

TABLE 8.3 Total Capacity of Distribution Transformer to be newly installed in the Valley

	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01
Total Peak Demand (MW)	85.23	93.09	99.36	107.36	116.06	125.51	135.79	146.99	159.17	172.44	186.91	202.67
Increased Demand (MW)	—	7.86	6.27	8.00	8.70	9.45	10.28	11.20	12.18	13.27	14.47	15.76
Demand be increased through Trans. (95% of the above) (MW) *1	—	7.47	5.96	7.60	8.27	8.98	9.77	10.64	11.57	12.61	13.75	14.97
Total Capacity added (MVA)	*2 (194.84)	8.30	6.62	8.44	9.18	9.98	10.85	11.82	12.86	14.01	15.27	16.64

*1 : Five (5) percents of the increased demand are assumed to be directly supplied from 11kV feeders.

*2 : Total capacity of the existing distribution transformers

Table 9.1 : Scope of Works of Power Sector Efficiency Project (PSEP)

A) SUBSTATIONS

SUBSTATION	Description of Works
1) Lainchar	a) Dismantling existing transformers (2x10MVA) b) Transportation of dismantled transformers to Bhaktapur c) Instalation of new transformers (2x15/18MVA) d) Replacement of CTs for transformer circuits (66kV GIS)
2) New Chabel	a) Extension of one 66kV line bay for N.Bhaktapur-N.Chabel line b) Modification of existing line bays
3) Bhaktapur	New 66/11kV substation (conventional type) a) 66/11kV 2x10MVA transformers (shifted from Lainchaur) b) Two 66kV transformer bays c) Three 66kV line bays d) One bus bar e) Two station service transformers f) One 11kV indoor metal enclosed switchgear (SF6, 15 cubicles) g) One control building including site preparation
4) Sunkosi	a) Replacement of the existing line trap
5) New Banewar	a) Addition of one transformer (3x6MVA) b) Extension of one 66kV transformer bay c) Extension of one 11kV transformer incoming bay d) Modification of existing line bays
6) Patan	a) Extension of one 66kV line bay for Siuchatar-Patan No.2 line b) Reshaping of 66kV New Banewar line bay c) Modification of 66kV Siuchatar-Patan No.1 line bay
7) Siuchatar	a) Extension of two 132kV line bays for Marsyangdi-Balaju line b) Extension of two 66kV line bays for Teku and Paten lines c) Modification of existing line bays
8) Balaju	a) Modification of existing 66kV line bays
9) Trisuli	a) Reshaping of two existing line bays and bus bar
10) Teku	New 66kV substation (GIS or air insulated metalclad) a) 66/11kV, 2x15/18MVA transformers b) Two 66kV Transformer bays c) One 66kV line bays (without CB) d) One 66kV bus bar e) Two station service transformers f) One 11kV metal enclosed switchgear (SF6, 21 cubicles) g) shifting all 11kV feeders to new switchgear
11) Devighat	a) Modification of 66kV New Chabel bay

B) TRANSMISSION LINES

Section		Length (km)	Specifications
From	To		
1) New Bhaktapur	New Chabel	10.5	a) 132kV design (initially 66kV use) b) Double circuit c) ACSR Bear conductors
2) Diversion of 66kV Sunkosi line to New Bhaktapur substation		1.75	a) 132kV design (initially 66kV use) b) Double circuit c) ACSR Bear conductors
3) Diversion of 132kV Marsyangdi-Balaju line to Siuchtar substation		1.15	a) 132kV b) Double circuit c) ACSR Bear conductors
4) Siuchatar	Teku	4.05	a) 66kV b) Double circuit c) ACSR Bear conductors

Source : Draft Tender Document, Volume 1/4 = Commercial Clauses

**Table 9.2 : Materials and Equipment for Loss Reduction Program (LRP)
(PHASE III)**

Following are major materials and equipment to be procured by NEA to fulfill the works for the LRP.

Material and Equipment	Quantity
(01) Meter Testing Equipment	2 sets
(02) Sealing materials:	
(a) Seal Plier	500 nos.
(b) Seal Ferrules/Wire	200,000 sets
(03) Energy Meter w/Service Enclosure:	
(a) Three Phase	2,000 nos.
(b) Single Phase (*1)	60,000 nos.
(04) Connectors	400,000 nos.
(05) Concentric Service Cable	250 km
(06) 4-core Low Tension Cable	50 km
(07) ACSR:	
(a) Rabbit	250 km
(b) Dog	100 km
(08) Poles (Steel, Prestressed Concrete and Wooden Poles) (*2)	7,000 nos.
(09) 11kV Static Capacitor with Fuse and Mounting Bracket	60 units
(10) 11/0.4kV Distribution Transformer (250kVA) with Lighting Arrester, Drop-out Switch and Bracket	100 nos.
(11) Tools and Equipments	1 lot
(12) Crane and Auger Mounted Truck	6 units
(13) Mini Truck	6 units
(14) Load Monitor	20 sets
(15) Aerial Bundled Cable for 11kV and L.T	75 km
(16) Fittings for the above Aerial Bundled Cable	1 lot
(17) Miscellaneous Items for Workshop	2 sets
(18) Equipment for Load Management Program	1 lot

Note: (*1) 35,000 nos. under Phase II and 25,000 nos. under Phase III.

(*2) Total number of Phase II and Phase III

Table 11.1 SPECIFICATION OF MAJOR EQUIPMENT (1/3)

A. TRANSFORMER

		Main Transfer		Station Service	
1	Type			Oil Dry epoxy resin molded	
2	Nominal Capacity	kVA	12.6	6	100, 50
3	Number of phase		1	1	3
4	Cooling system		ONAF	ONAF	AN
5	Rated frequency	Hz	50	50	50
6	Rated voltage				
	a) Primary	kV	$132/\sqrt{3}$	$66/\sqrt{3}$	11
	b) Secondary	kV	$66/\sqrt{3}$	$11/\sqrt{3}$	0.415-0.23
7	Rated continuous output				
	a) self cooling (ONAN)	kVA	8.6	6	100, 50
	b) Forced air cooling (ONAF)	kVA	12.6	-	-
8	Impedance voltage		9.24	7.3	-
9	Connection		YNyn0	YNyn0	Dy5
10	Tap changer		On-load	On-load	-
11	AC withstand voltage				
	a) 132kV side	kV	270	-	-
	b) 66kV side	kV	-	140	-
	c) 11kV side	kV	-	-	28
12	Impulse withstand voltage				
	a) 132kV side	kV	650	-	-
	b) 66kV side	kV	-	350	-
	c) 11kV side	kV	-	-	124
13	Kind of winding		copper	copper	copper

Table 11.1 SPECIFICATION OF MAJOR EQUIPMENT (2/3)

B. SWITCHGEAREQUIPMENT		132kV	66kV	11kV	Low Voltage
(A) Circuit Breaker					
1. Type		SF6 gas type	SF6 gas type	SF6 or Vacuum	Molded case
2. Operation		Pneumatic	Pneumatic	Motor operated	
3. Rated voltage a) Nominal b) Highest	kV kV	132 145	66 72	11 12	415/230 V 0.6
4. Rated current	A	800	600	1200, 800	225, 100, 50 (AF)
5. Short circuit Breaking current	kA	25	25	25	10
6. Break time	Cycle	3	3	5	-
7. Duration short circuit	Sec	2	2	2	-
8. Operation sequence		0-0.3 sec - CO-3 min-CO	0-0.3 sec - CO-3 min-CO	0-1 min - CO-3 min-CO	-
9. AC withstand voltage	kV	270	140	28	-
10. Impulse withstand voltage	kV	650	350	124	-
(B) Disconnecting Switch					
1. Type		Three pole, single throw	Three pole, single throw	Three pole, single throw	
2. Operation		Motor driven and/or manual	Motor driven and/or manual	Motor driven and/or manual	
3. Rated voltage a) Nominal b) Highest	kV kV	132 145	66 72	11 12	
4. Rated current	A	800	1200		
5. Rated short time current	kA	25	25	25	
6. AC withstand voltage	kV	270	140	28	
7. Impulse withstand voltage	kV	650	350	75	
(C) Potential device					
1. Type		Single phase oil filled potential device	Single phase oil filled potential device	Single phase, molded	Single phase, molded
2. Rated voltage a) Nominal b) Highest	kV V	132/43 110/43	66/43 110/43	11 110	0.415/43 110/43
3. Rated burden	VA	100	200	200	100
4. Accuracy class		0.5	1.0	1.0	1.0
5. AC withstand voltage	kV	270	140	28	
6. Impulse withstand voltage	kV	650	350	124	

Table 11.1 SPECIFICATION OF MAJOR EQUIPMENT (3/3)

		132kV	66kV	11kV	Low Voltage
(D) Current transformer					
1. Type		Single phase oil filled	Single phase oil filled	Single phase, molded	Single phase, molded
2. Rated voltage					
a) Nominal	kV	132/√3	66/√3	11	0.415/√3
b) Highest	V	110/√3	110/√3	110	110/√3
3. Rated current					
a) Primary	A	200-100	200-100	600-300	75
b) Secondary	A	5	5	5	5
4. Rated burden	VA	100	200	200	100
5. Accuracy class		0.5	1.0	1.0	1.0
6. AC withstand voltage	kV	270	140	28	
7. Impulse withstand voltage	kV	650	350	124	
(E) Power Fuse		N/A	N/A		N/A
1. Type				Single pole, current limiting, DS type, hook stick operated	
2. Operation					
3. Rated maximum voltage	kV	-	-	12	-
4. Rated current	A	-	-	10, 5	-
5. Short circuit breaking current	kA	-	-	25	-

N/A means "Not Applicable".

Table 12.1 List of Materials and Equipment for 11kV Main Feeders

11KV MAIN FEEDERS		KTM CENTRAL			KTM EAST			KTM WEST			LALITPUR		BHAKTAPUR	TOTAL
		Center of Town	Boudha-Jorpati (4km)	Baneswar (2.5km)	Baralgau-Gokarneswar (3km)	Airport Feeder (2.6km)	Sundarilal Feeder (9km)	Thankot Feeder (4km+4km)	Dharmas-thalli (2km)	Godawari 1 & 2 (3km)	Pharping Feeder (3.5km)	Nagarkot (4.5km+ 2.5km+2km)	QTY FOR 11KV MAIN FEEDERS	
		Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	Rqd Q'ty		
ACSR:														
WEASEL	(km)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RABBIT	(km)	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	10.0	
DOG	(km)	6.0	25.0	0.0	10.0	9.0	30.0	28.0	6.0	10.0	12.0	30.0	164.0	
Joint of ACSR:														
Weasel	(pcs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Rabbit	(pcs)	0.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	10.0	
Dog	(pcs)	6.0	25.0	0.0	10.0	9.0	30.0	28.0	6.0	10.0	12.0	30.0	164.0	
Tension Clamp of ACSR:														
Weasel	(pcs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Rabbit	(pcs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Dog	(pcs)	180.0	210.0	360.0	180.0	210.0	420.0	180.0	60.0	150.0	150.0	420.0	2,520.0	
11KV U/G CABLE: 3 CORES														
100 sq.mm	(km)	1.0	1.0	0.3	0.2	0.0	0.0	0.3	0.3	0.2	0.5	0.1	3.9	
200 sq.mm	(km)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	
C.H for 100 sq.mm	(set)	20.0	16.0	6.0	4.0	0.0	0.0	6.0	4.0	2.0	6.0	4.0	68.0	
C.H for 200 sq.mm	(set)	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	
11KV AL-OE Cable: 1 CORE														
60 sq.mm	(km)	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	
100 sq.mm	(km)	4.0	0.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.0	
Joint (60 sq.mm)	(pcs)	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	
Joint (100 sq.mm)	(pcs)	10.0	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.0	
11KV 10CT POLES:														
Transform.: H	(set)	5.0	10.0	10.0	5.0	5.0	10.0	15.0	2.0	5.0	5.0	13.0	85.0	
Dead End	(pcs)	0.0	0.0	0.0	0.0	10.0	10.0	5.0	3.0	5.0	0.0	9.0	42.0	
Straight	(pcs)	0.0	0.0	0.0	0.0	27.0	120.0	60.0	20.0	35.0	0.0	90.0	352.0	
Angle	(pcs)	0.0	0.0	0.0	0.0	20.0	50.0	10.0	5.0	15.0	0.0	31.0	131.0	
10CT POLES *:														
Dead End	(pcs)	5.0	10.0	10.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	
Straight	(pcs)	10.0	45.0	35.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.0	
Angle	(pcs)	9.0	15.0	15.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59.0	
20CT POLES:														
Dead End	(pcs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	7.0	12.0	
Straight	(pcs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	20.0	55.0	
Angle	(pcs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	10.0	25.0	
11KV Switch:														
Section	(set)	10.0	2.0	1.0	1.0	0.0	3.0	2.0	2.0	3.0	3.0	3.0	30.0	
Auto-Recl	(set)	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	2.0	
Multi-cct	(set)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
POLE TRANSFORMER:														
25 kVA	(set)	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	3.0	5.0	
50 kVA	(set)	0.0	0.0	4.0	1.0	0.0	3.0	5.0	0.0	0.0	0.0	8.0	21.0	
100 kVA	(set)	9.0	5.0	1.0	4.0	0.0	5.0	5.0	2.0	5.0	2.0	2.0	40.0	
150 kVA	(set)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
200 kVA	(set)	0.0	5.0	1.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	11.0	
250 kVA	(set)	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	
400/300V POLES	(set)	30.0	50.0	0.0	20.0	0.0	0.0	30.0	10.0	50.0	50.0	90.0	330.0	
400/230V AL-OW Cable:														
55 sq.mm	(km)	0.0	20.0	14.0	15.0	0.0	20.0	0.0	0.0	8.0	18.0	40.0	133.0	
95 sq.mm	(km)	0.0	0.0	0.0	0.0	0.0	0.0	10.0	8.0	0.0	0.0	0.0	18.0	
Joint	(pcs)	0.0	20.0	14.0	15.0	0.0	20.0	10.0	8.0	8.0	18.0	40.0	151.0	
11KV Drop-out Sw.	(pcs)	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	
11KV Lighn. Arrest.	(pcs)	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	
11KV Pin Insulator	(pcs)	0.0	0.0	0.0	0.0	100.0	0.0	200.0	0.0	0.0	110.0	150.0	560.0	
254mm dia. Disc Ins.	(pcs)	0.0	0.0	0.0	0.0	210.0	0.0	60.0	0.0	0.0	150.0	60.0	480.0	

Note: (1) Poles include cross-arms, stay-wires w/anchor, transformer platforms, cutout switches, L.As, Distribution Panel, Grounding System, Drop-Wires, etc. necessary for complete set.

(2) Multi-Circuit Switching Yard includes supports, switches (4 feeders) other necessary equipment.

(3) Poles marked with * are provided with support insulators in the vertical conductor arrangement.

Table 12.2 List of Materials and Equipment for 11kV Other Feeders

11kV MAIN FEEDERS		KTM CENTRAL		KTM EAST	KTM WEST		LALITPUR	BHAKTAPUR			TOTAL
		Ring Road	Additional Materials	Additional Materials	Kirtipur Feeder	Additional Materials	Additional Materials	Nagarkot Feeder	Thimi Feeder	Additional Materials	QTY FOR 11KV OTHER FEEDERS
MATERIALS AND EQUIPMENT		Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	Rqd Q'ty	
ACSR:											
WEASEL	(km)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RABBIT	(km)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DOG	(km)	6.0	1.0	10.0	5.0	0.0	15.0	6.0	12.0	5.0	60.0
Joint of ACSR:											
Weasel	(pcs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rabbit	(pcs)	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	10.0
Dog	(pcs)	6.0	2.0	10.0	5.0	0.0	15.0	6.0	12.0	5.0	61.0
Tension Clamp of ACSR:											
Weasel	(pcs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rabbit	(pcs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dog	(pcs)	60.0	0.0	300.0	66.0	0.0	100.0	100.0	200.0	30.0	856.0
11KV U/G CABLE: 3 CORES											
100 sq.mm	(km)	0.0	5.0	1.0	0.0	0.0	2.5	0.0	0.1	2.0	10.6
200 sq.mm	(km)	0.0	5.0	0.0	0.0	0.0	1.5	0.0	0.0	0.5	7.0
C.H for 100 sq.mm (set)		0.0	10.0	10.0	0.0	0.0	10.0	0.0	2.0	6.0	38.0
C.H for 200 sq.mm (set)		0.0	10.0	0.0	0.0	0.0	6.0	0.0	0.0	4.0	20.0
11KV AI-OE Cable: 1 CORE											
60 sq.mm	(km)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	6.0
100 sq.mm	(km)	0.0	6.0	5.0	0.0	6.0	0.0	0.0	0.0	0.0	17.0
Joint (60 sq.mm)	(pcs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	6.0
Joint (100 sq.mm)	(pcs)	0.0	6.0	5.0	0.0	6.0	0.0	0.0	0.0	0.0	17.0
11KV 1CCT POLES:											
Transform.: H	(set)	2.0	20.0	14.0	2.0	20.0	30.0	2.0	5.0	10.0	105.0
Dead End	(pcs)	2.0	10.0	10.0	4.0	10.0	0.0	4.0	3.0	10.0	53.0
Straight	(pcs)	24.0	56.0	50.0	19.0	60.0	200.0	24.0	47.0	40.0	520.0
Angle	(pcs)	6.0	10.0	26.0	5.0	30.0	0.0	10.0	15.0	30.0	132.0
1CCT POLES*:											
Dead End	(pcs)	0.0	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	20.0
Straight	(pcs)	0.0	0.0	0.0	0.0	0.0	150.0	0.0	0.0	0.0	150.0
Angle	(pcs)	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	50.0
2CCT POLES:											
Dead End	(pcs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Straight	(pcs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Angle	(pcs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11KV Switch:											
Section	(set)	1.0	10.0	7.0	1.0	7.0	5.0	1.0	1.0	17.0	50.0
Auto-Recl	(set)	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	3.0
Multi-cct	(set)	0.0	0.0	1.0	0.0	2.0	2.0	0.0	0.0	0.0	5.0
POLE TRANSFORMER:											
25 kVA	(set)	0.0	5.0	3.0	1.0	3.0	15.0	0.0	0.0	23.0	50.0
50 kVA	(set)	0.0	0.0	7.0	1.0	7.0	10.0	2.0	0.0	15.0	42.0
100 kVA	(set)	2.0	5.0	0.0	0.0	3.0	25.0	0.0	3.0	10.0	48.0
150 kVA	(set)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
200 kVA	(set)	0.0	10.0	4.0	0.0	10.0	17.0	0.0	0.0	6.0	47.0
250 kVA	(set)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0
400/300V POLES	(set)	50.0	0.0	0.0	20.0	0.0	0.0	25.0	40.0	0.0	135.0
400/230V AI-OW Cable:											
55 sq.mm	(km)	0.0	0.0	0.0	6.0	0.0	0.0	16.0	0.0	0.0	22.0
95 sq.mm	(km)	7.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0	15.0
Joint	(pcs)	7.0	0.0	0.0	6.0	0.0	0.0	16.0	8.0	0.0	37.0
11kV Drop-out Sw.	(pcs)	0.0	100.0	50.0	0.0	50.0	210.0	0.0	0.0	110.0	520.0
11kV Lightn. Arrest.	(pcs)	0.0	100.0	50.0	0.0	50.0	210.0	0.0	0.0	110.0	520.0
11kV Pin Insulator	(pcs)	0.0	0.0	0.0	0.0	600.0	600.0	0.0	0.0	500.0	1700.0
254mm dia. Disc Ins.	(pcs)	0.0	0.0	0.0	0.0	200.0	100.0	0.0	0.0	200.0	500.0

Note: (1) Poles include cross-arms, stay-wires w/anchor, transformer platforms, cutout switches, L.As, Distribution Panel, Grounding System, Drop-Wires, etc. necessary for complete set.

(2) Multi-Circuit Switching Yard includes supports, switches (4 feeders) other necessary equipment.

(3) Poles marked with * are provided with support insulators on one-shoulder conductor arrangement.

Table 12.3 List of Materials and Equipment for Low Tension Lines

LOW TENSION NETWORK		KTM CENTRAL	KTM EAST	KTM WEST	LALITPUR	BHAKTAPUR	TOTAL
MATERIALS AND EQUIPMENT		R'd Q'ty	R'd Q'ty	R'd Q'ty	R'd Q'ty	R'd Q'ty	R'd Q'ty
ACSR:							
WEASEL	(km)	15.0	15.0	15.0	85.0	60.0	190.0
RABBIT	(km)	40.0	20.0	25.0	55.0	35.0	175.0
Joint of ACSR:							
Weasel	(pcs)	15.0	15.0	15.0	85.0	60.0	190.0
Rabbit	(pcs)	40.0	20.0	25.0	55.0	35.0	175.0
Tension Clamp of ACSR:							
Weasel	(pcs)	200.0	200.0	200.0	200.0	200.0	1,000.0
Rabbit	(pcs)	200.0	200.0	200.0	200.0	200.0	1,000.0
L.T AL-OV Cable: (1-core)							
25 sq.mm (2 core)	(km)	20.0	0.0	0.0	0.0	0.0	20.0
25 sq.mm	(km)	40.0	5.0	0.0	0.0	0.0	45.0
35 sq.mm	(km)	0.0	0.0	0.0	2.0	2.0	4.0
50 sq.mm	(km)	0.0	0.0	0.0	0.0	0.0	0.0
95 sq.mm	(km)	0.0	0.0	0.0	0.0	0.0	0.0
100 sq.mm	(km)	8.0	0.0	0.0	0.0	0.0	8.0
150 sq.mm	(km)	12.0	0.0	0.0	8.0	8.0	28.0
240 sq.mm	(km)	4.0	0.0	0.0	0.0	4.0	8.0
300 sq.mm	(km)	0.0	0.0	0.0	2.0	2.0	4.0
Cable connector:							
25 sq.mm *	(km)	120.0	10.0	0.0	0.0	0.0	130.0
35 sq.mm *	(km)	0.0	0.0	0.0	5.0	5.0	10.0
50 sq.mm	(km)	0.0	10.0	0.0	10.0	0.0	20.0
95 sq.mm	(km)	0.0	0.0	0.0	0.0	0.0	0.0
100 sq.mm	(km)	20.0	0.0	0.0	0.0	0.0	20.0
150 sq.mm	(km)	30.0	0.0	0.0	20.0	20.0	70.0
240 sq.mm	(km)	10.0	0.0	0.0	0.0	10.0	20.0
300 sq.mm	(km)	0.0	0.0	0.0	5.0	5.0	10.0
LT U/G XLPE Cable:							
50 sq.mm (4 core)	(km)	2.0	0.0	0.0	0.0	0.0	2.0
100 sq.mm (4 core)	(km)	2.0	0.0	0.0	0.0	0.0	2.0
Cable Head for the above:							
50 sq.mm	(pcs)	5.0	0.0	0.0	0.0	0.0	5.0
100 sq.mm	(pcs)	5.0	0.0	0.0	0.0	0.0	5.0
Service Wire:							
6 sq.mm	(km)	15.0	0.0	0.0	0.0	0.0	15.0
25 sq.mm	(km)	30.0	0.0	0.0	0.0	0.0	30.0
400/230V POLES (set)		150.0	200.0	230.0	550.0	415.0	1,545.0
Spool Ins. w/Fitting	(pcs)	800.0	800.0	1,000.0	2,200.0	2,000.0	6,800.0
MCCB with Box:							
50A (4 branches)	(nos)	10.0	10.0	10.0	15.0	15.0	60.0
100A (4 branches)		0.0	15.0	10.0	57.0	69.0	151.0
175A (4 branches)		68.0	15.0	10.0	52.0	6.0	151.0
200A (4 branches)		0.0	0.0	0.0	30.0	50.0	80.0
300A (4 branches)	(pcs)	38.0	10.0	15.0	7.0	2.0	72.0
400A (4 branches)	(pcs)	25.0	0.0	0.0	20.0	7.0	52.0

Table 13.1 PRIORITY OF 11KV FEEDERS

FEEDER	VOLTAGE DROP		COND. CAPACITY		LOSS REDUCTION (MWH)		TOTAL WEIGHTING POINT	PRIORITY
	YEAR	WEIGHT	YEAR	WEIGHT	ANNUAL	WEIGHT		
SUNDARIJAL	1989/90	13	1996/97	6	442	7	26	2
GODAWARI-1	1993/94	9	Beyond 01	1	440	7	21.5	3
GODAWARI-2	1989/90	13	1988/99	4	903	9		
BOUDHA-JORPATI	1993/94	9	1990/91	12	2279	13	34	1
THANKOT	1992/93	10	2000/01	2	898	9	21	4
B.I.D	Beyond 01	1	1992/93	10	-	1	12	9
OLD PATAN-1	Beyond 01	1	1993/94	9	-	1	11	10
AIRPORT (N. BANES)	1993/94	9	1995/96	7	-	1	17	5
KIRTIPUR	1994/95	8	2000/01	2	430	7	17	5
AIRPORT (N. CHABE)	2000/01	2	1994/95	8	297	5	15	7
BANESWAR	1998/99	4	1994/95	8	173	3	15	7
NAGARKOT	1994/95	8	Beyond 01	1	278	5	14	8
PHARPING	1995/96	7	2000/01	2	358	7	16	6

NOTE: Weighting of priority for the voltage regulation an conductor current carrying capacity is 13 points for the year 1989/90 to 1 point for the year over 2000/01.

YEAR	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	OVER
WEIGHT	13	12	11	10	9	8	7	6	5	4	3	2	1

While, weighting for the energy loss reduction is assumed at 13 points for reduction of more than 1,000 MWh/year, 9 for 500-999 MWh/year, 7 for 300-499 MWh/year, 5 for 200-299 MWh/year, 3 for 100-199 MWh/year and 1 for less than 100 MWh/year

Table 14.1 Disbursement Schedule of Reinforcement and Extension Projects in the Valley

(Unit=1000US\$)

F.Year	HV Transmission and Substation						MV Distribution			Low Voltage Distribution						Total
	PSEP			JICA			JICA			LRP			JICA			
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	
1990/91																
1991/92	4140	460	4600				933	171	1104				5073	631	5704	
1992/93	4140	690	4830			7112	933	257	1190				12185	947	13132	
1993/94	4140	690	4830			3525 645 4170	933	257	1190				8598	1592	10190	
1994/95	1380	460	1840	10124		6359 10124	311	171	482	4312		4312	22486	631	23117	
1995/96				4764 1098 5862		3276 450 3726				946	136	1082	8986	1684	10670	
1996/97																
Total	13800	2300	16100	14888	1098	15986	20272	1095	21367	3110	856	3966	5258	136	5394	57328 5485 62813

Remarks: 1) PSEP = Power Sector Efficiency Project, IDA

LRP = Loss Reduction Program, IDA

JICA = This study

Table 14.2 Economic Internal Rate of Return

F.Year	Investment Cost (1000\$)						O/M Cost (1000\$)	Total Cost (1000\$)	Energy Sales (GWh)	Add. Energy Sales (GWh)	Add. Revenue (1000\$)	Balance (1000\$)
	PSEP (IDA)	JICA T/L&S/S	JICA MV	LRP (IDA)	JICA LV	Total						
0 1991/92	4554			1087		5641		5641	295.00	0.00	0	-5641
1 1992/93	4761		7112	1164		13037	113	13150	325.50	30.50	3562	-9587
2 1993/94	4761		4106	1164		10031	374	10405	359.00	64.00	7475	-2929
3 1994/95	1794	10124	6359	465	4312	23054	574	23628	395.80	100.80	11773	-11855
4 1995/96		5752	3681		1068	10501	1035	11536	436.40	141.40	16516	4979
5 1996/97							1245	1245	482.40	187.40	21888	20643
6 1997/98							1245	1245		187.40	21888	20643
7 1998/99							1245	1245		187.40	21888	20643
8 1999/00							1245	1245		187.40	21888	20643
9 2001/02							1245	1245		187.40	21888	20643
10 2002/03							1245	1245		187.40	21888	20643
11 2003/04							1245	1245		187.40	21888	20643
12 2004/05							1245	1245		187.40	21888	20643
13 2005/06							1245	1245		187.40	21888	20643
14 2006/07							1245	1245		187.40	21888	20643
15 2007/08							1245	1245		187.40	21888	20643
16 2008/09							1245	1245		187.40	21888	20643
17 2009/10							1245	1245		187.40	21888	20643
18 2010/11							1245	1245		187.40	21888	20643
19 2011/12							1245	1245		187.40	21888	20643
20 2012/13							1245	1245		187.40	21888	20643
21 2013/14							1245	1245		187.40	21888	20643
22 2014/15							1245	1245		187.40	21888	20643
23 2015/16							1245	1245		187.40	21888	20643
24 2016/17							1245	1245		187.40	21888	20643
25 2017/18							1245	1245		187.40	21888	20643
26 2018/19							1245	1245		187.40	21888	20643
27 2019/20							1245	1245		187.40	21888	20643
28 2020/21							1245	1245		187.40	21888	20643
29 2021/22							1245	1245		187.40	21888	20643
30 2022/23							1245	1245		187.40	21888	20643
31 2023/24							1245	1245		187.40	21888	20643
32 2024/25							1245	1245		187.40	21888	20643
33 2025/26							1245	1245		187.40	21888	20643
34 2026/27							1245	1245		187.40	21888	20643

Remarks :

EIRR 35.10 %

a) Exchange rate : 1 US\$ = Rs.28.6

b) Unit Benefit : Long-Run Marginal Cost
(LRMG and Tariff Study, Dec. 1990, EDF)

HV Customer : Rs.2.01/kWh)

MV Customer : Rs.3.34/kWh)

LV Customer : Rs.5.35/kWh)

Rs.5.35 - Rs.2.01 = Rs.3.34 (US\$0.1168/kWh)

Table 14.3 Financial Internal Rate of Return

F.Year	Investment Cost (1000\$)						O/M Cost (1000\$)	Total Cost (1000\$)	Energy Sales (GWh)	Add. Energy Sales (GWh)	Add. Revenue (1000\$)	Balance (1000\$)
	PSEP (IDA)	JICA T/L&S/S	JICA MV	LRP (IDA)	JICA LV	Total						
0 1991/92	4600			1104		5704		5704	295.00	0.00	0	-5704
1 1992/93	4830		7112	1190		13132	114	13246	325.50	30.50	2315	-10931
2 1993/94	4830		4170	1190		10190	377	10567	359.00	64.00	4858	-5709
3 1994/95	1840	10124	6359	482	4312	23117	581	23698	395.80	100.80	7651	-16047
4 1995/96		5862	3726		1082	10670	1043	11713	436.40	141.40	10732	-981
5 1996/97							1256	1256	482.40	187.40	14224	12967
6 1997/98							1256	1256		187.40	14224	12968
7 1998/99							1256	1256		187.40	14224	12968
8 1999/00							1256	1256		187.40	14224	12968
9 2001/02							1256	1256		187.40	14224	12968
10 2002/03							1256	1256		187.40	14224	12968
11 2003/04							1256	1256		187.40	14224	12968
12 2004/05							1256	1256		187.40	14224	12968
13 2005/06							1256	1256		187.40	14224	12968
14 2006/07							1256	1256		187.40	14224	12968
15 2007/08							1256	1256		187.40	14224	12968
16 2008/09							1256	1256		187.40	14224	12968
17 2009/10							1256	1256		187.40	14224	12968
18 2010/11							1256	1256		187.40	14224	12968
19 2011/12							1256	1256		187.40	14224	12968
20 2012/13							1256	1256		187.40	14224	12968
21 2013/14							1256	1256		187.40	14224	12968
22 2014/15							1256	1256		187.40	14224	12968
23 2015/16							1256	1256		187.40	14224	12968
24 2016/17							1256	1256		187.40	14224	12968
25 2017/18							1256	1256		187.40	14224	12968
26 2018/19							1256	1256		187.40	14224	12968
27 2019/20							1256	1256		187.40	14224	12968
28 2020/21							1256	1256		187.40	14224	12968
29 2021/22							1256	1256		187.40	14224	12968
30 2022/23							1256	1256		187.40	14224	12968
31 2023/24							1256	1256		187.40	14224	12968
32 2024/25							1256	1256		187.40	14224	12968
33 2025/26							1256	1256		187.40	14224	12968
34 2026/27							1256	1256		187.40	14224	12968

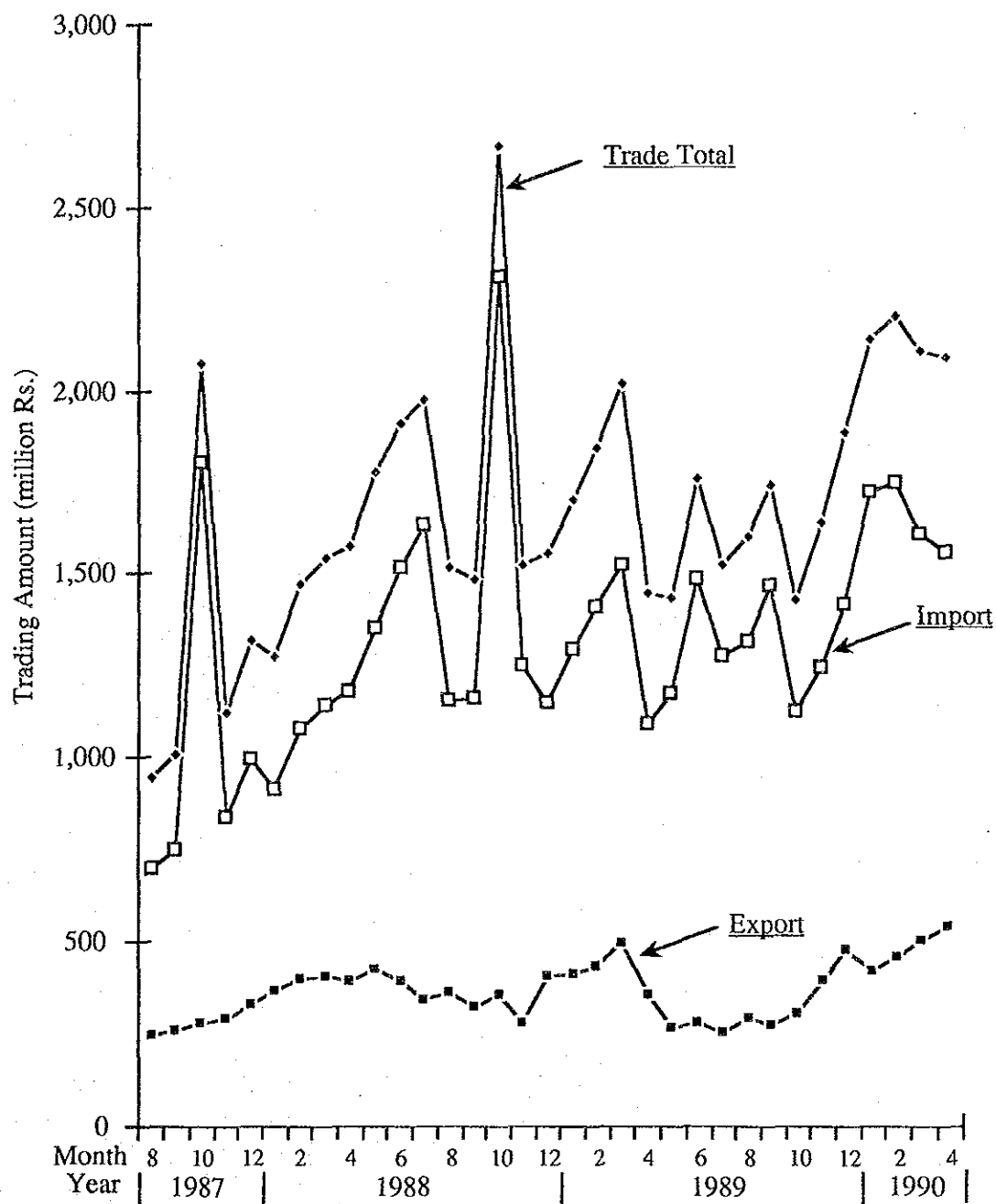
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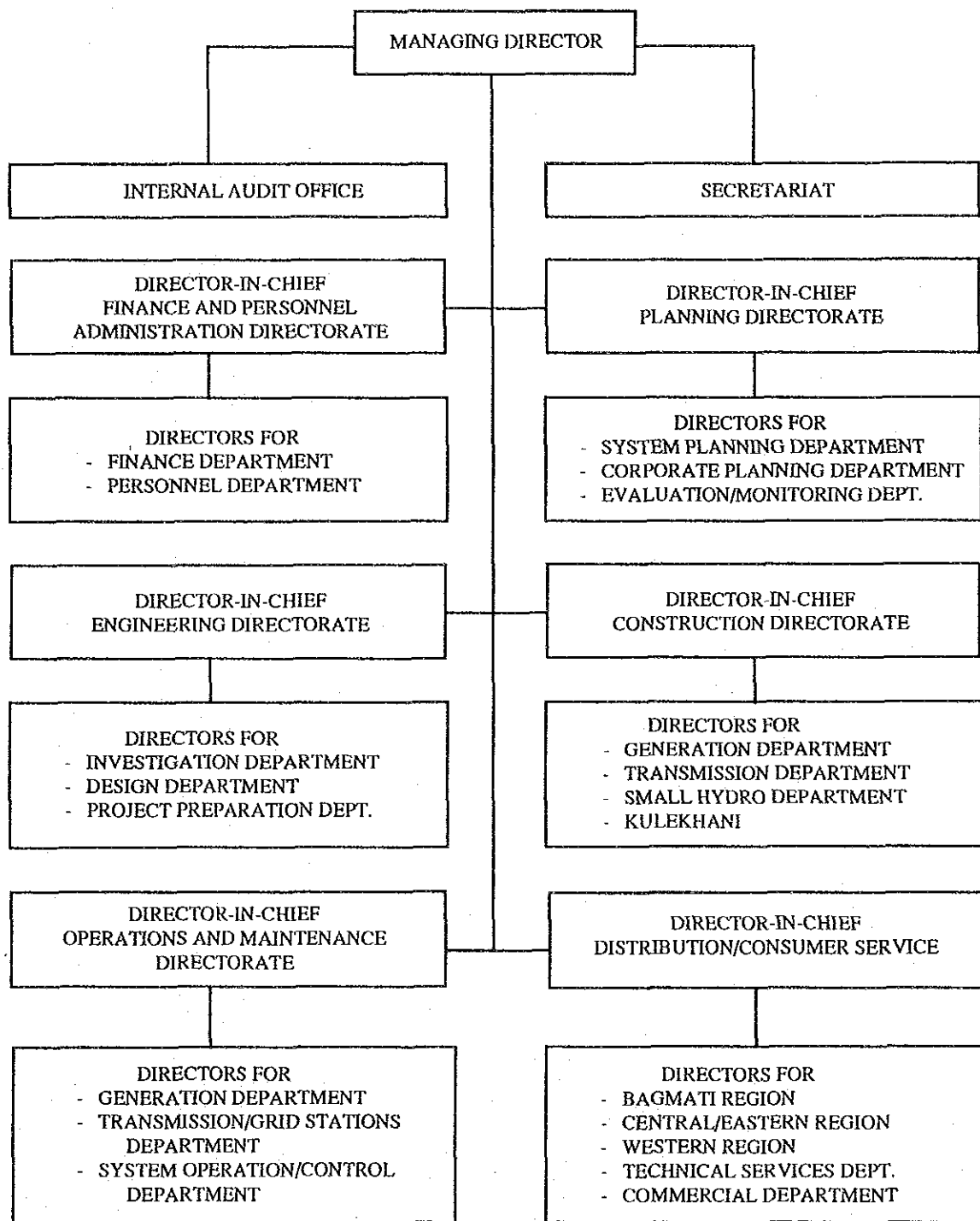
FIRR 21.30 %

a) Exchange rate : 1 US\$ = Rs.28.6

b) Unit Benefit : Theoretical Tariffs (Average=Rs.2.75/kWh)
 (LRMG and Tariff Study, Dec. 1990, EDF)
 HV Customer Rs.1.04/kWh)
 MV Customer Rs.1.50/kWh) Rs.3.21 - Rs.1.04 = Rs.2.17 (US\$ 0.0759/kWh)
 LV Customer Rs.3.21/kWh)

FIGURES

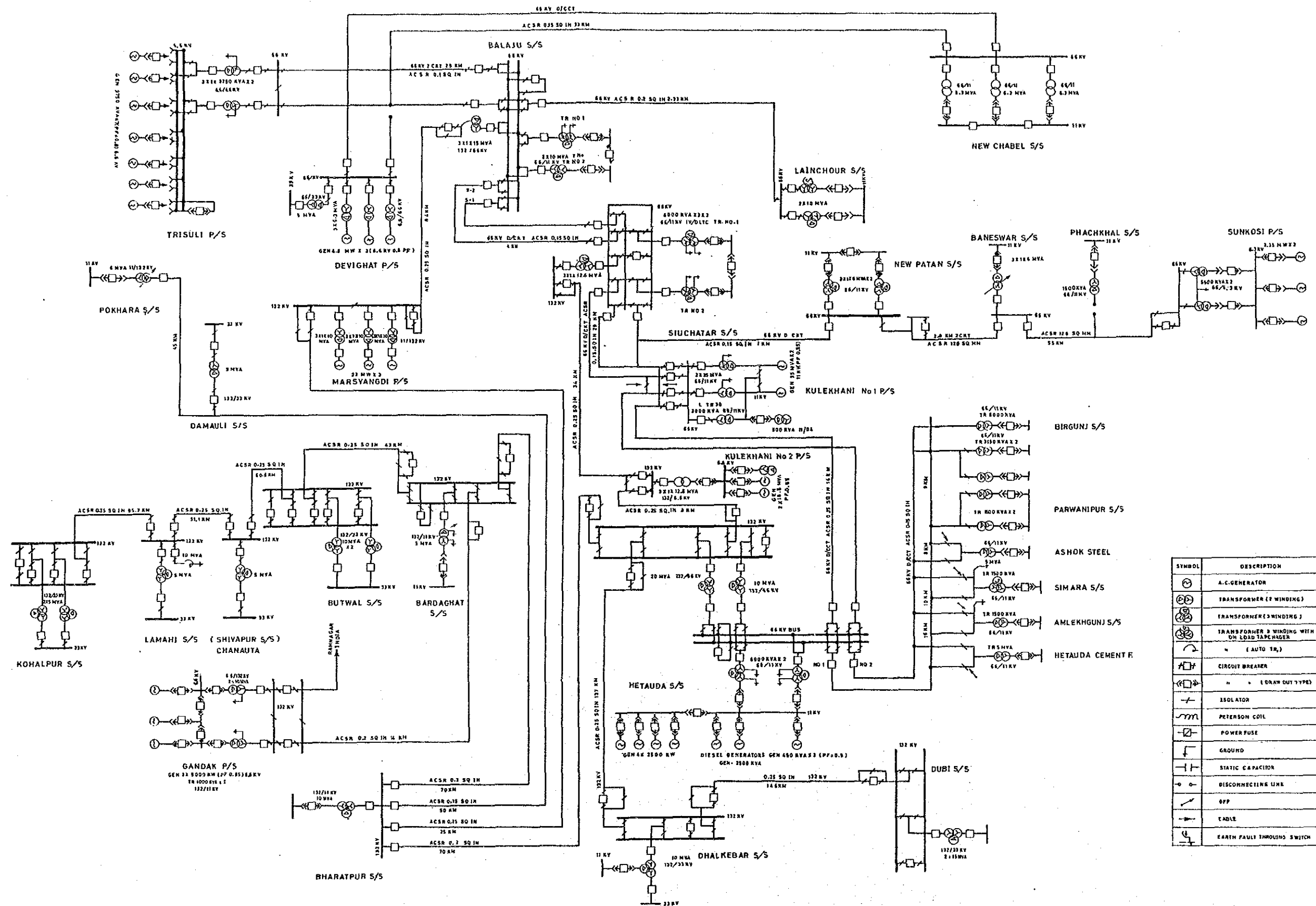




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EXTENSION AND REINFORCEMENT OF
POWER T/L AND D/L SYSTEM IN
KATHMANDU VALLEY

NEPAL ELECTRICITY AUTHORITY
JAPAN INTERNATIONAL
COOPERATION AGENCY

TITLE
Fig. 4.1
Nepal Electricity Authority
Organization Chart

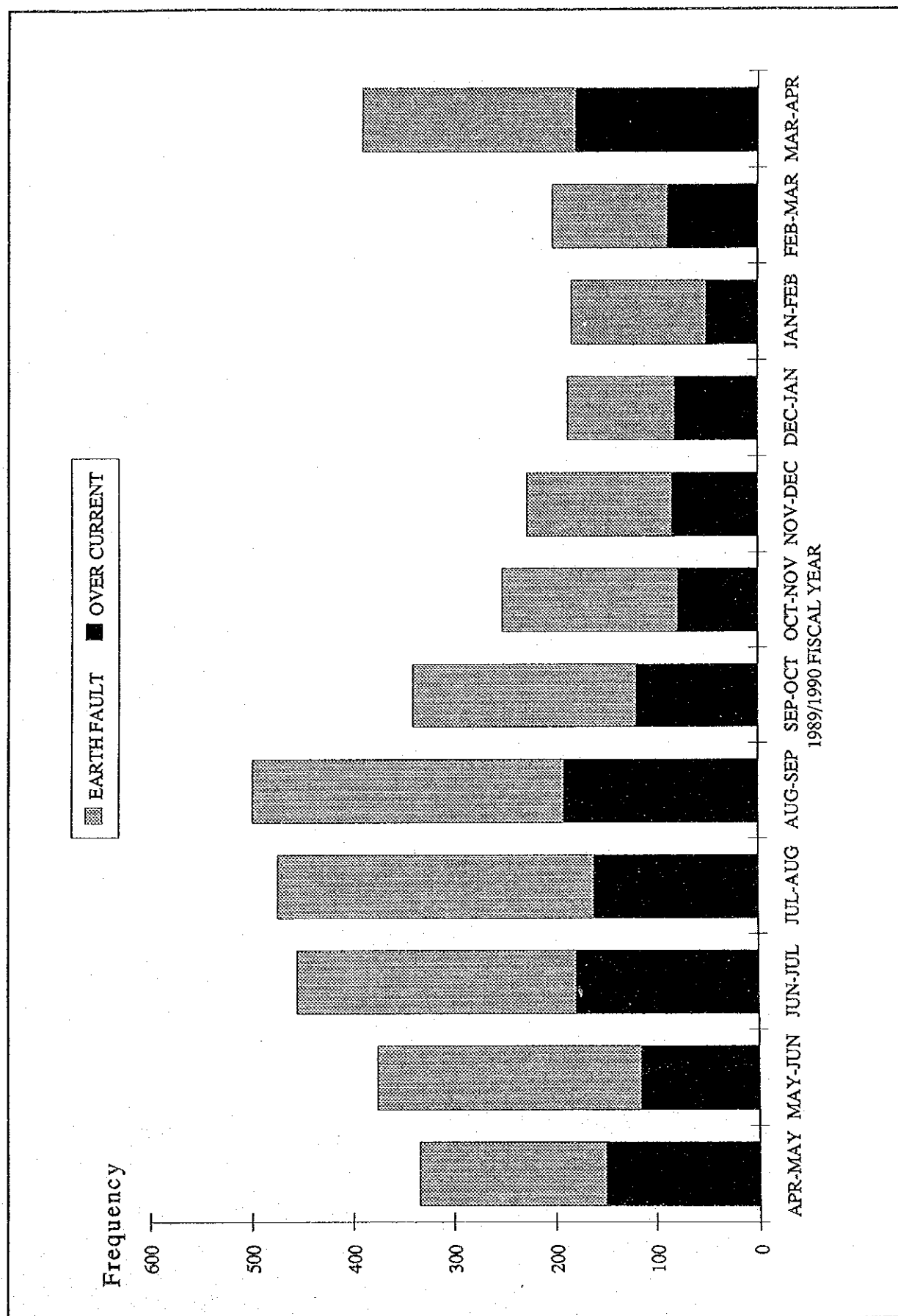


SYMBOL	DESCRIPTION
	A.C. GENERATOR
	TRANSFORMER (2 WINDING)
	TRANSFORMER (3 WINDING)
	TRANSFORMER 3 WINDING WITH ON LOAD TAPCHANGER
	" (AUTO TR.)
	CIRCUIT BREAKER
	" (DRAW OUT TYPE)
	PETERSON COIL
	POWER FUSE
	GROUND
	STATIC CAPACITOR
	DISCONNECTING LINK
	OFF
	TABLE
	EARTH FAULT THROUGH SWITCH

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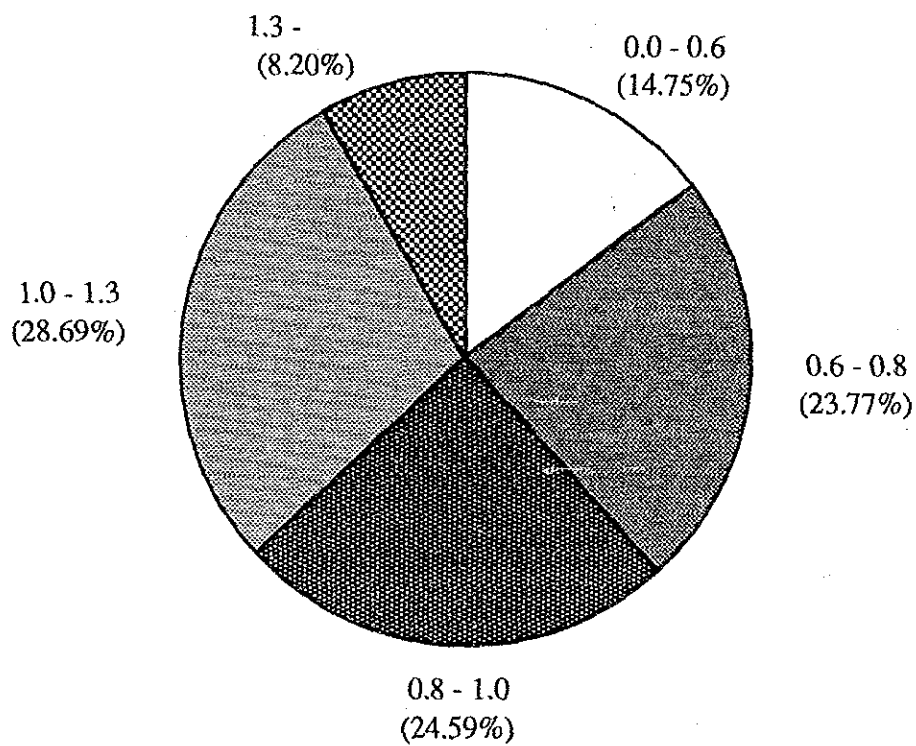
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Fig. 4.2
Power System Diagram of
Central Nepal Power System



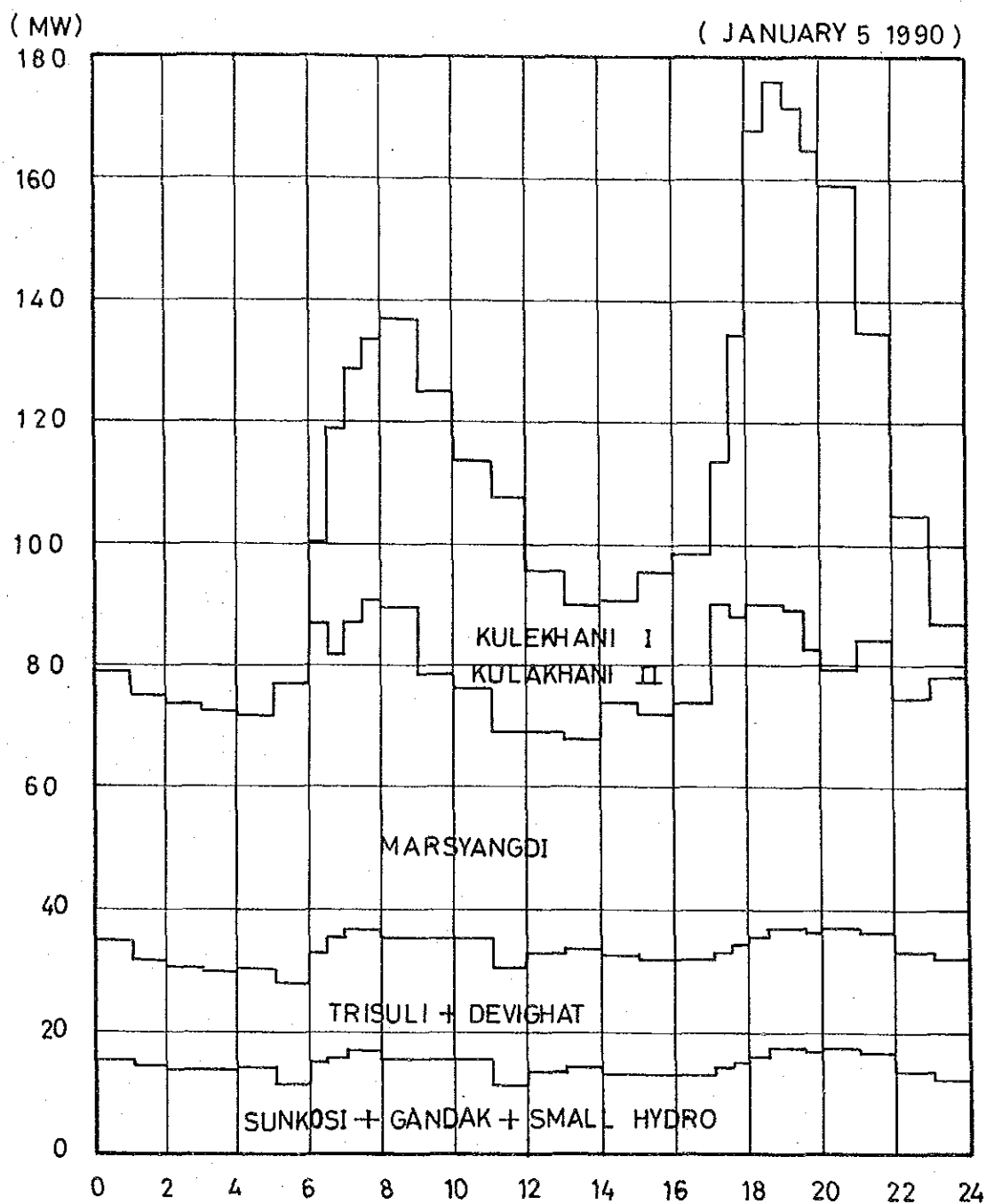
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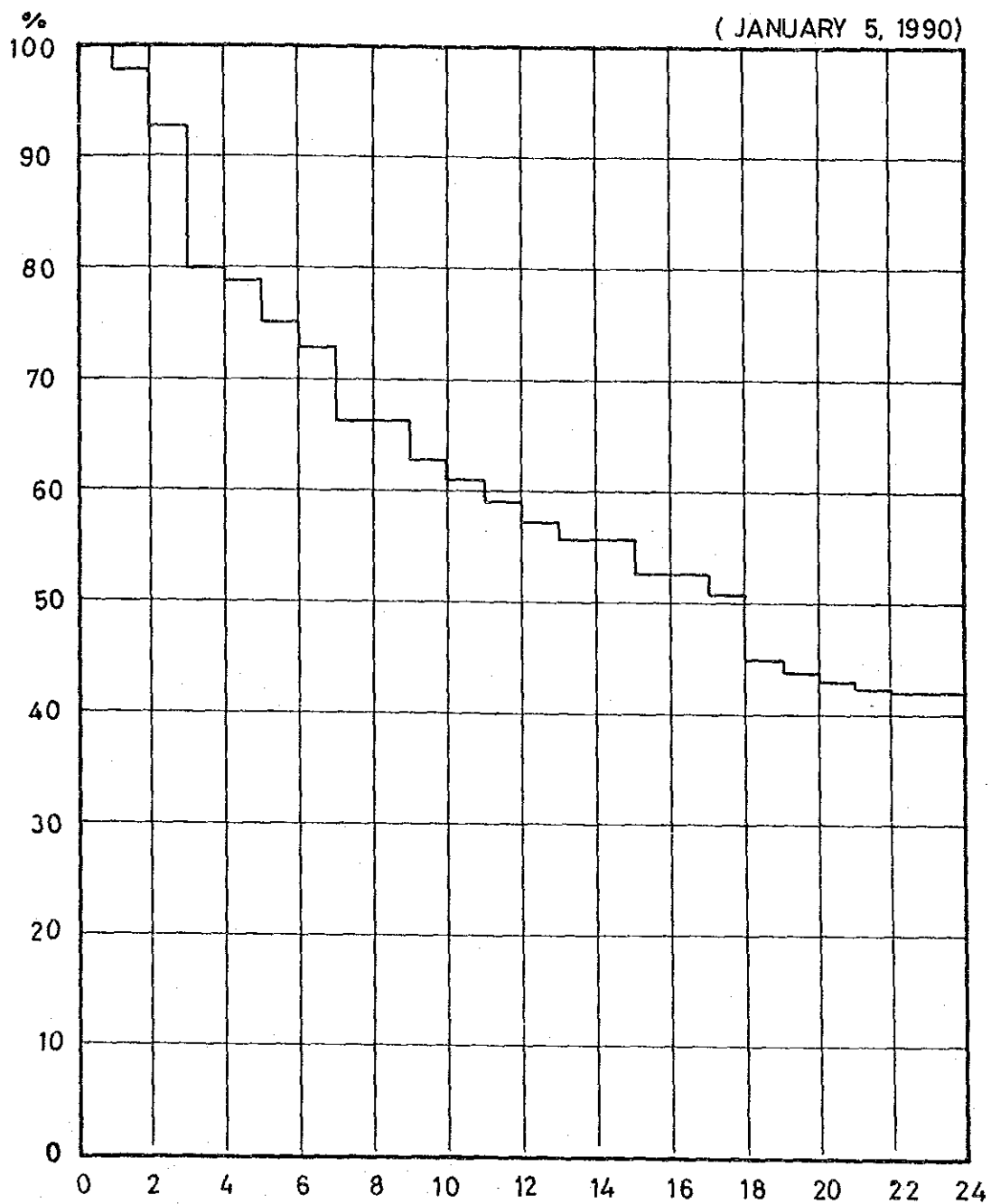
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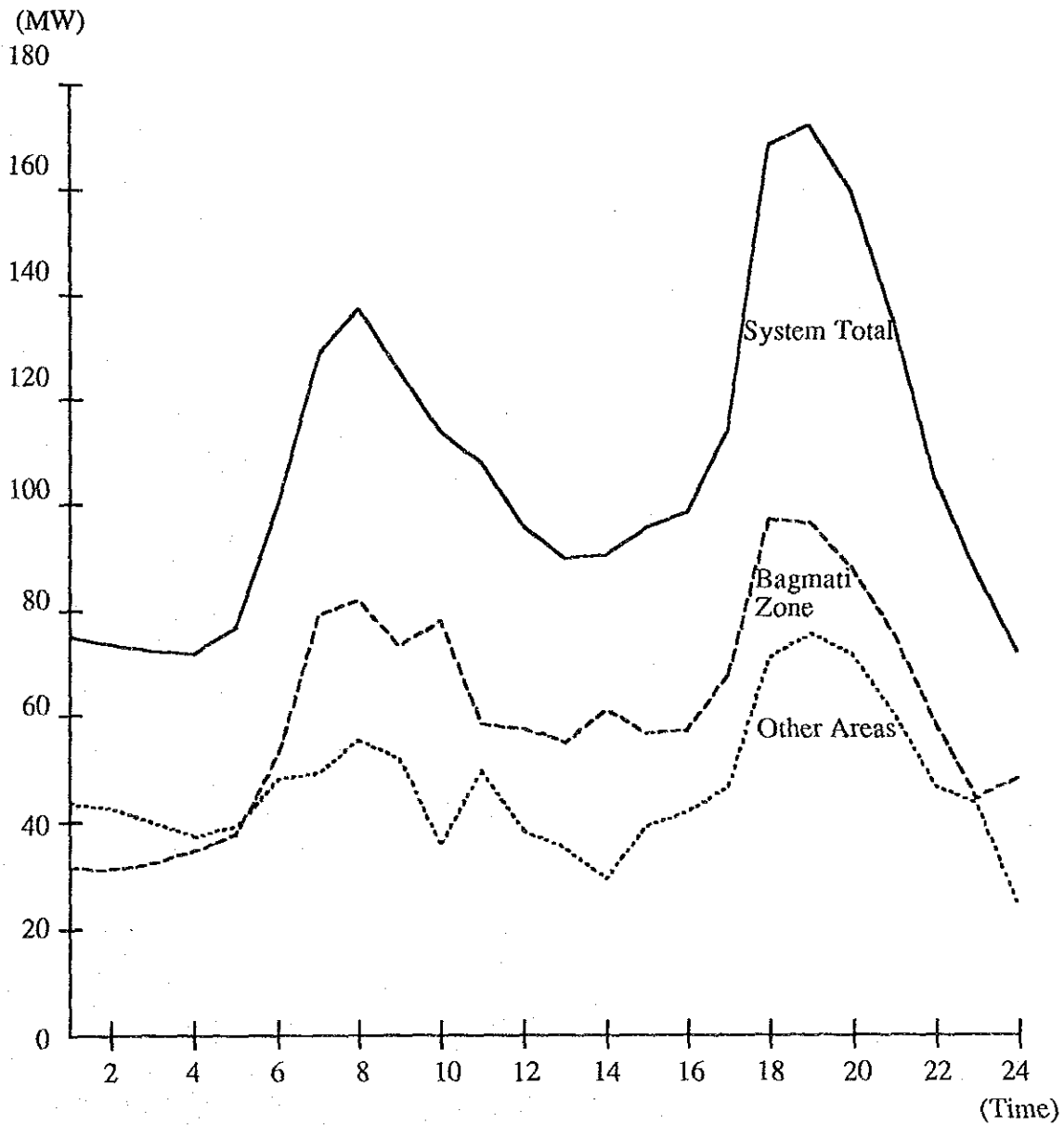
TITLE
Fig. 4.3
Total Monthly Tripping Frequency
of 11kV D/L



(Measured in Lalitpur Division in 1989/90)





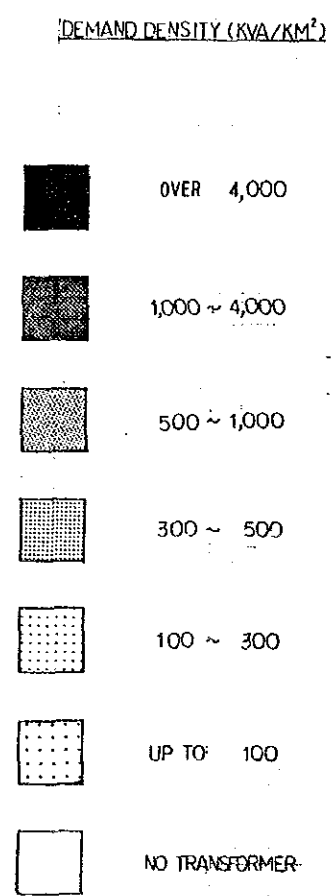
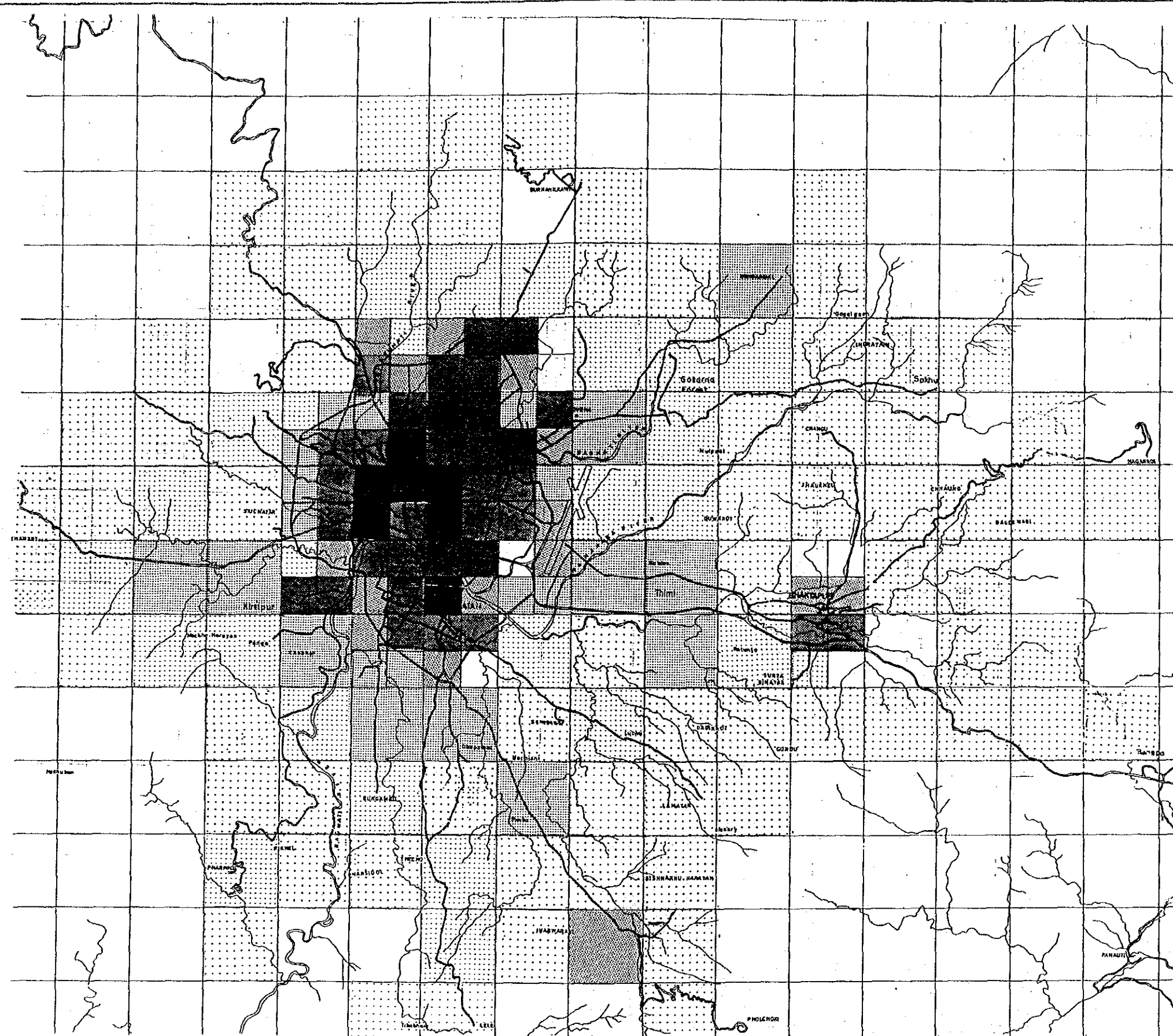


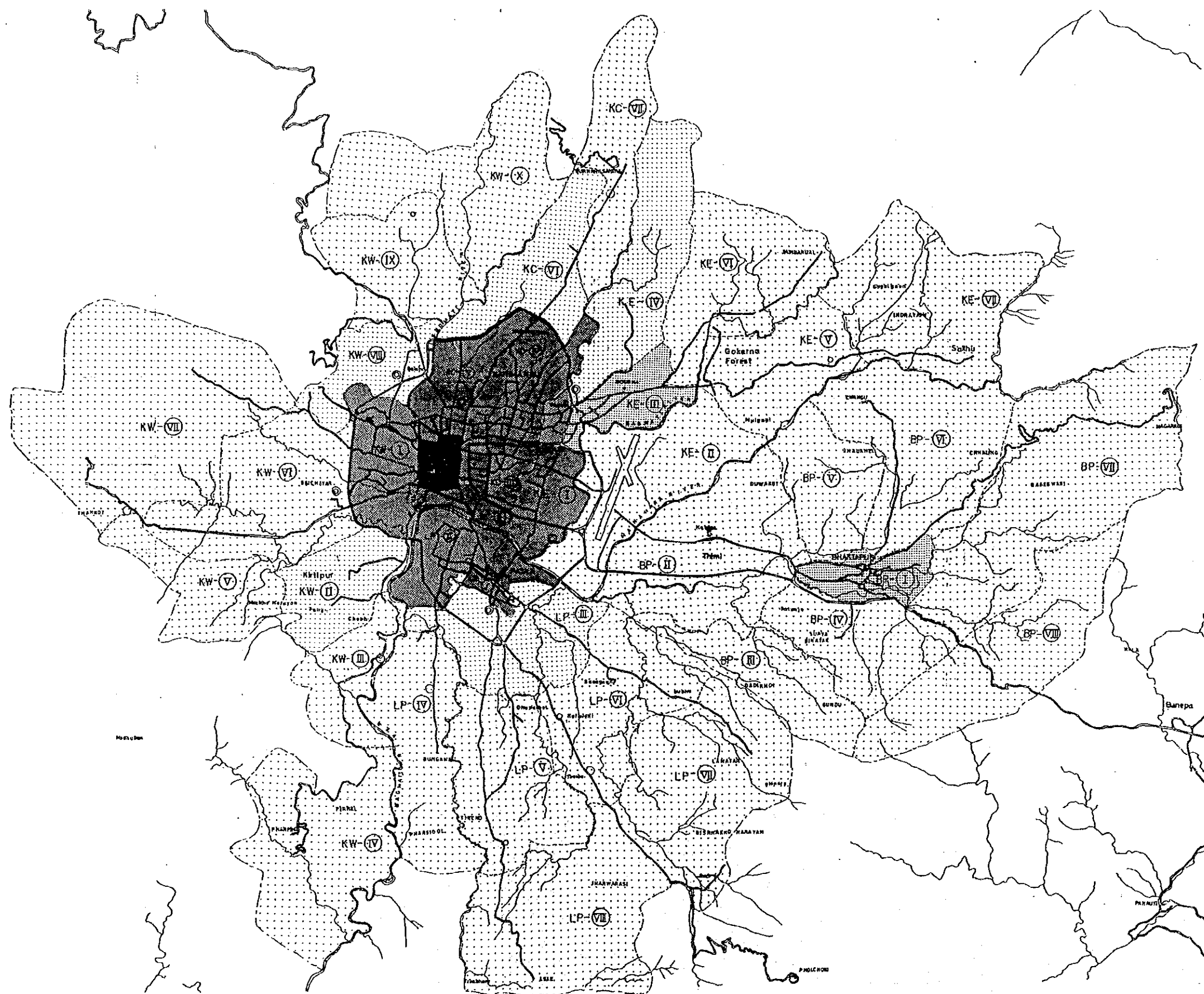
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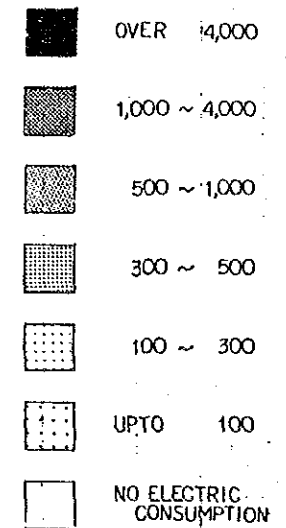
TITLE

Fig. 5.3
Daily Load Curve by
Area on January 5, 1990





DEMAND DENSITY (KW/KM²)



LEGEND

⊙: EXISTING S/S

•: EXISTING SWITCHING STATION

KC: KATHMANDU CENTRAL DIVISION

KW: KATHMANDU WESTERN DIVISION

KE: KATHMANDU EASTERN DIVISION

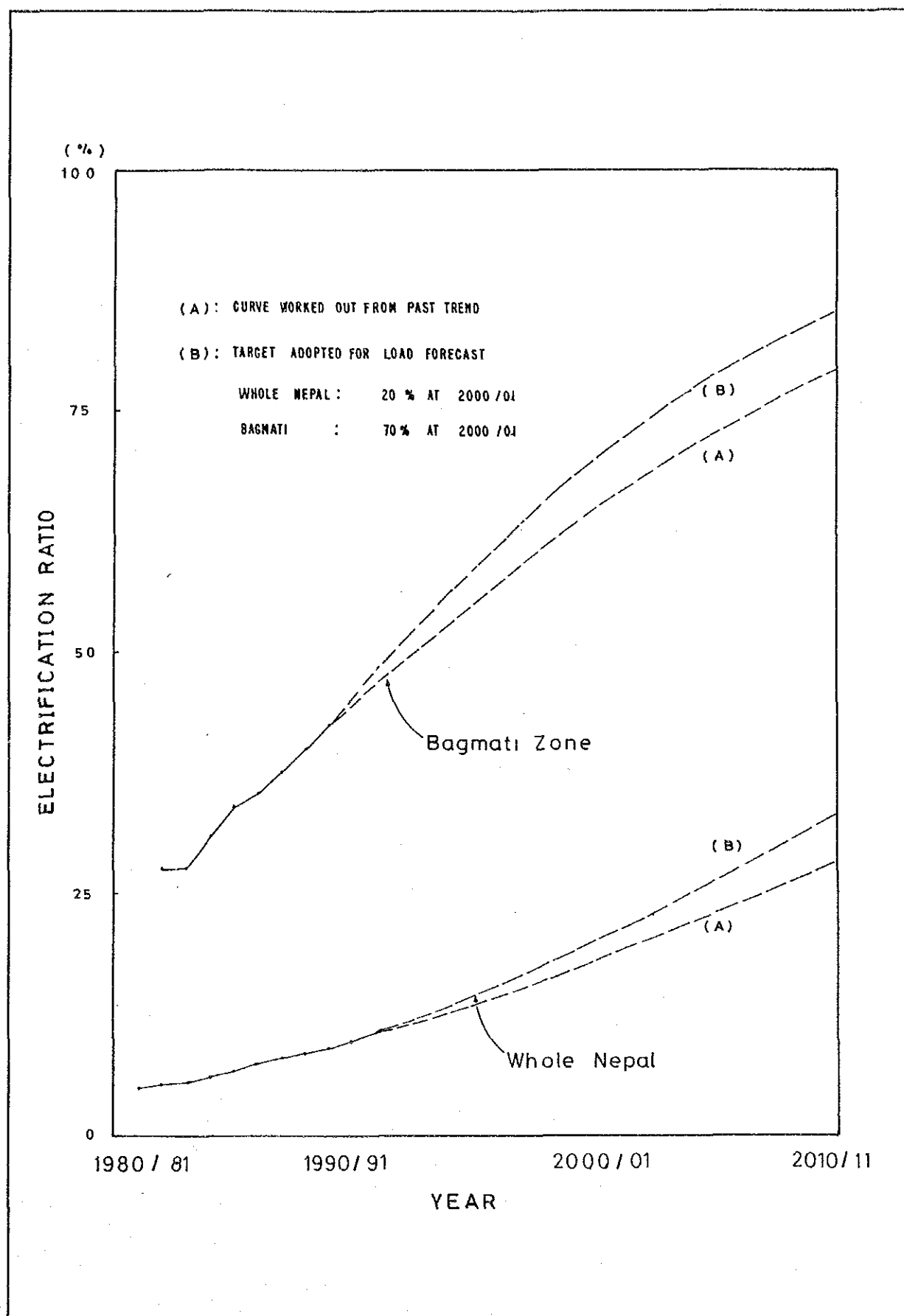
LP: LALITPUR DIVISION

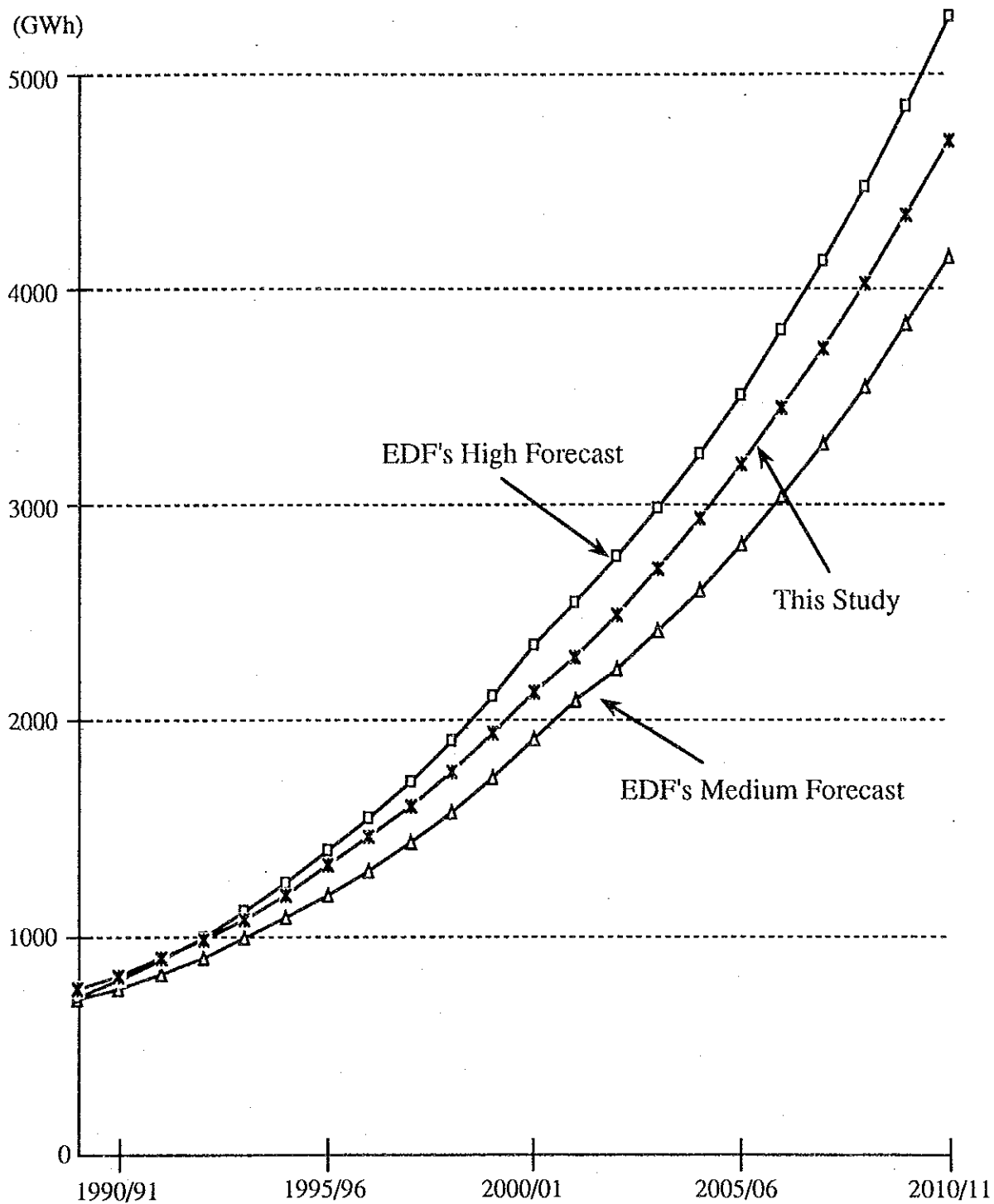
BP: BHAKTAPUR DIVISION

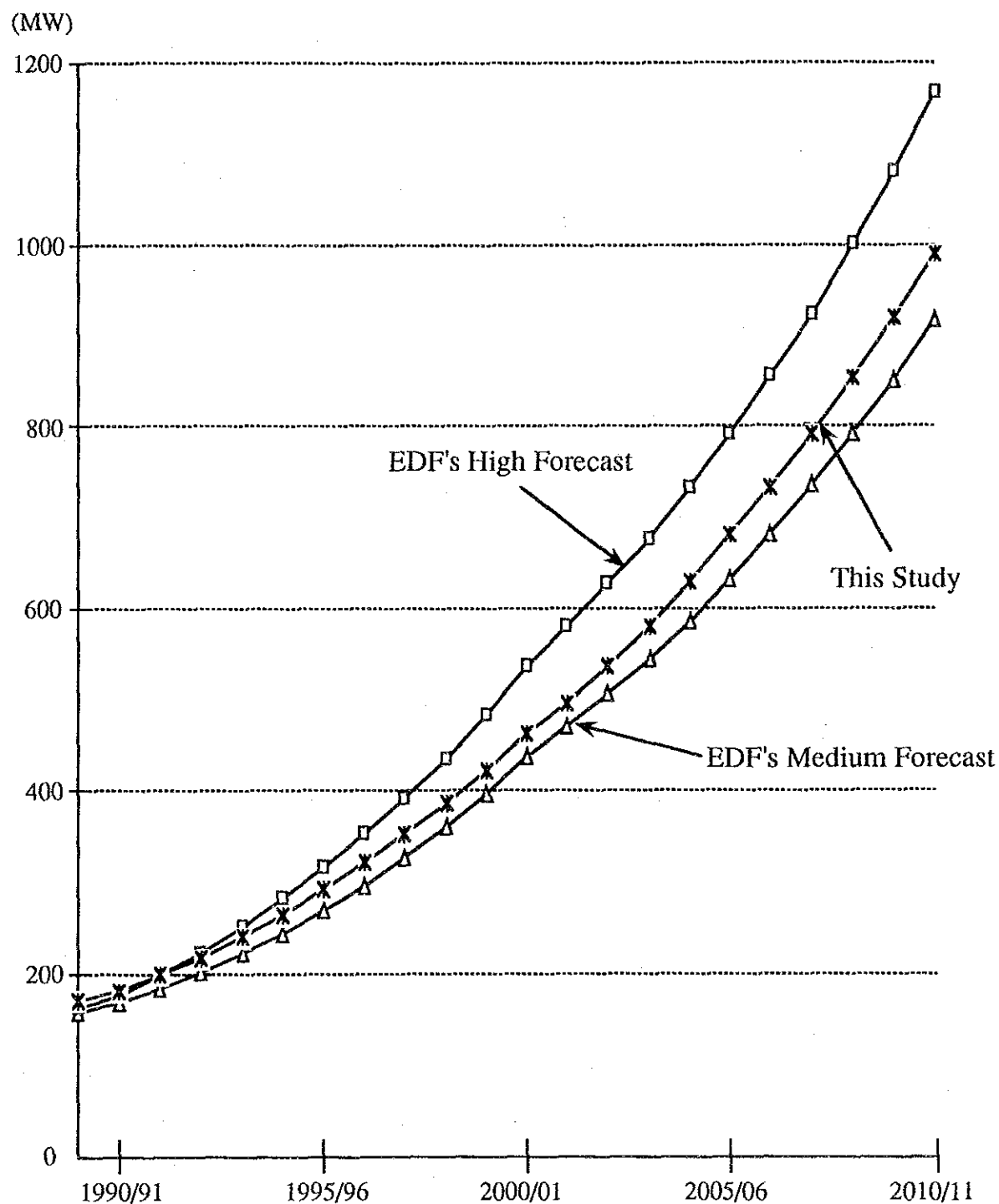
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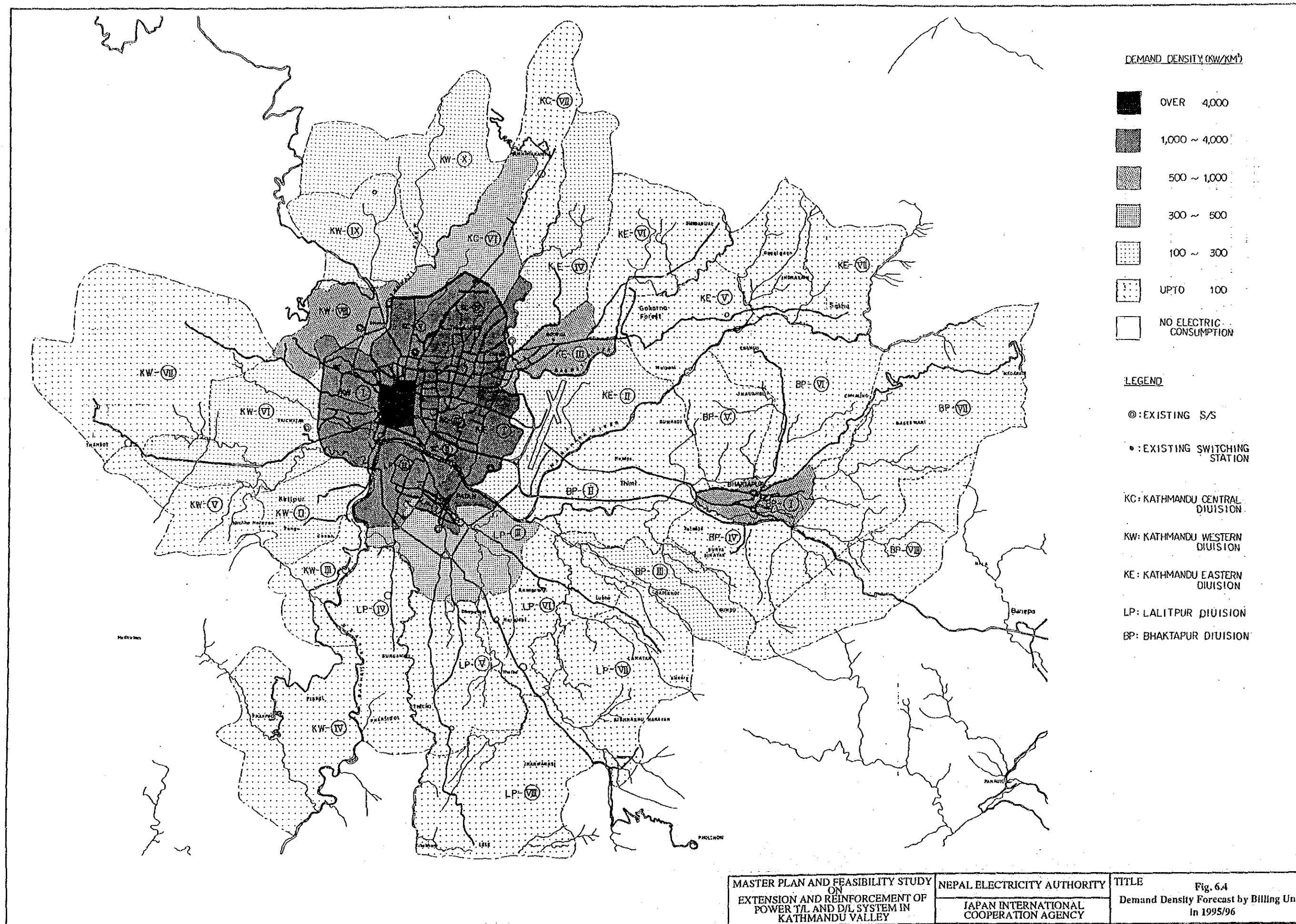
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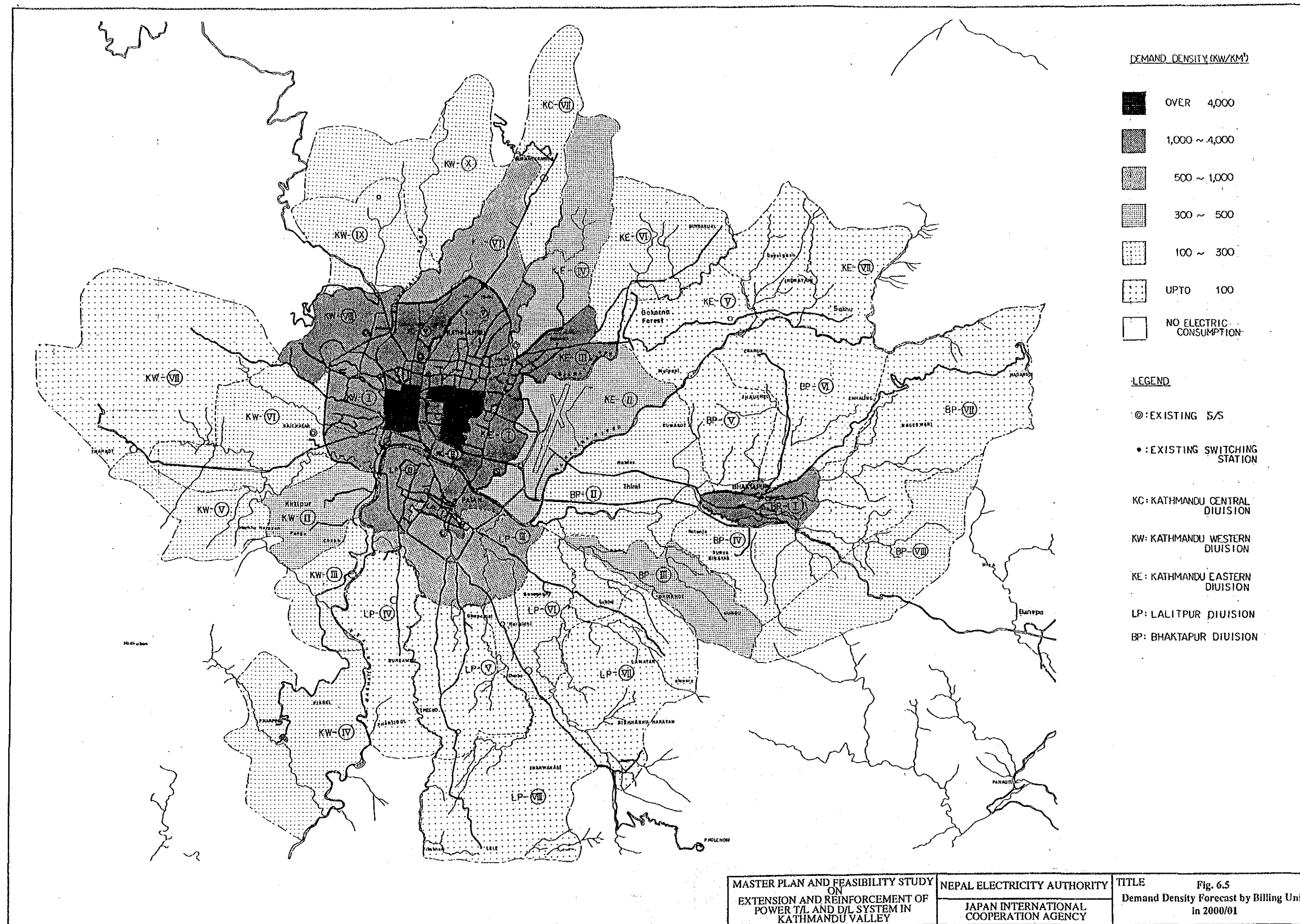
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Fig. 5.5
Demand Density by Billing Unit
(kW/sq.km)

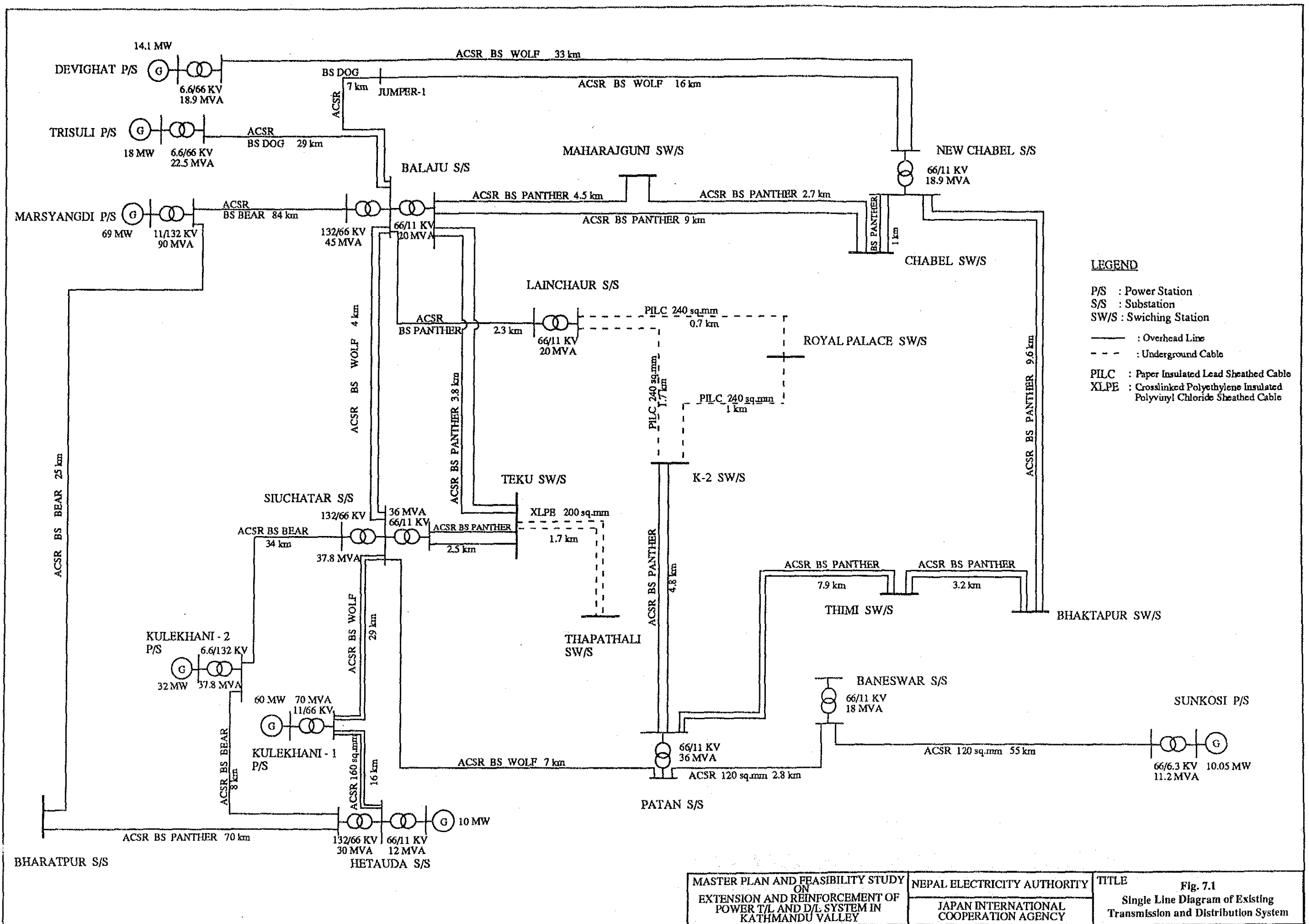


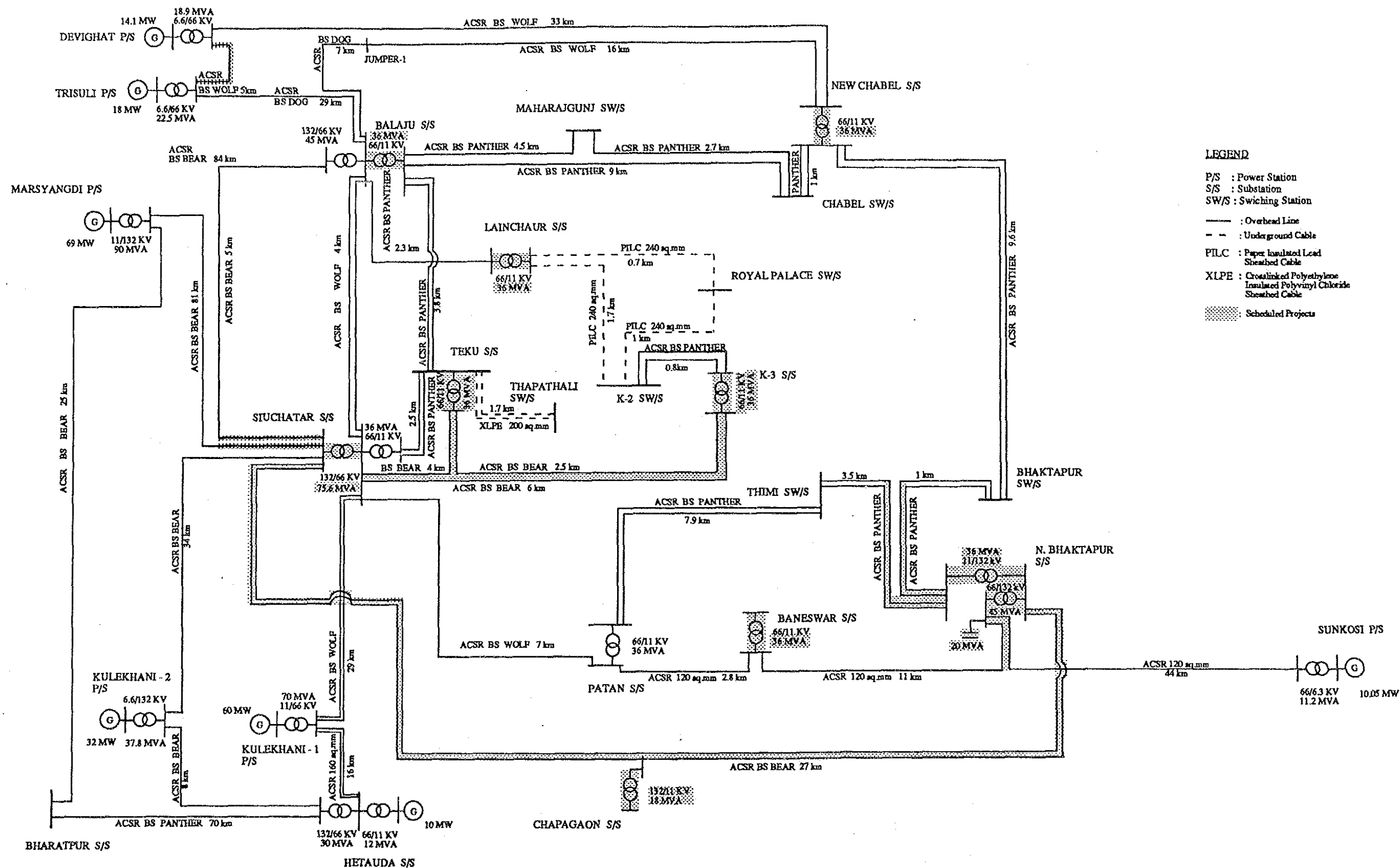








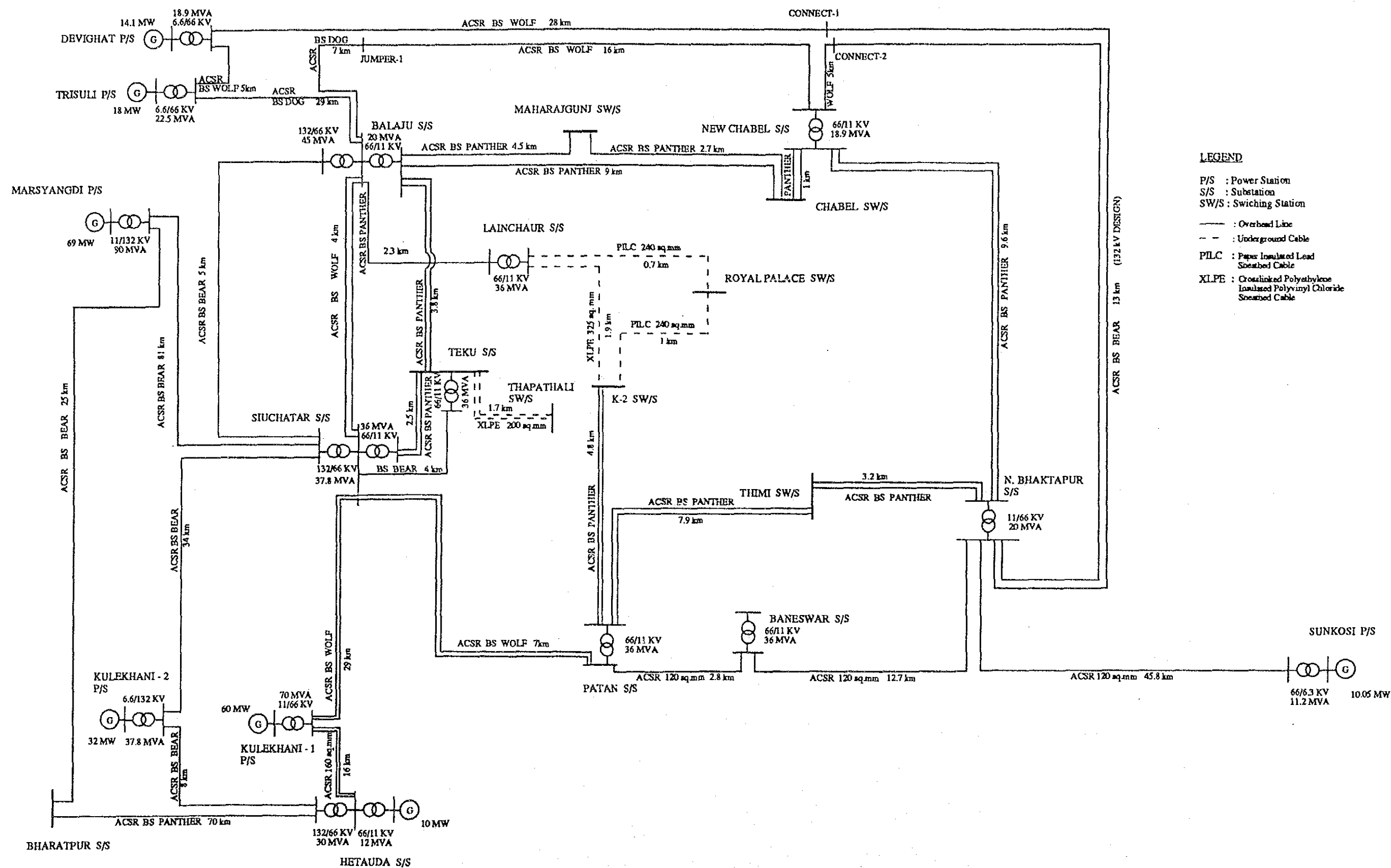




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TITLE Fig. 7.5
Single Line Diagram of Scenario-B
In the Stage 2000/01



LEGEND

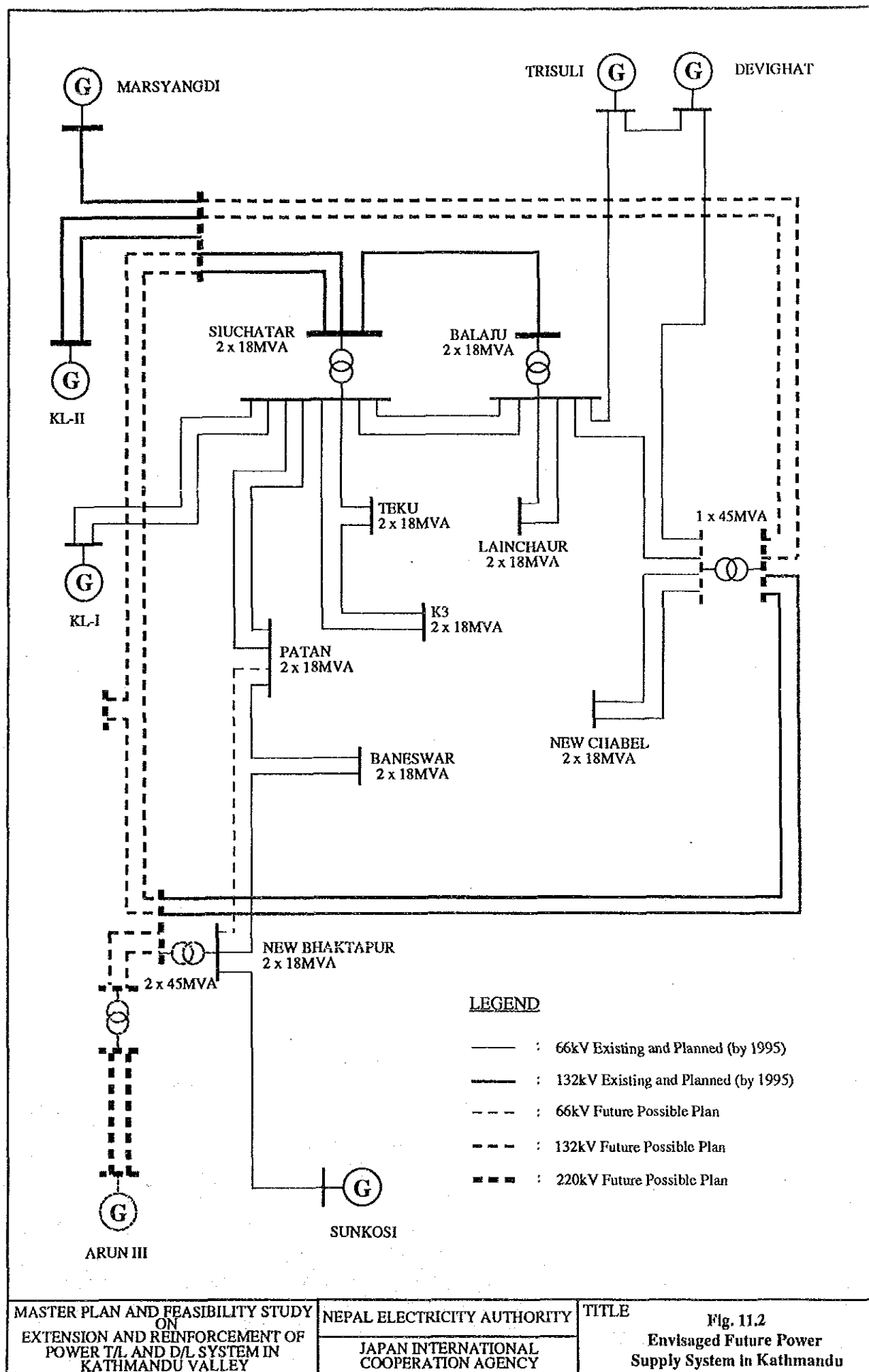
- P/S : Power Station
- S/S : Substation
- SW/S : Switching Station
- : Overhead Line
- - : Underground Cable
- PILC : Paper Insulated Lead Sheathed Cable
- XLPE : Crosslinked Polyethylene Insulated Polyvinyl Chloride Sheathed Cable

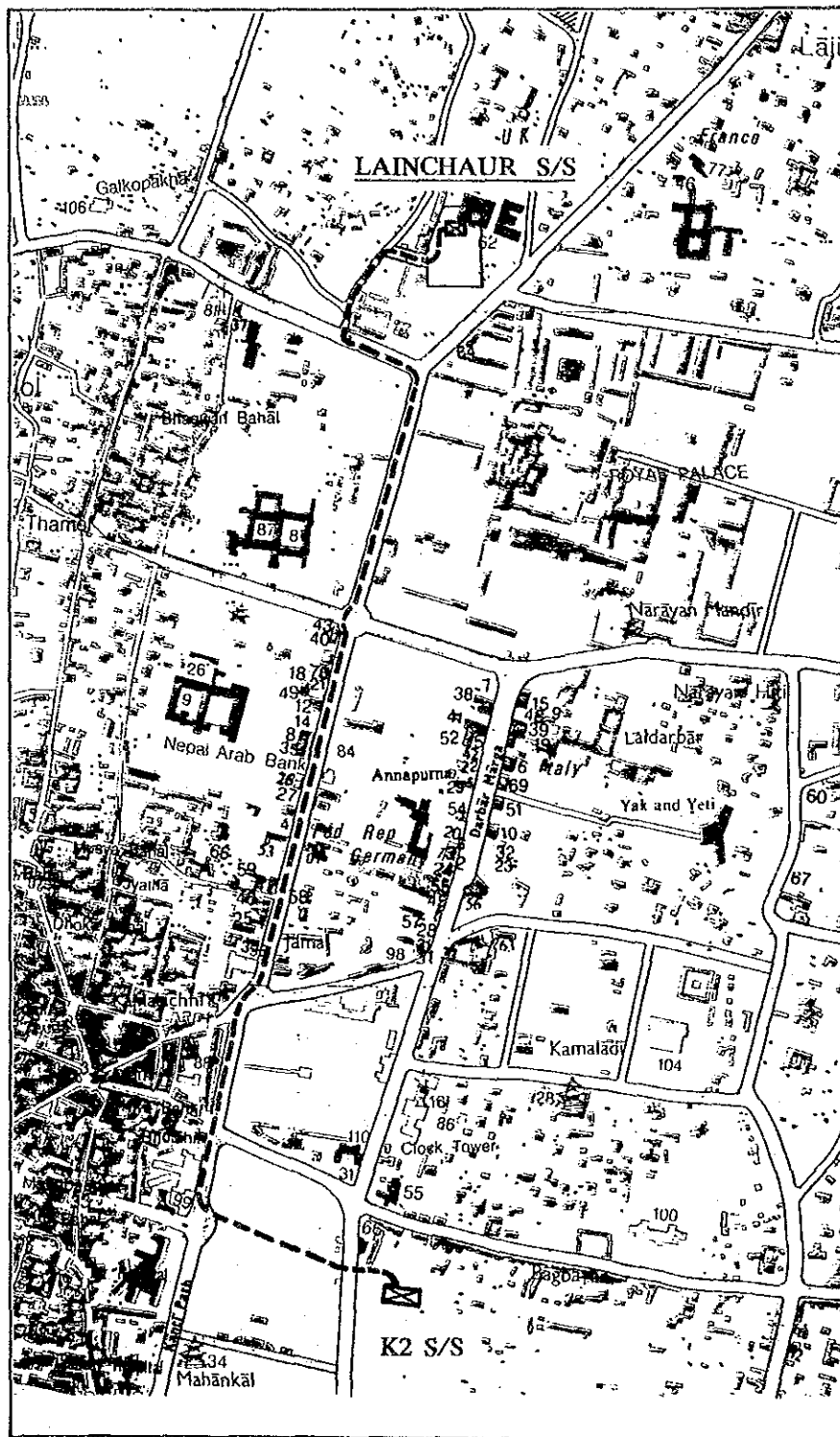
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ON
EXTENSION AND REINFORCEMENT OF
POWER T/L AND D/L SYSTEM IN
KATHMANDU VALLEY

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Fig. 11.1
Single Line Diagram of Transmission
and Ring Main Distribution System

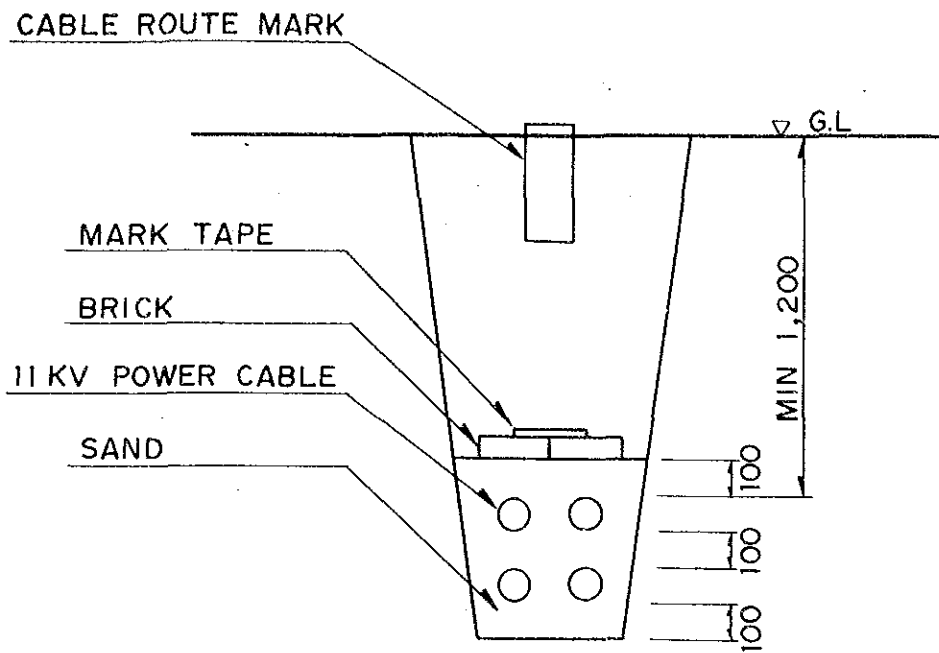
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the hundredth is the fact that the



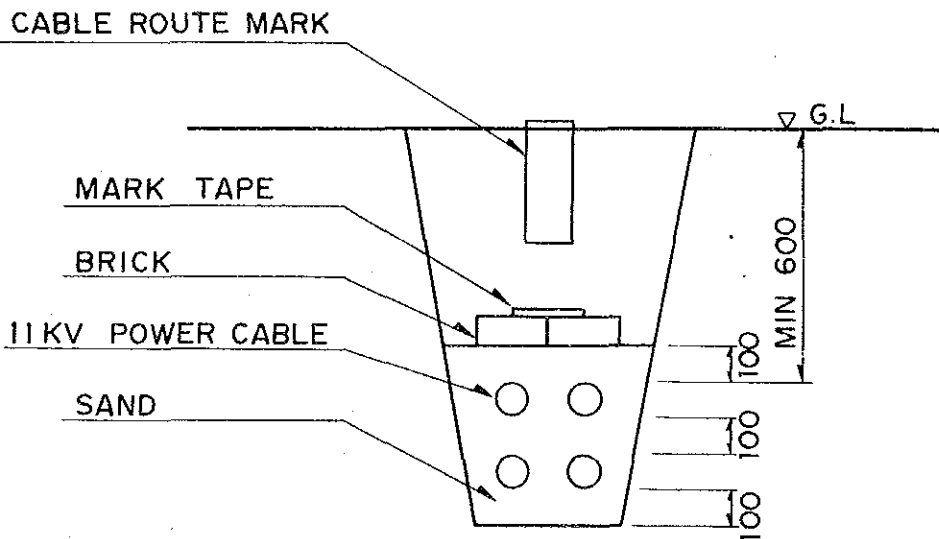


----- : 11kv Underground Cable Line Route

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ALONG ROAD

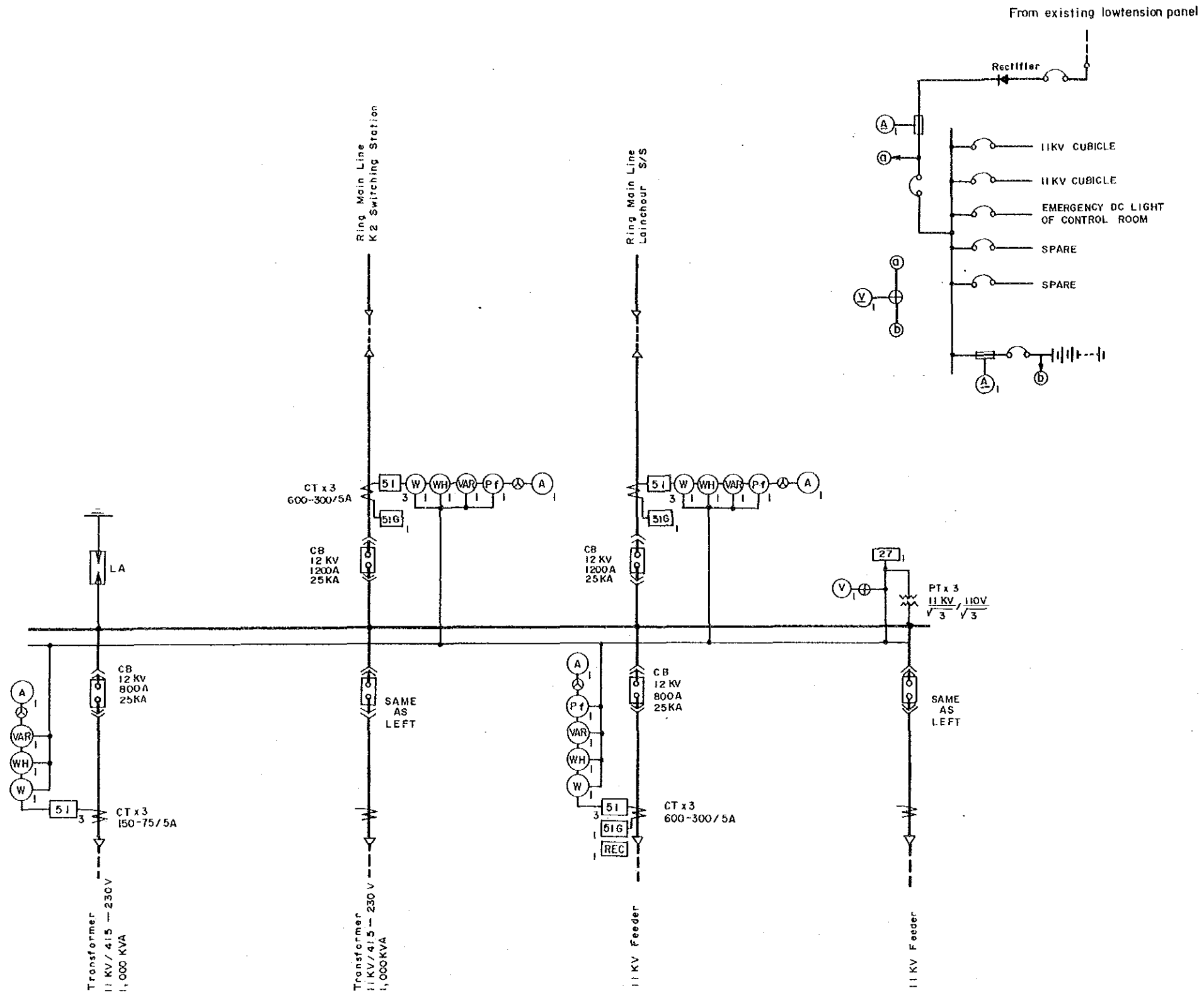


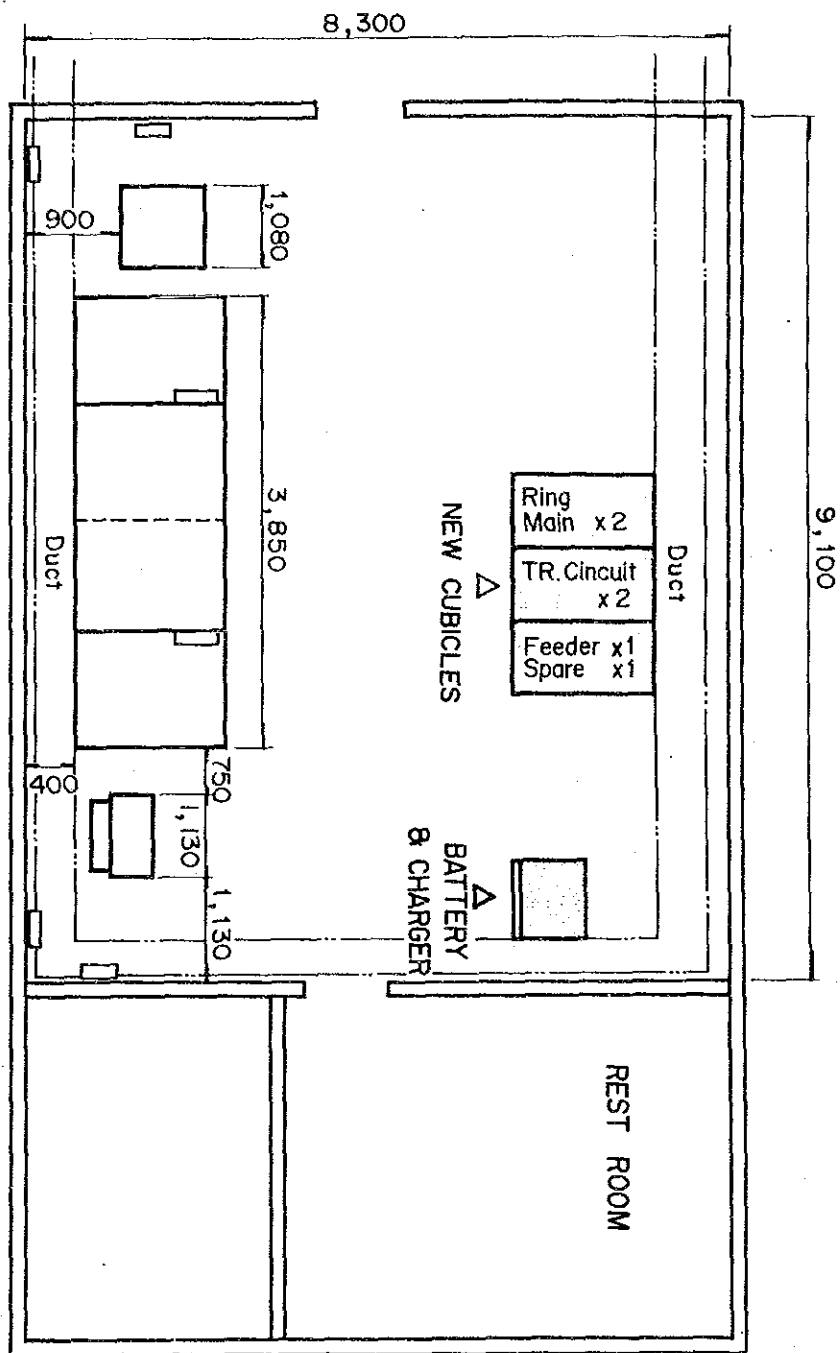
GENERAL TERRAIN



Y	TITLE	Fig. 11.6 (2) Outdoor Switchyard Layout Plan of Sluchatar S/S
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LEGEND	
BCT	BUSHING CURRENT TRANSFORMER
CB	CIRCUIT BREAKER
CCT	COMPENSATING CURRENT TRANSFORMER
CH	CABLE HEAD
CT	CURRENT TRANSFORMER
DS	DISCONNECTING SWITCH
LA	LIGHTNING ARRESTER
MCB	MOLDED CASE CIRCUIT BREAKER
MTR	MAIN TRANSFORMER
PF	POWER FUSE
PT	POTENTIAL TRANSFORMER
PD	POTENTIAL DEVICE
REC	RECLOSING RELAY
S.TR	STATION SERVICE TRANSFORMER
(A)	AC AMMETER
(A)	DC AMMETER
(PF)	POWER FACTOR METER
(PL)	PILOT LAMP
(V)	AC VOLTAGE METER
(V)	DC VOLTAGE METER
(VAR)	VAR METER
(W)	WATT METER
(WH)	WATTHOUR METER
27	UNDER VOLTAGE RELAY
51	OVER CURRENT RELAY
51G	OVER CURRENT RELAY
64D	DC GROUND RELAY





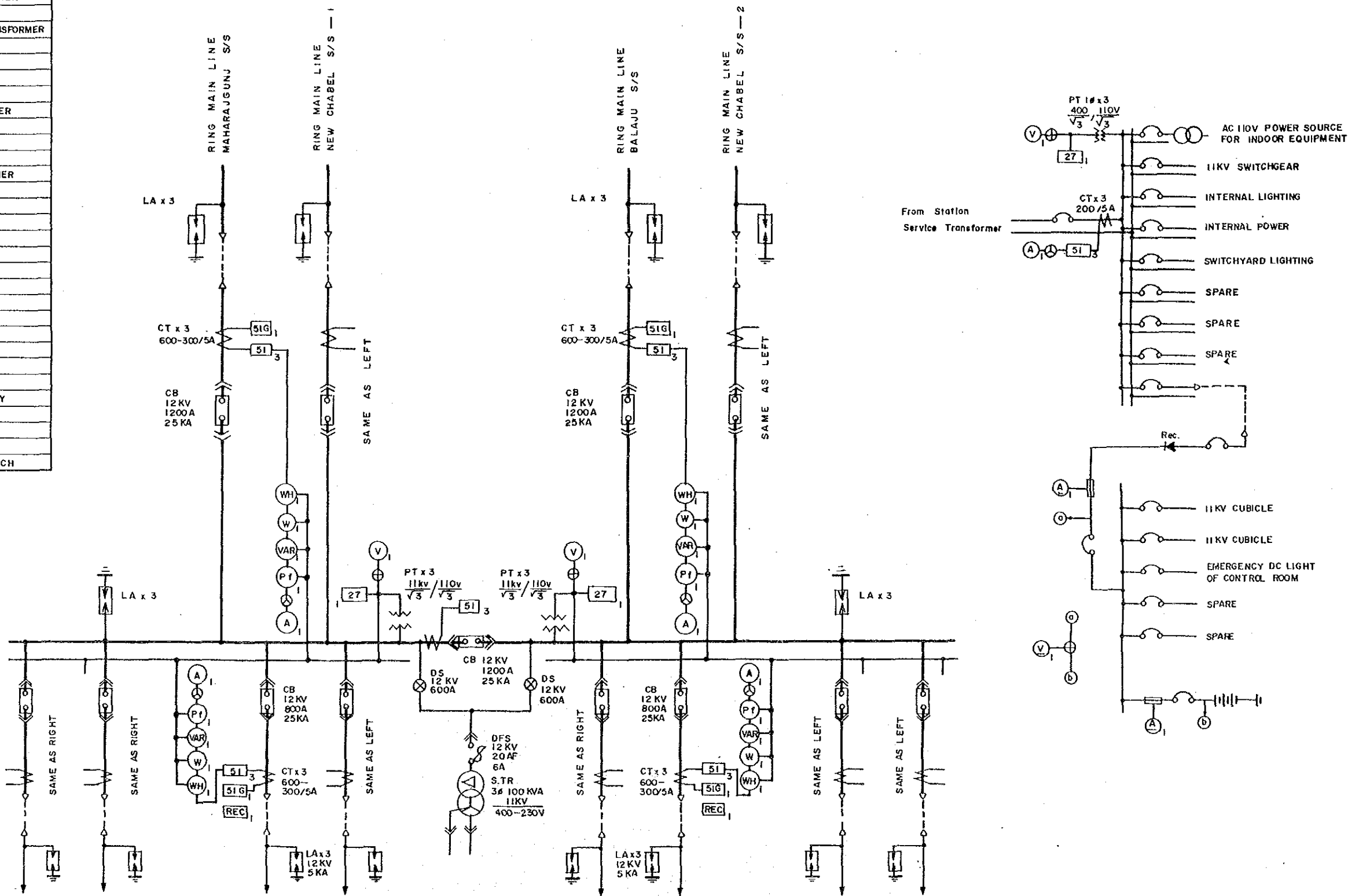
Works under the Project

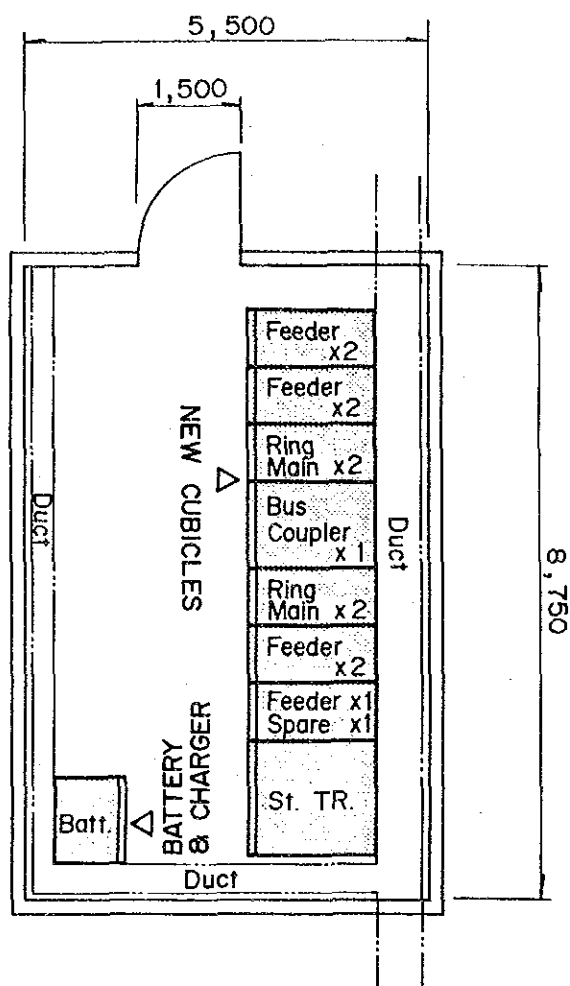
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Fig. 11.8
11kV Indoor Cubicles Layout Plan
of Royal Palace Switching Station

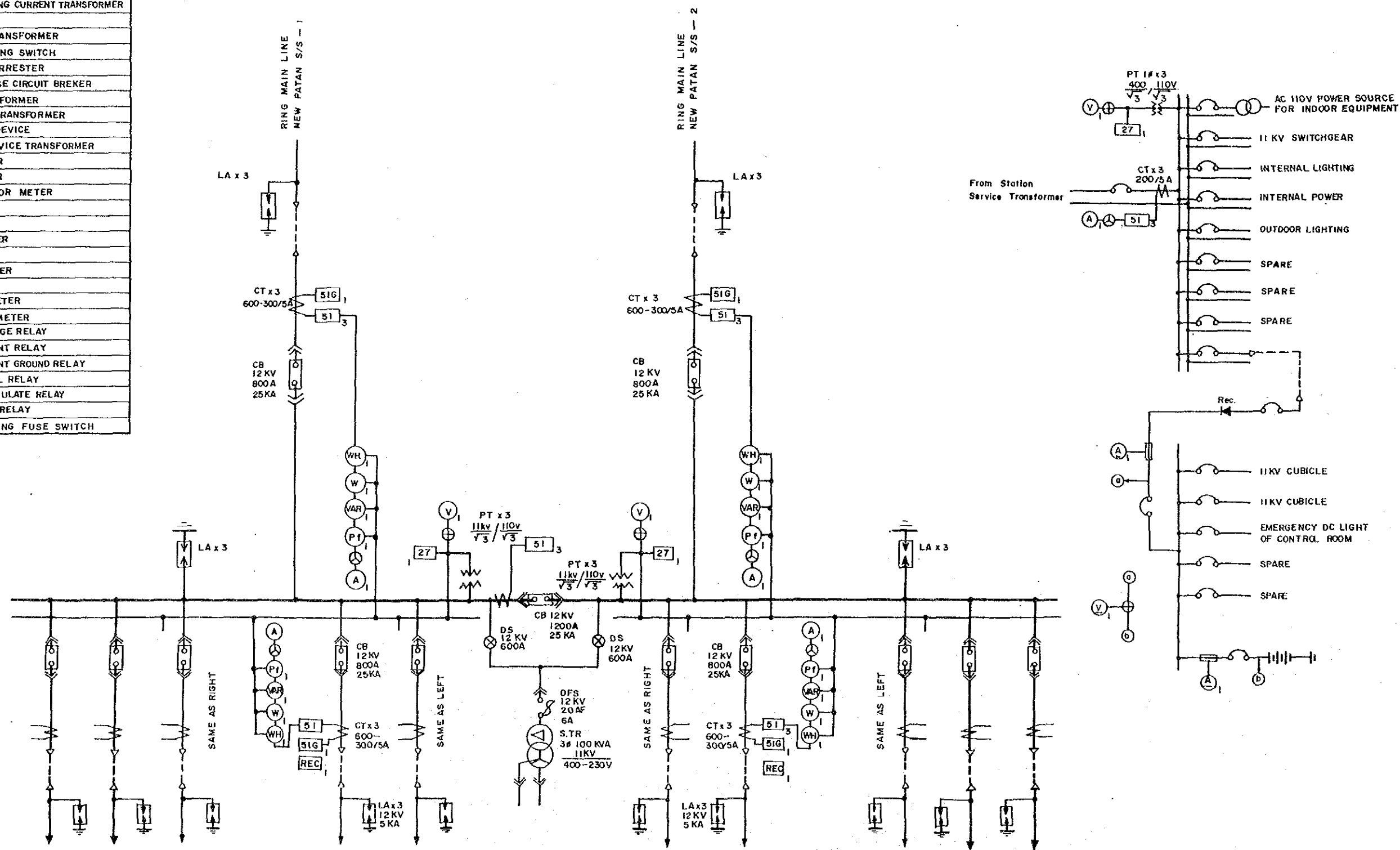
LEGEND	
BCY	BUSHING CURRENT TRANSFORMER
CB	CIRCUIT BREAKER
CCY	COMPENSATING CURRENT TRANSFORMER
CH	CABLE HEAD
CT	CURRENT TRANSFORMER
DS	DISCONNECTING SWITCH
LA	LIGHTNING ARRESTER
MCB	MOLDED CASE CIRCUIT BREAKER
M.T.R	MAIN TRANSFORMER
PT	POTENTIAL TRANSFORMER
PD	POTENTIAL DEVICE
STR	STATION SERVICE TRANSFORMER
(A)	AC AMMETER
(A)	DC AMMETER
(P)	POWER FACTOR METER
(W)	VAR METER
(PL)	PILOT LAMP
(SY)	SYNCHRONIZER
(V)	VOLT METER
(V)	DC VOLT METER
(W)	WATTMETER
(WH)	WATTHOURLMETER
(F)	FREQUENCYMETER
27	UNDER VOLTAGE RELAY
51	OVER CURRENT RELAY
51G	OVER CURRENT GROUND RELAY
87	DIFFERENTIAL RELAY
90	VOLTAGE REGULATE RELAY
PWR	PLOTT WIRE RELAY
DFS	DISCONNECTING FUSE SWITCH





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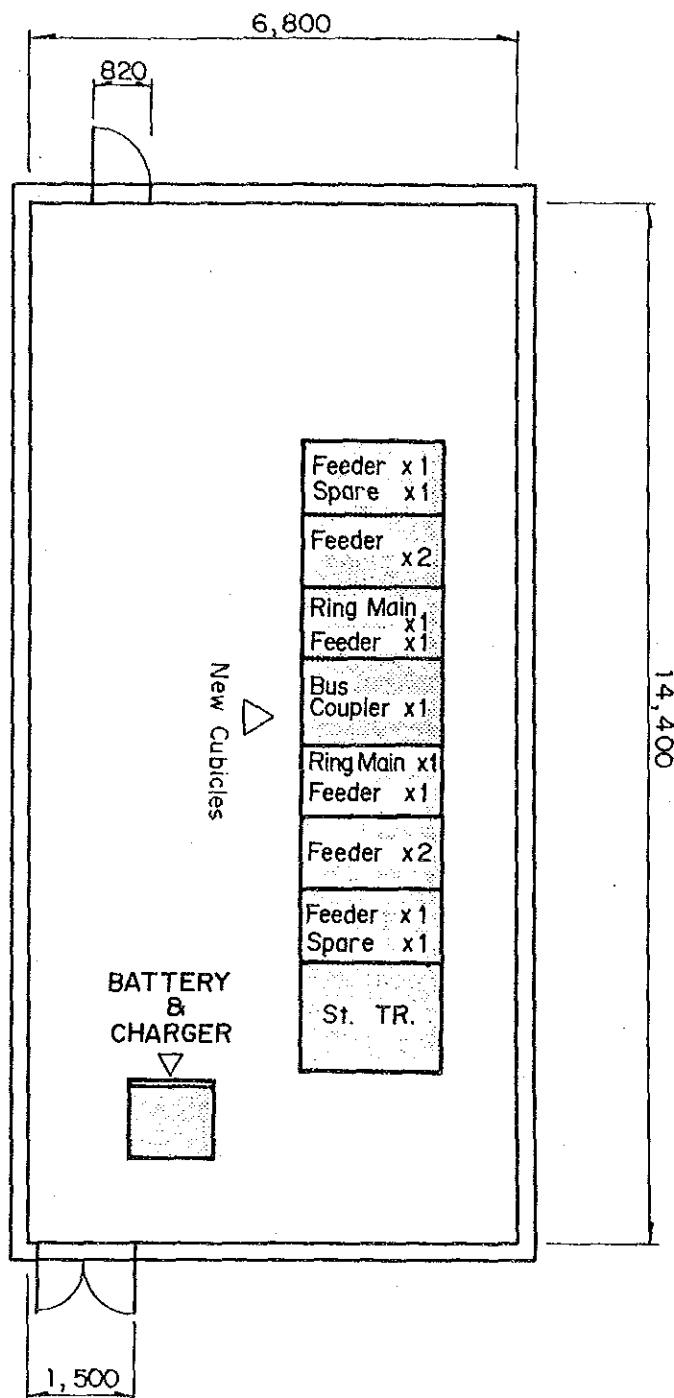
LEGEND	
BCT	BUSHING CURRENT TRANSFORMER
CB	CIRCUIT BREAKER
CCT	COMPENSATING CURRENT TRANSFORMER
CH	CABLE HEAD
CT	CURRENT TRANSFORMER
DS	DISCONNECTING SWITCH
LA	LIGHTNING ARRESTER
MCB	MOLDED CASE CIRCUIT BREAKER
M.TR	MAIN TRANSFORMER
PT	POTENTIAL TRANSFORMER
PD	POTENTIAL DEVICE
STR	STATION SERVICE TRANSFORMER
(A)	AC AMMETER
(A)	DC AMMETER
(PF)	POWER FACTOR METER
(VAR)	VAR METER
(PI)	PILOT LAMP
(SY)	SYNCHRONIZER
(V)	VOLT METER
(V)	DC VOLT METER
(W)	WATTMETER
(WH)	WATTHOUREMETER
(F)	FREQUENCYMETER
27	UNDER VOLTAGE RELAY
51	OVER CURRENT RELAY
51G	OVER CURRENT GROUND RELAY
87	DIFFERENTIAL RELAY
90	VOLTAGE REGULATE RELAY
PWR	PILOT WIRE RELAY
DFS	DISCONNECTING FUSE SWITCH




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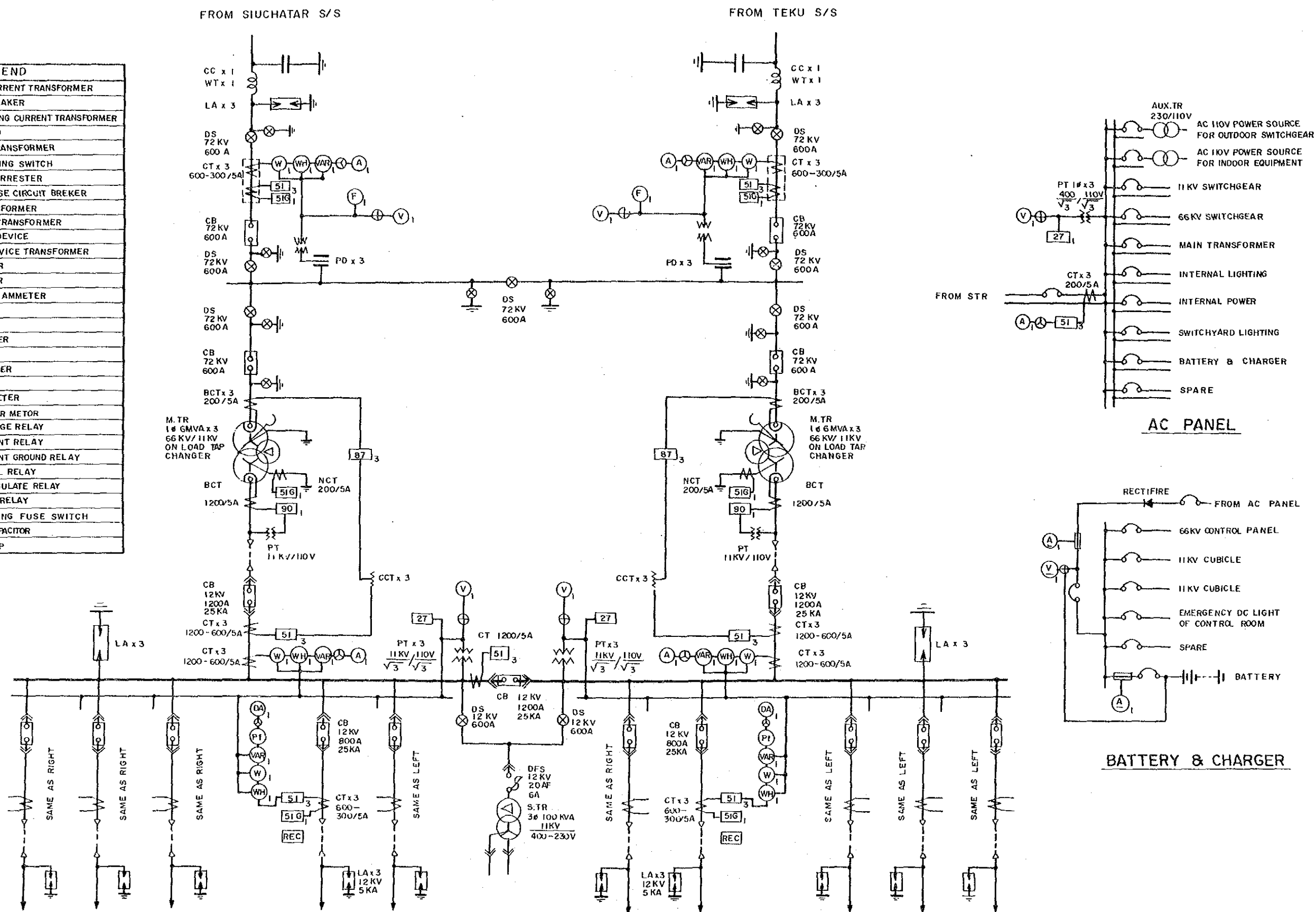
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Fig. 11.11
Single Line Diagram of
Old Patan Switching Station



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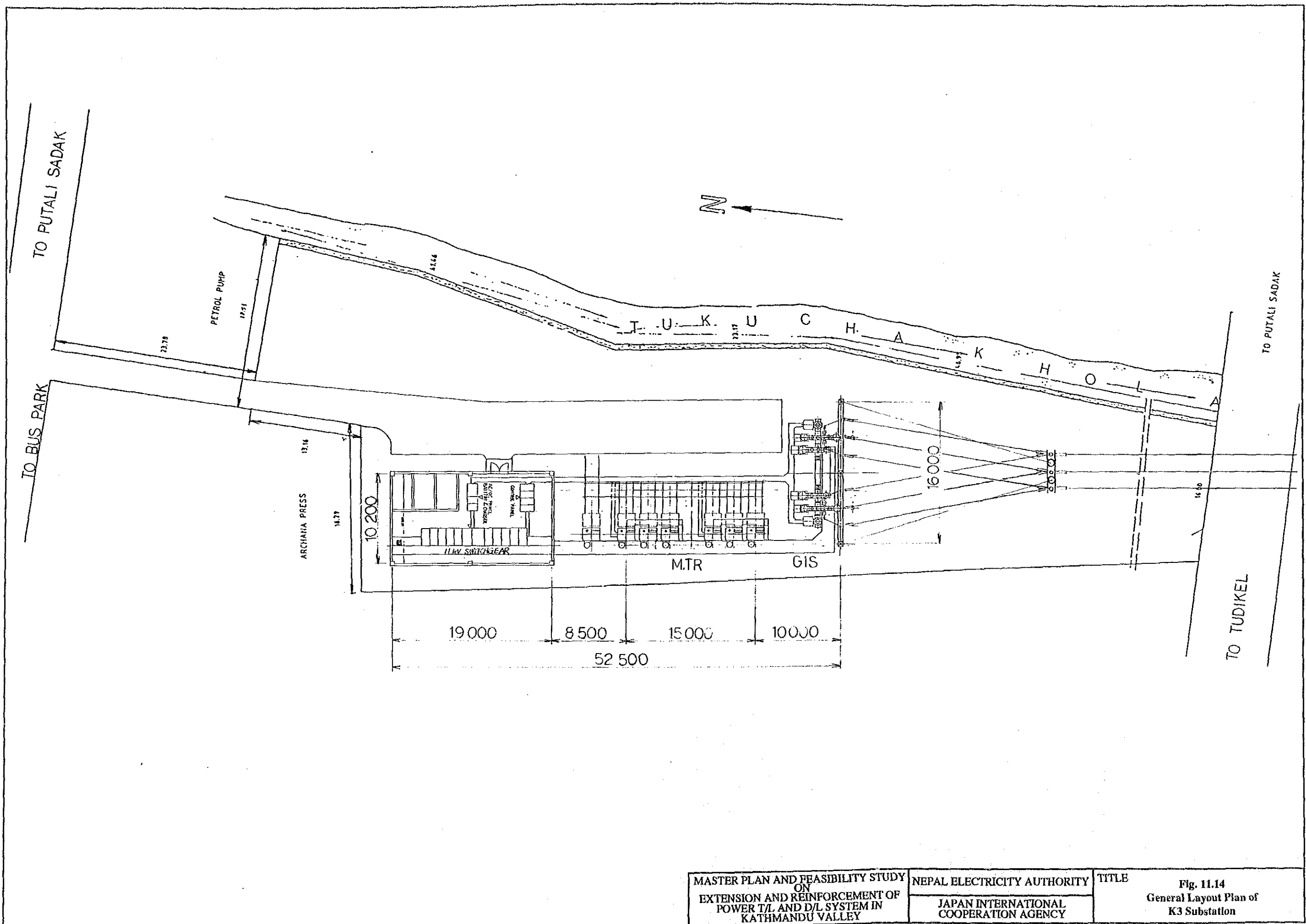
LEGEND	
BCT	BUSHING CURRENT TRANSFORMER
CB	CIRCUIT BREAKER
CCT	COMPENSATING CURRENT TRANSFORMER
CH	CABLE HEAD
CT	CURRENT TRANSFORMER
DS	DISCONNECTING SWITCH
LA	LIGHTNING ARRESTER
MCB	MOLDED CASE CIRCUIT BREAKER
M.T.R	MAIN TRANSFORMER
PT	POTENTIAL TRANSFORMER
PD	POTENTIAL DEVICE
STR	STATION SERVICE TRANSFORMER
A	AC AMMETER
DA	DC AMMETER
VAR	VAR METER
PL	PILOT LAMP
SY	SYNCHRONIZER
V	VOLT METER
DC V	DC VOLT METER
W	WATTMETER
WH	WATTHOURMETER
PF	POWER FACTOR METER
27	UNDER VOLTAGE RELAY
51	OVER CURRENT RELAY
51G	OVER CURRENT GROUND RELAY
87	DIFFERENTIAL RELAY
90	VOLTAGE REGULATE RELAY
PWR	PILOT WIRE RELAY
DFS	DISCONNECTING FUSE SWITCH
CC	COUPLING CAPACITOR
WT	WAVE TRAP

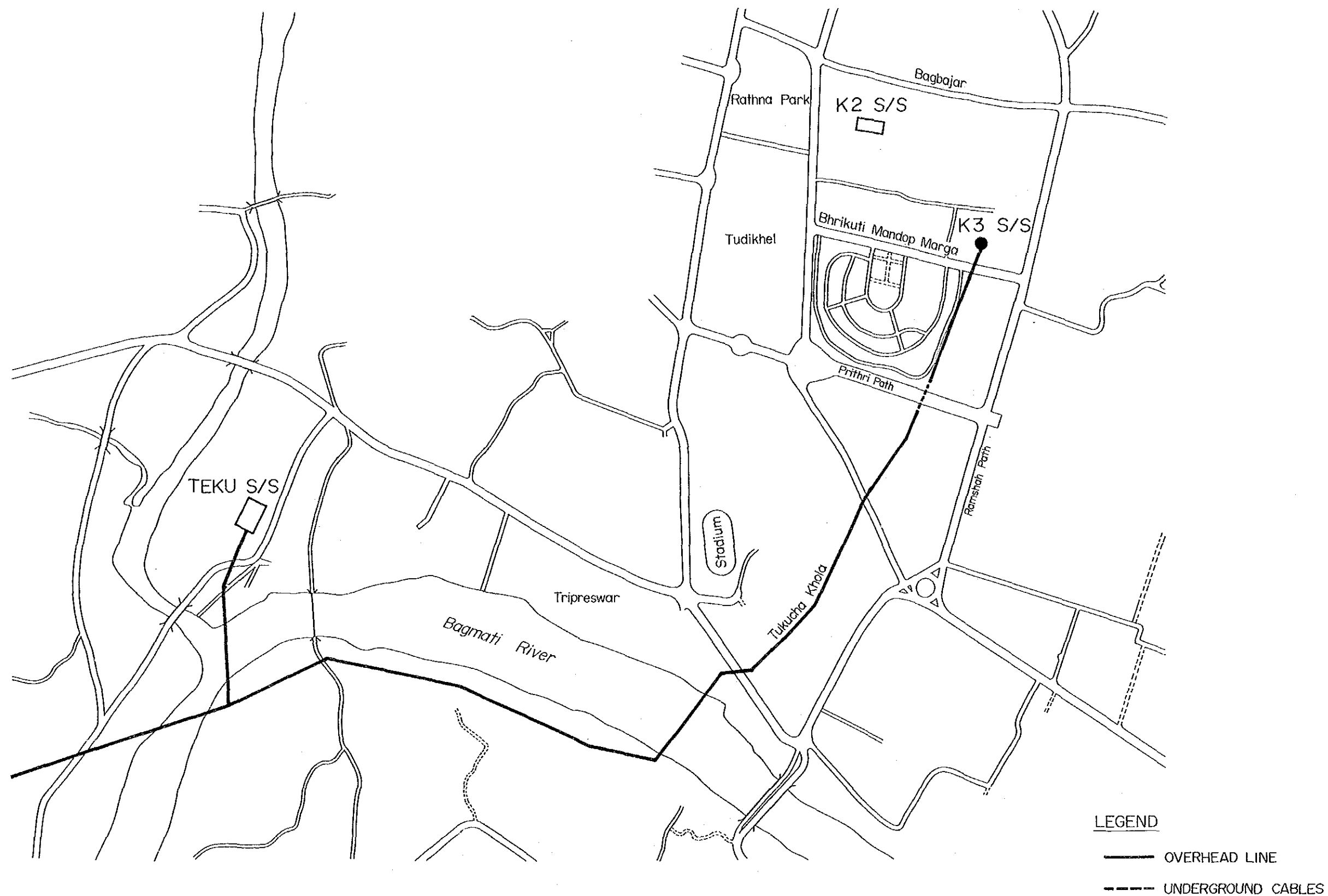


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Fig. 11.13
Single Line Diagram of
K3 Substation



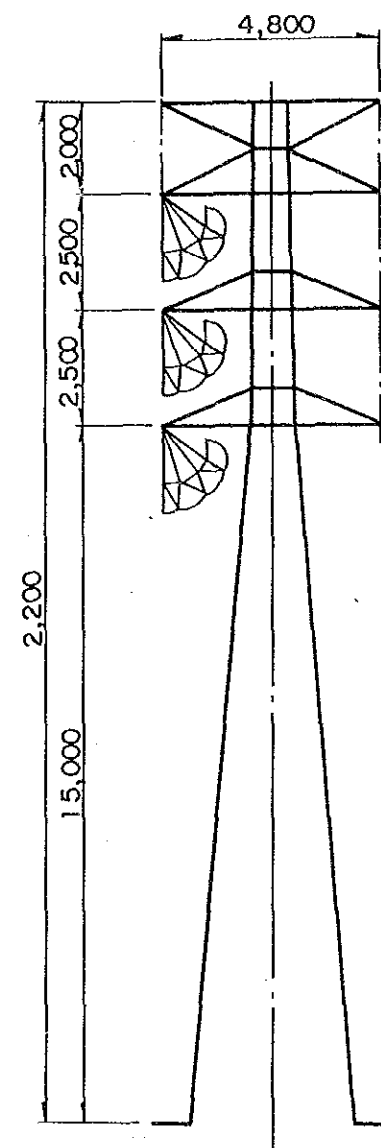


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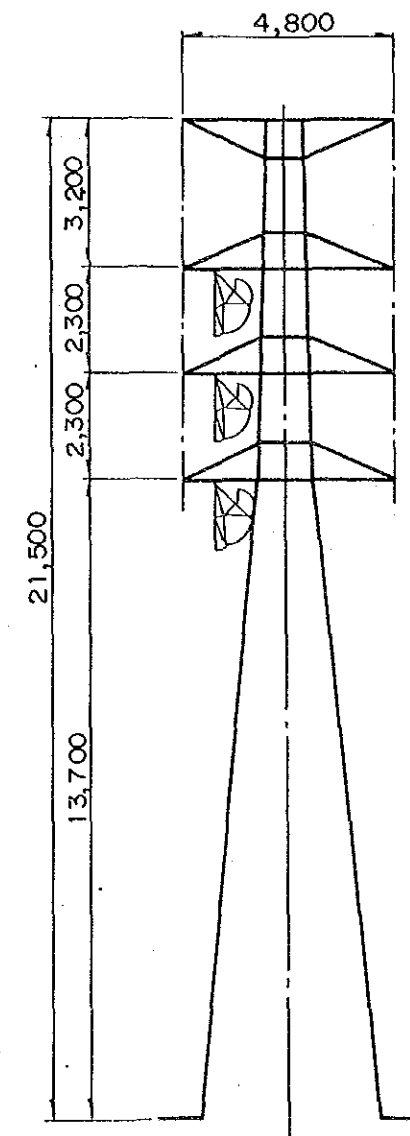
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Fig. 11.15
Route Map of 66kV Teku-K3 Line

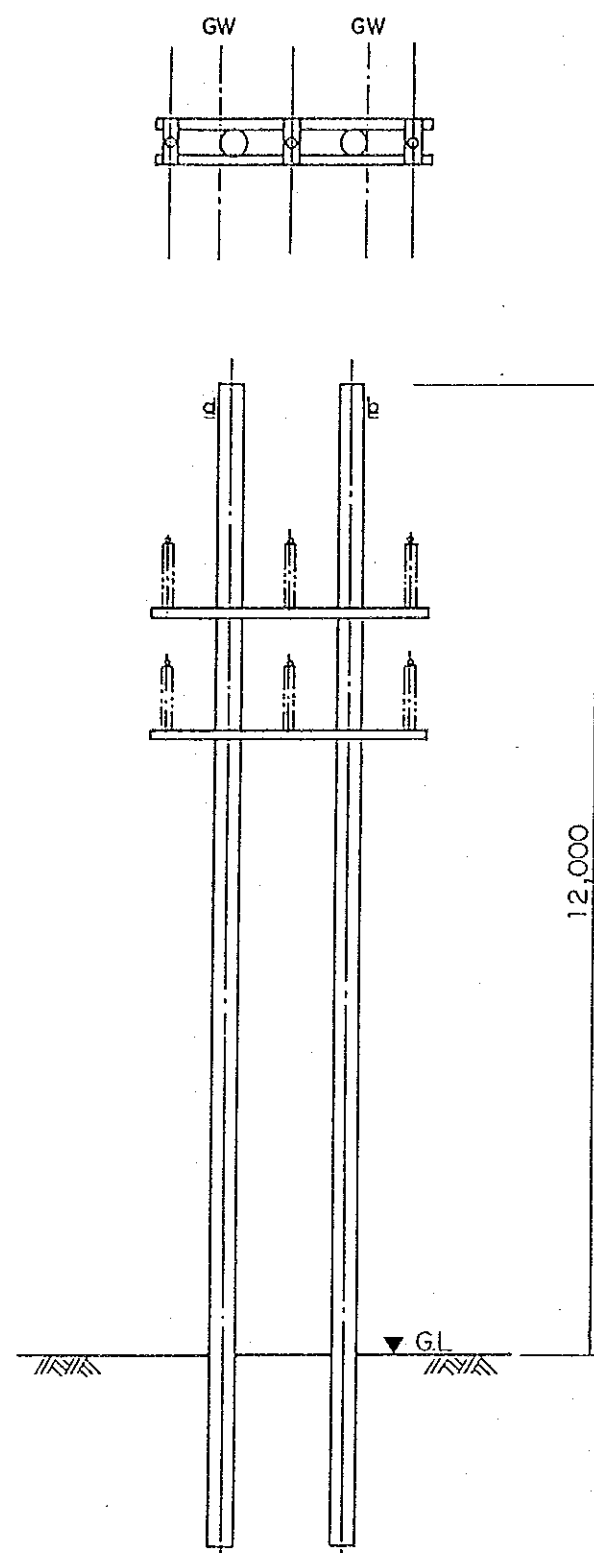


SUSPENSION TYPE

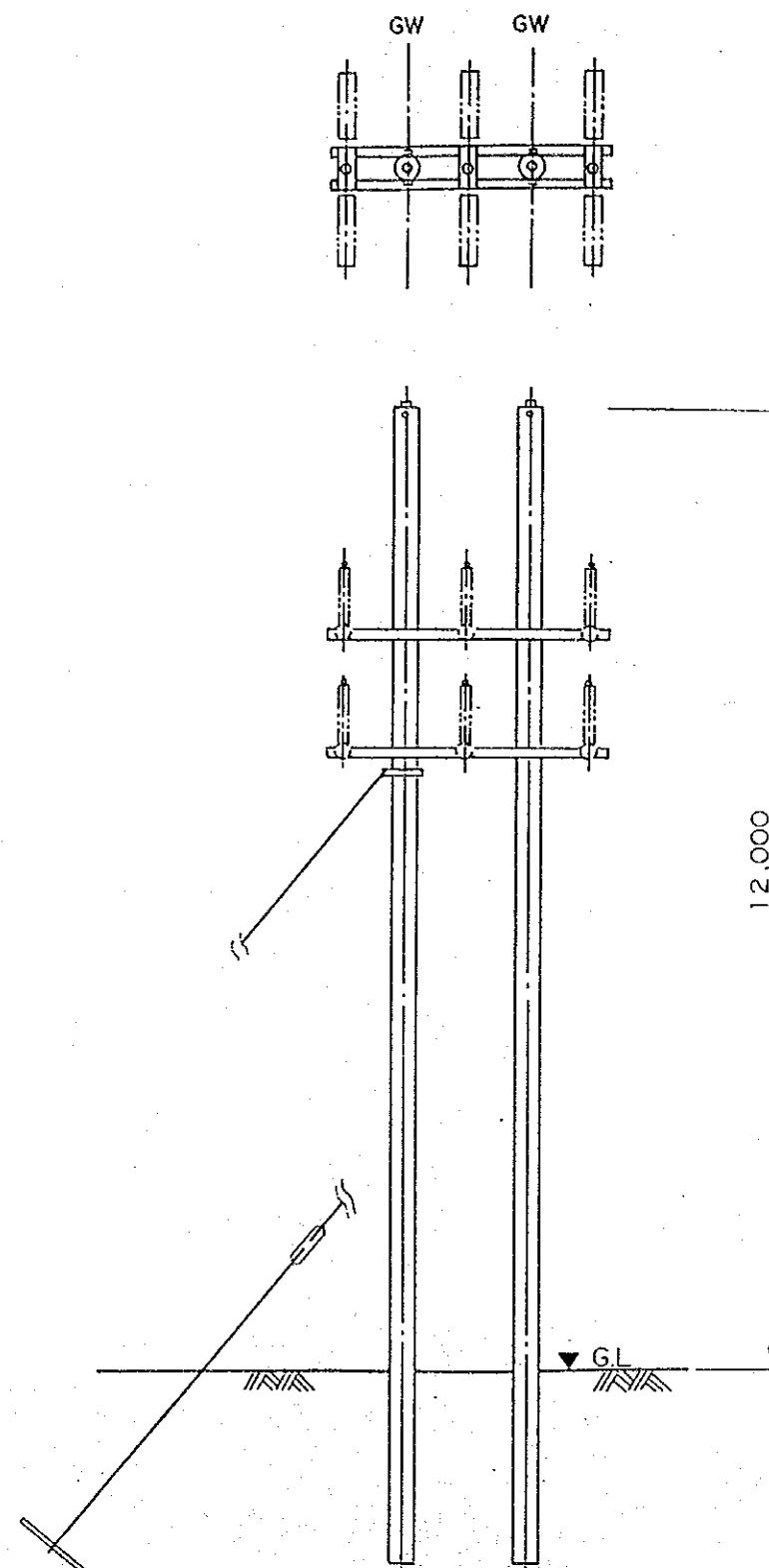


TENSION TYPE

MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY	NEPAL ELECTRICITY AUTHORITY	TITLE Fig. 11.16 Steel Tower of 66kV Transmission Line
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STRAIGHT TYPE



ANGLE TYPE

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TITLE
Fig. 11.17
Steel Pole of 66kV Transmission Line

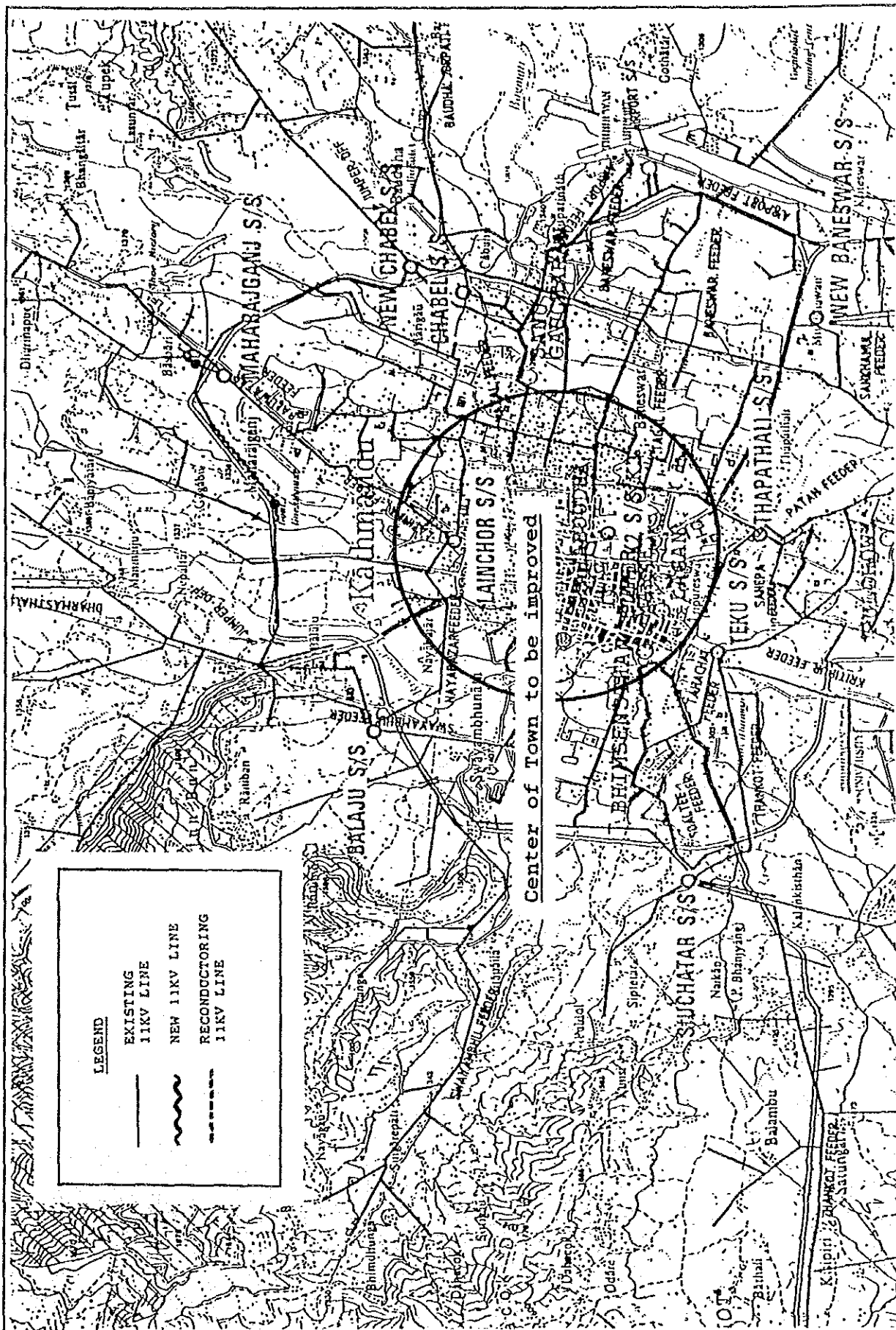
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Y	TITLE
	Fig. 12.1 11kV Distribution System in Kathmandu Valley



<p>MASTER PLAN AND FEASIBILITY STUDY ON EXTENSION AND REINFORCEMENT OF POWER T/L AND D/L SYSTEM IN KATHMANDU VALLEY</p>	<p>NEPAL ELECTRICITY AUTHORITY JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>TITLE Fig. 12.2 Reinforcement Plan in Kathmandu Central Division</p>
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