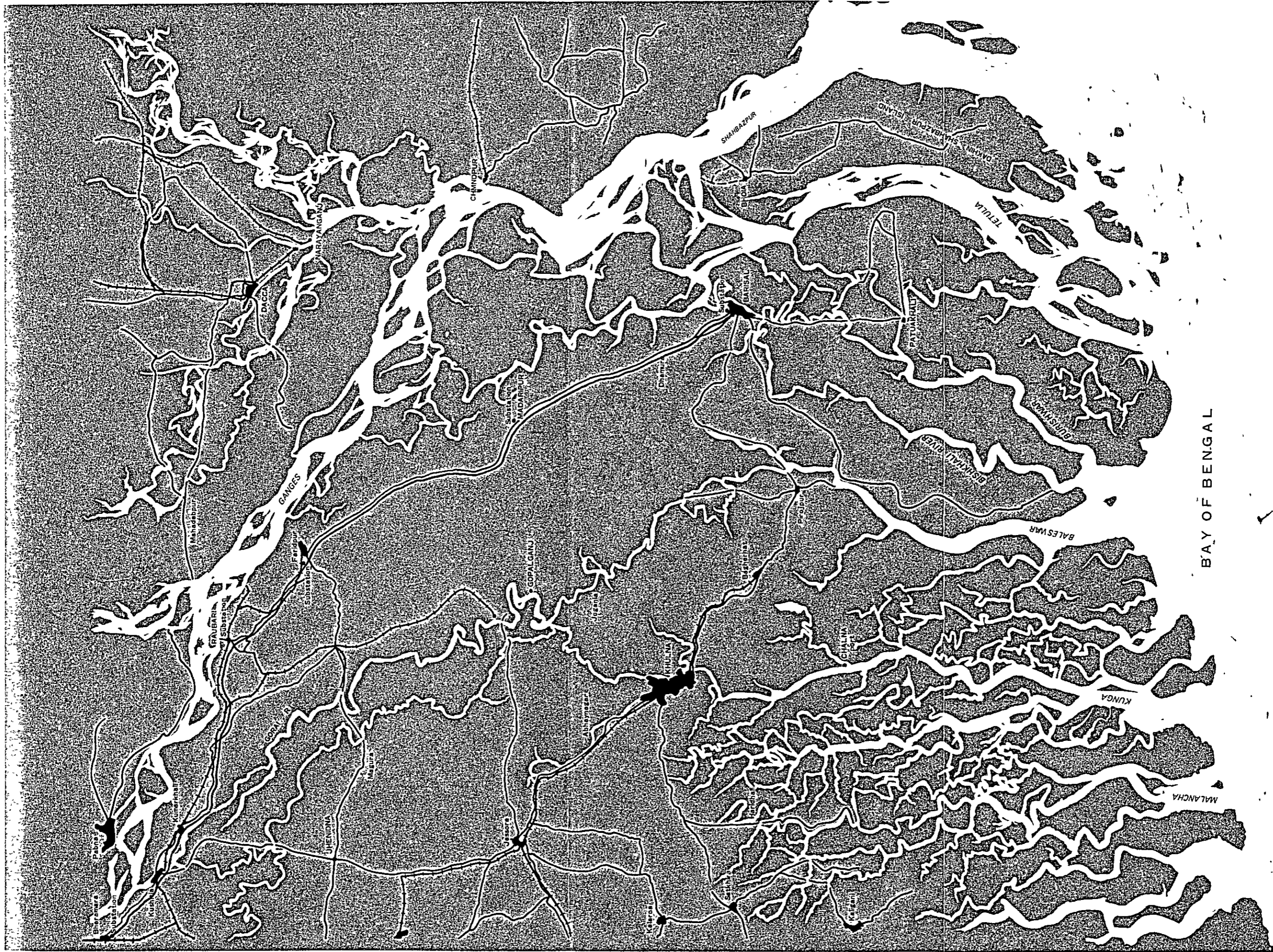


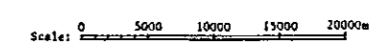
ANNEX IV

送電線ルート図

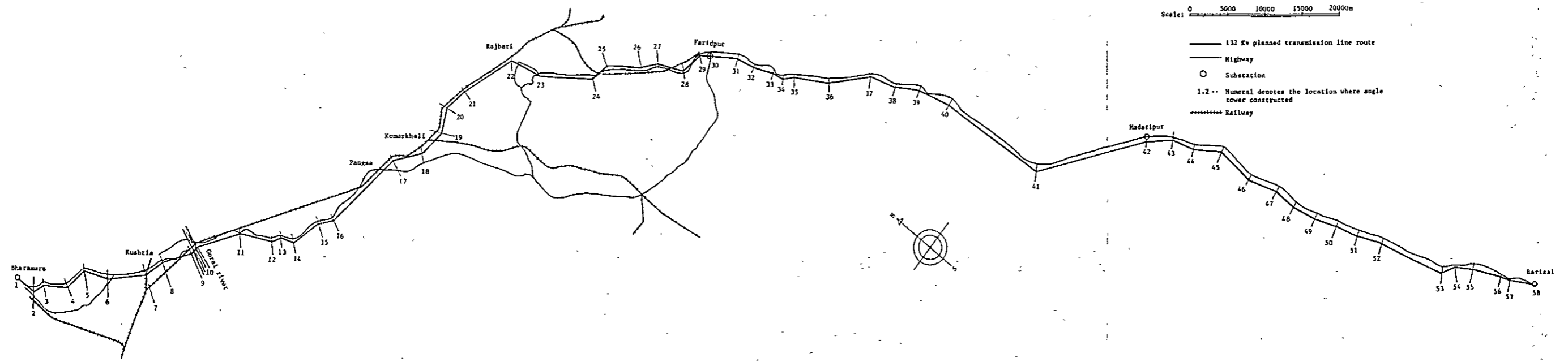


BAY OF BENGAL

ASSEX IV-2  
TRANSMISSION ROUTE (1/250,000)



- 132 Kv planned transmission line route
- Highway
- Substation
- 1.2.. Numeral denotes the location where angle tower constructed
- Railway

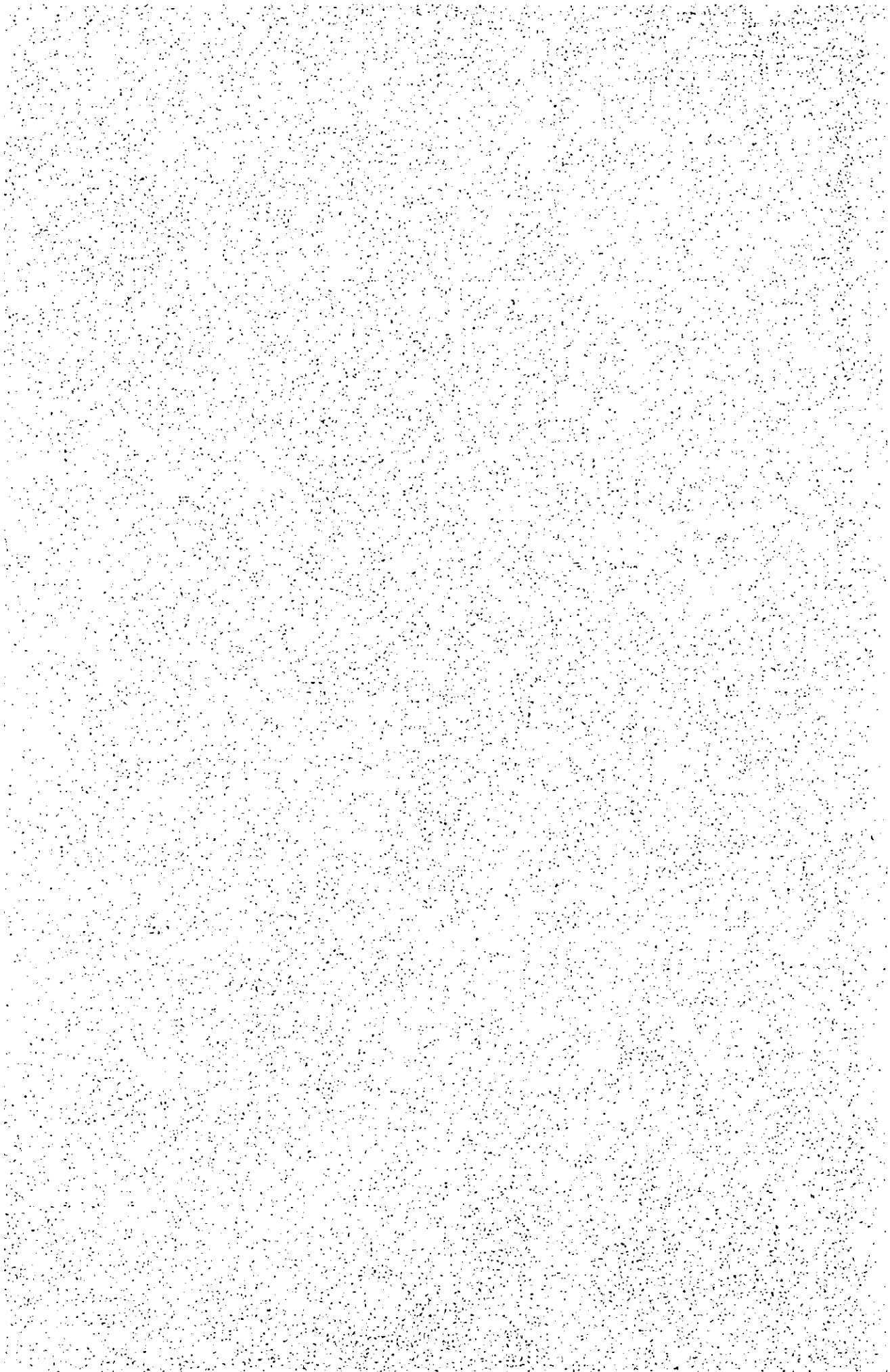


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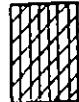
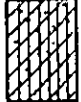



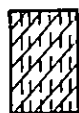

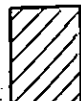



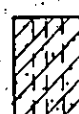




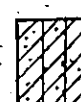

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ANNEX V

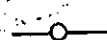
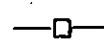
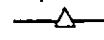

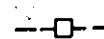
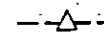



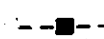
土質柱状図



Explanation of soil symbol

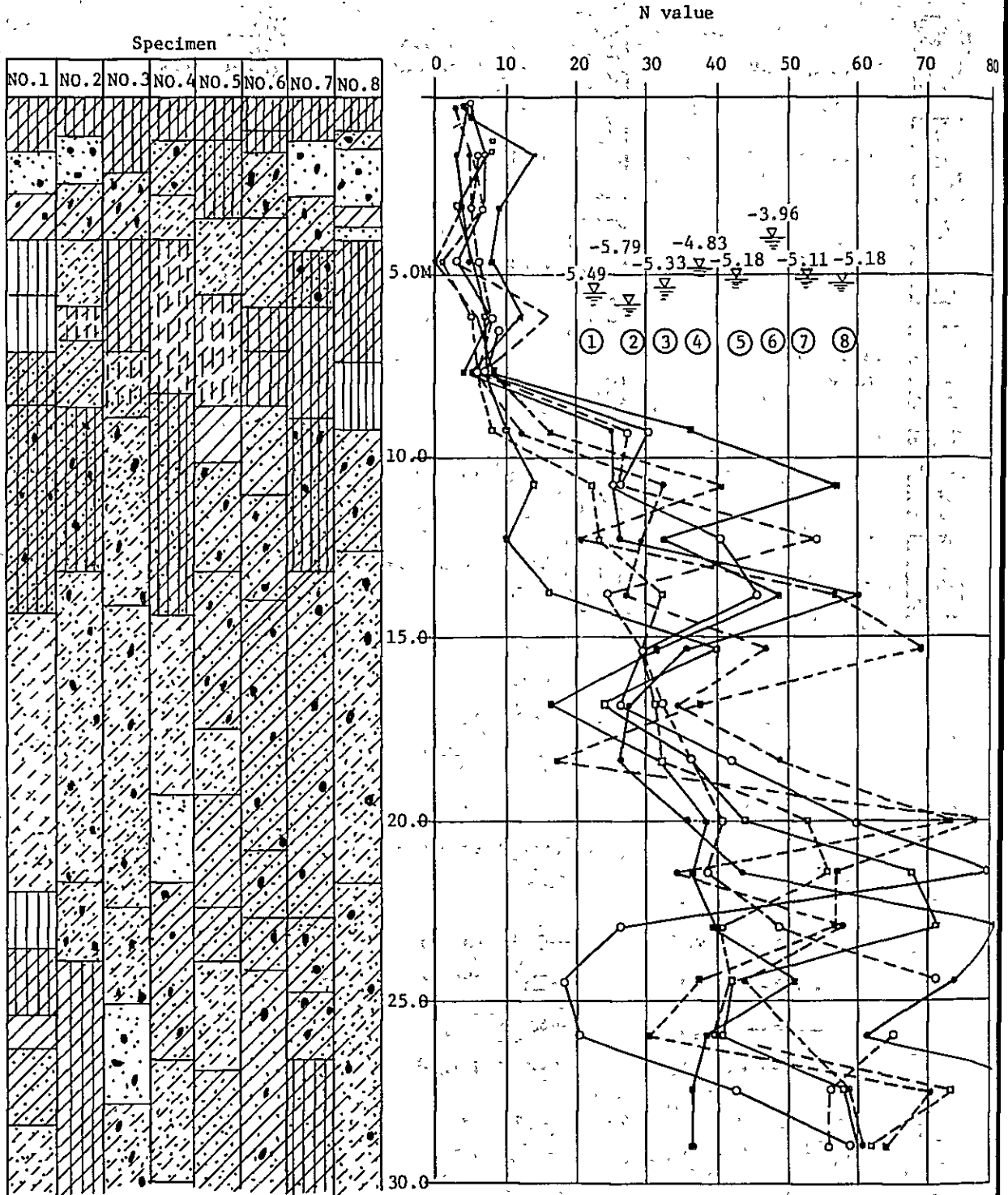
	SILTS & CLAYS		SILTS & CLAYS with fine sand		silty fine SAND trace mica
	silty CLAY		silty CLAY		CLAYS & SILTS
	clayey SILT		SILT		silty fine SAND
	sandy SILT trace mica		CLAY		SILT with clay trace fine sand
	fine SAND trace mica		silty fine SAND		SAND trace silt & mica
	silty SAND		SILT, trace fine sand		SAND

Classification of N value line

	NO. 1		NO. 5		NO. 9
	NO. 2		NO. 6		NO. 10
	NO. 3		NO. 7		
	NO. 4		NO. 8		

ANNEX V-1

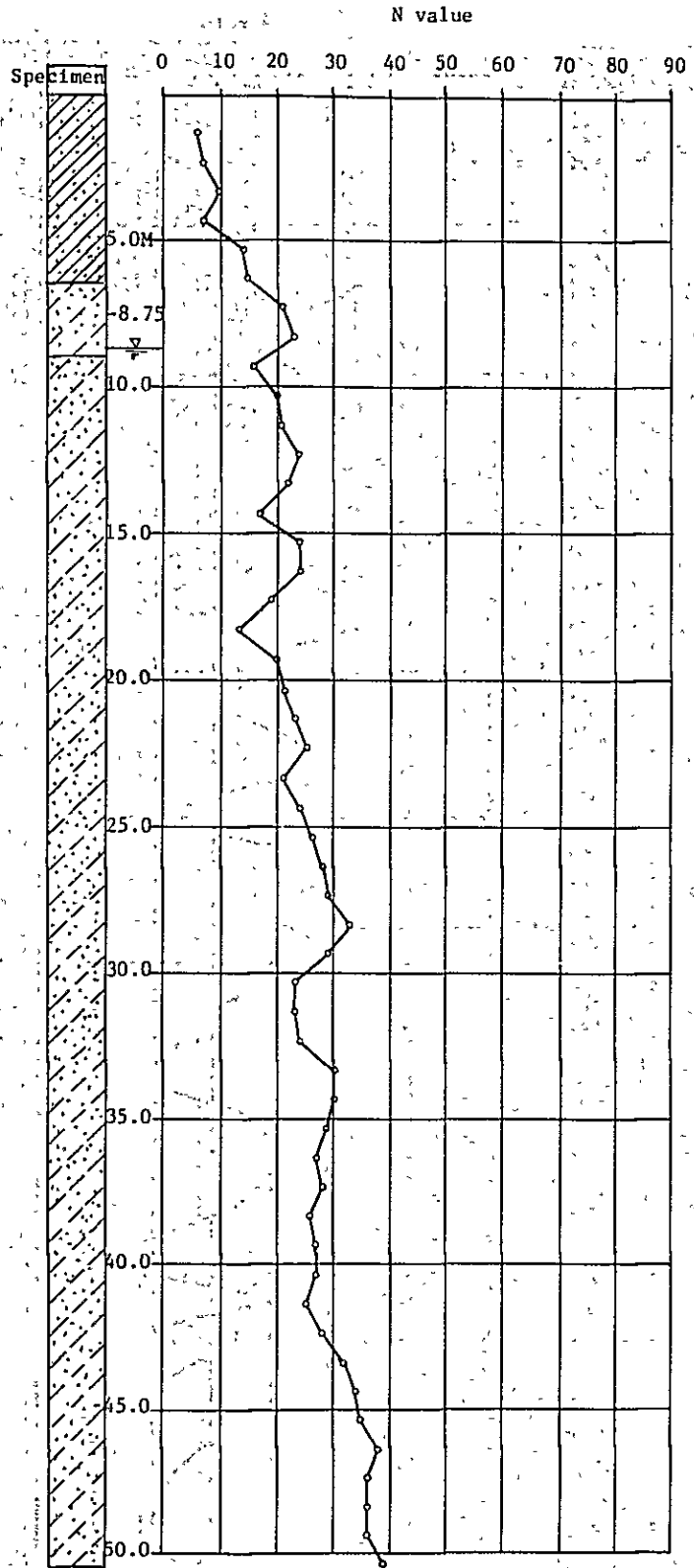
BLOCK NO.1 BORING LOG





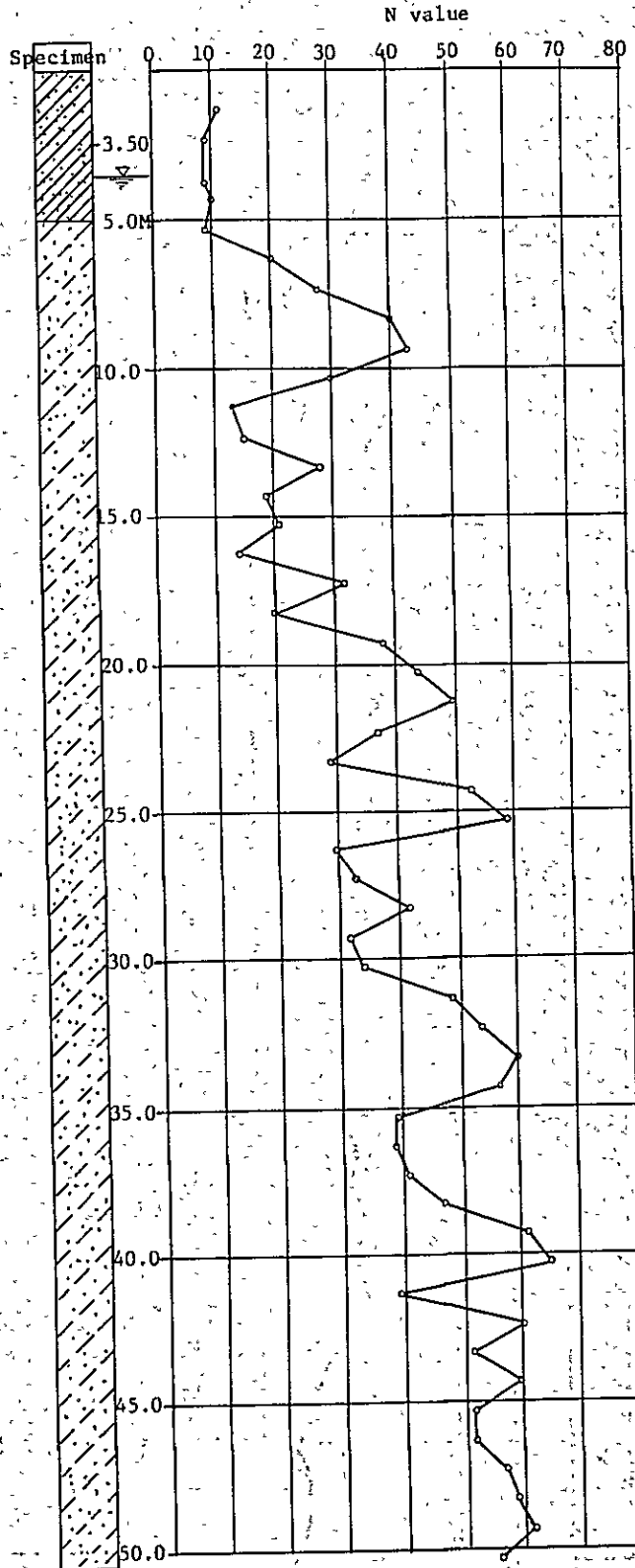
ANNEX V-2

BLOCK NO. 2 BORING LOG

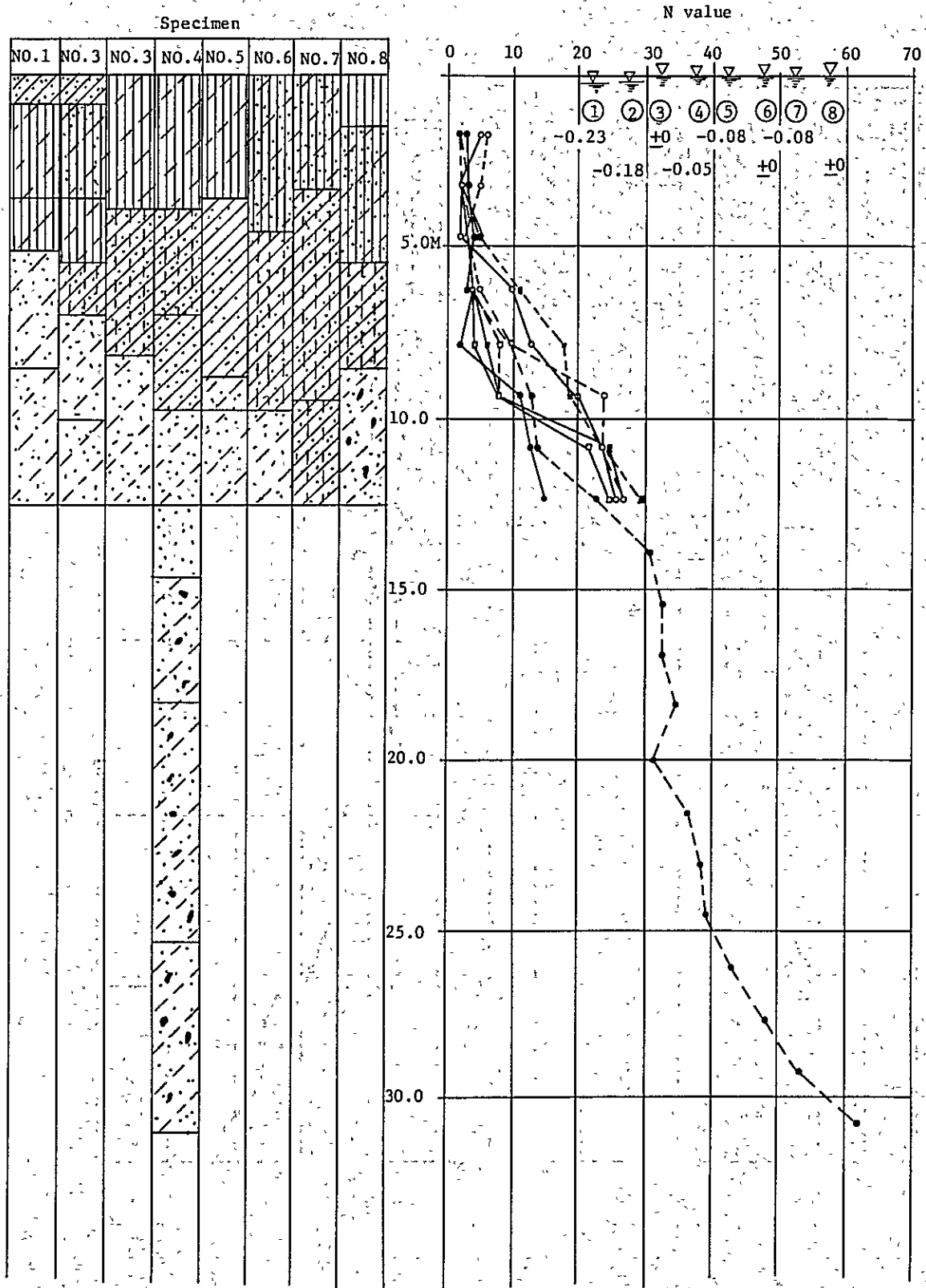


ANNEX V-3

BLOCK NO. 3. BORING LOG

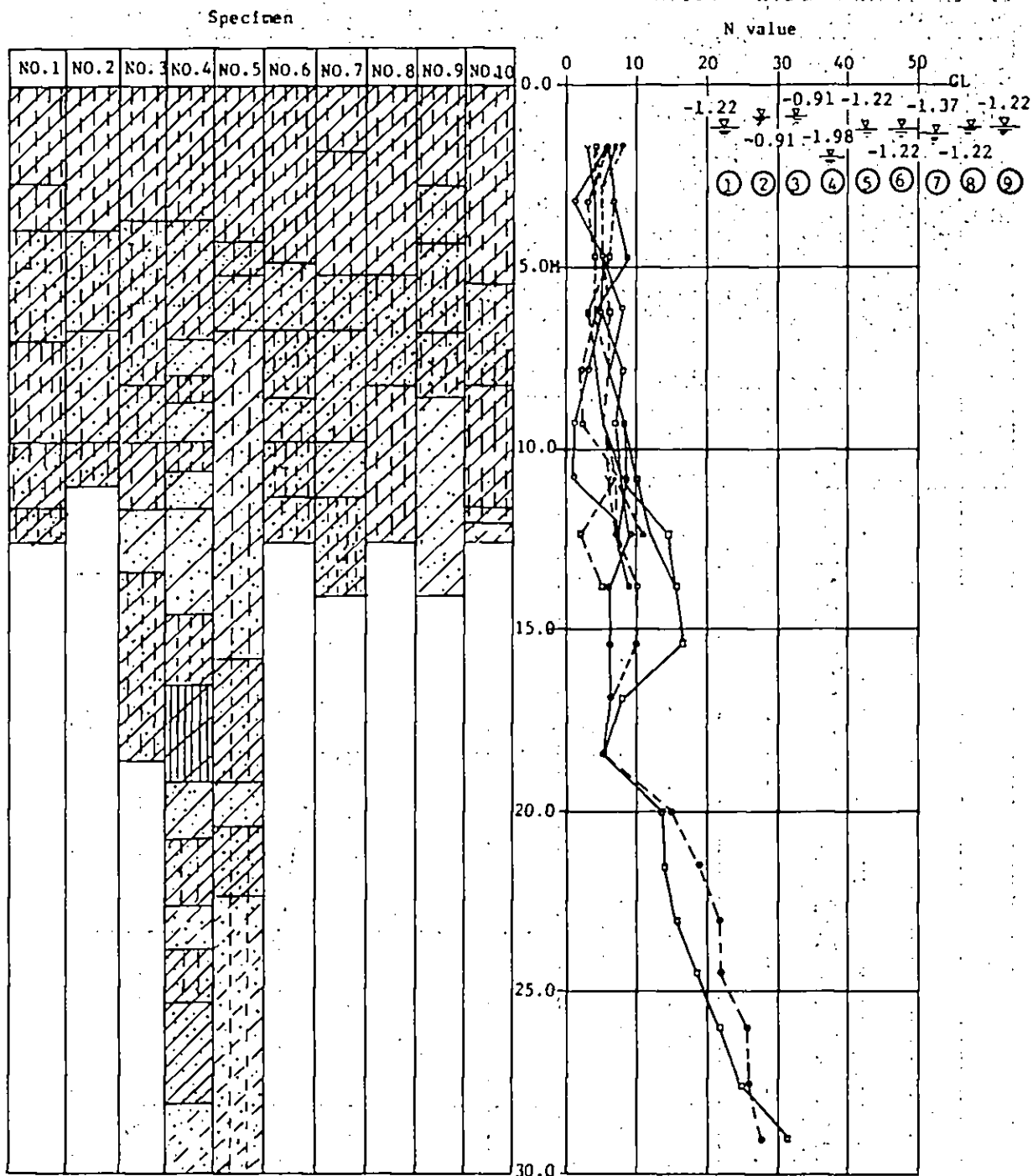


ANNEX V-4  
BLOCK NO. 4 BORING LOG



Annex V-5

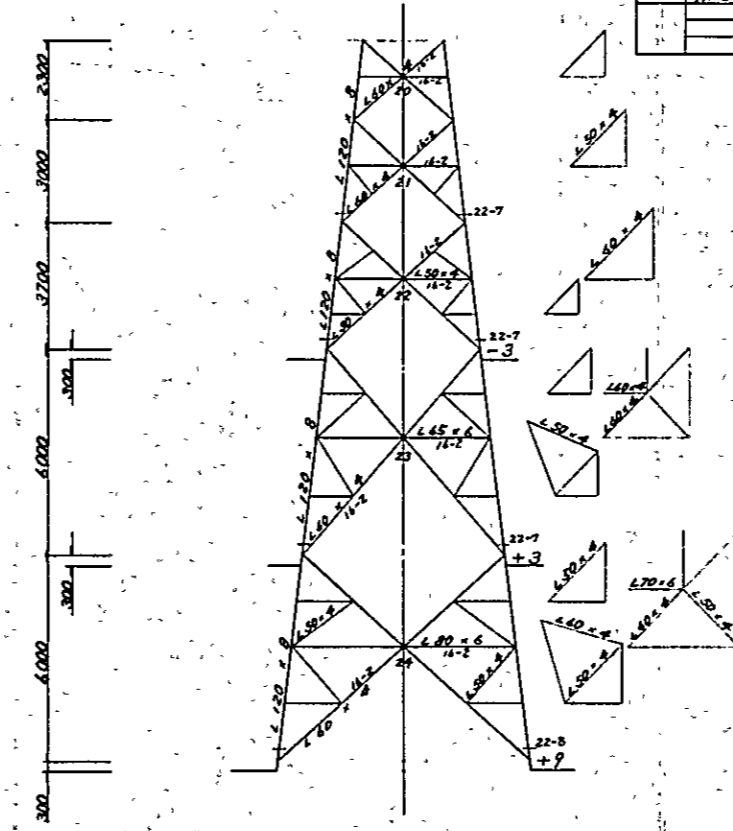
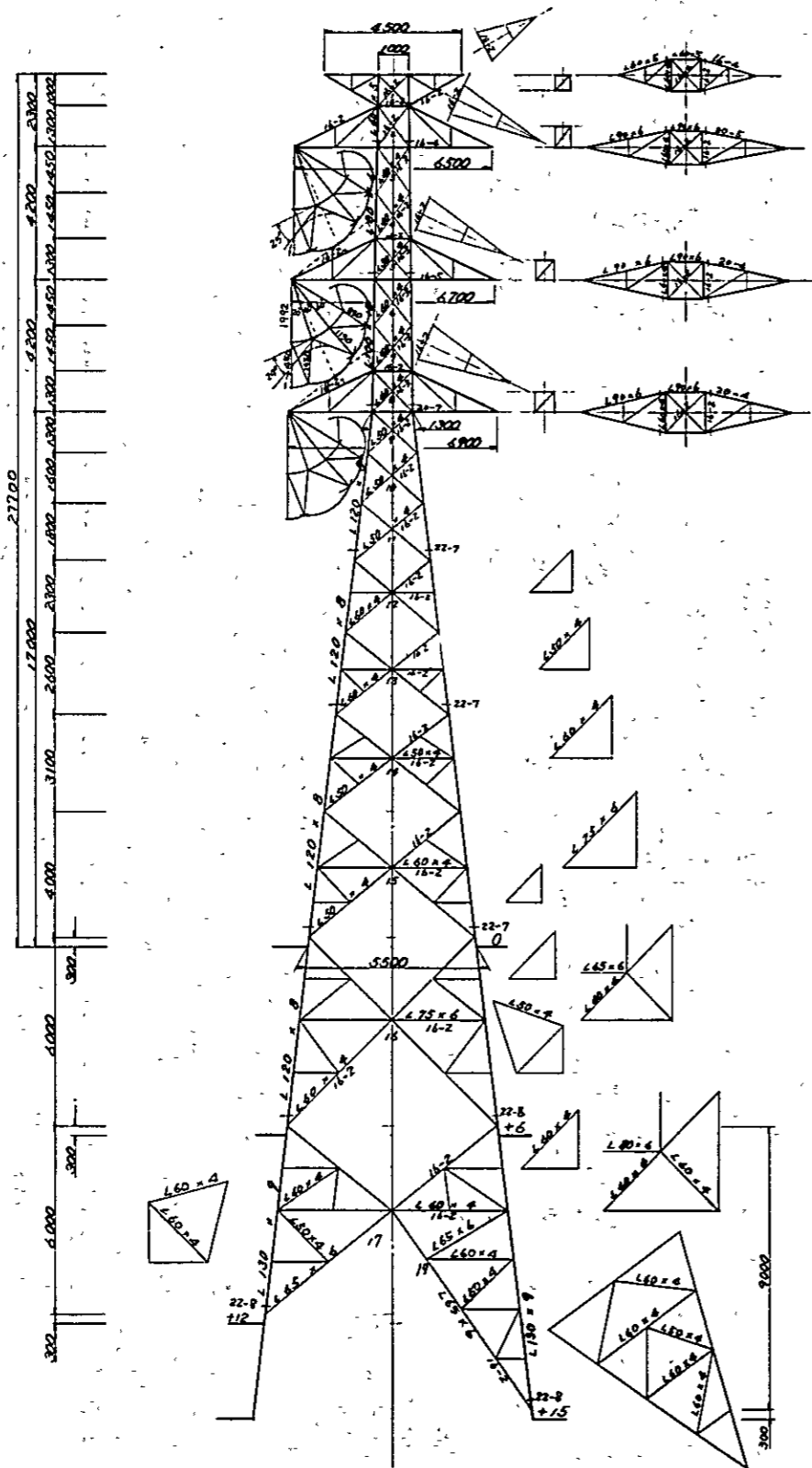
BLOCK NO. 5 BORING LOG



ANNEX VI

鐵塔構造図

TYPE "A" TOWER (S = 1/100)



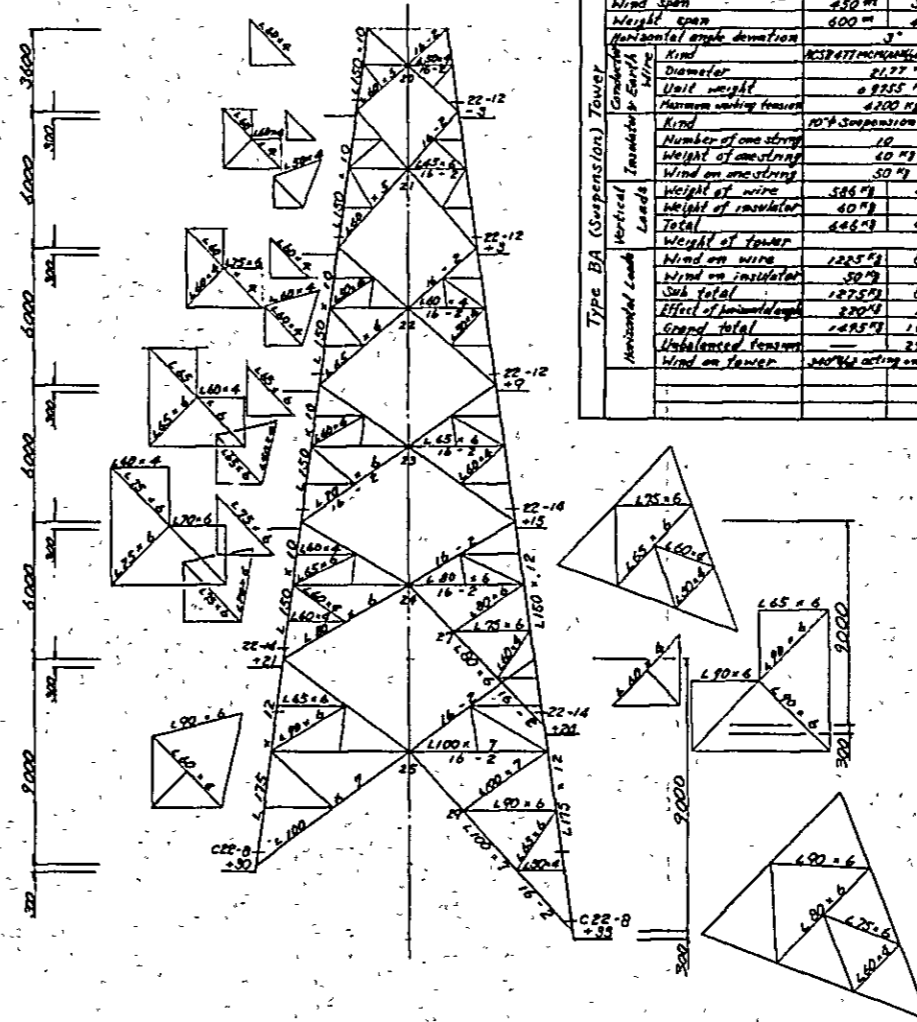
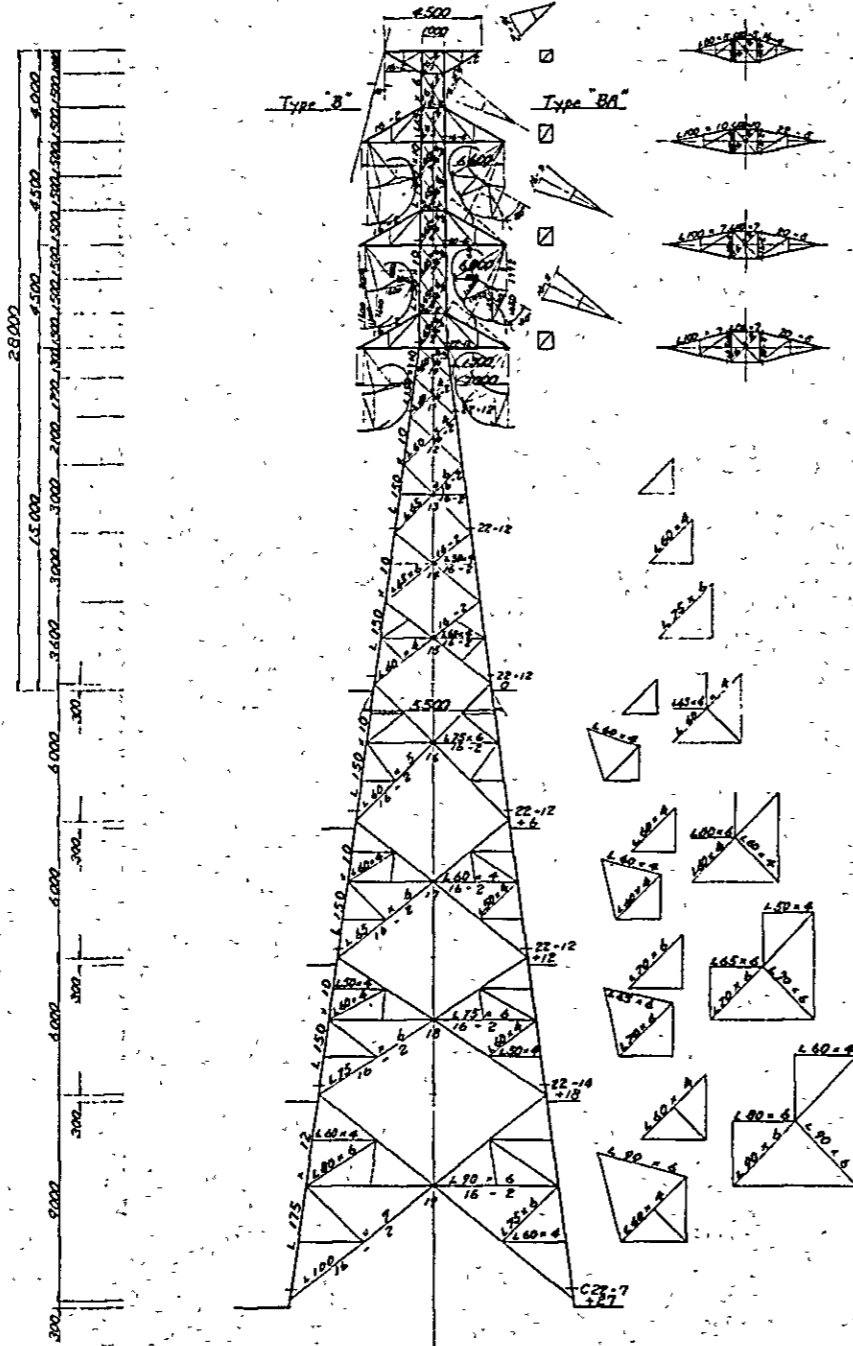
LOAD TABLE

Item	Conductor		Earth Wire		Remarks	
	Normal Condition	Broken wire Condition	Normal Condition	Broken wire Condition		
Normal condition	All wires intact					
Broken wire condition	Any one conductor or earth wire broken					
Wind span	300 m	210 m	300 m	210 m	(S)	
Weight span	500 m	350 m	500 m	350 m	(S)	
Horizontal angle deviation	3°		3°		(B)	
Conductor	Kind	KSR 477 M2111M40x5174		G.S.W. SS (2/2)		
	Diameter	21.72 mm		9.6 mm	(D)	
	Unit weight	2.255 N/m		2.456 N/m	(W)	
	Maximum working tension	2200 N		1.850 N	Per one conductor (P)	
Insulator	Kind	10" Suspension insulator				
	Number of one string	10				
Vertical Load	Weight of one string	60 N				
	Weight of tower	50 N				
	Weight of wire	488 N	782 N	223 N	157 N	W S
Horizontal Load	Weight of insulator	60 N				
	Total	548 N	402 N	223 N	157 N	At one acting point
	Wind on wire	217 N	572 N	369 N	252 N	125 MW · D · S · 10 <sup>-3</sup>
	Wind on insulator	50 N	50 N			
	Sub total	267 N	622 N	369 N	252 N	
	Effect of horizontal angle	220 N	156 N	103 N	72 N	2 P · 3 in 2
	Grand total	1087 N	778 N	472 N	324 N	At one acting point
Unbalanced tension	2240 N		1365 N		At one acting point (S)	
Wind on tower	300 N acting on the projected area of one face member					

- Notes:
- Member Without mark: L 45 x 4
  - Bolt Without mark: M 16 x 1
  - Material
    - SS 41 L 45 x 4 ~ L 100 x 10, M 16
    - SS 50 M 20, M 22
    - SS 55 L 120 x 8 Up

APPROVED BY		BANGLADESH POWER DEVELOPMENT BOARD 132 KV BHERAMARA-BARISAL TRANSMISSION LINE TYPE "A" TOWER (2 CCT) STRUCTURAL DRAWING
CHECKED BY		
DESIGNED BY		
DATE May 11, '79		
DATE OF ISSUE		
SCALE	1/100	DRG. NO. 7001

TYPE 'B' & 'BA' TOWER (S = 1/150)



LOAD TABLE

Item	Conductor		Earth Wire		Remarks
	Normal Condition	Broken Wire Condition	Normal Condition	Broken Wire Condition	
<b>Type B (Angle) Tower</b>					
Normal Condition All wires intact					
Broken wire condition Any one conductor or earth wire broken					
Wind span	300 m	210 m	300 m	210 m	(S)
Weight span	500 m	350 m	500 m	350 m	(S)
Horizontal angle deviation	15°		15°		(B)
Kind	ACSR 47/7/35/10/4/1/21		G.S.W. 55 (7/35)		
Diameter	21.77 mm		9.6 mm		(D)
Unit weight	0.8755 N/m		0.446 N/m		(W)
Maximum working tension	4200 N		1850 N		Per one conductor (P)
Kind	10° Suspension insulator		---		
Number of one string	11		---		
Weight of one string	70 N		---		
Wind on one string	55 N		---		
Weight of wire	488 N	362 N	223 N	157 N	N.S.
Weight of insulator	190 N	190 N	---	---	
Total	678 N	552 N	223 N	157 N	At one acting point
Weight of tower	---				
Wind on wire	217 N	172 N	360 N	252 N	125 N/m <sup>2</sup> D.S. 10 <sup>-3</sup>
Wind on insulator	110 N	110 N	---	---	
Sub total	327 N	282 N	360 N	252 N	
Effect of horizontal angle	1822 N	768 N	502 N	357 N	2 P Sin θ/2
Grand total	2826 N	1450 N	862 N	609 N	At one acting point
Unbalanced tension	---		1850 N		At one acting point
Wind on tower	200 N/m <sup>2</sup> acting on the projected area of one face number				
<b>Type BA (Suspension) Tower</b>					
Normal condition All wires intact					
Broken wire condition Any one conductor or earth wire broken					
Wind span	450 m	300 m	450 m	300 m	(S)
Weight span	600 m	420 m	600 m	420 m	(S)
Horizontal angle deviation	3°		3°		(B)
Kind	ACSR 47/7/35/10/4/1/21		G.S.W. 55 (7/35)		
Diameter	21.77 mm		9.6 mm		(D)
Unit weight	0.8755 N/m		0.446 N/m		(W)
Maximum working tension	4200 N		1850 N		Per one conductor (P)
Kind	10° Suspension insulator		---		
Number of one string	10		---		
Weight of one string	60 N		---		
Wind on one string	50 N		---		
Weight of wire	584 N	410 N	260 N	180 N	N.S.
Weight of insulator	40 N	40 N	---	---	
Total	624 N	450 N	260 N	180 N	At one acting point
Weight of tower	---				
Wind on wire	1265 N	800 N	580 N	372 N	125 N/m <sup>2</sup> D.S. 10 <sup>-3</sup>
Wind on insulator	50 N	50 N	---	---	
Sub total	1825 N	890 N	580 N	372 N	
Effect of horizontal angle	230 N	154 N	103 N	73 N	2 P Sin θ/2
Grand total	2055 N	1044 N	683 N	445 N	At one acting point
Unbalanced tension	---		1850 N		At one acting point
Wind on tower	200 N/m <sup>2</sup> acting on the projected area of one face number				

- Notes:
- Member  
Without mark : L 45 x 4
  - Bolt  
Without mark : M16 x 1
  - Material  
SS 41 L 45 x 4 ~ L 100 x 10, M16  
SS 50 M 20, M 22  
SS 55 L 120 x 8 Up  
SC-4 CM 22

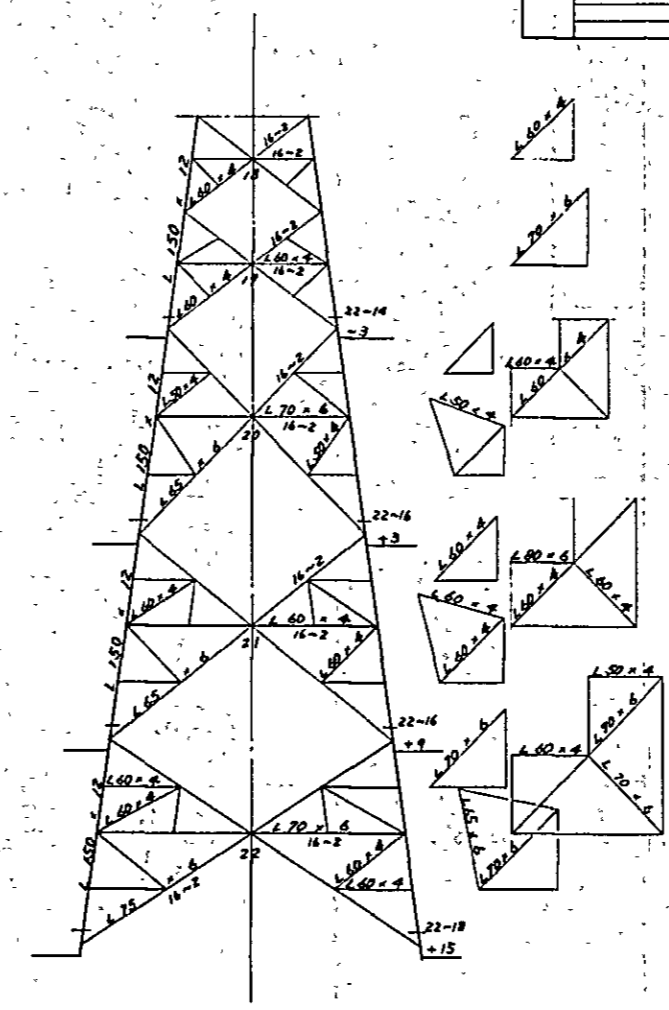
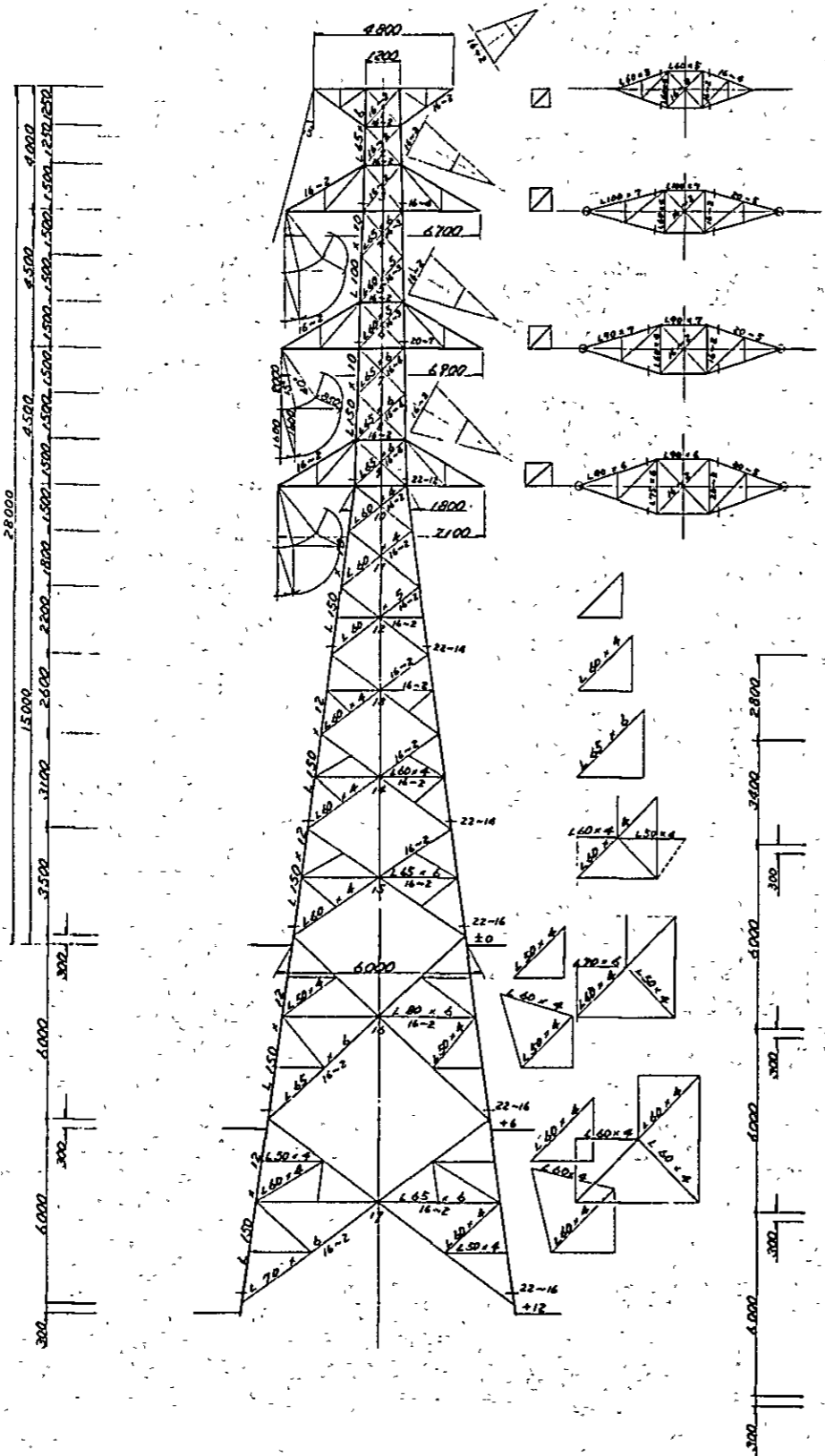
**BANGLADESH POWER DEVELOPMENT BOARD**

APPROVED BY: \_\_\_\_\_  
 CHECKED BY: \_\_\_\_\_  
 DESIGNED BY: \_\_\_\_\_  
 DRAWN BY: \_\_\_\_\_  
 DATE: May 11, '79  
 DATE IN CHARGE: \_\_\_\_\_

132 KV BHERAMARA-BARISAL TRANSMISSION LINE  
 TYPE 'B' & 'BA' TOWER (2CCT)  
 STRUCTURAL DRAWING

SCALE: 1/50  
 DRR. NO. 7002

TYPE "C" TOWER (S=1/100)



LOAD TABLE

Item	Conductor		Earth Wire		Remarks
	Normal Condition	Broken Wire Condition	Normal Condition	Broken Wire Condition	
Normal Condition	All wires intact				
Broken wire condition	Any one conductor or earth wire broken				
Wind span	300m	210m	300m	210m	(S)
Weight span	500m	350m	500m	350m	(S)
Horizontal angle deviation	30°		30°		(S)
Kind	ACSR 7/35/2.6/5.0/1.4/0.5		G. S. W. 65 (7/2.5)		
Diameter	21.77 mm		9.5 mm		(D)
Unit weight	0.8735 N/m		0.444 N/m		(W)
Maximum working tension	4200 N		1850 N		Per one conductor (P)
Kind	107 Suspension insulator				
Number of one string	1 (1S)		1 (1ES)		
Height of one string	30		30		
Wind on one string	33		30		
Weight of wire	488		223		1.57 m.s.
Weight of insulator	200		200		
Total	688		423		At one acting point
Weight of tower					
Wind on wire	217		360		1.25 Mpa 0-5 10 <sup>-3</sup>
Wind on insulator	160		160		
Sub total	377		520		
Effect of horizontal load	2125		1010		2.7 Sin 9/2
Grand total	3502		1530		At one acting point
Unbalanced tension	—		1850		At one acting point
Wind on tower	300 N acting on the projected area of one face members				

- Notes:
- 1 Member  
Without mark : L45 x 4
  - 2 Bolt  
Without mark : M16 ~ 1
  - 3 Material  
SS41 L45 x 4 ~ L100 x 10, M16  
SS50 M20, M22  
SS55 L120 x 8 Up

BANGLADESH POWER DEVELOPMENT BOARD

APPROVED BY: \_\_\_\_\_

CHECKED BY: \_\_\_\_\_

DESIGNED BY: \_\_\_\_\_

DRAWN BY: \_\_\_\_\_

DATE: May 11 '77

DATE OF ISSUE: \_\_\_\_\_

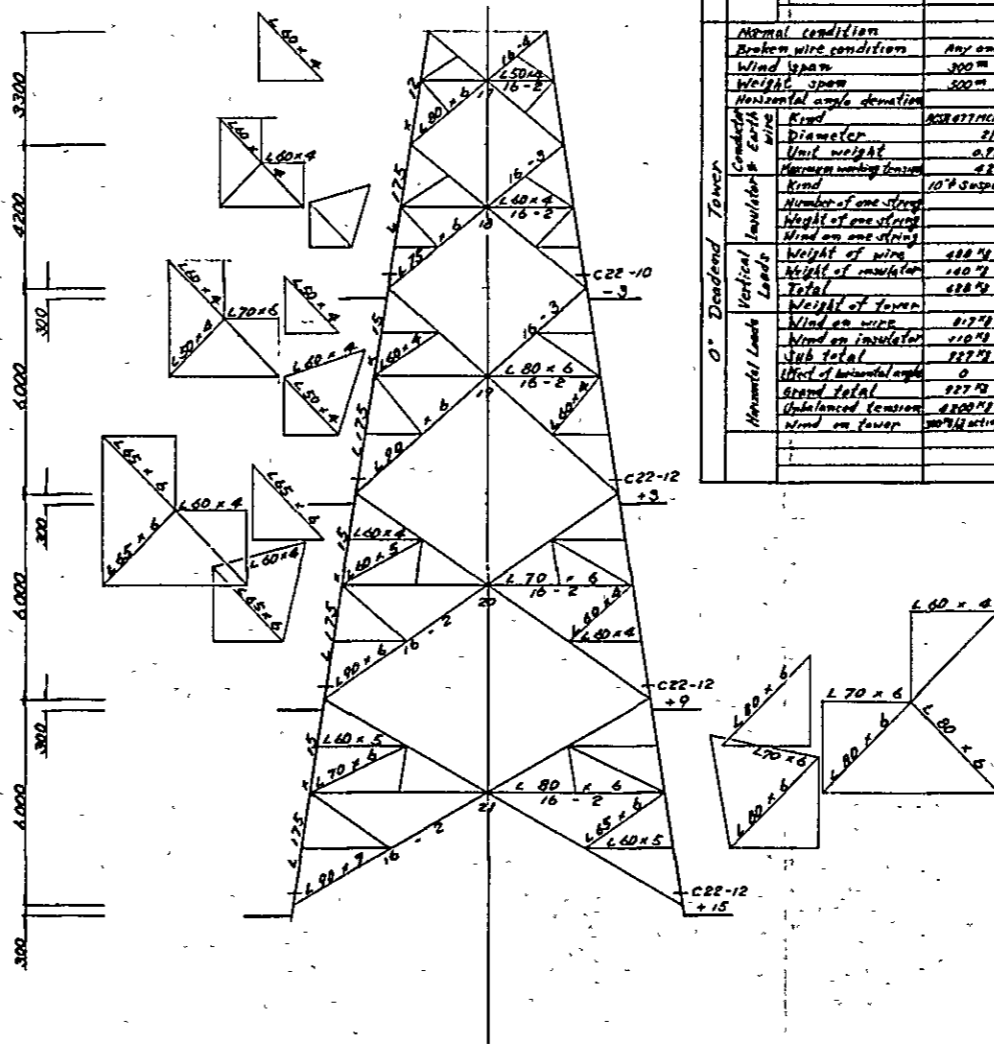
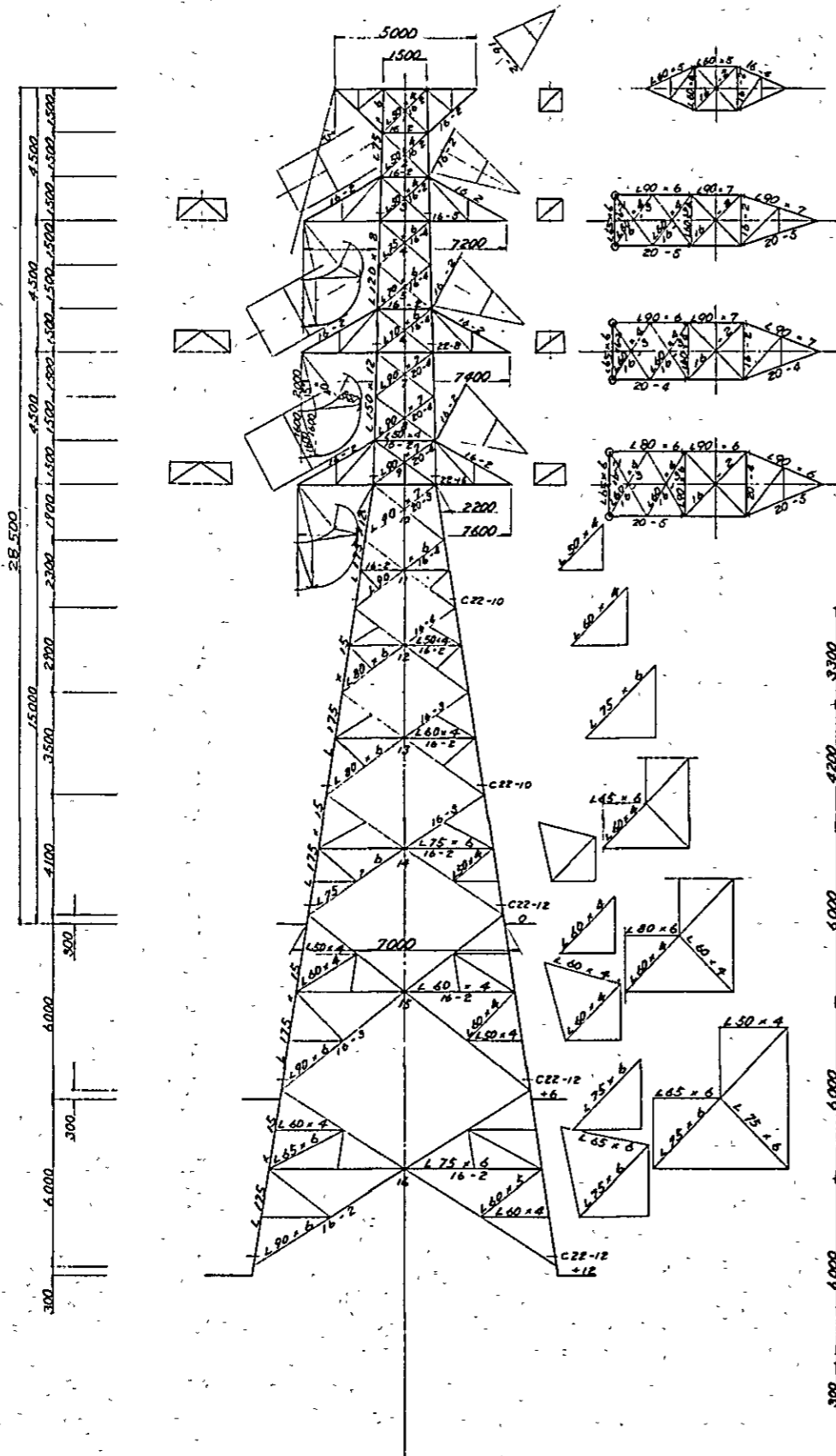
SCALE: 1/100

132KV DHARAMAPA BARISAL TRANSMISSION LINE  
TYPE "C" TOWER (ZCC7)  
STRUCTURAL DRAWING

DRG. NO. 7003



TYPE "D" TOWER (S=1/100)



LOAD TABLE

Item	Conductor		Earth Wire		Remarks
	Normal Condition	Broken wire Condition	Normal Condition	Broken wire Condition	
Normal condition	All wires intact				
Broken wire condition	Any one conductor or earth wire broken				
Wind span	300m	210m	300m	210m	(S)
Weight span	300m	350m	300m	350m	(S)
Horizontal angle deviation	40°		40°		(S)
Wire	ACSR 7/19/2.0/30 (6+27/19)		G.S.W. 55 (2/22)		
Diameter	21.77mm		9.6mm		(D)
Unit weight	0.2755 N/m		0.444 N/m		(W)
Minimum working tension	2200 N		1250 N		Per one conductor (D)
Insulator	10 P Suspension insulator				
Number of one string	11 (S)	10 (S)			
Height of one string	70.9	48.9			
Wind on one string	55.9	50.9			
Weight of wire	488.9	362.9	223.9	157.9	W.S.
Weight of insulator	260.9	260.9			
Total	748.9	623.9	223.9	157.9	At one acting point
Height of tower					
Wind on wire	817.9	572.9	360.9	252.9	125.9/m <sup>2</sup> D.S. 10 <sup>-3</sup>
Wind on insulator	210.9	210.9			
Sub total	1027.9	783.9	360.9	252.9	
Wind on horizontal angle	0	0	0	0	2 P Sin 9/2
Grand total	1027.9	783.9	360.9	252.9	At one acting point
Unbalanced tension	0	0	0	0	At one acting point
Wind on tower	50% acting on the projected area of one face member				

- Notes:
- Member  
Without mark : L 45 x 4
  - Bolt  
Without mark : M16~1
  - Material  
SS 41 L 45 x 4 ~ L 100 x 10, M16  
SS 50 M20, M22  
SS 55 L 120 x 8 Up  
SCr 4 CM22

BANGLADESH POWER DEVELOPMENT BOARD

APPROVED BY: \_\_\_\_\_

CHECKED BY: \_\_\_\_\_

DESIGNED BY: \_\_\_\_\_

DRAWN BY: \_\_\_\_\_

DATE: May 11, '79

SCALE: 1/100

132 KV BHERAMARA-BARISAL TRANSMISSION LINE TYPE "D" TOWER (2CCT) STRUCTURAL DRAWING

DRG. NO. 7004



## ANNEX VII

### 西部地区送電系統図および変電所関係図

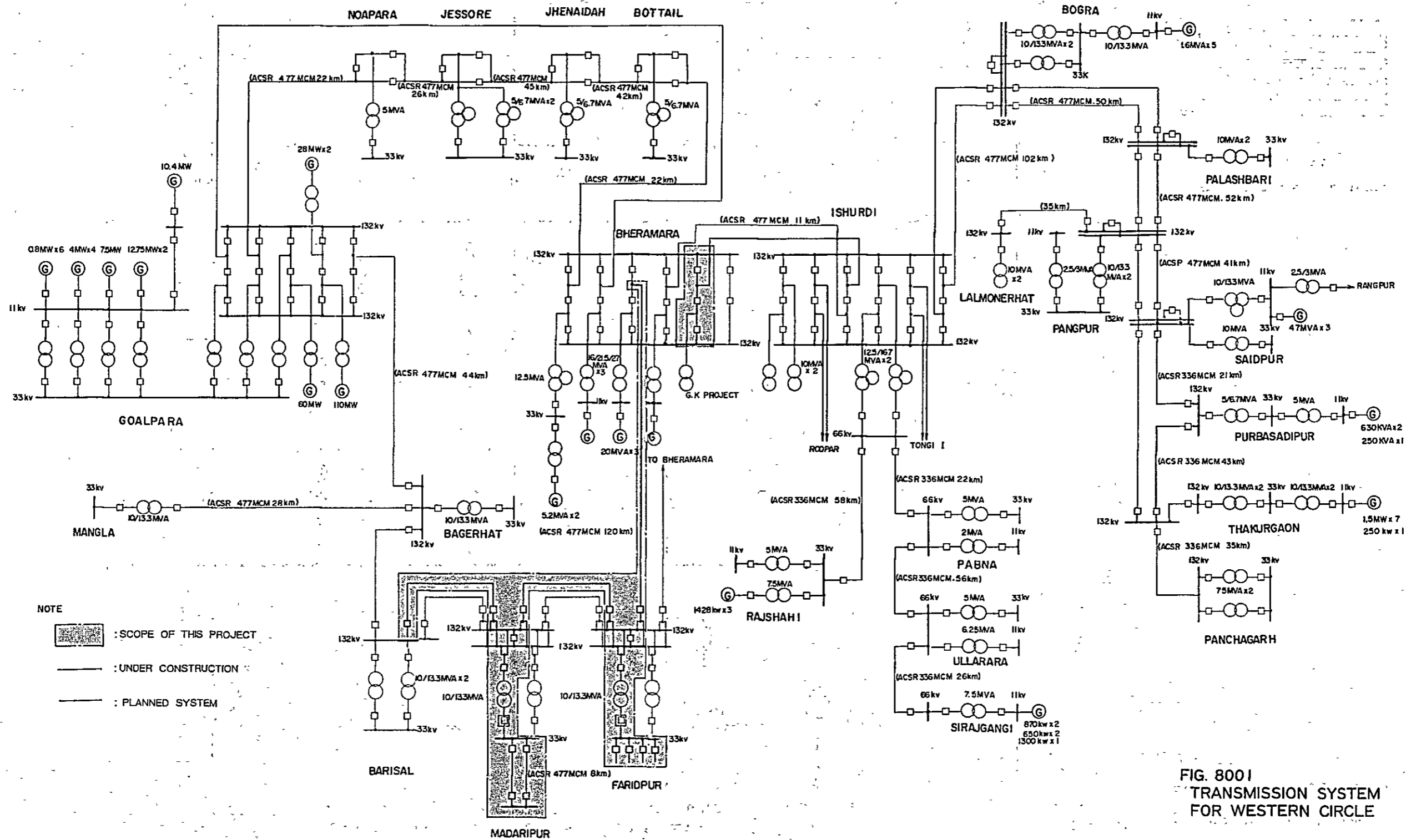
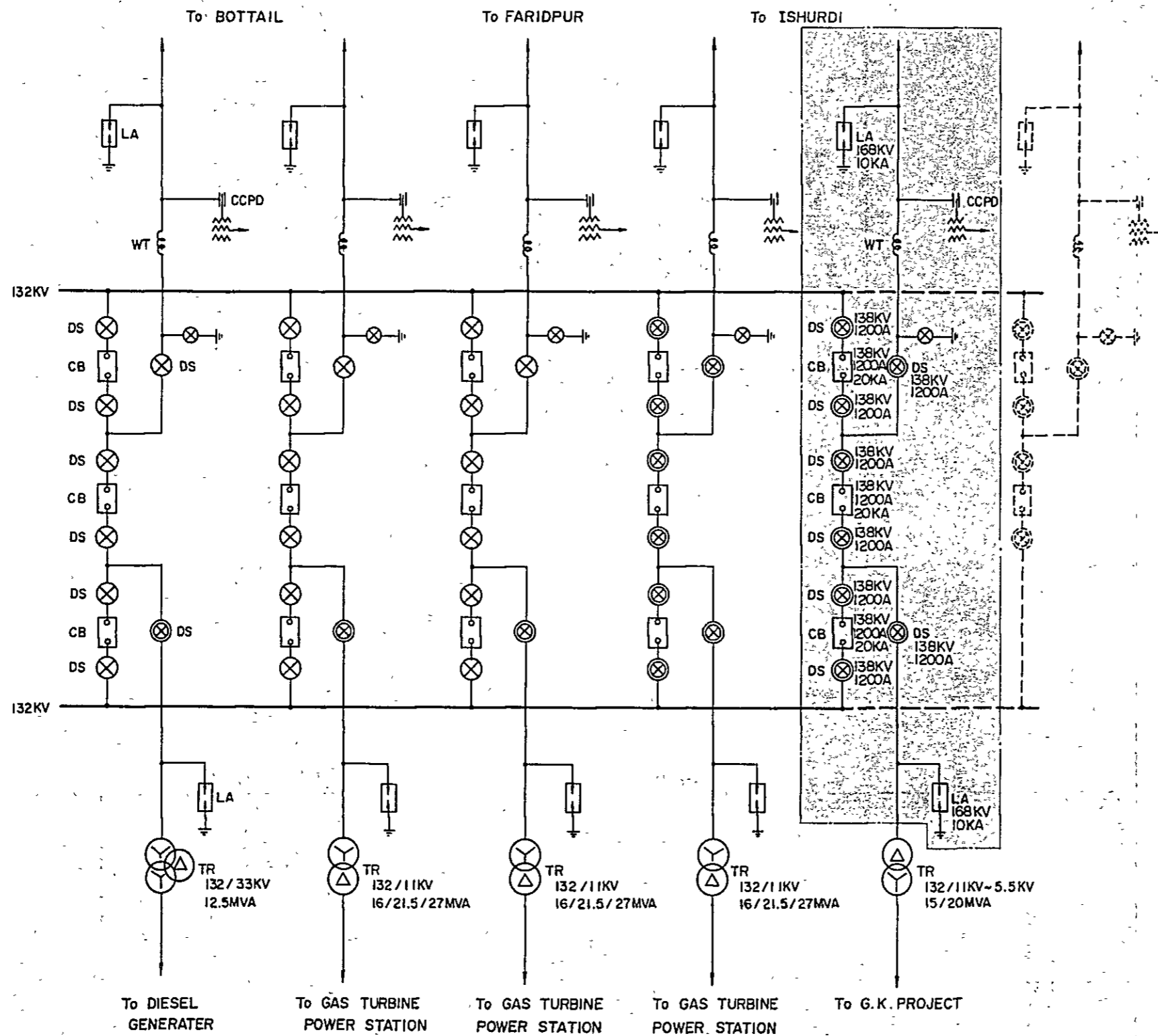


FIG. 8001  
TRANSMISSION SYSTEM  
FOR WESTERN CIRCLE



**LEGEND**

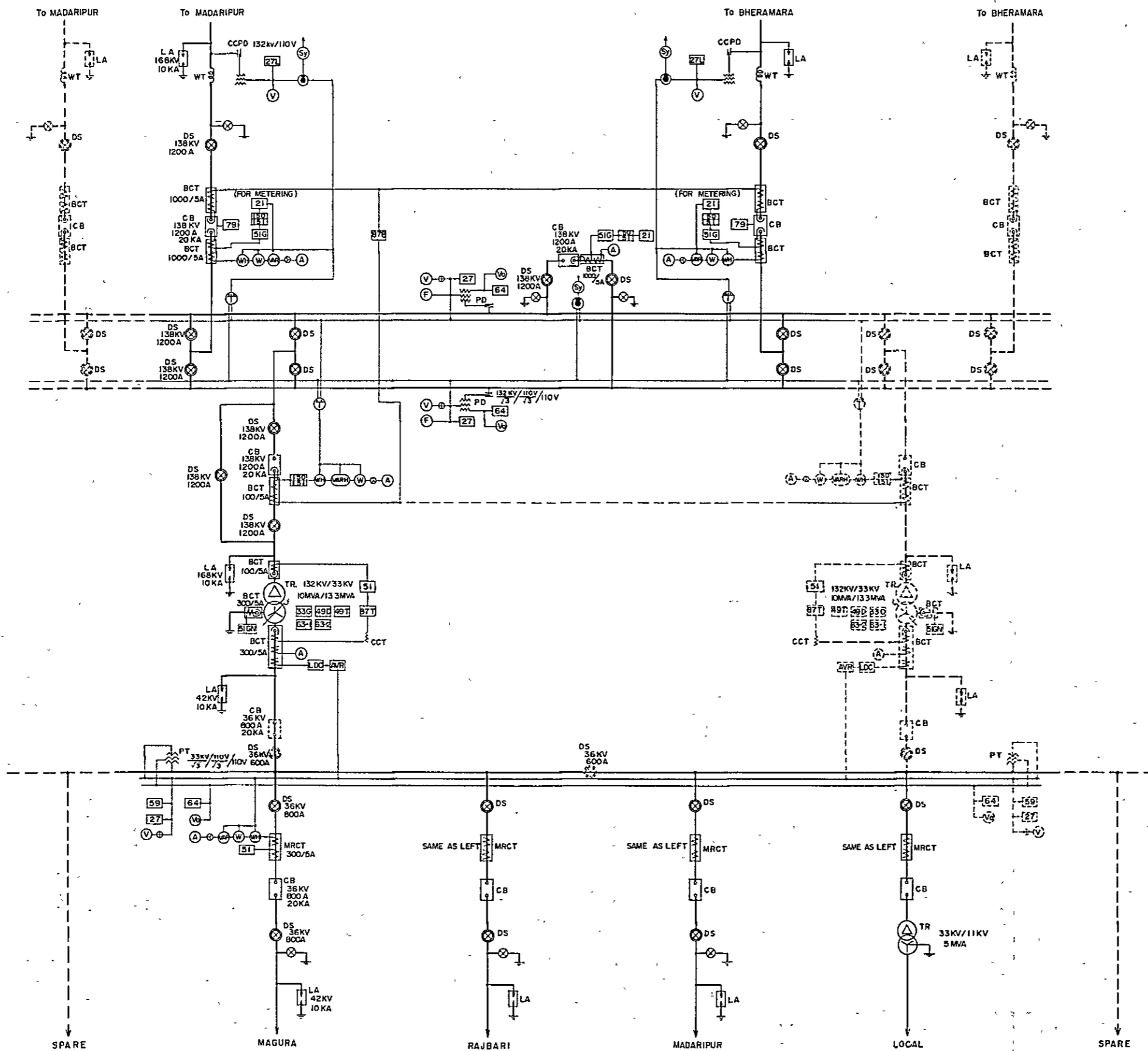
TR	TRANSFORMER
CB	CIRCUIT BREAKER
DS	DISCONNECTING SWITCH
CCPD	COUPLG CAPACITOR POTENTIAL DEVICE
LA	LIGHTNING ARRESTER
WT	WAVE TRAP

**NOTE**

☐ : SCOPE OF THIS PROJECT

..... DOTTED LINE DENOTES THE FUTURE EXTENSION.

FIG. 8002  
 BHEARMARA SUBSTATION  
 SINGLE LINE DIAGRAM

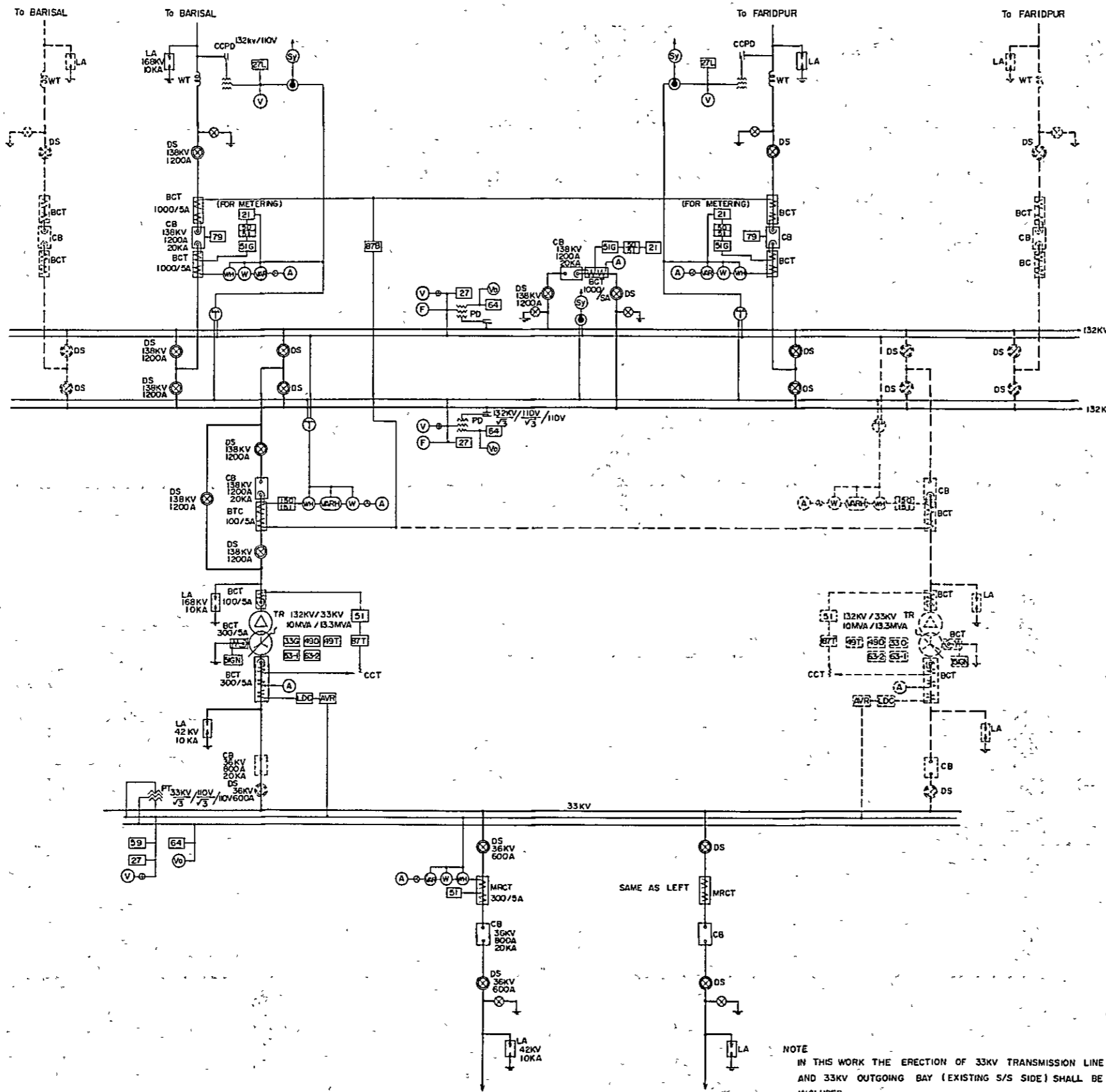


LEGEND

SYMBOL	DESCRIPTION
(V)	VOLTMETER
(V)	ZERO PHASE SEQUENCE VOLTMETER
(A)	AMMETER
(W)	WATTMETER
(WH)	WATT-HOUR METER
(V)	VAR METER
(F)	FREQUENCY METER
(S)	SYNCHROSCOPE
(S)	SYNCHRONISING SWITCH
(R)	RESETTING MULTI-CONTACT RELAY
(C)	VOLTMETER CHANGE OVER SWITCH
(C)	AMMETER CHANGE OVER SWITCH
TR	TRANSFORMER
CB	CIRCUIT BREAKER
DS	DISCONNECTING SWITCH
MRCT	MULTIRATIO CURRENT TRANSFORMER
BCT	BUSHING TYPE CURRENT TRANSFORMER
PD	CAPACITOR TYPE POTENTIAL DEVICE
PT	POTENTIAL TRANSFORMER
CCPD	COUPLING CAPACITOR POTENTIAL DEVICE
LA	LIGHTNING ARRESTER
WT	WAVE TRAP
LDC	LINE DROP COMPENSATOR
CCT	CURRENT COMPENSATING TRANSFORMER
21	DISTANCE RELAY
25	SYNCHRONIZING CHECK RELAY
27	UNDERVOLTAGE RELAY
33G	OL LEVEL GAUGE FOR TRANSFORMER
49D	OL TEST TRANSFORMER FOR TRANSFORMER OIL
49T	OL TEST TRANSFORMER FOR TRANSFORMER WINDING
50	INSTANTANEOUS OVERCURRENT RELAY
51	AC TIME OVER CURRENT RELAY
51G	OVER CURRENT GROUND RELAY
59	OVER VOLTAGE RELAY
63-1	BUCHHOLZ'S RELAY 1ST STAGE
63-2	BUCHHOLZ'S RELAY 2ND STAGE
64	OVER VOLTAGE GROUND RELAY
78	RECLOSING RELAY
87	DIFFERENTIAL CURRENT RELAY

NOTE  
DOTTED LINE DENOTES  
THE FUTURE EXTENSION.

FIG. 8003  
FARIDPUR SUBSTATION  
SINGLE LINE DIAGRAM



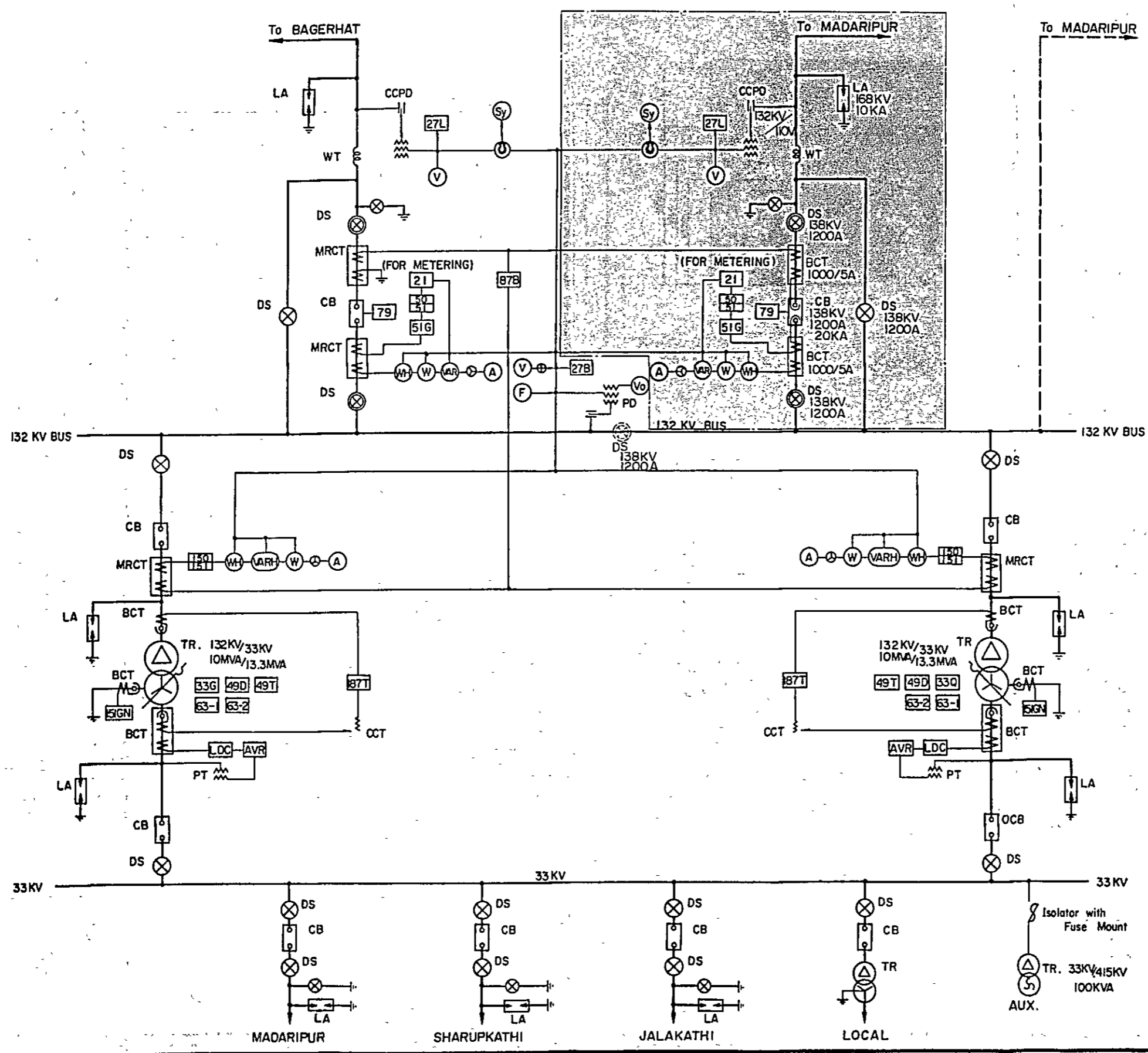
**LEGEND**

SYMBOL	DESCRIPTION
(V)	VOLTMETER
(0)	ZERO PHASE SEQUENCE VOLTMETER
(A)	AMMETER
(W)	WATTMETER
(Wh)	WATT-HOUR METER
(F)	FREQUENCY METER
(S)	SYNCHROSCOPE
(S)	SYNCHRONISING SWITCH
(R)	RESETTING MULTI-CONTACT RELAY
(D)	VOLTMETER CHANGE-OVER SWITCH
(D)	AMMETER CHANGE-OVER SWITCH
(TR)	TRANSFORMER
(CB)	CIRCUIT BREAKER
(DS)	DISCONNECTING SWITCH
(MRCT)	MULTI RATIO CURRENT TRANSFORMER
(BCT)	BUS TIE TYPE CURRENT TRANSFORMER
(P.D)	CAPACITOR TYPE POTENTIAL DEVICE
(PT)	POTENTIAL TRANSFORMER
(CCPD)	Coupling Capacitor Potential Device
(LA)	LIGHTNING ARRESTER
(WT)	WAVE TRAP
(LDC)	LINE DROP COMPENSATOR
(CCT)	CURRENT COMPENSATING TRANSFORMER
(21)	DISTANCE RELAY
(23)	SYNCHRONISING CHECK RELAY
(27)	UNDERVOLTAGE RELAY
(330)	Oil Level Gauge for Transformer
(490)	Oil Type Transformer
(49T)	Oil Type Transformer
(49T)	Oil Type Transformer
(50)	INSTANTANEOUS OVERCURRENT RELAY
(51)	AC TIME OVER CURRENT RELAY
(51G)	OVER CURRENT GROUND RELAY
(59)	OVER VOLTAGE RELAY
(63-1)	BUSCHOLTZ'S RELAY 1ST STAGE
(63-2)	BUSCHOLTZ'S RELAY 2ND STAGE
(64)	OVER VOLTAGE GROUND RELAY
(79)	RECLDSING RELAY
(87)	DIFFERENTIAL CURRENT RELAY

**NOTE**  
 DOTTED LINE DENOTES  
 THE FUTURE EXTENSION

**FIG. 8004**  
**MADARIPUR SUBSTATION**  
**SINGLE LINE DIAGRAM**

**NOTE**  
 IN THIS WORK THE ERECTION OF 33KV TRANSMISSION LINE  
 AND 33KV OUTGOING BAY (EXISTING S/S SIDE) SHALL BE  
 INCLUDED



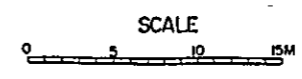
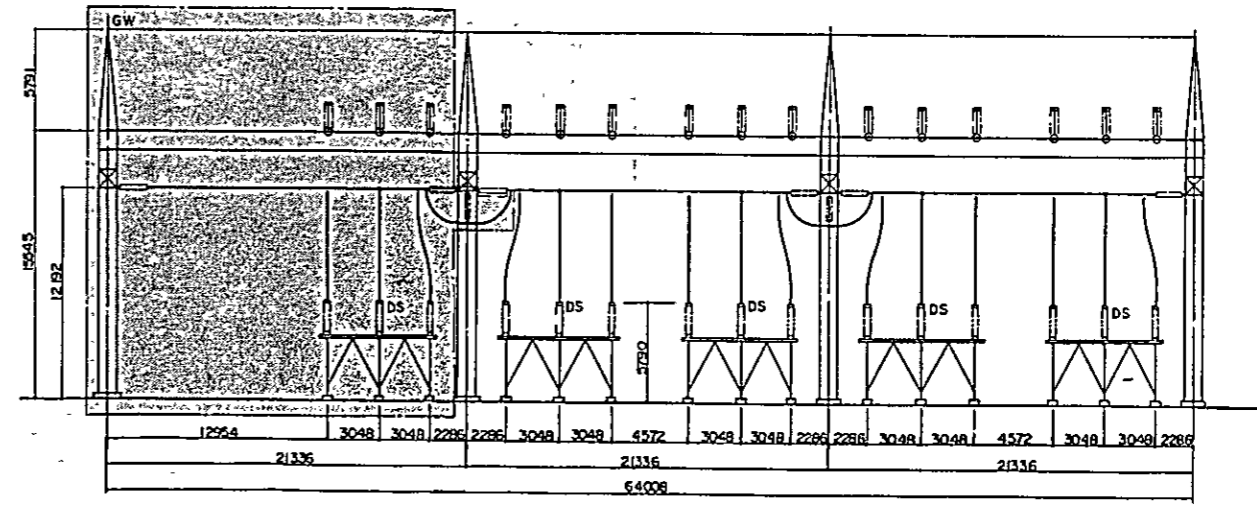
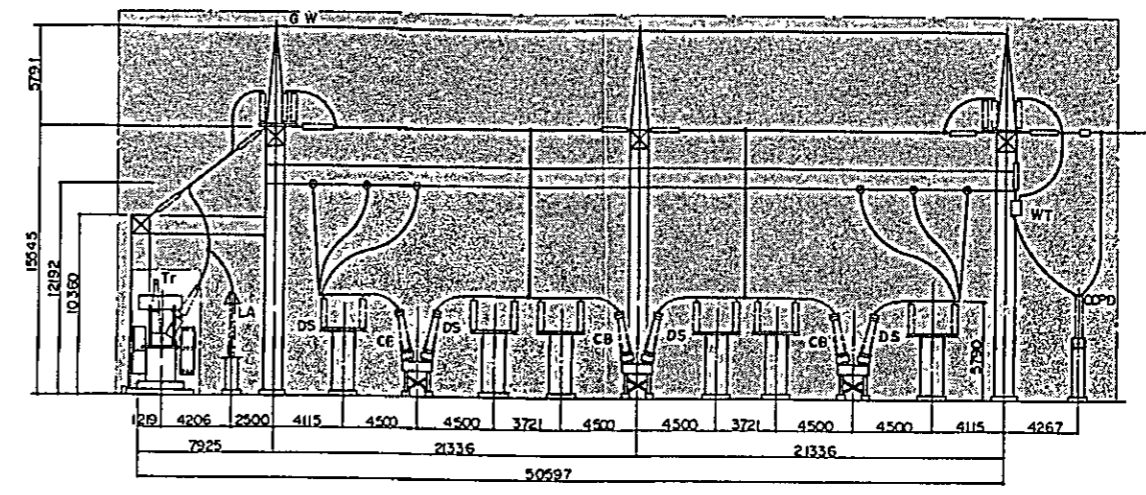
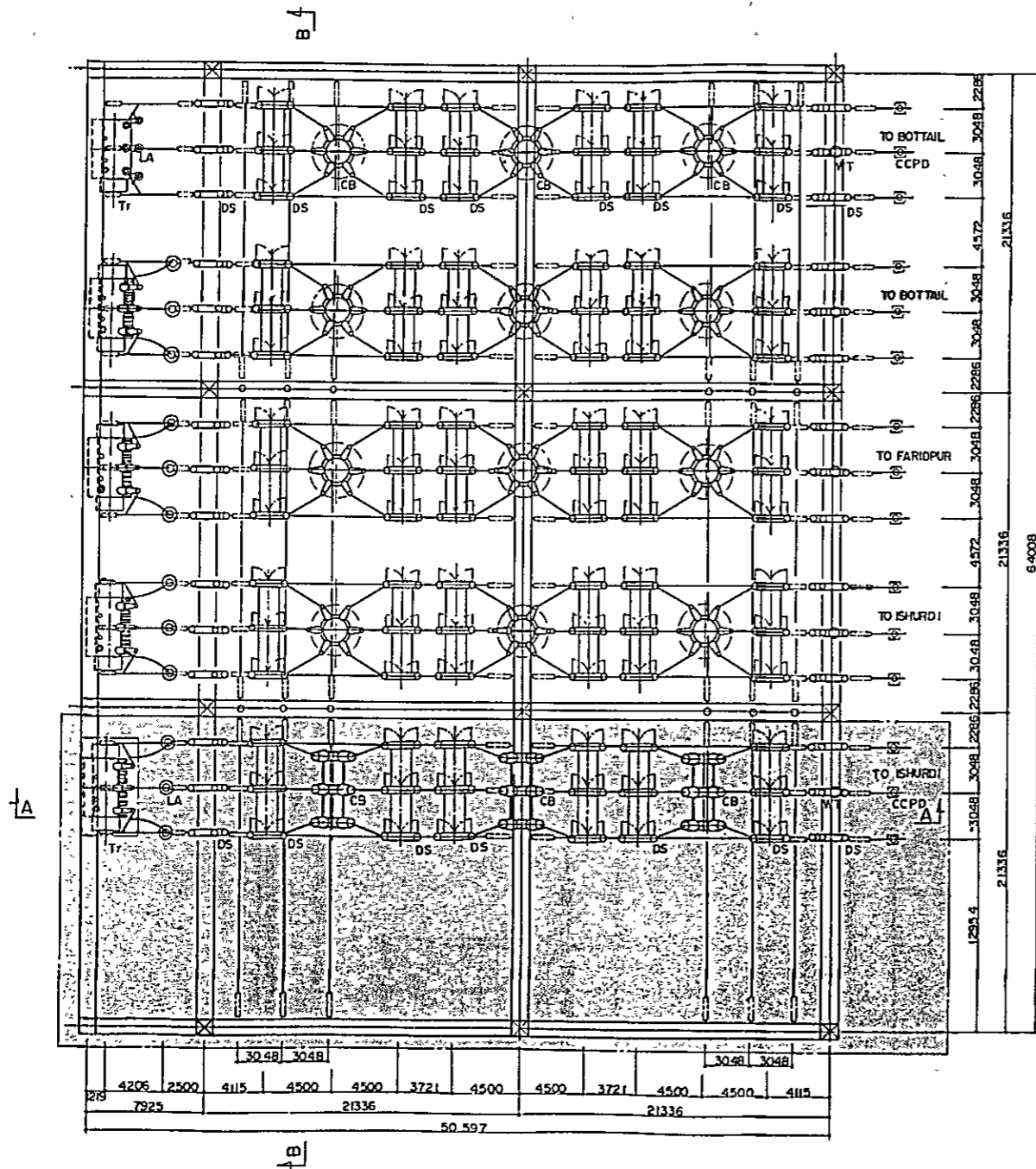
**LEGEND**

SYMBOL	DESCRIPTION
(V)	VOLTMETER
(A)	AMMETER
(W)	WATTMETER
(WH)	WATT-HOUR METER
(VAR)	VARMETER
(F)	FREQUENCY METER
(Sy)	SYNCHROSCOPE
(⊕)	VOLTMETER CHANGE-OVER SWITCH
(⊙)	AMMETER CHANGE-OVER SWITCH
TR	TRANSFORMER
CB	CIRCUIT BREAKER
DS	DISCONNECTING SWITCH
MRCT	MULTI RATIO CURRENT TRANSFORMER
BCT	BUSHING TYPE CURRENT TRANSFORMER
PD	CAPACITOR TYPE POTENTIAL DEVICE
PT	POTENTIAL TRANSFORMER
CCPD	COUPLING CAPACITOR POTENTIAL DEVICE
LA	LIGHTNING ARRESTER
WT	WAVE TRAP
LDC	LINE DROP COMPENSATER
CCT	CURRENT COMPENSATING TRANSFORMER
21	DISTANCE RELAY
25	SYNCHRONIZING CHECK RELAY
27	UNDERVOLTAGE RELAY
330	OIL LEVEL GAUGE FOR TRANSFORMER
49D	DIAL TYPE THERMOMETER FOR TRANSFORMER OIL
49T	DIAL TYPE THERMOMETER FOR TRANSFORMER WINDING
50	INSTANTANEOUS OVERCURRENT RELAY
51	A.C TIME OVER CURRENT RELAY
51G	OVER CURRENT GROUND RELAY
63-1	BUCHHOLTZ'S RELAY 1ST STAGE
63-2	BUCHHOLTZ'S RELAY 2ND STAGE
79	RECLOSEING RELAY
87	DIFFERENTIAL CURRENT RELAY
(V <sub>0</sub> )	ZERO PHASE SEQUENCE VOLTMETER
(Sy)	SYNCHRONISING SWITCH

NOTE  
 [Symbol] : SCOPE OF THIS PROJECT  
 DOTTED LINE DENOTES THE FUTURE EXTENSION.

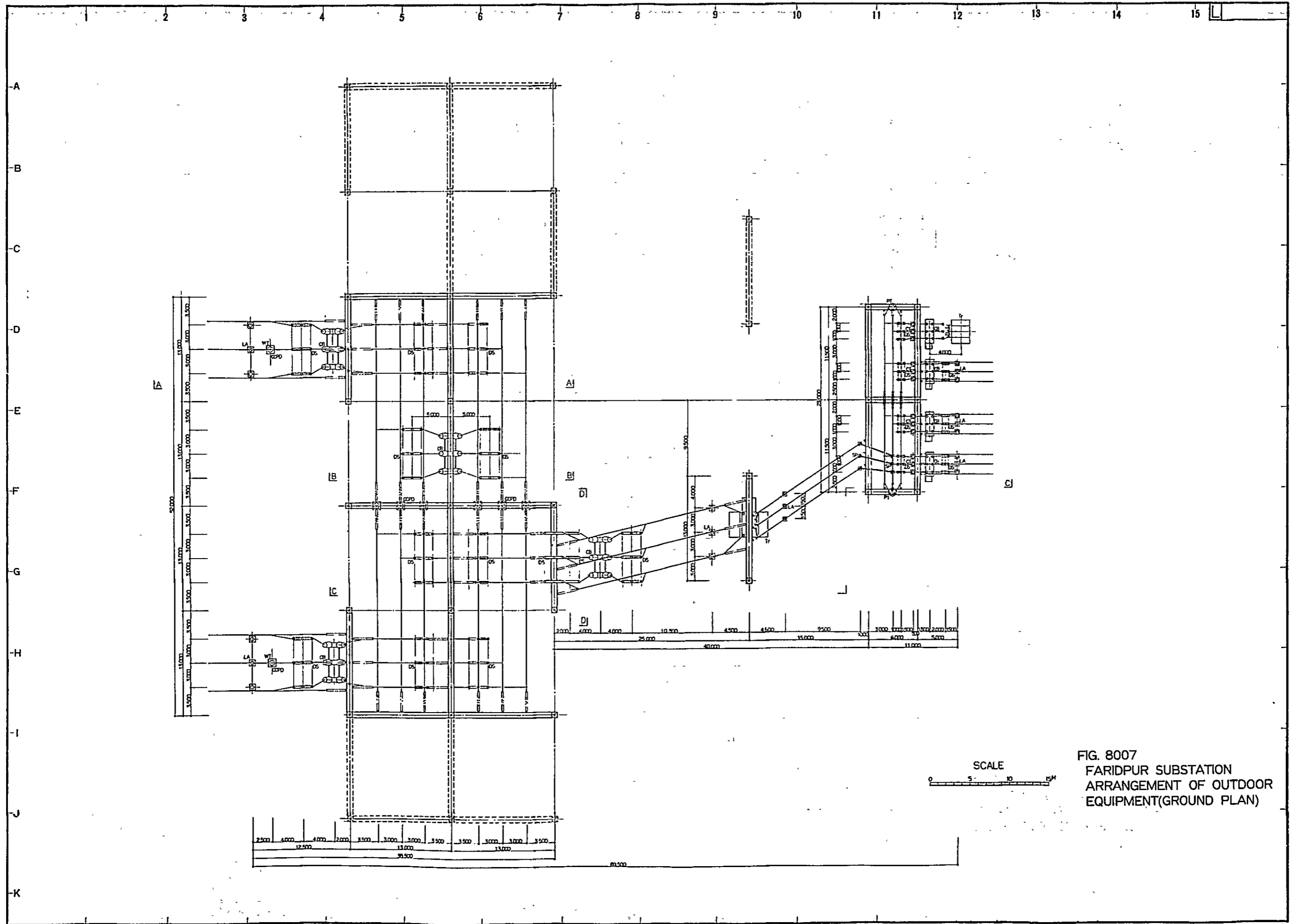
FIG. 8005  
 BARISAL SUBSTATION  
 SINGLE LINE DIAGRAM

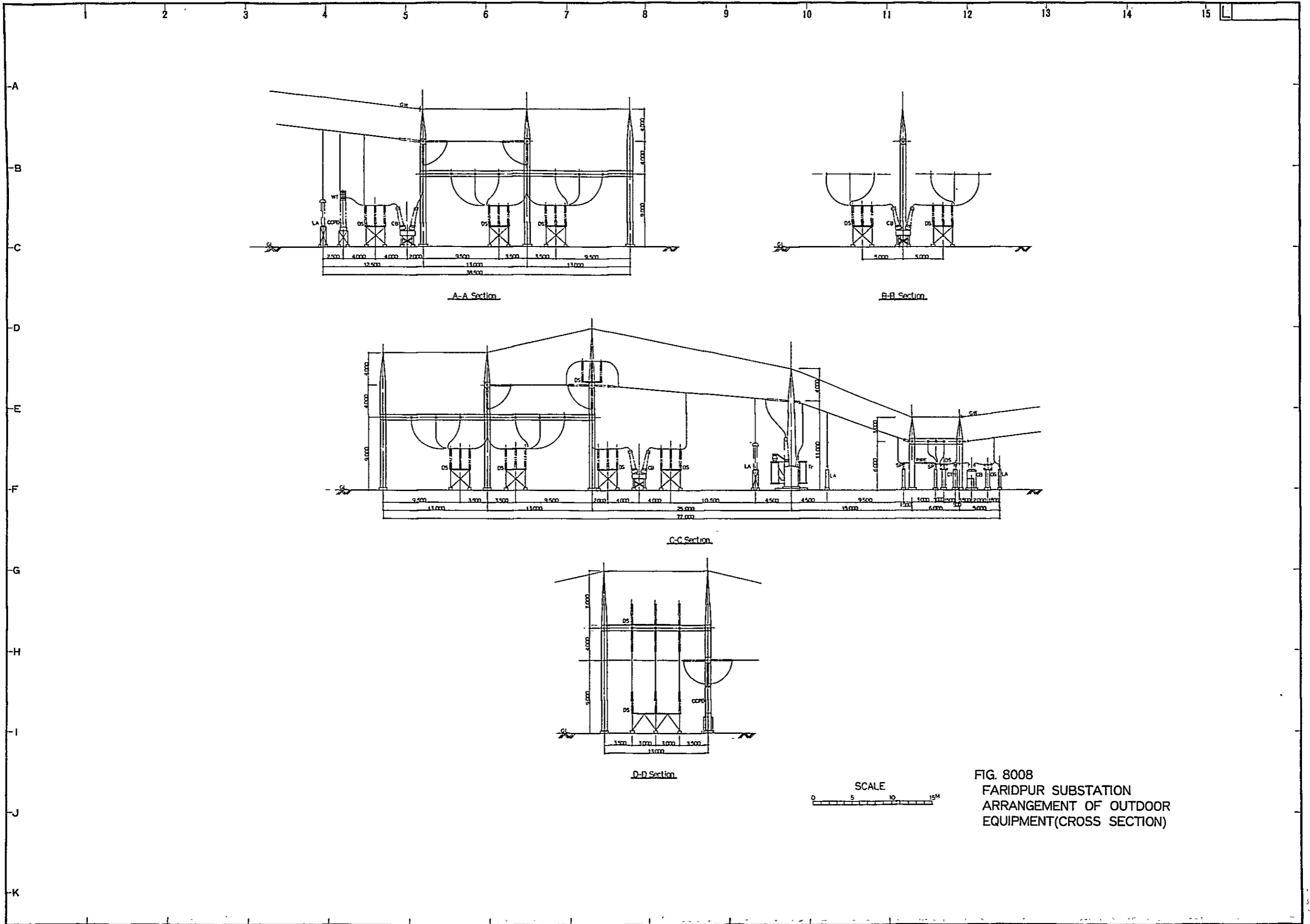




NOTE  
[ ] : SCOPE OF THIS PROJECT

FIG. 8006  
BHERAMARA SUBSTATION  
ARRANGEMENT OF OUTDOOR EQUIPMENT





A-A Section

B-B Section

C-C Section

D-D Section

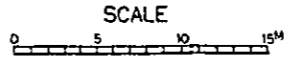


FIG. 8008  
 FARIDPUR SUBSTATION  
 ARRANGEMENT OF OUTDOOR  
 EQUIPMENT(CROSS SECTION)

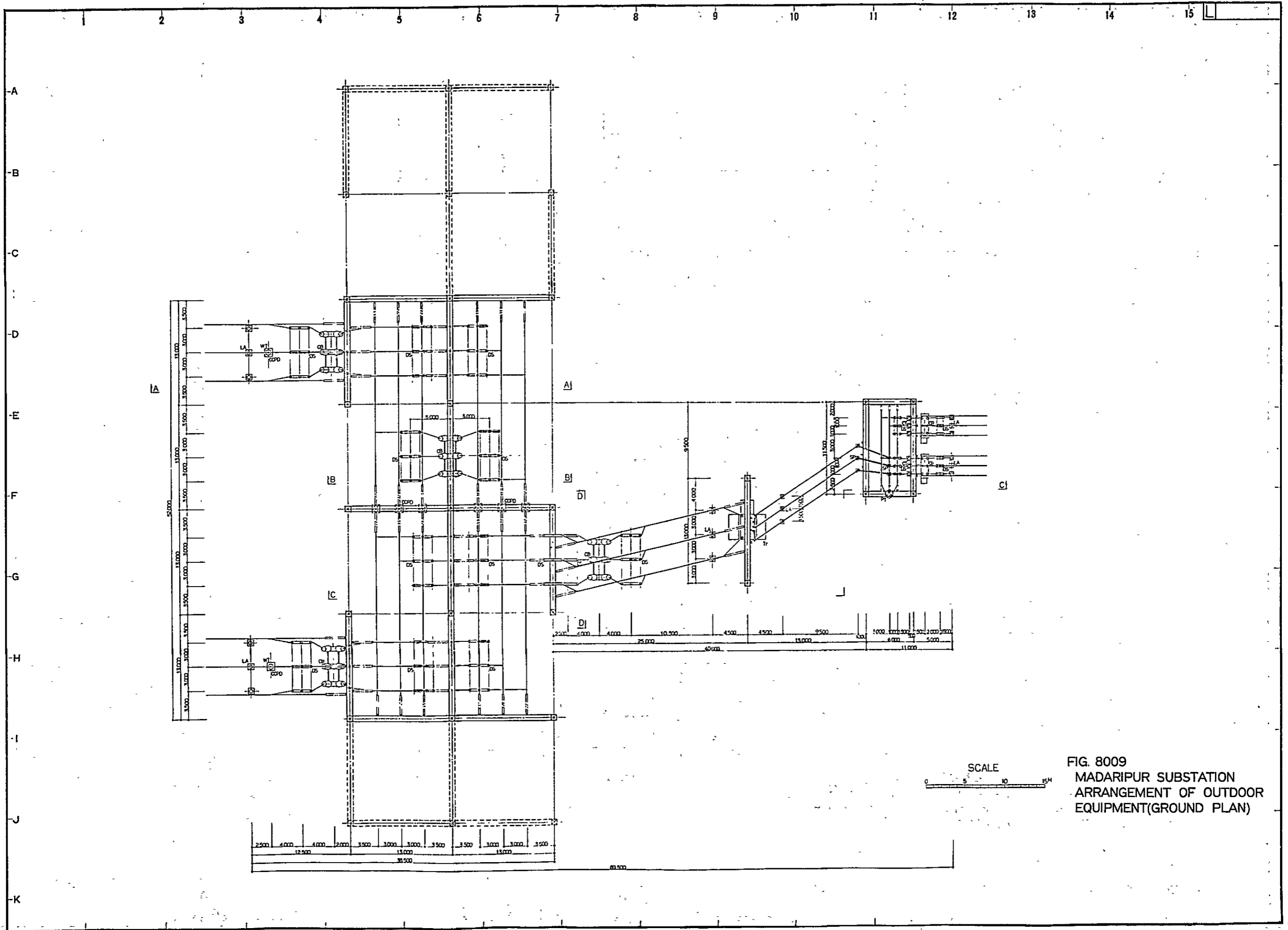


FIG. 8009  
MADARIPUR SUBSTATION  
ARRANGEMENT OF OUTDOOR  
EQUIPMENT(GROUND PLAN)

SCALE  
0 5 10 15M

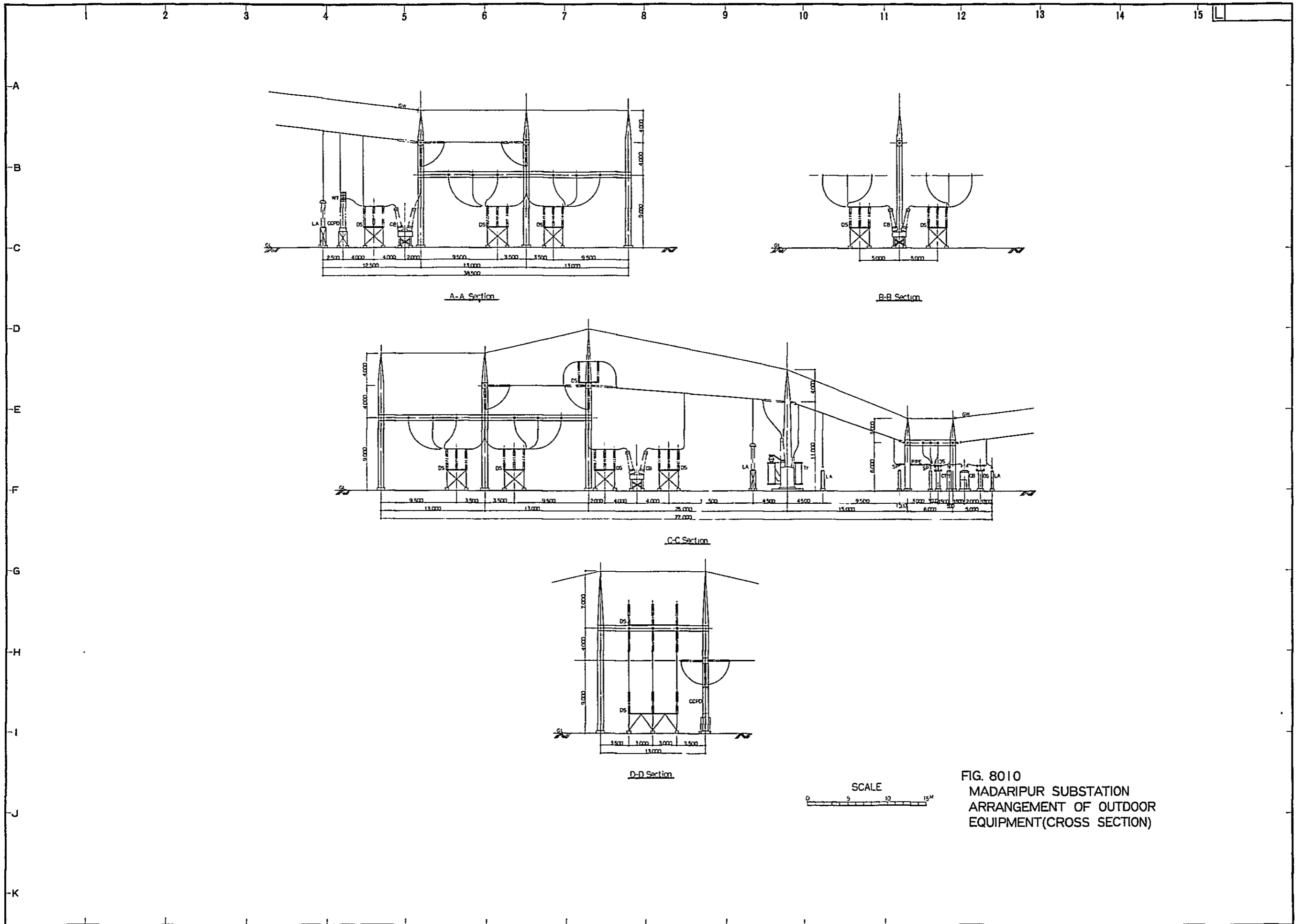
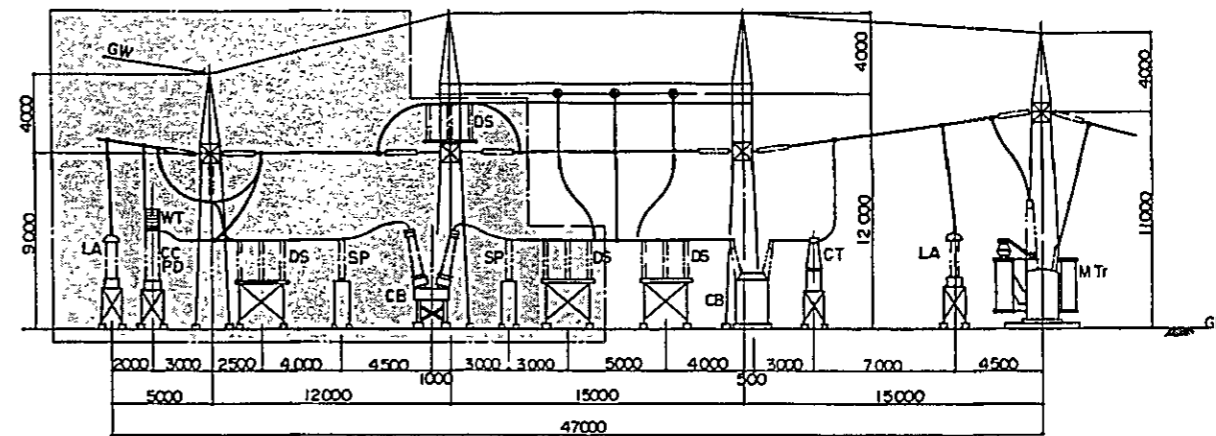
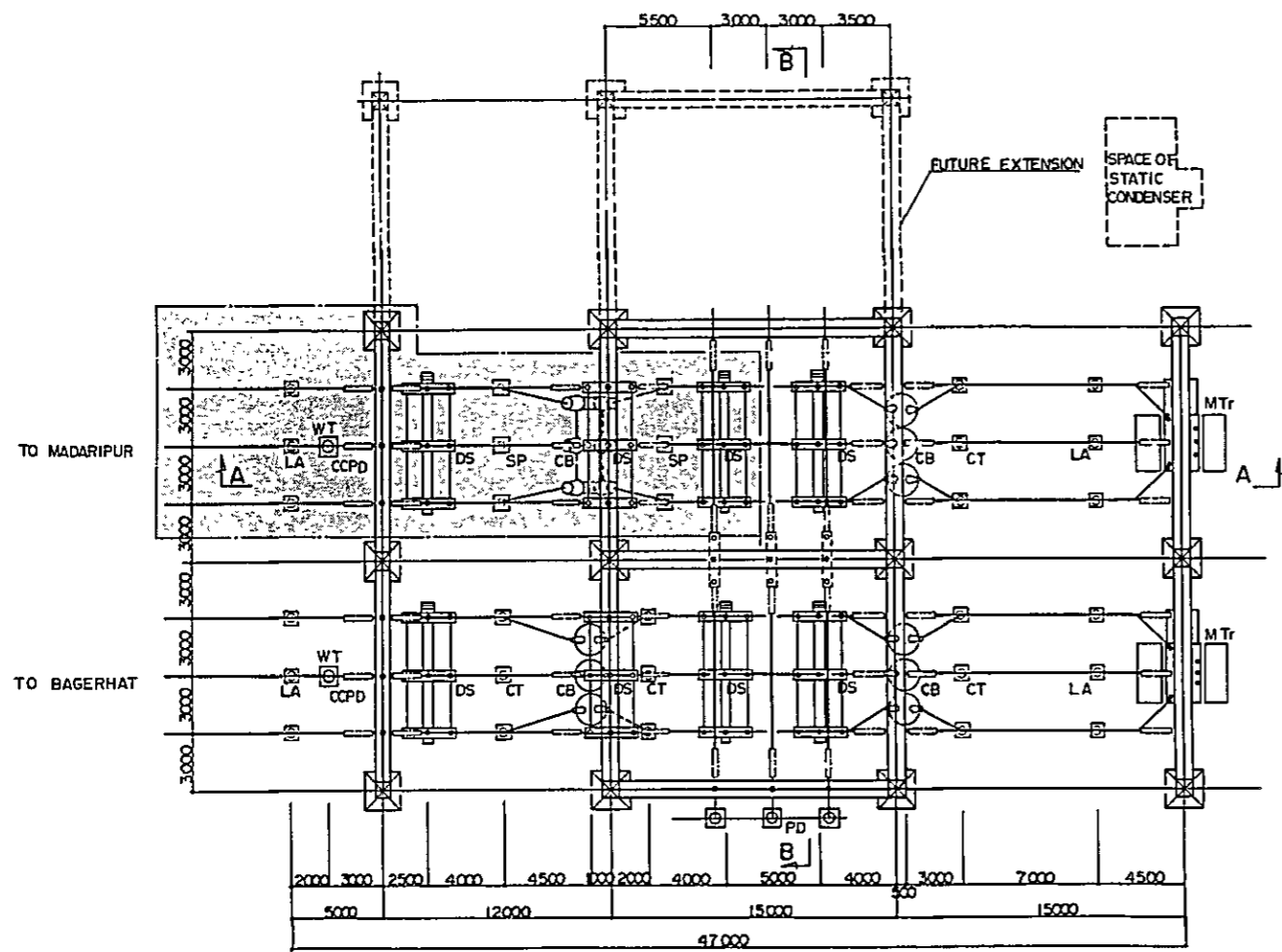
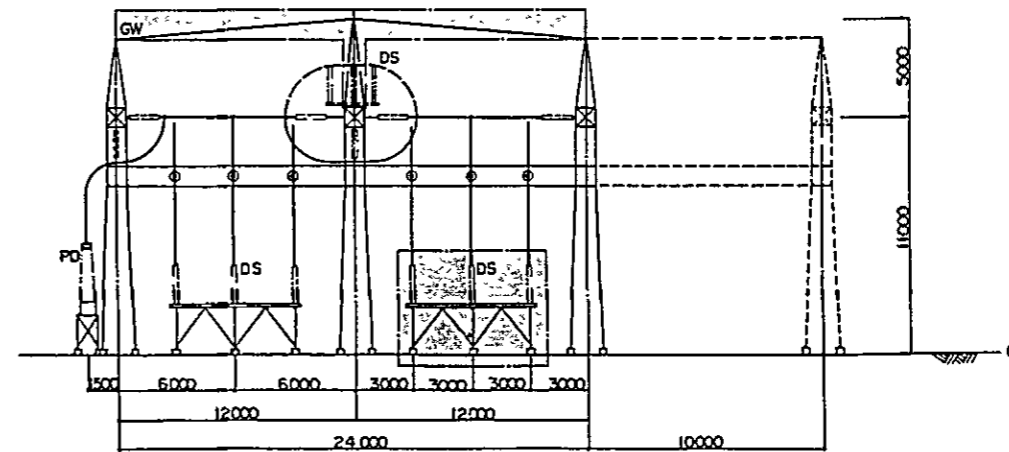


FIG. 8010  
 MADARIPUR SUBSTATION  
 ARRANGEMENT OF OUTDOOR  
 EQUIPMENT(CROSS SECTION)



A - A SECTION



B - B SECTION

NOTE  
 [Solid Line Box]: SCOPE OF THIS PROJECT  
 [Dotted Line Box]: DOTTED LINE DENOTES THE FUTURE EXTENSION

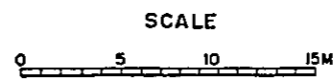


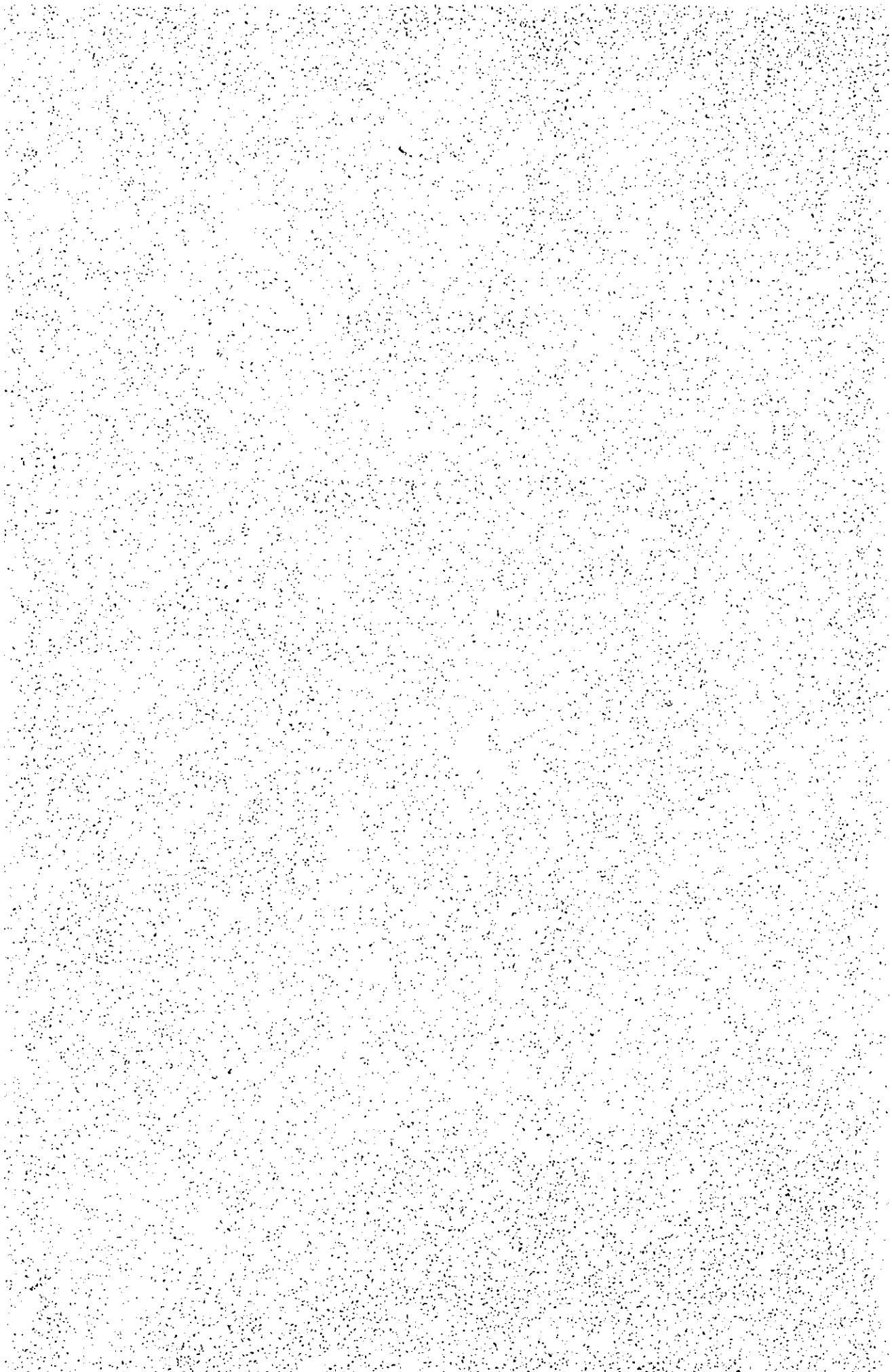
FIG. 8011  
 BARISAL SUBSTATION  
 ARRANGEMENT OF OUTDOOR EQUIPMENT



## ANNEX VIII

### BPDB電力収支状況





ANNEX VIII-1 ENERGY COST AND SALES REVENUE IN BPDB (1977/78)

Description		East Zone	West Zone	Total
1	Installed Capacity (kW)	525,575	226,563	752,138
2	Maximum Capability (kW)	408,406	148,587	556,993
3	Generation in 1,000 kWh/Year	1,444,291	468,499	1,912,790
4	Fuel cost in 1,000 TK	61,524	336,789	398,313
5	Generation Expenditure in 1,000TK	124,440	363,753	488,193
6	Energy Sales in 1,000 kWh	908,839	295,661	1,204,501
7	Energy Sales in 1,000 TK	418,820	138,106	556,926
8	Supply cost in 1,000 TK	369,565	439,469	809,034
9	Generation Cost/kWh in Paisa	8.6	77.6	25.5
10	Sales cost/kWh in Paisa	40.7	148.6	67.2
11	Average tariff/kWh in Paisa	46.1	46.7	46.2

## 算 出 方 法

### (1) Generation Cost

Generation Expenses (total)	488.193 × 10 <sup>3</sup> TK
(-) Fuel cost (total)	398.313 "
その他の発電費用	89.880 "

その他の費用は installed capacity に比例すると仮定すれば、

東西の capacity 比率は 7 : 3 となるので此の比率でその他の発電費用を割り振れば

$$\text{East} \quad 89.880 \times 10^3 \times 0.7 = 62.916 \times 10^3 \text{ TK}$$

$$\text{West} \quad 89.880 \times 10^3 \times 0.3 = 26.964 \times 10^3 \text{ TK}$$

各地域の fuel cost とその他の発電費用を加えれば東西別の発電費用が得られる。

$$\text{East} \quad 61.524 + 62.916 = 124.440 \times 10^3 \text{ TK}$$

$$\text{West} \quad 336.789 + 26.964 = 363.753 \times 10^3 \text{ TK}$$

(註) 発電所のための減価償却の記載がなく此の発電費用には減価償却を含まず

### (2) Total Cost

電力事業1年間の費用(減価償却を含む)は  $809.034 \times 10^3$  TK

これより fuse cost を差し引けば

$$\text{その他の total 費用} = 410.721 \times 10^3 \text{ TK}$$

一方 energy sales in KWH の東西比は約

$$0.75 : 0.25$$

となっているのでその他の費用を上この比で配分すれば

$$\text{East} \quad 410.721 \times 0.75 = 308.041 \times 10^3 \text{ TK}$$

$$\text{West} \quad 410.721 \times 0.25 = 102.680 \times 10^3 \text{ TK}$$

Total 費用は(上の数字に fuel cost を加える)

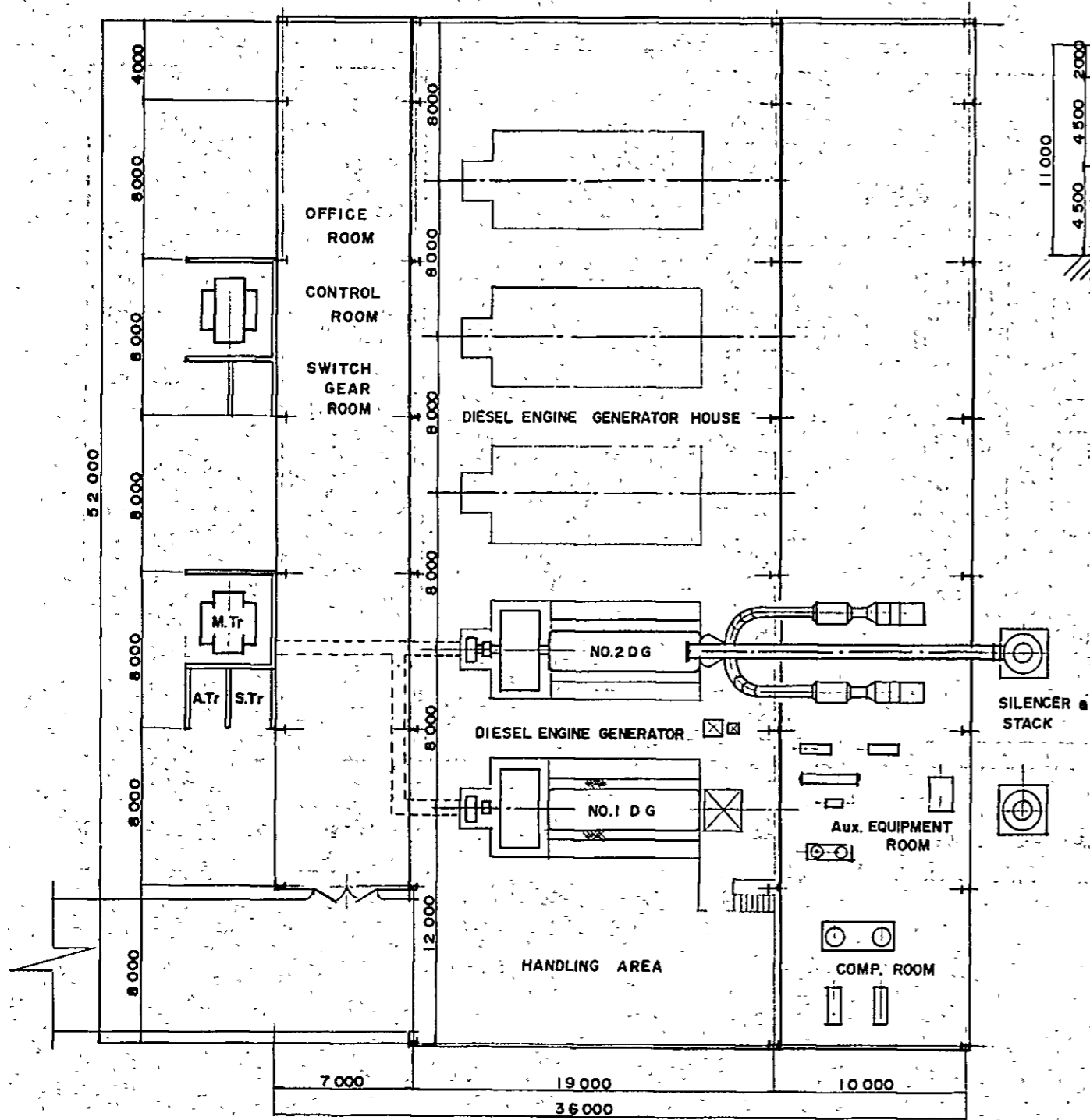
$$\text{East} \quad 61.524 + 308.041 = 369.565 \times 10^3 \text{ TK}$$

$$\text{West} \quad 336.789 + 102.680 = 439.469 \times 10^3 \text{ TK}$$

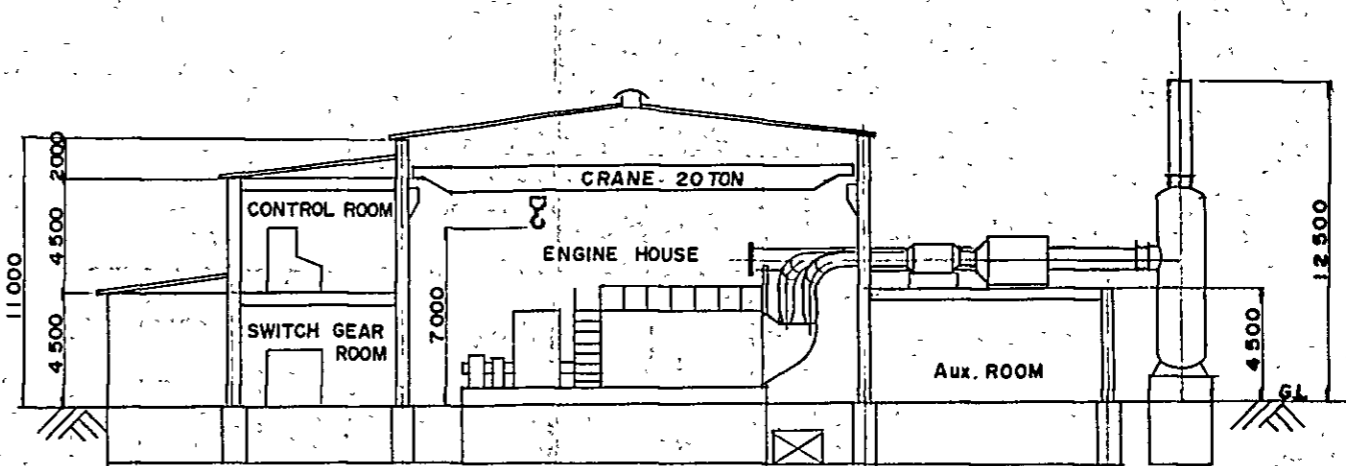
(註) 此の計算には isolated も合んでいる

## ANNEX IX

### 火力発電所機器配置図 (代案)



PLAN



ELEVATION

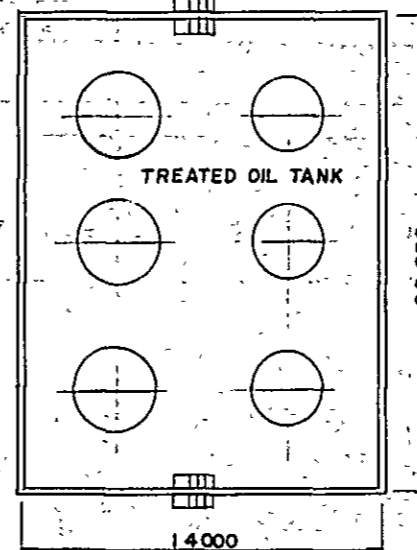
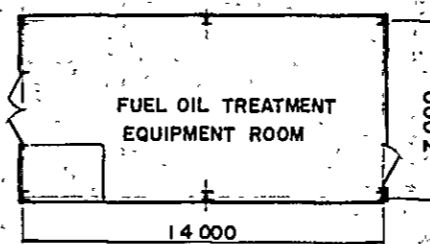


FIG. 11001  
ARRANGEMENT OF DIESEL ENGINE  
GENERATOR HOUSE  
( PLANT CAPACITY : 6000 kw x 2, 7000 kw x 3 )

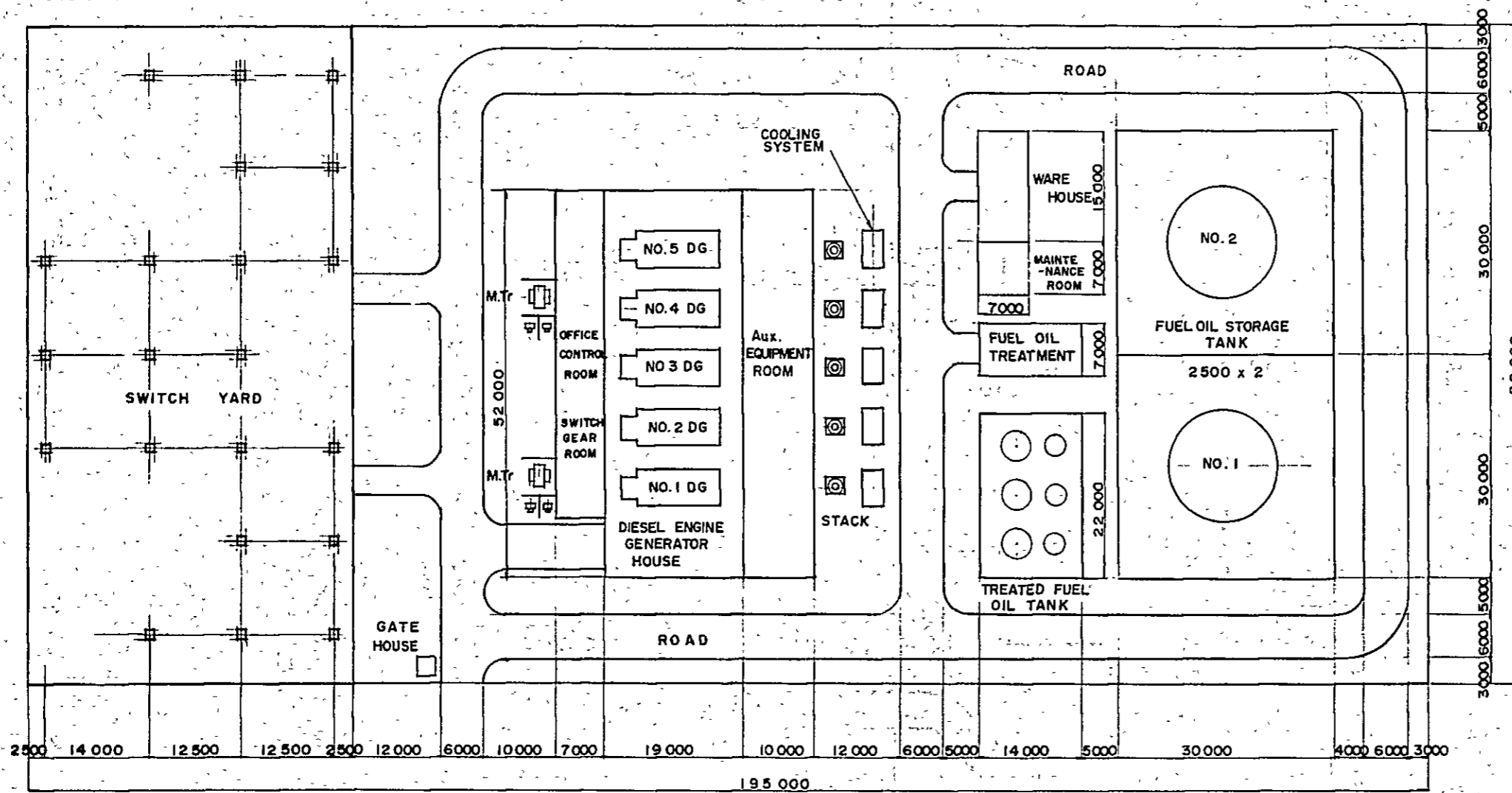


FIG. 11002  
 SITE LAYOUT PLAN FOR DIESEL  
 ENGINE POWER PLANT  
 ( PLANT CAPACITY : 6000<sup>kw</sup> x 2, 7000<sup>kw</sup> x 3 )

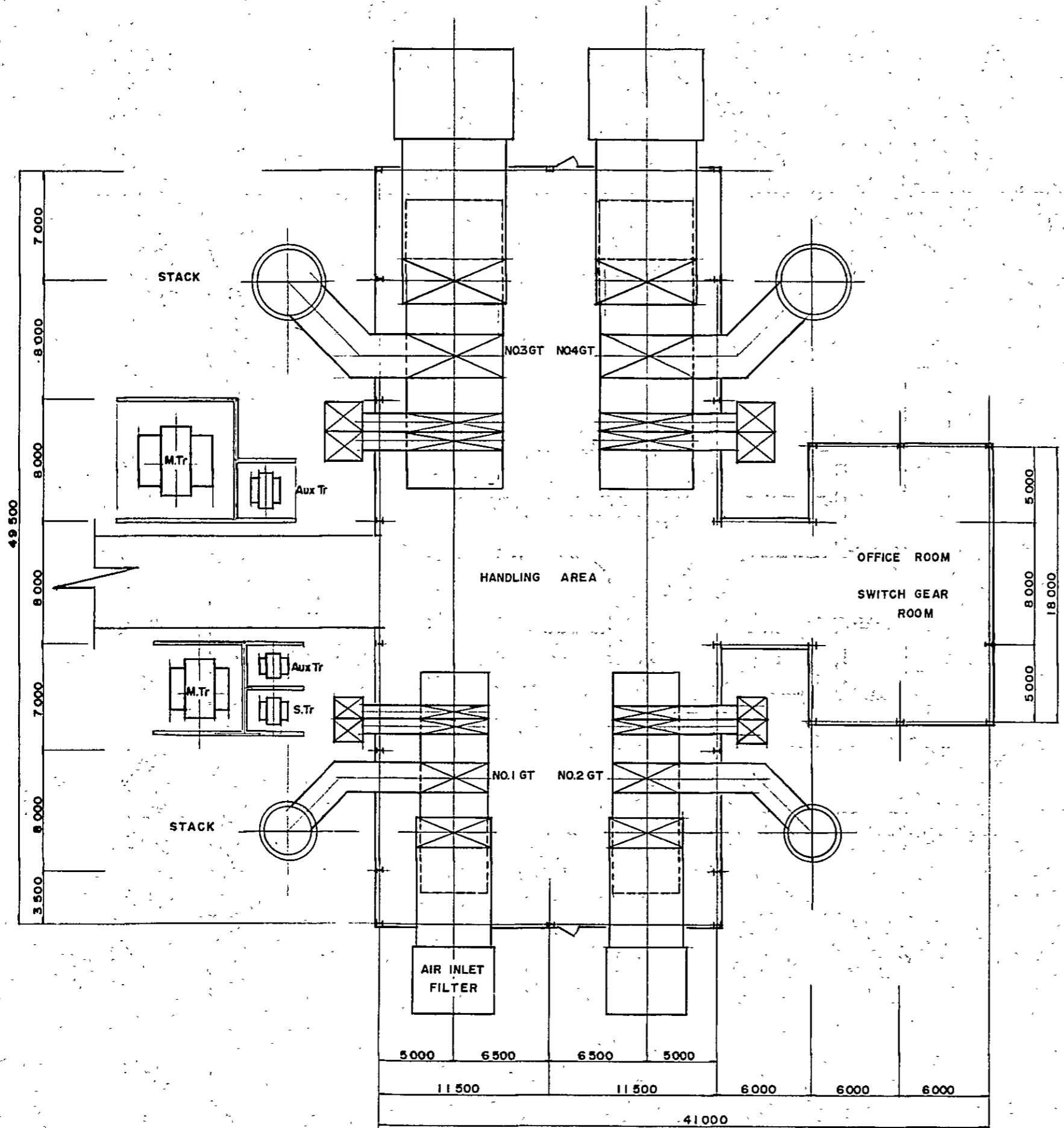


FIG. 11003  
 ARRANGEMENT OF GAS TURBINE  
 GENERATOR HOUSE  
 ( PLANT CAPACITY : 10000<sup>kw</sup> x2, 20000<sup>kw</sup> x2 )

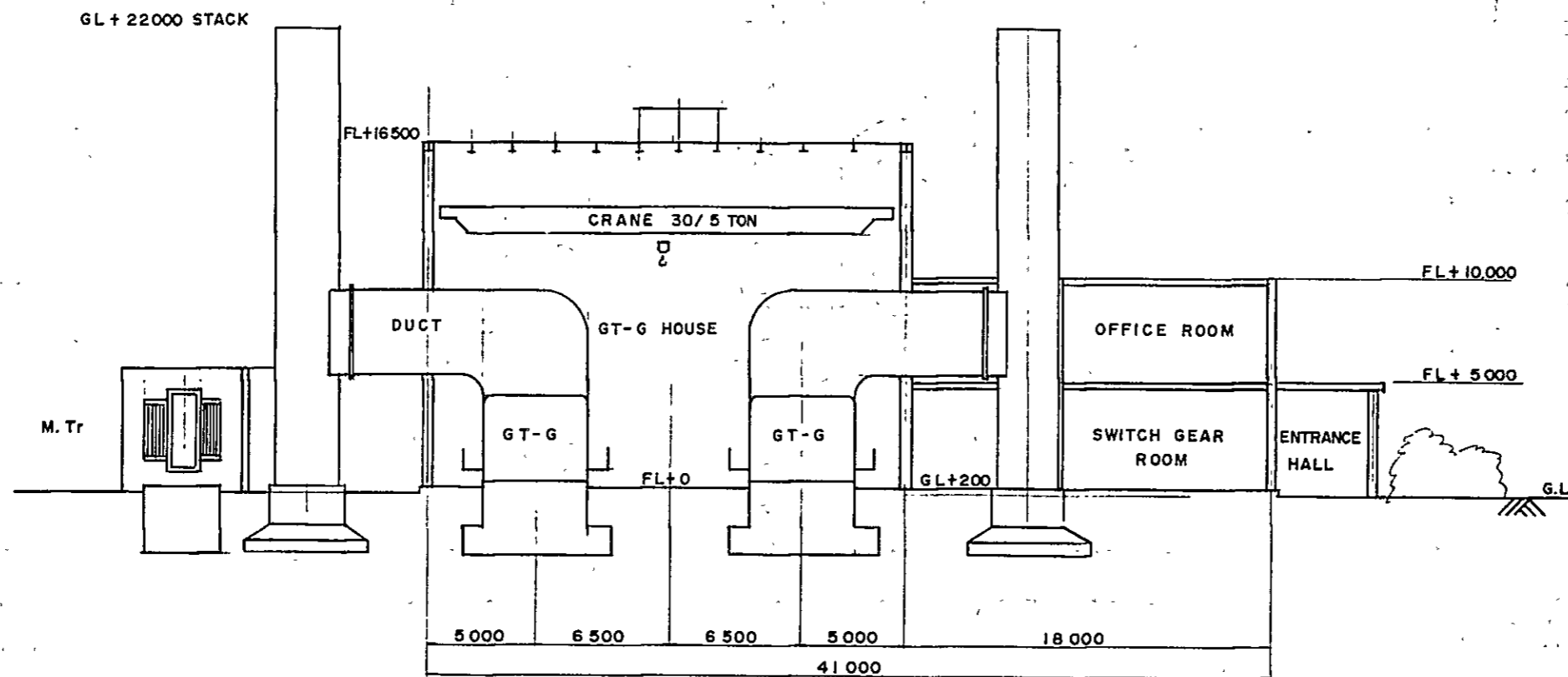


FIG. 11004

ELEVATION OF GAS-TURBINE  
GENERATOR HOUSE

( PLANT CAPACITY : 10 000 kW x 2 ; 20 000 kW x 2 )



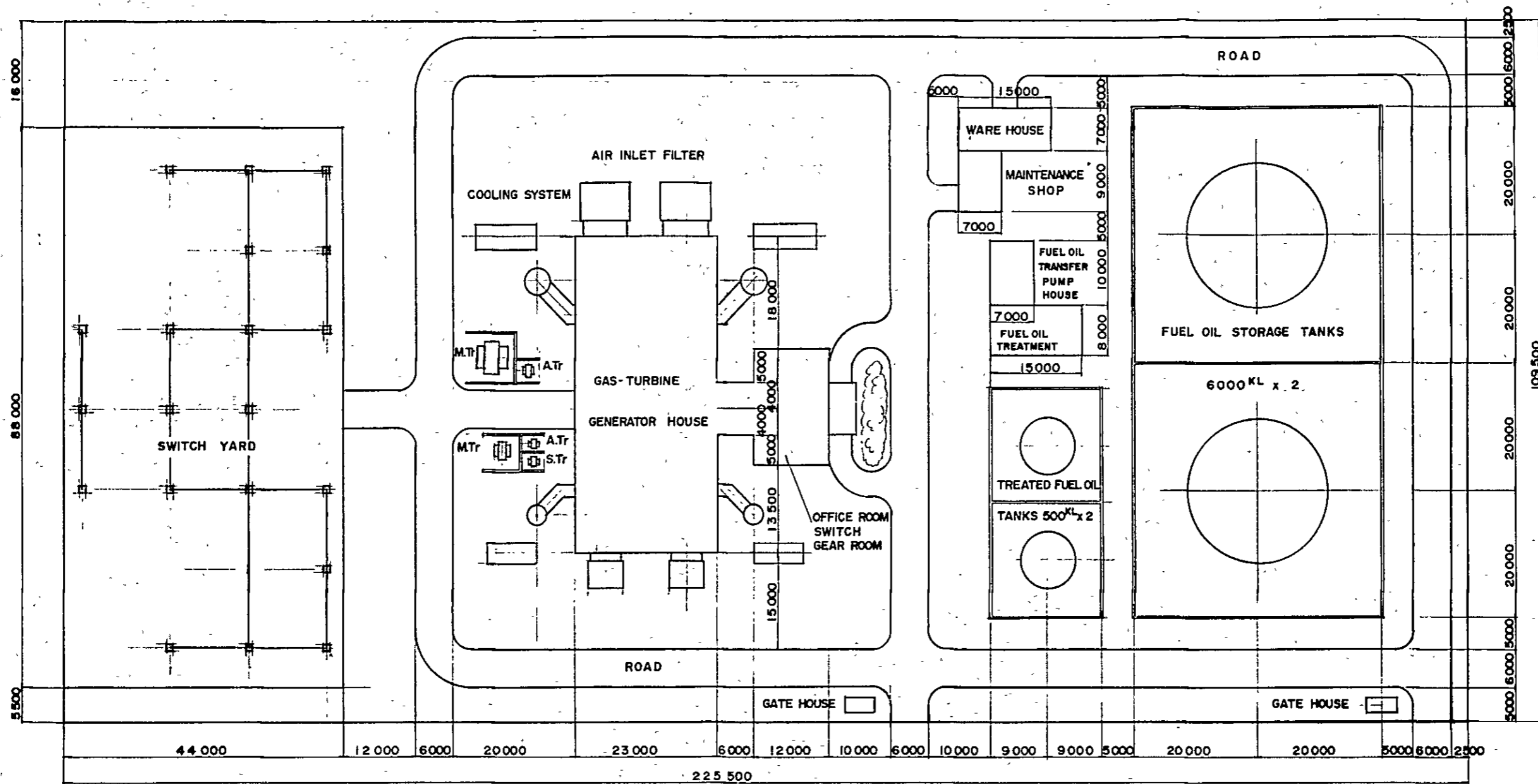
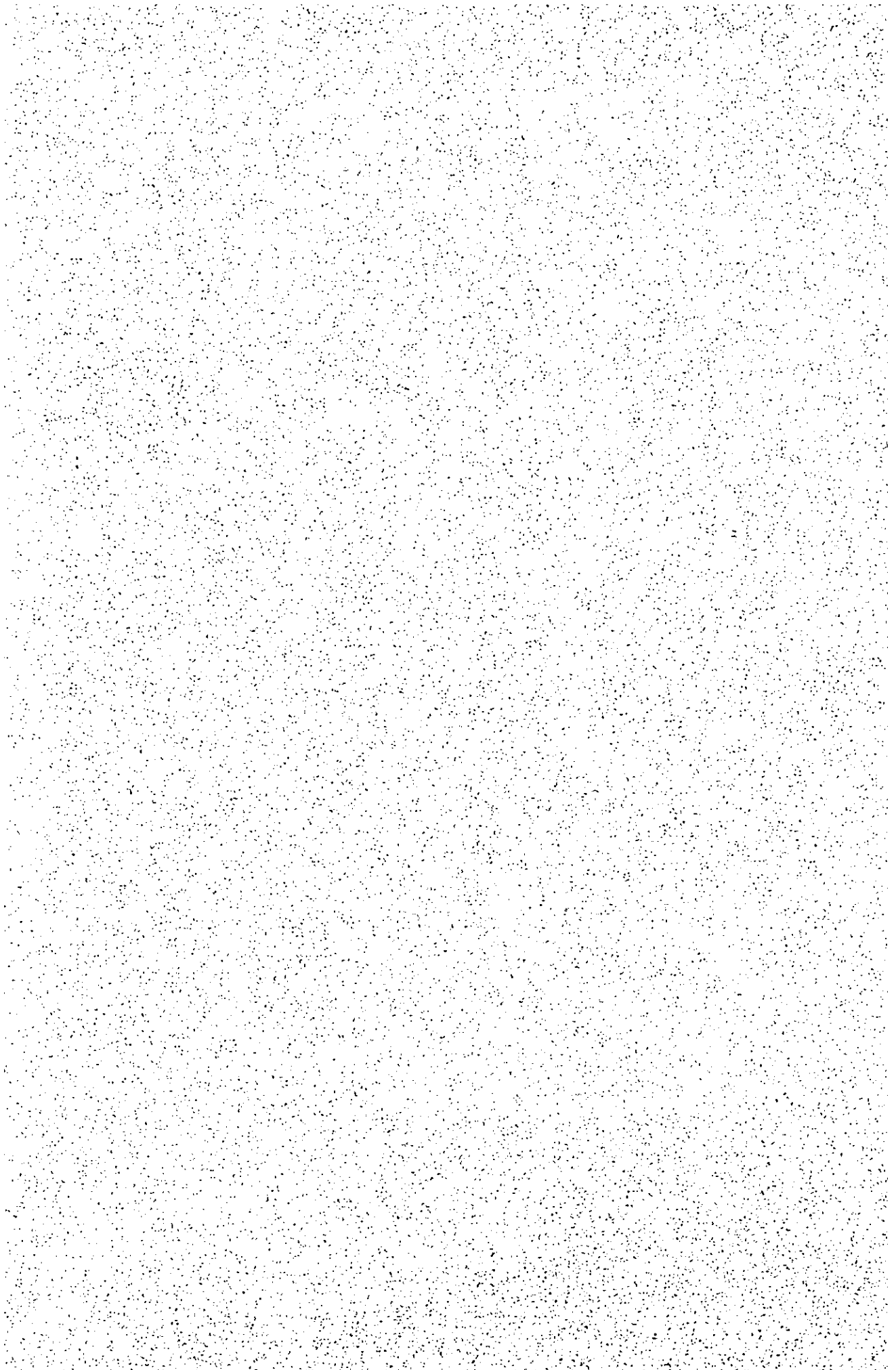


FIG. 11005  
 SITE LAYOUT PLAN FOR  
 GAS-TURBINE POWER PLANT  
 ( PLANT CAPACITY : 10000kw x2, 20000kw x 2 )



## ANNEX X

### プロジェクトに関するB/C試算



## 1. 評価のための条件

### (1) 需要想定

本プロジェクトに関する需要伸長は 5-1-2 により 1990 年まで 16%、1995 年までは 11% とする。なお 1995 年以降は 7% とする。

### (2) エスカレーション

価格は入札時期 1981 / 82 年の価格に固定した。

但し、財務分析の場合はそれ以降の価格の上昇はプライスコンティンジェンシーの形で計上した。経済分析に於てはプライスコンティンジェンシーは算入しなかった。

### (3) 電気料金

B P D B の経営は Annex VIII に示す通り電力収支状況はマイナスとなっている。そのため現在電気料金の値上げを申請中であり本送電線運転開始の 1985 / 86 年には新電気料金が採用されていることは確実である。新料金による平均売電単価は 65 paisa / KWH となることも大体きままっている。

### (4) プロジェクト評価のための電力コスト

現在 B P D B が、プロジェクト評価のために採用している各母線に於る電力コストは Fig X-1 の通りである。

電気料金が 65 paisa になってもこの比例関係が保たれるとして、本プロジェクトに関係する 132 KV、33 KV 母線電力コストおよび売り価格を算定すると次のようになる。

#### ・ 132 KV 母線のコスト

$$22 \text{ paisa} \times \frac{65.0}{46.2} = 30 \text{ paisa}$$

#### ・ 33 KV 母線売り価格

$$27.5 \text{ paisa} \times \frac{65.0}{46.2} = 39 \text{ paisa}$$

しかしながら東西連系線による電源コストの低減を考え 132 KV 母線のコストは  $30 - 5^{**} = 25 \text{ paisa}$  とする。

\*\* 東西連系線による電力コストの低減について。

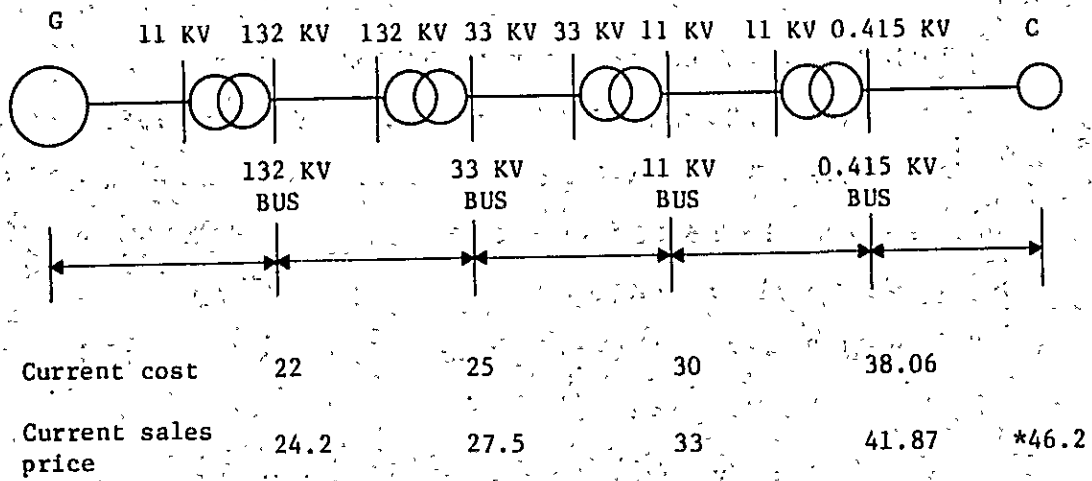
Annex XIII に示す通り 1977 / 78 年の全国平均発電コストは 25.5 paisa で

ある。東西連系により西部地区の電力量の 1 / 3 が東部の廉価な電力により賄われるとすると発電コストは、

$$\frac{(1,444,291 + \frac{468,499}{3}) \times 86 + \frac{468,499 \times 2}{3} \times 77.6}{1,912,790} \div 20 \text{ paisa}$$

既に東西連系による効果は  $25 - 20 = 5$  paisa となる。

Fig. X-1 Power cost at each bus



\*: Calculated from Annual Report, 1977/78

## 2. 財務及び経済分析

### 2.1 検討方法及び条件

#### (1) 分析方法

B / C ratio (割引率15%及び4%)による。

#### (2) 検討期間

1979 / 80 ~ 2008 / 2009の30年間

#### (3) 年度別建設費

a. 1984 / 85迄, Table 10 - 8 資金計画による。

b. 1985 / 86以降, Table 1.1 - 4 の将来計画による。

#### (4) 電力需要

本計画に関連する電力需要としては、次の地区を対象とし、負荷率は50%とする。

• G. K. project 用負荷

• Rajbari 地区負荷 (当初は Faridpur SS より供給)

• Faridpur 地区負荷

• Madaripur 地区負荷

• Barisal 変電所負荷の25%

a. 最大需要電力 (MW)

Table X - 1 の通り

b. 電力量 (GWH)

Table X - 2 の通り

#### (5) 利益及び費用

a. 利益: 売電利益 - 維持費

売電利益とは、132KV送電線が電源から購入した電力料金と、この送電線が、33KV配電線に売った電力料金との差額である。

b. 費用: 建設費

### 2.2 財務分析

#### (1) 本送電線計画の利益及び費用

Table X - 2 の通り

(2) B / C ratio

Table X - 3 の通り

a. 割引率 15% 0.198 / 1.0

b. " 4% 0.667 / 1.0

2.3 経済分析

(1) 控除項目

財務分析の費用から下記項目を控除して経済分析の費用とする。

a. 非熟練工の賃銀

送電線、変電所、建家の建設費のうち直接工事に携わる工員の賃銀は建設工事が無ければ支払われぬ性質のものであるからその賃銀の半分は社会に還元されるものとみなす。

b. 外国よりの講入機材CIF価格の20%が輸入税として徴集されるので此の金額は国家に還元されるものとみなす。

c. 国内産資材の5%は物品税として徴集されているが、この税額は国家に還元される。

d. 建設中利子

e. 土地代及び補償費

(2) 控除後の建設費及び維持費

Table X - 4 の通り

(3) 本送電線の利益及び費用（控除後）

Table X - 5

(4) B / C ratio

Table X - 5 の通り

a. 割引率 15% 0.231 / 1.0

b. " 4% 0.771 / 1.0



Table X-1 Power Demand Forecast in each Area

Unit: MW

Year	G.K Project	Rajbari	Faridpur	Modaripur	Borisal	Total
1984/1985	13.5	4.2	5.1	-	-	22.8
85/86	13.5	4.9	5.9	-	-	24.3
86/87	13.5	5.7	6.8	3.7	3.5	33.2
87/88	13.5	6.6	7.9	4.3	4.1	36.4
88/89	13.5	7.6	9.2	4.9	4.8	40.0
89/90	13.5	8.9	10.6	5.7	5.5	44.2
90/91	13.5	9.9	11.8	6.3	6.1	47.6
91/92	13.5	11.0	13.1	7.0	6.8	51.4
92/93	13.5	12.2	14.5	7.8	7.6	55.6
93/94	13.5	13.5	16.1	8.7	8.4	60.2
94/95	13.5	15.0	17.9	9.6	9.3	65.3
95/96	13.5	16.1	19.2	10.3	10.0	69.1
96/97	13.5	17.2	20.5	11.0	10.6	72.8
97/98	13.5	18.4	21.9	11.8	11.4	77.0
98/99	13.5	19.7	23.4	12.6	12.2	81.4
99/2000	13.5	21.0	25.1	13.5	13.1	86.2
2000/01	13.5	22.5	26.8	14.5	14.0	91.3
01/02	13.5	23.6	28.1	15.2	14.7	95.1
02/03	13.5	24.8	29.5	16.0	15.4	99.2
03/04	13.5	26.0	31.0	16.8	16.2	103.5
04/05	13.5	27.3	32.6	17.6	17.0	108.0
05/06	13.5	28.7	34.2	18.5	17.9	112.8
06/07	13.5	30.2	35.9	19.4	18.8	117.8
07/08	13.5	31.7	37.7	20.4	19.7	123.0
08/09	13.5	33.2	39.6	21.4	20.7	128.4
09/10	13.5	34.9	41.6	22.5	21.7	134.2

Note: The growth ratios in Power Demand, except the G.K. project, are estimated as follows:

up to 89/90 16%, 90/91 - 94/95 11%,  
 95/96 - 2,000/2001 7%,  
 after 01/02 5%.

Table X-2 Benefit and Cost of the Project (Financial)

Year	Power Demand MW	Energy GWH	Benefit (10 <sup>3</sup> TK)			Cost (10 <sup>3</sup> TK) (Construction - Costs)
			Sales Margin (+)	Maintenance Cost (-)	Net Benefit	
79/80						6,263
80/81						9,710
81/82						154,190
82/83						104,077
83/84	21.5	94.2	13,188	5,485	7,703	141,267
84/85	22.8	99.9	13,986	8,310	5,676	114,064
85/86	30.6	134.0	18,760	10,591	8,169	
86/87	33.2	145.4	20,356	10,591	9,765	
87/88	36.4	159.4	22,316	10,591	11,725	8,390
88/89	40.0	175.2	24,528	10,759	13,769	
89/90	44.2	193.6	27,104	10,759	16,345	28,796
90/91	47.6	208.5	29,190	11,335	17,855	4,413
91/92	51.4	225.1	31,514	11,423	20,091	
92/93	55.6	243.5	34,090	11,423	22,667	93,320
93/94	60.2	263.7	36,918	13,518	23,400	
94/95	65.3	286.0	40,040	13,518	26,522	
95/96	69.1	302.7	42,378	13,518	28,860	
96/97	72.8	318.9	44,646	13,518	31,128	
97/98	77.0	337.3	47,222	13,518	33,704	
98/99	81.4	356.5	49,910	13,518	36,392	8,390
99/2000	86.2	377.6	52,864	13,686	39,178	16,782
2000/01	91.3	399.9	55,986	14,022	41,964	
01/02	95.1	416.5	58,310	14,022	44,288	
02/03	99.2	434.5	60,830	14,022	46,808	16,782
03/04	103.5	453.3	63,462	14,358	49,104	
04/05	108.0	473.0	66,220	14,358	51,862	
05/06	112.8	494.1	69,174	14,358	54,816	
06/07	117.8	516.0	72,240	14,358	57,882	
07/08	123.0	538.7	75,418	14,358	61,060	
08/09	128.4	562.4	78,736	14,358	64,378	

Table X-3, Benefit Cost Ratio (Financial)

10<sup>3</sup>TK

Year	15% Discount Rate		4% Discount Rate	
	Net Benefit	Cost (Construction)	Net Benefit	Cost (Construction)
79/80		6,263		6,263
80/81		8,443		9,337
81/82		116,590		142,557
82/83		68,432		92,524
83/84	4,404	80,770	6,585	120,756
84/85	2,822	56,710	4,665	93,752
85/86	3,532		6,456	
86/87	3,671		7,421	
87/88	3,833	2,743	8,567	6,130
88/89	3,914		9,674	
89/90	4,040	7,118	11,042	19,454
90/91	3,838	949	11,598	2,867
91/92	3,755		12,549	
92/93	3,684	15,165	13,613	56,048
93/94	3,307		13,513	
94/95	3,259		14,727	
95/96	3,084		15,409	
96/97	2,893		15,980	
97/98	2,723		16,637	
98/99	2,557	590	17,273	3,982
99/2000	2,394	1,025	17,880	7,659
2000/01	2,230		18,415	
01/02	2,046		18,688	
02/03	1,880	8674	18,991	6,809
03/04	1,715		19,157	
04/05	1,575		19,454	
05/06	1,448		19,772	
06/07	1,330		20,074	
07/08	1,220		20,362	
08/09	1,118		20,643	
Total	72,272	365,472	379,145	568,138

B/C ratio 0.198/1.0 0.667/1.0

Table X-4 Maintenance and Construction Costs  
Using in Economic Analysis

10<sup>3</sup> TK

Year	Maintenance Costs				Construction Costs					
	Sales Margin (+)	Unskilled labor cost to be reserved to social (-)	Maintenance Cost after reservation (-)	Net Benefit after reservation	Construction cost	Import duties	Taxes for locally produced material	Unskilled labor cost to be reserved to social	Total of reservation	Construction cost after reservation
79/80					6,263					6,263
80/81					9,710	243		3070	3,313	6,397
81/82					154,190	15,839	762	534	17,135	137,055
82/83					104,077	6,692	895	633	8,220	95,857
83/84	13,188	429	5,056	8,132	141,267	12,900	762	534	14,196	127,071
84/85	13,986	429	7,881	6,105	114,064	6,687	916	649	8,252	105,812
85/86	18,760	858	9,733	9,027						
86/87	20,356	858	9,733	10,623						
87/88	22,316	858	9,733	12,583	8,390	1,053	4	3	1,060	7,330
88/89	24,528	871	9,888	14,640						
89/90	27,104	871	9,888	17,216	28,796	3,445	43	32	3,520	25,276
90/91	29,190	914	10,421	18,769	4,413	496	12	9	517	3,896
91/92	31,514	921	10,502	21,012						
92/93	34,090	921	10,502	23,588	93,320	12,830	105	78	13,013	80,307
93/94	36,918	1078	12,440	24,478						
94/95	40,040	1078	12,440	27,600						
95/96	42,378	1078	12,440	29,938						
96/97	44,646	1078	12,440	32,206						
97/98	47,222	1078	12,440	34,782						
99/99	49,910	1078	12,440	37,470	8,390	1,053	4	3	1,060	7,330
99/2000	52,864	1091	12,595	40,391	16,782	2,105	8	6	2,119	14,663
2000/01	55,986	1116	12,906	43,080						
01/02	58,310	1116	12,906	45,404						
02/03	60,830	1116	12,906	47,924	16,782	2,105	8	6	2,119	14,663
03/04	63,462	1141	13,217	50,245						
04/05	66,220	1141	13,217	53,003						
05/06	69,174	1141	13,217	55,957						
06/07	72,240	1141	13,217	59,023						
07/08	75,418	1141	13,217	62,201						
08/09	78,736	1141	13,217	65,519						

\*Land purchasing cost and compensation for right-of-way

Table X-5 Benefit Cost Ratio (Economic)

Year	Net Benefit	Cost (Construction)	Present Value (15% discount)		Present Value (4% discount)	
			Benefit	Cost	Benefit	Cost
1979/80		6,263		6,263		6,263
80/81		6,397		5,563		6,151
81/82		137,055		103,633		126,715
82/83		95,857		63,028		85,217
83/84	8,132	127,071	4,649	72,653	6,951	108,621
84/85	6,105	105,812	3,035	52,607	5,018	86,970
85/86	9,027		3,903		7,134	
86/87	10,623		3,994		8,073	
87/88	12,583	7,330	4,113	2,396	9,194	5,356
88/89	14,640		4,162		10,286	
89/90	17,216	25,276	4,256	6,248	11,631	17,076
90/91	18,769	3,896	4,034	837	12,192	2,531
91/92	21,012		3,927		13,124	
92/93	23,588	80,307	3,834	13,050	14,166	48,232
93/94	24,478		3,459		14,135	
94/95	27,600		3,392		15,325	
95/96	29,938		3,199		15,984	
96/97	32,206		2,993		16,534	
97/98	34,782		2,811		17,169	
98/99	37,470	7,330	2,633	515	17,785	3,479
99/2000	40,391	14,663	2,468	896	18,434	6,692
2000/01	43,080		2,289		18,905	
01/02	45,404		2,098		19,158	
02/03	47,924	14,663	1,925	589	19,444	5,949
03/04	50,245		1,755		19,602	
04/05	53,003		1,610		19,882	
05/06	55,957		1,478		20,183	
06/07	59,023		1,356		20,470	
07/08	62,201		1,242		20,743	
08/09	65,519		1,138		21,009	
<b>Total</b>			<b>75,753</b>	<b>328,278</b>	<b>392,531</b>	<b>509,252</b>

B/C ratio

0.231/1.0

0.771/1.0

Year	Month	Day	Time	Location	Remarks
1950	1	1	08:00	...	...
1950	1	2	08:00	...	...
1950	1	3	08:00	...	...
1950	1	4	08:00	...	...
1950	1	5	08:00	...	...
1950	1	6	08:00	...	...
1950	1	7	08:00	...	...
1950	1	8	08:00	...	...
1950	1	9	08:00	...	...
1950	1	10	08:00	...	...
1950	1	11	08:00	...	...
1950	1	12	08:00	...	...
1950	1	13	08:00	...	...
1950	1	14	08:00	...	...
1950	1	15	08:00	...	...
1950	1	16	08:00	...	...
1950	1	17	08:00	...	...
1950	1	18	08:00	...	...
1950	1	19	08:00	...	...
1950	1	20	08:00	...	...
1950	1	21	08:00	...	...
1950	1	22	08:00	...	...
1950	1	23	08:00	...	...
1950	1	24	08:00	...	...
1950	1	25	08:00	...	...
1950	1	26	08:00	...	...
1950	1	27	08:00	...	...
1950	1	28	08:00	...	...
1950	1	29	08:00	...	...
1950	1	30	08:00	...	...
1950	1	31	08:00	...	...
1950	2	1	08:00	...	...
1950	2	2	08:00	...	...
1950	2	3	08:00	...	...
1950	2	4	08:00	...	...
1950	2	5	08:00	...	...
1950	2	6	08:00	...	...
1950	2	7	08:00	...	...
1950	2	8	08:00	...	...
1950	2	9	08:00	...	...
1950	2	10	08:00	...	...
1950	2	11	08:00	...	...
1950	2	12	08:00	...	...
1950	2	13	08:00	...	...
1950	2	14	08:00	...	...
1950	2	15	08:00	...	...
1950	2	16	08:00	...	...
1950	2	17	08:00	...	...
1950	2	18	08:00	...	...
1950	2	19	08:00	...	...
1950	2	20	08:00	...	...
1950	2	21	08:00	...	...
1950	2	22	08:00	...	...
1950	2	23	08:00	...	...
1950	2	24	08:00	...	...
1950	2	25	08:00	...	...
1950	2	26	08:00	...	...
1950	2	27	08:00	...	...
1950	2	28	08:00	...	...
1950	2	29	08:00	...	...
1950	2	30	08:00	...	...
1950	3	1	08:00	...	...
1950	3	2	08:00	...	...
1950	3	3	08:00	...	...
1950	3	4	08:00	...	...
1950	3	5	08:00	...	...
1950	3	6	08:00	...	...
1950	3	7	08:00	...	...
1950	3	8	08:00	...	...
1950	3	9	08:00	...	...
1950	3	10	08:00	...	...
1950	3	11	08:00	...	...
1950	3	12	08:00	...	...
1950	3	13	08:00	...	...
1950	3	14	08:00	...	...
1950	3	15	08:00	...	...
1950	3	16	08:00	...	...
1950	3	17	08:00	...	...
1950	3	18	08:00	...	...
1950	3	19	08:00	...	...
1950	3	20	08:00	...	...
1950	3	21	08:00	...	...
1950	3	22	08:00	...	...
1950	3	23	08:00	...	...
1950	3	24	08:00	...	...
1950	3	25	08:00	...	...
1950	3	26	08:00	...	...
1950	3	27	08:00	...	...
1950	3	28	08:00	...	...
1950	3	29	08:00	...	...
1950	3	30	08:00	...	...
1950	3	31	08:00	...	...









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