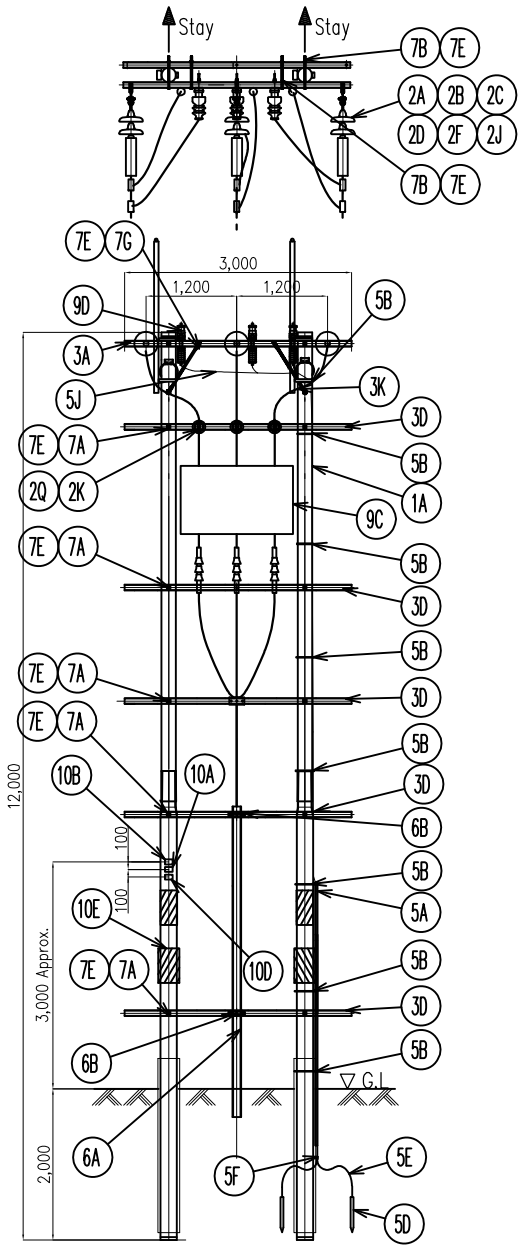
PART.NO.	DESCRIPTION	Q'TY	項目
1A	Steel Pole 12m with Pole Cap	1	鋼管柱 12m キャップ付
4A	Stay Band (Double)	1	支持バンド（ダブル）
4E	Stay Band (Single)	1	支持バンド（シングル）
4F	Stay Wire	50m	支線
4H	Dead End Grip for Insulator	2	巻付グリップ碍子用
4J	Dead End Grip for Thimble	6	巻付グリップシンブル用
4K	Stay Insulator 33kV	1	支線用碍子 33kV
4M	Turnbuckle	1	ターンバックル
4N	Stay Rod	1	支線棒
4P	Stay Plate	1	支線プレート
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti−climbing	5m	昇降防止用有刺鉄線

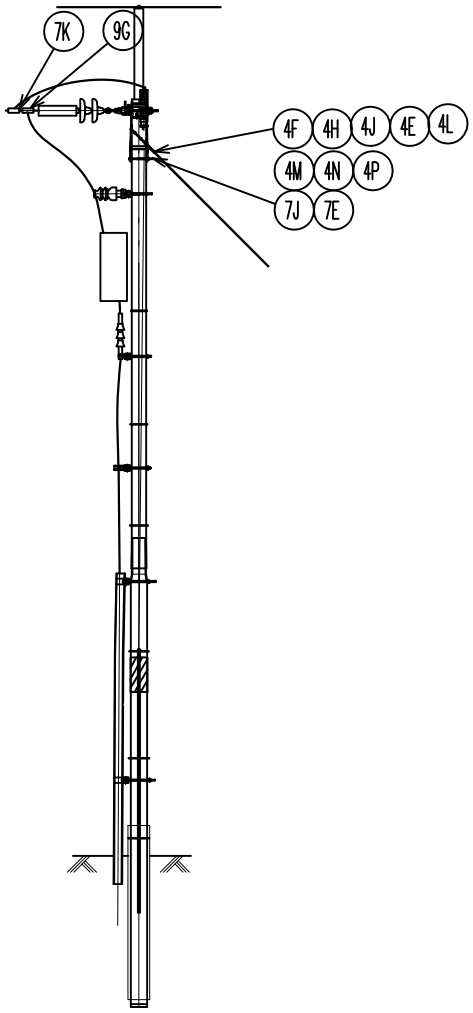
(S=1/100)

DWG No. DL-E-13

Stay Wire Pole, Pole Type J

支線柱，電柱の種別 J





PART NO.	DESCRIPTION	QTY	項目
1A	Steel Pole 12m with Pole Cap	2	鋼管柱 12m キャップ付き
2A	Disc Insulator	6	皿碍子
2B	Anchor Shackle	3	アンカーシャックル
2C	Ball Eye	3	ボールアイ
2D	Socket Eye	3	ソケットアイ
2F	Dead End Clamp for 11kV(ACSR100)	3	11kV 引留クランプ(ACSR100)
2J	Twist Strap	3	ねじりストラップセット
2K	11kV Pin Insulator	3	11kV ピン碍子
2Q	Aluminum Bind Wire 4.0mm	9m	アルミニウム結束線 4.0mm
3A	Crossarm 75x75x3.2x3000	2	腕金 75x75x3.2x3000
3D	Crossarm 75x75x3.2x3000 for Terminal	5	引留用 腕金 (75x75x3.2x3000)
3K	Crossarm Brace Pipe type	4	腕金支持金物
4E	Stay Band	2	支線バンド(シングル)
4F	Stay Wire	30m	支線
4H	Dead End Grip for Insulator	4	巻付グリップ碍子用
4J	Dead End Grip for Thimble	8	巻付グリップシンブル用
4L	Stay Insulator 11kV	2	支線用碍子 11kV
4M	Turnbuckle	2	ターンバックル
4N	Stay Rod	2	支線棒
4P	Stay Plate	2	支線プレート
5A	PVC Protection Pipe L=4.0m	1	PVC 保護管 L=4.0m
5B	Stainless Band	6	ステンレスバンドセット
5D	Ground Rod 14x1500	2	接地棒 14x1500
5E	Lead Wire Terminal	2	引出し端子
5F	Compression Connector (38-22)	2	圧着端子 (38-22)
5J	Grounding Wire (IV38sq.mm)	20m	接地線 (IV38sq.mm)
6A	Protection Pipe for Cable (PVC150)	4m	ケーブル保護管 (PVC150)
6B	Pipe Saddle	2	管止め具
7A	Bolt&Nut M16x400(Pole/Crossarm)	12	ボルトナット M16x400(電柱/腕金)
7B	Double Arming Bolt M16x400(Pole/W-Crossarm,)	2	ダブルボルト M16x400(電柱/二重腕金)
7E	Square Washer	38	角座金
7G	Bolt&Nut M16x120(Crossarm/Brace)	4	ボルトナット M16x120(腕金/支持金物)
7J	Bolt&Nut M16x300(Pole/Brace)	2	ボルトナット M16x300(電柱/支持金物)
7K	Bolt type Connector for 33kV(ACSR100/ACSR100)	6	ボルトタイプコネクター 11kV(ACSR100/ACSR100)
9C	11kV Line Switch	1	11kV ラインスイッチ
9D	11kV Lightning Arrester	3	11kV 避雷器
9G	Bolt type Connector (ACSR100 / Cu 38)	3	ボルトタイプコネクター (ACSR100 / Cu 38)
10A	Pole Number Plate	1	電柱番号札
10B	Danger Plate	1	危険表示札
10D	Japanese National Flag Plate	1	日章旗ステッカー
10E	Barbed Wire for anti-climbing	10m	昇降防止用有刺鉄線

(S=1/100)

DWG No. DL-E-14

Terminal Pole (11kV) Type K

引留柱 (11kV) 電柱の種別 K

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

As the Project shall be implemented based on the Japan's Grant Aid Scheme, it shall be approved by the Government of Japan and commence after the Exchange of Notes (E/N) between two countries and the Grant Agreement (G/A) between JICA and Tanzanian government shall be exchanged. Basic policy and special considerations needed for the Project implementation are shown below.

(1) Project Implementing Body

The supervisory responsible agency for implementing the Project on the Tanzanian side is the Ministry of Energy and Minerals (MEM), and the implementing agency is Tanzania Electric Supply Company (TANESCO). The MEM department heading the Project is the Energy and Petroleum Department, but TANESCO shall head O&M once the facilities enter in service. To keep the Project moving smoothly, the MEM Energy and Petroleum Department and TANESCO must appoint project representatives and keep close contact with the Japanese consultant and the Contractor.

The appointed TANESCO project representative must explain project details sufficiently to MEM and TANESCO project staff and project area residents so that they shall cooperate with project implementation.

(2) Consultant

The Japanese Consultant shall enter a design and supervision agreement with TANESCO to support procure and install equipment for the Project, and produce detailed design and supervise construction work related to the Project. Along with drafting Tender Documents, the Consultant shall handle bidding process on behalf of TANESCO, the project implementing body.

(3) Contractor

In accordance with Japan's Grant Aid Scheme, independent Japanese Contractor selected by Tanzanian side through open bidding shall procure and install equipment for the project.

The Contractor need to continue supplying spare parts, support for failures, and other services after the project is completed, and as such must give due consideration to a post-delivery communication and coordination for equipment and facilities.

(4) Need for Dispatching Engineers

This Project is complex, combining construction of substations with civil engineering, construction and installation of substation facilities at multiple sites as well as work on 17.2 kilometers of distribution lines and reinforcement of transmission lines spanning 7.5 kilometers. Construction shall also need to be coordinated with existing substation facilities which need to

be linked. With the majority of the work being done concurrently, it is essential that foremen familiar with the Japan's Grant Aid Scheme be dispatched from Japan to keep management and site guidance for the whole works consistent in terms of scheduling, quality, finished forms and safety management.

Highly skilled engineers are needed during equipment installation and for post-installation adjustments and testing for the substation facilities and 132kV transmission lines, so local contractors cannot be used for anything besides Labors. Engineers must be sent from Japan to fulfill these roles and handle quality control, technical guidance and schedule management.

2-2-4-2 Implementation Conditions

(1) Tanzania Construction Conditions and Technology Transfers

There are a number of general construction and electrical contractors in Dar es Salaam which can accept orders for Labors, transportation vehicles and construction equipment within Tanzania, as well as general workers for project civil engineering and construction work for substations and work on transmission and distribution lines. However, given that this is a Japan's Grant Aid Project and requires concurrent work at multiple sites, including mutual coordination between sites and overall management, it is essential that Japanese engineers be dispatched to handle schedule management, quality control and safety management.

Meanwhile, highly skilled engineers are needed for substation facility installation and for post-installation adjustments and testing, so local contractors cannot be used for anything besides Labors. As such, it is best that Japanese contractors hire Labors and procure mounting equipment and other materials from local contractors, and dispatch Japanese engineers. Also, the Japanese engineers are to train Tanzanian engineers on the job training (OJT) during the installation period as a technology transfer.

(2) Using Local Equipment and Materials

There is much precedent showing that aggregate, cement, rebar and other materials for use in civil engineering and construction work can be procured locally. Thus, in the interest of developing local industries, equipment that can be procured locally is to be used to the extent possible when formulating the construction plan. That being said, Tanzania relies on imports for the principle distribution equipment and materials needed for the Project. Local Tanzanian materials are not usable, so materials and equipment shall be procured from Japan or third countries.

(3) Safety Measures

While Tanzania has relatively less security issues than neighboring countries, they do have cases of pickpocketing, theft, burglary and robbery. General crime tends to increase after fasting and before and after Christmas and other religious holidays. There are also concerns that crime

intensity could increase in urban areas with increased smuggling of arms, narcotics and other illicit materials by illegal immigrants and over stayers from neighboring countries. Sites for the project are located in Dar es Salaam, an area that is easily accessible and easy to monitor project execution. Still, security conditions could destabilize, and sufficient care must be taken to prevent equipment theft and ensure the safety of construction staff. The Tanzanian government shall take necessary measures for safety, the Japanese side shall also be taking the safety measures.

(4) Tax Exemption

The Tanzanian exemption procedure (including VAT) for equipment and materials procured for the Project is as follows: 1) the Contractor requests TANESCO to exempt the materials, 2) TANESCO requests the Ministry of Finance to issue a tax exemption letter via MEM, 3) the Ministry of Finance issues the tax exemption letter to customs, with a copy issued to MEM and the Contractor. When procured equipment and materials arrive at port in Tanzania, the Contractor is required to attach the above copy of the tax exemption letter with the given shipping documents to be submitted to customs for tax exemption. Care must be taken that tax exemption delays do not impact project progress.

2-2-4-3 Scope of Works

The Japanese side shall procure, install, test and adjust reinforced, expanded and new substations, 132kV transmission line reinforcement and 33kV distribution line work for the Project in the Japanese and Tanzanian construction scopes and perform necessary civil engineering and construction work. The Tanzanian side shall handle leveling of sites, connection of the enhanced, expanded or new substations to existing distribution lines and other work. Detailed work demarcation for Japanese and Tanzanian sides is as shown in Table 2-2-4-3.1.

Table 2-2-4-3.1 Procurement and Construction Work Demarcation for the Project

Item	Procurement		Installation Work		Notes
	Japan	Tanzania	Japan	Tanzania	
1. General Construction					
(1) Compensation associated with relocation plan		○		○	To be completed before commencement of the works by the Japanese side.
(2) Provide equipment/material storage yard		○		○	To be completed before commencement of the works by the Japanese side.
(3) Ensure work safety for site workers		○		○	Work safety measures to be taken as necessary during works.
(4) Support and compensate consumers for necessary power outages during works		○		○	
(5) Inform consumers of planned power outages during works		○		○	
(6) Road transport restrictions		○		○	(As necessary)
(7) Provide disposal site for surplus soil and gray water		○		○	(As necessary)

Item	Procurement		Installation Work		Notes
	Japan	Tanzania	Japan	Tanzania	
(8) Secure connections for construction facilities (water, drainage, rainwater, phone equipment, etc.)		○		○	(As necessary)
(9) Procure office furniture and fixtures		○		○	(As necessary)
2. Reinforcement and Expansion of Existing Substations					
Reinforcement of Existing Substation: Ilala Substation					
(1) Remove waste and existing structures at the Sites		○		○	To be completed before commencement of the works by the Japanese side.
(2) Site leveling, reclamation and drainage work		○		○	(As necessary)
(3) Leveling access roads		○		○	(As necessary)
(4) Drainage facilities for access roads		○		○	(As necessary)
(5) Temporary fence and gates	○		○		
(6) Construction of control buildings (incl. construction and fire-fighting equipment)	○		○		
(7) Substation civil engineering (incl. equipment foundations, site roads and outdoor lighting)	○		○		
(8) Substation work (equipment procurement, installation, commissioning, adjustment, etc.)	○		○		
(9) Earthing works	○		○		
(10) Connecting 132kV transmission lines	○		○		
(11) Extending 132kV bus-bar	○		○		
(12) Replacing 132kV disconnecting switches, CTs, etc.	○		○		
(13) Transfer protection and control panel for new 15-MVA 33/11kV transformers to control building		○		○	(New equipment delivered by AfDB)
(14) Connecting existing 33kV and 11kV distribution lines with enhanced substation facilities		○		(○)	TANESCO to connect according to Japanese schedule and direction.
(15) Replacing outgoing CTs for 132kV transmission line	○		○		(on Ubungo Substation side)
(16) Reuse existing 33kV outdoor circuit breakers at other substations		○		○	(Delivered under JICA follow-up project)
(17) Outgoing 11kV distribution lines (to cable head of the first poles)	○			○	(Connection and testing shall be done by the Japanese side)
Expansion of Existing Substation: Msasani Substation)					
(1) Remove waste and existing structures at the Sites		○		○	To be completed before commencement of the works by the Japanese side.
(2) Transferring existing emergency generator		○		○	(incl. related distribution line work)
(3) Site leveling, reclamation and drainage work		○		○	(As necessary)
(4) Leveling access roads		○		○	(As necessary)
(5) Drainage facilities for access roads		○		○	(As necessary)
(6) Temporary fence and gates	○		○		
(7) Control building construction	○		○		
(8) Substation civil engineering (incl. equipment foundations, site roads and outdoor lighting)	○		○		
(9) Substation work (equipment procurement, installation, commissioning, adjustment, etc.)	○		○		
(10) Earthing works	○		○		
(11) Connecting 33kV distribution lines with expanded substation facilities	○		○		
(12) Outgoing 11kV distribution lines (to the first poles)	○			○	(Connection and testing shall be done by the Japanese side)

Item	Procurement		Installation Work		Notes
	Japan	Tanzania	Japan	Tanzania	
(13) Connection with existing substation facilities (11kV side)	○			(○)	TANESCO to connect according to Japanese schedule and direction.
3. New Substation Construction (Jangwani Beach, Mwananyamala and Muhimbili Substations)					
(1) Remove waste and existing structures at the Sites		○		○	To be completed before commencement of the works by the Japanese side.
(2) Site leveling, reclamation and drainage work		○		○	
(3) Leveling access roads		○		○	(As necessary)
(4) Drainage facilities for access roads	(○)	○	(○)	○	(As necessary)
(5) Temporary fence and gates	○		○		
(6) Permanent fence and gates		○		○	
(7) Construction of control buildings (incl. construction and fire-fighting equipment)	○		○		
(8) Substation civil engineering (incl. equipment foundations, site roads and outdoor lighting)	○		○		
(9) Substation work (equipment procurement, installation, commissioning, adjustment, etc.)	○		○		
(10) Connecting 33kV distribution lines with substation facilities	○		○		
(11) Earthing works	○		○		
(12) Outgoing 11kV distribution lines (to the first poles)	○			○	(Connection and testing shall be done by the Japanese side)
4. 132kV Transmission Line Expansion and 33kV Distribution Line Work					
(1) Securing access roads, wayleaves and usage permissions for construction of 132kV transmission lines and 33kV distribution lines		○		○	
(2) Improvement work for access roads, wayleaves and usage permissions for construction of 132kV transmission lines and 33kV distribution lines	○		○		(As necessary)
(3) Cutting trees and moving/removing obstacles in above wayleave		○		○	(As necessary)
(4) 132kV transmission line reinforcement and 33kV distribution line work (incl. overhead grounding wire)	○		○		
(5) Connecting with above related substation facilities	○		○		
5. Other					
(1) Spare parts, maintenance tools (incl. testing equipment)	○			○ (storage)	Maintenance tools shall also be used in Japanese installation work.
(2) Delivery testing			○	○ (witness)	
(3) OJT(On-the-Job Training)			○ (guidance)	○ (selection of engineer)	

Note: Circles denote scope.

2-2-4-4 Consultant Supervision

According to Japan's Grant Aid Scheme, the Consultant is to form a project team consistent with the final design and construction supervision based on the spirit of the basic design and smoothly completes the work. Construction requires mutual coordination between sites; the Project sites are in an urban area with much public activity, and the Project is complex, combining construction of substations with civil engineering, construction and installation of substation facilities at multiple sites

as well as distribution line work and reinforcement of transmission lines. No less than four engineers shall be stationed to handle schedule management, quality control, work progress control and safety management: one each for the Ilala Substation, the other substations, transmission and distribution facilities and civil engineering/construction. Other engineers shall also be dispatched to manage construction progress with equipment installation, commissioning and adjustments, delivery testing and other work. As necessary, a domestic expert is to witness factory inspections and pre-shipment inspections for equipment manufactured domestically, and also supervise to prevent problems after unloading equipment at the Sites.

(1) Basic Policy for Construction Management

As basic policy, the Consultant is to supervise progress such that the work is completed within the given construction period. Along with ensuring equipment is delivered on time up to the quality and finished forms given in the agreement, they are to supervise and advise the Contractor so that they can perform the work safely at the Sites.

The followings are the main points to be kept in mind for construction supervision.

1) Schedule Management

The Consultatnt shall compare actual progress against the work schedule planned at time of contract monthly and weekly so that the Contractor shall keep the delivery schedule given in the contract. If they interpret work to be behind schedule, the Consultant shall warn the Contractor and request them to submit and implement plans to get back on schedule, and guide the Contractor so they can complete the work and deliver equipment within the contract construction period. The following items shall be compared between work schedule and project progress:

- Work progress – progress of equipment and material manufacturing and site civil engineering and construction
- Equipment and material transport to the Sites – equipment and materials for substation, transmission and distribution facilities, civil engineering and construction
- Temporary works and readiness of construction machinery
- Productivity and actual numbers of engineers, skilled workers, Labors and other workers

2) Quality and Work Progress Control

The Consultant shall determine whether equipment manufactured, delivered or installed and facilities built meet the equipment and facility quality and finished forms required in the contract documentation. The Consultant shall request the Contractor to immediately correct, change or revise the work if quality or finished form is in danger of being compromised. Management shall be based on the following items:

- Verify fabrication drawings and specifications for equipment
- Witness factory inspections for equipment or verify inspections
- Verify packaging, transportation and temporary placements on the Sites

- ◆ Verify working drawings and installation manual procedures for equipment
- ◆ Verify equipment commissioning, adjustment, testing and inspection reports
- ◆ Supervise site installation of equipment and witness commissioning, adjustments, tests and inspections
- ◆ Verify equipment working drawings, fabrication drawings, and finished forms

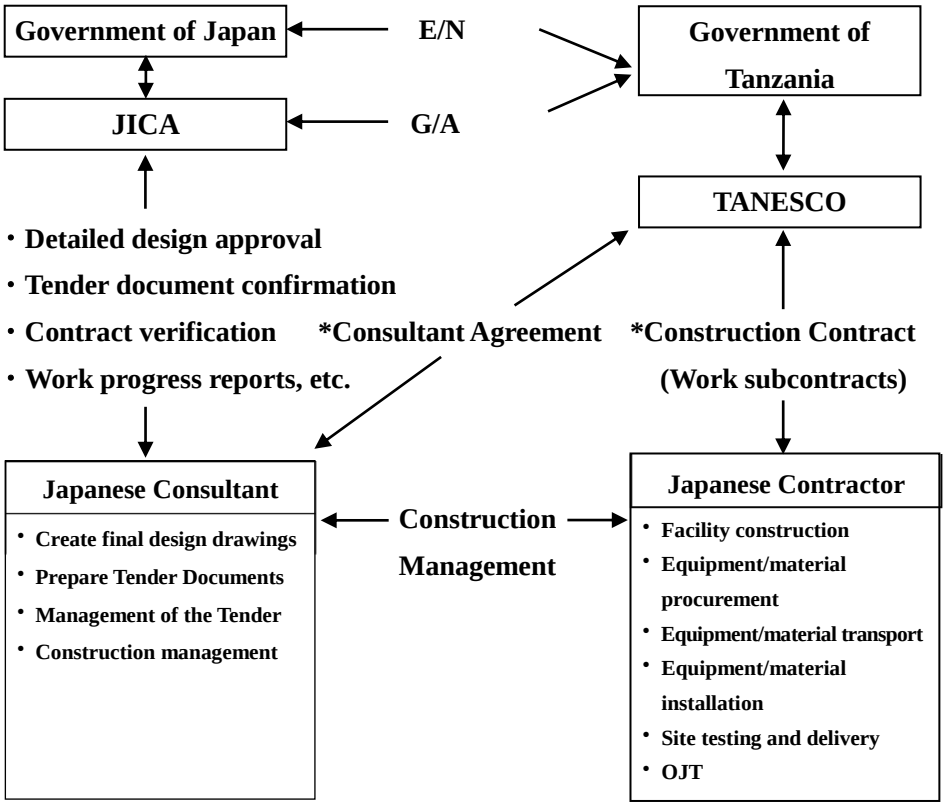
3) Safety Management

The Consultant shall consult and work together with the contractor's representative, and manage work safely to prevent any occupational accidents on the Sites during the construction period or accidents involving third parties. The following actions are to be taken in terms of site safety management:

- ◆ Establish safety management regulations and select a safety manager
- ◆ Prevent disasters through regular inspection of construction machinery
- ◆ Decide a service route for transport machinery and other work vehicles, and ensure safe driving
- ◆ Strictly insist workers take advantage of worker benefits and take leave

(2) Overall Relationships concerning Project Implementation

Figure 2-2-4-4.1 shows the mutual relationships between Project parties including the Consultant supervision.



*JICA shall verify Consultant Agreement and Construction Contract

Figure 2-2-4-4.1 Project Relation Diagram

(3) Construction Managers

The Contractor shall procure and supply equipment and materials for ancillary work on substation, transmission and distribution facilities, as well as install substation, transmission and distribution equipment. Further, they shall subcontract local Tanzanian contractor to perform the work. Accordingly, the Contractor is required to ensure subcontractor fully comply with the work schedule, quality, finished form and safety measures given in the work contract. To accomplish this, the Contractor shall deploy engineers with experience in similar overseas work to guide and advise local contractors.

Given the scale and details of the substation, transmission and distribution equipment installation work for this project, contractors station at least the number of engineers given in Table 2-2-4-4.1 is recommended.

Table 2-2-4-4.1 Engineers to be dispatched by the Contractor

Title of engineers	Number of engineers	Responsibilities	Dispatch period
Local procurement supervisor (Substation-1)	1	Supervision of all installation works (Ilala Substation), coordination with related agency, acquisition of approval, implementation of OJT, equipment and materials procurement management, customs clearance procedures, labor management, accounting	Throughout the installation period
Local procurement supervisor (Substation-2)	1	Supervision of installation works (Msasani, Muhimbili, Jangwani Beach, Mwananyamala Substations), equipment and materials procurement management, labor management, accounting	Throughout the installation period
Local procurement supervisor (Transmission/distribution)	1	Supervision of installation works (transmission/distribution), implementation of OJT, equipment and materials procurement management, labor management, accounting	Throughout the installation period
Inspector 1 (Transmission/distribution facilities)	1	Confirmation and verification of shop drawings for equipment, pre-shipping inspection	Drawing approval period
Inspector 2 (Substation facilities)	1	Confirmation and verification of shop drawings for equipment, pre-shipping inspection, equipment test	Equipment test and pre-shipping inspection period
Local procurement supervisor (Architectual engineer 1)	1	Site Manager; Supervision of construction works, On-site inspection, coordination with related agency, acquisition of approval	Construction works period
Local procurement supervisor (Architectual engineer 2)	1	Assistance to the Site Manager	Construction works period
Local procurement supervisor (Equipment engineer)	1	Supervision of construction facility works, On-site inspection	Construction works period
Local procurement supervisor (Clerical)	1	Office clerk	Construction works period
Procurement assistant 1 (Locally recruited)	1	Assistance to local procurement supervisor, coordination of On-site inspection, coordination of local subcontractor, OJT assistant	Throughout the installation period
Procurement assistant 2 (Locally recruited)	1	Office clerk: Assistance to local procurement supervisor, coordination of On-site inspection, coordination of local subcontractor, OJT assistant	Throughout the installation period
Procurement assistant 3 (Locally recruited)	1	Office boy	Throughout the construction and

Title of engineers	Number of engineers	Responsibilities	Dispatch period
			installation period
Procurement assistant 4 (Locally recruited)	1	Security (three shifts)	Construction works period
Procurement assistant 5 (Locally recruited)	1	Security (three shifts, four sites)	Construction works period

2-2-4-5 Quality Control Plan

In terms of the quality control plan, the consultant shall determine whether equipment manufactured, delivered or installed and facilities built meet the equipment and facility quality and finished forms required in the contract documentation. The Consultant shall request the Contractor to immediately correct, change or revise the work if quality or finished shape is in danger of being compromised. Management shall be based on the following items:

① Examination of shop drawings and specifications for equipment and materials
② Observation of factory inspections or examination of factory inspections results
③ Examination of methods of packaging, transportation and temporary storage on the Sites
④ Examination of shop drawings and installation manual for equipment
⑤ Examination of commissioning, adjustment, test and inspection reports
⑥ Supervision of installation for equipment and observation of commissioning, adjustments, test and inspections
⑦ Examination of shop drawings and progress at the Sites

2-2-4-6 Procurement Plan

There are no manufacturers in Tanzania for substation, transmission or distribution equipment to the scale of those to be procured and installed in the Project. Various equipment and materials in Tanzanian projects are thus procured from European countries and Japan based on project funding. Some European substation equipment manufacturers do have local distributors and manufacturing plants for substations, switch gears and related equipment, but few have the necessary systems in place to handle accidents, repairs, spare parts and other post-delivery services for high-voltage transformers and distribution equipment. In contrast, TANESCO is familiar with O&M of Japanese equipment as procured in past Japan's Grant Aid and has faith in Japanese after-delivery service systems. It is thus highly preferable that Japanese products are used for the central equipment in the Project. In light of these local conditions, factors such as ease of facility O&M for Tanzanian engineers, as well as spare parts procurement, accident support and other post-delivery services must be considered when selecting a supplier for substation facility equipment for the Project.

However, the 132kV system to be procured for the Project is a European standard voltage class; corresponding Japanese systems are 154kV. Due to differences in insulation, Japanese circuit breakers, disconnectors and other switching equipment are not expected to be price competitive. Thus, procurement shall be opened up to other DAC countries in addition to Japan to keep things competitive.

Given the above, the suppliers for equipment and materials used in this project are as follows.

(1) Locally Procured Equipment and Materials

Construction equipment/materials: Cement, sand, concrete aggregate, concrete roadblocks, brick, wood, gasoline, diesel, construction vehicles, cranes, trailers and other temporary work equipment/materials

(2) Equipment and Materials Procured in Japan

1) Substation Facility Equipment and Materials

132/33kV and 33/11kV transformers, Station service transformer, etc.

2) Transmission and Distribution Line Equipment and Materials

Transmission and distribution line equipment and materials: steel poles, insulator, cross arms, earthing equipment, etc.

(3) Equipment and materials to be procured from Japan or other DAC countries

132kV facilities, 33kV and 11kV switchgears, Control system, etc.

Items procured in Japan shall also be packed to sufficiently withstand long marine transport, port unloading, inland transport to the Project Sites and storage.

The port of discharge for equipment and materials shall likely be Dar es Salaam Port. The port is well equipped with large-scale unloading facilities and shall pose no problems in discharging project payloads. Roads from port to the Project Sites are well paved.

2-2-4-7 Operational Guidance Plan

Before completing construction, guidance on initial operation and regular O&M for equipment procured for the Project shall be performed. The manufacturer shall give such guidance as on-site OJT and in accordance with the O&M supervision manuals. They shall also teach how to maintain transformer insulating oil and repair TANESCO vacuum oil purifiers. Insulating oil maintenance training is expected to be for workshop and subsidiary group leader class staff with OJT training on the Sites.

To keep this guidance plan moving smoothly, TANESCO must appoint a full-time engineer to attend the OJT and keep close contact with the Consultant and the Contractor. The appointed TANESCO engineer must build up the skill level of staff unable to attend and work to improve TANESCO maintenance abilities.

2-2-4-8 Implementation Schedule

Based on the Japan's Grant Aid Scheme, the Project implementation schedule is given in Figure 2-2-4-8.1.

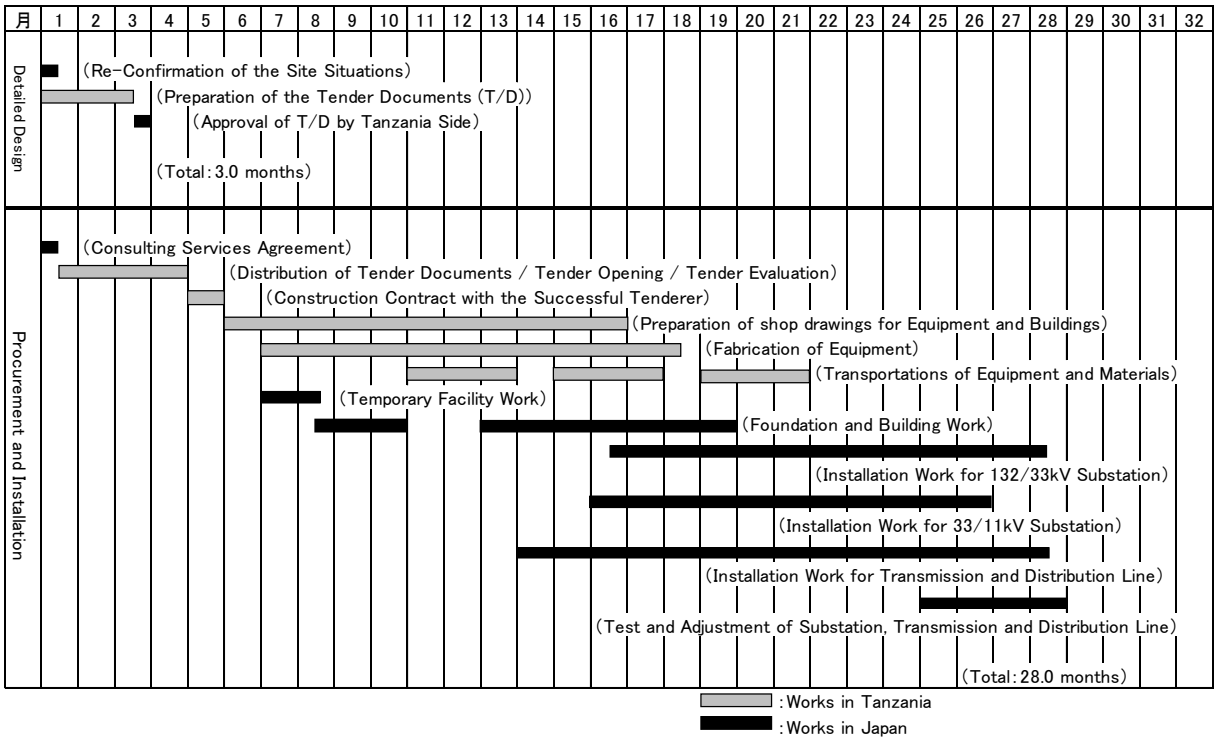


Figure 2-2-4-8.1 Project Implementation Schedule

2-3 Obligations of Recipient Country

Other than the items assigned in Section 2-2-4-3, Tanzanian side is responsible for the following:

Common Items

(1) To provide necessary information and data for the Project

(2) To secure tax exemption and customs clearance and unloading necessary equipment and materials for the Project at Tanzanian port swiftly

(3) To exempt taxes and tariffs and provide conveniences regarding products and services required for the Project and Japanese nationals dispatched therein

(4) To exempt business taxes regarding products and services required for the Project, Japanese corporations and individuals

(5) To bear excess weight charges for domestic transport

(6) To bear registration fees for the Consultant and the Contractor

(7) To pay commission fees to the Japanese bank in relation to opening of a bank account and payment for the Project

(8) To bear all items not covered under Japan's Grant Aid when implementing the Project

(9) To appoint professional engineers to transfer O&M techniques for the Project, confirm construction works and attend quality inspections during the construction period

(10) To properly and effectively use and maintain the facilities and equipment procured under the Japan's Grant Aid

(11) To compensate the people affected by the Project and obtain necessary agreement

(12) To inform consumers of planned power outages during construction work

(13) To relocate gravesites at the wayleave area for 132kV transmission line

(14) Environmental monitoring

Preparation Work

(15) To obtain the land acquisition for new substations

(16) To provide work offices, equipment and material storage yard and temporary yard.

(17) To level the land for construction of substations, transmission lines and distribution lines

(18) To relocate waste and unused equipment on the Sites

(19) To prepare temporary storage facility for insulation oil of 90MVA transformer and dispose it

(20) To construct fences and gates (permanent)

(21) To level access roads for Ilala Substation

(22) To relocate 11kV end pole and accessories at Ilala Substation

(23) To secure access road for construction of 132kV transmission line

(24) To secure access road to Muhimbili Substation

(25) To cut trees in 33kV distribution lines

(26) To remove unused conductor, insulators, accessories, etc. on existing transmission line

Tanzania Side Work

(27) To connect between reinforcement, expansion and new substations and existing 33kV and 11kV distribution lines

(28) To connect between the Multiplexers and Micro SCADA System of Ilala Substation

(29) To connect necessary GCC/DCC system to related equipment

2-4 Project Operation Plan

2-4-1 Basic Plan

Proper O&M for the transmission, distribution and substation facilities, as well as preservation of their surrounding environments, are essential to improving consumer trust in power supply in the Project area and steady power supply management. As such, appropriate preventative maintenance is recommended to reduce the rate of facility accidents and improve trust, safety and efficiency levels.

The basic concepts for transmission, distribution and substation facility O&M are shown in Figure 2-4-1.1. Preventive maintenance must be the focus for maintenance of equipment and facilities procured, installed and built for the Project.

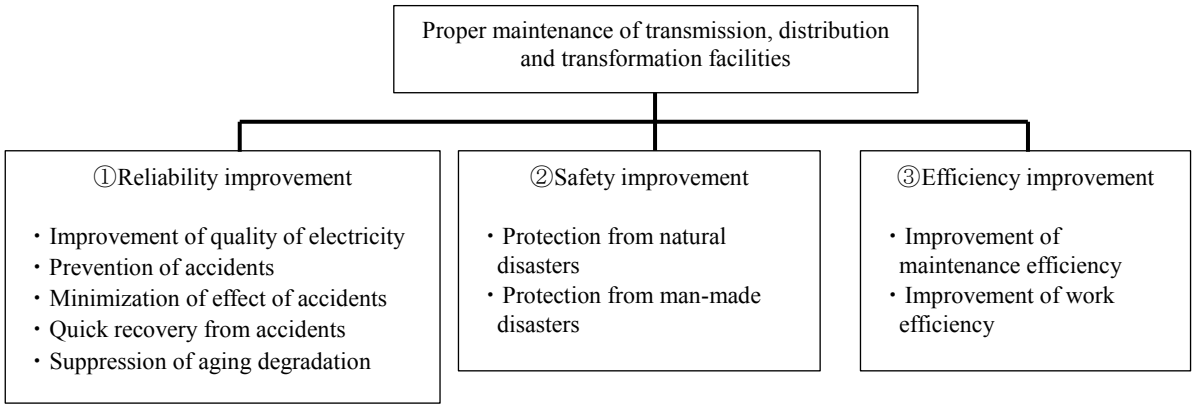


Figure 2-4-1.1 Basic Concepts for Transmission, Distribution and Substation Facility Maintenance

In the Project, engineers dispatched from Japanese contractor are planned to train local engineers in O&M for the transmission, distribution and substation facilities during installation and the testing and adjustment periods. The fruits of this OJT can be fully reaped by also having Japan furnish the necessary spare parts, tools for testing and maintenance, and O&M manuals, and establishing an O&M system for after services have started.

2-4-2 Operation and Maintenance Structure

TANESCO plans to organize a system with the following local offices under the overall supervision of the TANESCO Ubungo headquarters. Therefore, a proper organization and personnel structure for managing power operations can be expected.

Kinondoni North Regional Office

- Jangwani Beach Substation
- Mwananyamala Substation
- Msasani Substation (Existing)
- 33kV distribution lines connecting Tegeta and Jangwani Substations Beach, Makumbusho and Msasani Substations, and Makumbusho and Mwananyamala Substations

Ilala Regional Office

- Muhimbili Substation
- Ilala Substation (Existing)
- 132kV transmission line between Ubungo and Ilala Substations, and 33kV distribution line between New City Center and Muhimbili Substations

2-4-3 Regular Inspection Items

(1) Regular Inspections for Substation Facilities

The standard regular inspection items for the substation facilities procured and installed in the Project are given in Table 2-4-3.1.

As given in the table, inspections for the above facilities are classed as follows: 1) Daily inspections, which a sensory check to detect abnormal heat, sounds and smells from equipment, 2) Regular inspections, which check equipment for loose bolts, surface dirt or damage on insulation and other charging section items not checked on daily inspections, and 3) Detailed inspections, which include functional checks of interlock mechanisms between devices and precision maintenance of instrumentation.

Normal inspections shall be conducted once every one to two years, and detailed inspections shall be conducted once every four years. Fuses, metering, relays and other components of switchboard with deteriorating performance, reduced insulation, contact wear or change in qualities should be replaced as appropriate on regular and detailed inspections upon confirming component qualities and frequency of use.

Table 2-4-3.1 Inspection Items for Standard Facility Equipment

Inspection Items	Details of Inspection (Method)	Daily	Regular	Detailed
Visual appearance	State of switch indicators and display lights	○	○	
	Abnormal noise and/or smells	○	○	
	Overheat and discoloration of terminal	○	○	
	Cracking, damage or staining of bushings and porcelain tubes	○	○	
	Rust on mounting cases, frame, etc.	○	○	
	Abnormal heat (temperature gauge)	○	○	
	Clamping of bushing terminal (mechanically checked)	○	○	
Operating Devices and Control Panel	Display conditions on measuring instruments	○	○	○
	Indication on operation counters		○	○
	Dampness, rust or staining on operation box or panel		○	○
	Refilling oil, cleaning		○	○
	Clamping of distributing terminals	○	○	○
	Confirmation of switching display status		○	○
	Air or oil leaks		○	○
	Confirmation of pressures (air, etc.) before/after operation		○	○
	Confirmation of operation meter		○	○

Inspection Items	Details of Inspection (Method)	Daily	Regular	Detailed
	Rust, deformation and/or damage on springs (maintenance)	○	○	○
	Abnormalities of tightening pins		○	○
	Inspection of auxiliary switches and relays (maintenance)		○	○
	Inspection of DC control power source	○		
Measure and Test	Measurement of insulating resistance		○	○
	Measurement of contact resistance			○
	Breakage of heater wires		○	○
	Operation test of relay		○	○

(2) Regular Inspections for Transmission Lines

① Breakage and uneven sag of electric conductors

② Damage of insulators

③ Contact between lines and trees, etc

④ Scratches on steel towers, loose bolts or leaning

⑤ Damage of tower foundations

(3) Regular Inspections for Distribution Lines

Maintenance of distribution line is the most important services to consumers and entails discovering breakdown, damage and breakage areas through routine inspection patrols and implementing immediate recovery work when breakdowns occur. Preventive measures are also needed, such as cutting trees when there is risk of earthing faults, etc. being caused by contact of lines with trees and so on. The main points which should be checked for during routine patrols are as follows:

① Breakage of electric conductors

② Damage of insulator

③ Contact between lines and trees, etc

④ Scratches on pole damage

⑤ Tilted poles

⑥ Distribution transformer condition, oil leaks

⑦ Check switch status

2-4-4 Spare Part Purchasing Plan

(1) Spare Part Categories

Spare parts covered in this project are classified into the following applications:

① Consumables

② Replacement parts

(2) Selection Criteria for Each Spare Part Category

① Consumables

Parts which wear and deteriorate with daily operations and must be replaced regularly. Represents 100% of the number expected to be required annually.

② Replacement parts

Parts which do not wear and deteriorate with daily operations, but are likely to be damaged and need repairs. Represents 100% of the number expected to be required annually.

(3) Maintenance Tools

Testing instruments and tools needed for proper O&M in the Project shall be procured. (Please refer to Table 2-2-2-4.19 Spare Parts for 5 Substations)

(4) Budgeting for Spare Parts and Maintenance Tools

Spare parts for substation, transmission line and distribution line equipment include spare parts for replacement due to deterioration and replacement parts needed for accidents and other emergencies. Spare parts must be purchased once Tanzanian side surveys the parts needed for the regular inspections described above.

The Project plans include procurement of the minimum spare parts and maintenance tools needed for one year. Tanzanian side is responsible for preparing a budget for purchasing additional necessary spare parts at latest one year after project completion.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Costs to be borne by the Tanzanian side

2,043,000 US$ (approximately 196 million yen)

Tanzania itemized details and their amounts are as given below:

① Securing of land for material storage 16,000 US$ (1,500,000 JPY)

② Payment of bank commission based on banking: 52,000 US$ (5,000,000 JPY)
- Commission of the Authorization to Pay (A/P)
- Payment commission

③ Registration for Japanese supervisors and engineers for construction period: 35,000 US$ (3,400,000 JPY)

④ Expenses for necessary power outages during construction period: 15,000 US$ (1,400,000 JPY)

⑤ RAP Compensation: 270,000 US$ (26,000,000 JPY)

⑥ Expenses for relocation of gravesites 110,000 US$ (10,600,000 JPY)

⑦ Expenses for EIA procedures 30,000 US$ (2,900,000 JPY)

⑧ Excess weight charges for domestic transport: 66,000 US$ (6,400,000 JPY)

⑨ Expenses for substations: 790,000 US$ (76,100,000 JPY)
(Leveling the land, Removing the un-used equipment, Construction of fences and gates, etc.)

⑩ Expenses for 132kV transmission lines: 55,000 US$ (5,300,000 JPY)
(Leveling the land for the work space, Removing the un-used conductor, insulators and accessories, etc.)

⑪ Expenses for 33kV distribution lines: 604,000 US$ (58,200,000 JPY)
(Replacement of the existing 11kV distribution line interfered with the new 33kV distribution line, Construction of 11kV distribution line from new 33/11kV substations)

(2) Estimation criteria

① Time of estimation: August 2013

② Exchange rate: 1 US$ = 96.32 JPY (TTS average from February to April 2013)

③ Construction/procurement period: Periods for detailed design, equipment procurement and installation are as shown in the construction schedule.

④ Other: This project is implemented according to the Japan's Grant Aid Scheme.

2-5-2 Operation and Maintenance Cost

The Kinondoni North regional office and Ilala regional office operate and maintain existing substations, transmission lines and distribution lines in the Project area under the overall supervision of the TANESCO headquarters. These offices shall also operate and maintain the expanded, reinforced and new substations along with the reinforced and new transmission and distribution lines in the Project after they are provided. As the Ilala Substation and Msasani Substation already have operators dispatched, they shall not need any new appointments with the Project reinforcement and expansion. New substations shall be unmanned, also not needing any new appointments. The same offices shall support reinforced and new transmission and distribution lines outside the substations under present conditions.

Also note that the replacement parts and consumables given in Table 2-2-2-4.19 must be stocked at all times in order to properly operate the substations built or updated in the Project. This shall require regional offices to budget roughly 1,186 million Tsh (3% of equipment costs) if needed. With TANESCO repair and maintenance costs of 11,470 million Tsh in 2011, O&M costs for new and updated substations in the Project should stay within the budget.

CHAPTER 3 PROJECT EVALUATION

Chapter 3 Project Evaluation

3-1 Preconditions

Concerning the preconditions for the Project implementation such as compensation for relocation of local residents, land acquisition for substations, securing of storage space for equipment and materials, securing of access roads and work areas for 132 kV transmission lines, removal of trees and crops from the route of 33 kV distribution lines and obtainment of environmental approval for the Project implementation, there is no outstanding issue in the Project implementation, as Tanzanian side has already started necessary procedures and has experience with a similar Japan's Grant Aid Project for power transmission, distribution and substation system. However, Tanzanian side shall conduct following tasks by the time of commencement of the Project.

(1) It is necessary to ensure that compensation will be provided to and consent will be obtained from the local residents who will be affected by the construction of substations, reinforcement of 132 kV transmission lines and construction of 33 kV distribution lines in the Project.

(2) It is necessary to ensure that sites for construction and storage yard for equipment and materials will be secured and land use permit will be obtained before the commencement of construction.

(3) It is necessary to secure budget for environmental assessment for the Project and obtain required permits.

3-2 Necessary Inputs by the Recipient Country

The Tanzanian side shall take the following tasks to realize and sustain the effects of the Project.

(1) The Tanzanian side shall, without delay, connect the equipment and materials reinforced/expanded in the Project to the existing facilities and construct 11 kV and low-voltage distribution lines to supply power from the substations to consumers.

(2) There have been supports activities of multiple donors in and around the city of Dar es Salaam and some sites and components of such activities may overlap with those of the Project. Assistant among donors will be important for the implementation of the Project and the Tanzanian side shall conduct management and coordination so that there will be no delay in the implementation of the assistance plans of the donors related to the Project. The construction of New City Center Substation with the assistance from Finland has especially strong relation to the Project. The New City Center Substation, which will be completed in February 2015, will be a very important substation that will supply power to Muhimbili Substation, which will be constructed in the Project.

(3) To monitor and control the substations that will be reinforced, expanded or constructed in the Project, the Tanzanian side shall modify existing Grid Control Center (GCC) and Distribution Control Center (DCC) and make connection with the micro SCADA system.

(4) The Tanzanian side shall immediately appoint engineers and have them participate in the OJT (On the Job Training) that will be conducted in the Project. They shall also disseminate information to

other engineers who cannot participate in the training.

(5) To optimize the use of the transmission/distribution and substation facilities that shall be procured and installed by the Project, the Tanzanian side shall conduct continuously appropriate operation and maintenance after the completion of the Project.

3-3 Important Assumptions

The followings are the external conditions for the realization and maintaining of the Project effect.

(1) Continuous promotion of the Power System Master Plan (2012 Update) , established by the Tanzanian government

(2) Political and economic stability of the country

(3) Continuous operation and maintenance of the Equipment

(4) Continuous support from other donors to the Energy sector

3-4 Project Evaluation

3-4-1 Relevance

As shown below, the Project shall contribute to the realization of the development plan and energy policy of Tanzania as well as benefit the general citizens including impoverished people. Therefore, the Project is deemed relevant as a Grant Aid Project.

(1) Number of Beneficiaries

The target area of the Project is the city of Dar es Salaam, which is the economic center of Tanzania and an important city that support the economic growth rate of over 6% every year. The Project shall reinforce, expand and construct substations and transmission and distribution lines in Kinondoni and Ilala regions. About 1.77 million people in Kinondoni and about 1.22 million people in Ilala shall gain benefit such as reducing the power loss, voltage drop, numbers of power outage, and numbers of non-electrified houses. Table 3-4-1.1 shows the number of consumers at this moment at each region. Table 3-4-1.2 shows the number of consumers who will be expected to newly connect the power lines by the implementation of the Project. There is a report that says the household electrification rate in Dar es Salaam is about 51%. The number of power consumers is expected to increase in the future.

Table 3-4-1.1 Number of Existing Customers at this moment

Region	Component in the project	Number of customers **Household**	Number of customers **Industrial/Commercial Facility, Factory**	Number of customers **Public facility**		
				Hospital	Colleges, Universities, Secondary Schools, Primary Schools	Churches, Mosques
Kinondoni North	・Expansion of Msasani Substation ・Construction of New Jangwani Beach Substation ・Construction of New Mwananyamala Substation ・Construction of New 33kV Distribution line	95,205	275	25	30	40
Ilala	・Reinforcement of Ilala Substation ・Reinforcement of 132kV Transmission Line ・Construction of New Muhimbili Substation ・Construction of New 33kV Distribution line	109,303	414	30	40	50
Total		204,508	689	55	70	90

Source: TANESCO

Table 3-4-1.2 Number of New Customers after the Completion of the Project

Region	Component in the project	Number of new customers **Household**	Number of new customers **Industrial/Commercial Facility, Factory**	Number of new customers **Public facility**		
				Hospital	Colleges, Universities, Secondary Schools, Primary Schools	Churches, Mosques
Kinondoni North	・Expansion of Msasani Substation ・Construction of New Jangwani Beach Substation ・Construction of New Mwananyamala Substation ・Construction of New 33kV Distribution Line	39,343	975	5	157	8
Ilala	・Reinforcement of Ilala Substation ・Reinforcement of 132kV Transmission Line ・Construction of New Muhimbili Substation ・Construction of New 33kV Distribution Line	6,000	625	4	250	10
Total		45,343	1,600	9	407	18

Source: TANESCO

(2) Urgency

During the period of privatization of TANESCO from 1992 to 2006, there was no public support from the government or other donors and reinforcement of facilities to meet increasing demand or maintenance/repair of existing facilities were hardly carried out. Therefore, many existing equipment and facilities have become old and there is often power outage probably caused by aging degradation. Moreover, the capacity of substations and transmission and distribution facilities cannot catch up with the rapidly increasing demand and the existing facilities chronically have to have overload operation. As the situation is critical with frequent power outage in many places, the urgency of the Project is high.

(3) Contribution to the Stable Operation of Public Welfare Facilities

Japan's Country Assistance Policy for the United Republic of Tanzania includes improvement of administrative services to all citizens as one of the priority areas. As improvement of infrastructure is essential to effective and efficient provision of public services, the implementation of the Project shall contribute to the reinforcement of the administration system. Stable power supply to public welfare facilities (e.g., schools, hospitals and churches) shall

relieve such issues as power outage and voltage drop and therefore shall contribute to stable operation of such facilities as well as to the improvement of education and medical services. Moreover, stable power supply in Dar es Salaam, which is the economic center of the country, shall not only be beneficial to public welfare facilities but also to all the citizens of Tanzania as it shall make a significant contribution to the industrial and economic growth of the country.

(4) Operation and Maintenance Capabilities

Kinondoni North and Ilala Regional Offices, which are in charge of the target area of the Project, conduct operation and maintenance of 132/33 kV primary substations, 33/11 kV substations, 132 kV transmission lines and 33/11 kV distribution lines on a daily basis and have enough experience in operation and maintenance of such facilities for transmission and distribution lines and substations. Therefore, Tanzania is considered to have a sufficient level of technical skills to operate and maintain the equipment that shall be provided by the Project.

JICA is also implementing the Project for "Capacity Development of Efficient Distribution and Transmission Systems", a technical cooperation project with a focus on operation and maintenance of distribution and substation facilities and the engineers of the regional offices receive training in the Project. Synergetic effect with this project is expected.

(5) Project to Contribute to the Development Plan of Tanzania

In July 2010, the Tanzanian government developed the 3rd Poverty Reduction Strategy (PRS) MKUKUTA II, which consists of the following three development strategies to achieve economic growth and poverty reduction.

Strategy 1: Growth and Reduction of Income Poverty
Strategy 2: Improvement of Quality of Life and Social Wel-Being
Strategy 3: Good Governance and Accountability

For the energy sector, the PRS has a goal to "supply reliable and inexpensive energy to consumers". Also, the National Energy Policy, developed in February 2003, sets a goal for the energy sector to "create the foundation for the supply of safe, reliable, efficient, cost-competitive and environmentally-friendly energy in a method that provides access in all sectors". As the Project aims at improving capacity and quality of power supply to Dar es Salaam, it will contribute to the development plan of Tanzania.

(6) Scheme of Japan's Grant Aid

The contents and schedule of the Project are achievable in the scheme of a Grant Aid Project as major equipment will be sourced from Japan and the Project will be completed within the timeframe of the E/N. Therefore, the Project can be implemented with no special difficulty.

3-4-2 Effectiveness

The impacts expected from the implementation of the Project are as follows.

(1) Quantitative Impacts

Outcome indicator	Base value (2012) (Current value)	Target (2019) (3 years after the completion of the Project)
1. No. of beneficiaries *1		
	381,225 households	428,602 households
2. Equipment capacity		
132 kV transmission line (Ubungo Substation – Ilala Substation)	200MVA	440MVA
132/33 kV transformer (Ilala Substation)	210MVA	240MVA
33/11 kV transformer) (Reinforced, expanded and constructed substations)	45MVA	105MVA
3. Power outage time and frequency*2		
	26.3 hours/month	23.7 hours/month
4. Percentage of voltage drop		
	4.8% *3	4.3% *3
5. Power loss		
Kinondoni Region	16.4%	12.7% *4
Ilala Region	14.9%	11.2% *4

*1 Number of households is calculated based on the number of residents in Kinondoni and Ilala regions (4 numbers per household) and electrification rate in Dar es Salaam. Number of households in 2019 is calculated with Table 3-4-1.2. (2012 Population and Housing Census, March 2013)

*2 Power outage time of 33 kV systems at Ilala Substation is used as the current value for the monthly average power outage time. The target is set at 10% lower than the current level.

*3 Percentage of voltage drop of the 33 kV system at the Ilala Substation is used as the current value. The target is set at 10% lower than the current level.

*4 Calculated with reference to the Power System Master Plan (2012 Update) and Annual Report 2011.

(2) Qualitative Impacts (Whole Project)

Current status and issues	Measures in the Project (Works for cooperation)	Level of impact and improvement made by the Project
In Dar es Salaam, there are frequent power interruptions and voltage drop caused by the deterioration and overload of the transmission, distribution and substation facilities. Dar es Salaam has the following issues; 1. Interfering with the industrial and economic development 2. Affecting the stable operation of medical institution and public facilities. 3. Deteriorating the living environment of local citizens	Substations, transmission lines and distribution lines shall be reinforced, expanded and newly constructed.	・ The provision of stable power supply shall make a contribution to the industrial and economic development, the stable operation of medical institution and public facilities and improvement of the living environment of local citizens (About 1.77 million people in Kinondoni and about 1.22 million people in Ilala). ・ The Project shall indirectly contribute to about 4.36 million people in Dar es Salaam. Therefore, the beneficial effect of the Project will be large.

The following table shows impacts of each component of the Project.

(3) Qualitative Impacts (by component)

No	Component	Current issues and expected impacts
1	Reinforcement of Ilala Substation	As the Project plans to increase the capacity of power transmission from Ubungo to Ilala Substations by about 240 MVA and newly install 2 units of 60 MVA transformers that can operated in parallel, the load on existing equipment that has been in overload operation shall be mitigated. Stable power supply to the city is expected to produce such positive impacts as economic and industrial revitalization, the stable operation of medical and public facilities and improvement of living environment. As both the economy and the population are expected to grow at a high rate, the impacts shall be significant. Moreover, projects of other donors are implemented to expand the power transmission and distribution network in the city and are expected to produce synergetic effect in collaboration with the Project.
2	Expansion of Msasani Substation	Currently, the substation has a 15 MVA transformer and three 11 kV distribution lines. However, there is always demand of about 14 MVA and the usage rate is high. Mitigation of such overload operation shall relieve such issues as voltage drop and increase the reliability of power supply. The area is an important area where many government officials live and this site is given the second highest priority after Ilala Substation.
3	Construction of Muhimbili Substation	Muhimbili National Hospital, the largest facility that shall benefit from the beneficiaries of Muhimbili Substation, has an issue of medical service degradation caused by unstable power supply. Stable power supply by implementation of the Project is expected to generate significant positive impacts, e.g., improvement of medical services and reduction of fuel cost for power generation. As Muhimbili University of Health and Allied Sciences are located next to the hospital, positive impacts on healthcare professionals, staff and students are also expected. • Muhimbili National Hospital No. of inpatients: about 1,200 No. of outpatients: about 1,000～1,200 per day No. of staff: about 2,700 • Muhimbili University of Health and Allied Sciences No. of students: about 2,700 No. of staff: about 600
4	Construction of Jangwani Beach Substation	Heavy- or over-load operation of secondary substations nearby the planned site for the Jangwani Beach substation located at Kinondori region causes such issues as failures, accidents and shortened life of power equipment and reliability of power supply has been lowered. As the population of the region is expected to grow at an annual rate of 5.6% and further development of commercial and industrial facilities including hotels is also expected, power demand is likely to grow further. Construction of Jangwani Beach Substation, which will receive 33 kV power, is expected to relieve load on other substations and improve reliability of power supply as well as produce positive impact on new customers.

No	Component	Current issues and expected impacts
5	Construction of Mwananyamala Substation	The planned site of the Mwananyamala Substation in the Kinondoni region is located in a residential area. The area also has many public welfare facilities such as churches and schools. Secondary substations nearby the planned site are in heavy- or over-load operation and the population of the area is expected to grow at an annual rate of 5.6%. Construction of Mwananyamala Substation is expected improve reliability of power supply and produce positive impact on the residents in the area.