CHAPTER 2. DESIGN POLICY

The engineering criteria and the design policy, used this time, do not substantially differ from those used in the previous survey. Therefore, those engineering criteria and design policy are not described again in this report. The items newly considered in the design work, this time, are introduced in the following.

2.1 Items Relating to Local Cable System Design

(1) Use of Jelly Filled Cable

Jelly filled cable is to be used for the underground portion of primary cable, pursuant to the criteria of use applicable to stalpeth cable. However, the maximum number of pairs for each conductor size is to be one rank lower than that for stalpeth cable in consideration of jelly filled cable hardness to bending or increase of outer cable diameter due to bending as compared with stalpeth cable.

This is to avoid trouble at the time of cable laying in the existing conduit with places where the radius of curvature is smaller than the normal value. If no trouble takes place after the cable laying, the transfer to multipair cable should be made gradually in the later series of cable work.

1) Type of Cable to be Used

Cable of the undermentioned construction is scheduled to be used.

a. Conductor insulation: Foam skin insulation
b. Electrical characteristics: The same as electrical characteristics of stalpeth cable used at present
c. Cable sheath: Aluminium bonded, PE sheath

2) Number of Pairs

Conductor Size (ømm)	Number of Pairs							
0.4	3000	2400	1800	1200	900	600	300	100
0.5				1200	900	600	300	100
0.65					900	600	300	100
0.9							300	100

(2) Criteria of Use Ready Access Terminal and Stub Terminal

Cable terminals for aerial line are to be used ready access terminal and stub terminal. The criteria of use applicable to them are as follows:

1) Ready access terminal is to be used in the section where a small number of aerial lines (1-2 cables) are installed and in the area where the damage to cable by ants is unlikely.
2) Stub terminal is to be used in the section where a large number of aerial lines are installed and in the area the damage to cable by ants is likely.

(3) Low Guy

For low guys, TOT used in many cases the guy rods established by MEA. However, in and after the current design, the shared use of guy rods by MEA and TOT is to be discontinued because the use of separate buy rods for power lines and telephone lines is preferable from the viewpoint of maintenance.

Guys already installed by the shared use of MEA's guy rods will continue to be used if there is no change in the design of facilities.

(4) Pulling-Box in Front of Cross-Connecting Cabinet

The connection of stub cable to be entered into the cross-connecting cabinet is made in the pulling-box. However, in case the manhole is located near the cross-connecting cabinet, stub cable is entered directly into the manhole for connection.

The conclusion reached this time is that, considering the surface traffic volume over the main conduit or the need for water pumping at the time of cable connection, it is more advisable to establish the pulling-box at the road side near the cross-connecting cabinet. Thus, beginning this time, the pulling-boxes are to be established in front of all cross-connecting cabinets.

2.2 Items Relating to Civil Work Design

(1) Branch Duct for Cable Rising from Main Conduit

In the past, at the time of main conduit construction, the spare branch duct for cable rising was also constructed. Beginning with the current design, this practice is to be discontinued and, instead, the duct window is to be established for the manhole concerned.

(2) Conduit Crossing of Road by Pushing Method

The conventional method to have the underground conduit cross the road was to excavate the road surface and lay the conduit in the excavation. However, beginning with the current design, the pushing method is to be adopted in lieu of the road surface excavation.

(3) The type of conduit to be laid in the waterway is to be determined later by TOT. Therefore, the type of such conduit is not indicated in the conduit design drawing.

(4) The standard design for waterway crossing of the underground conduit is to use the private bridge for telephone cable. The bridge is of construction to support the conduit directly by the bridge piers.

In case the interval between the supporting points (bridge piers) of the conduit is more than 7m, the bridge is to be designed as the combination bridge with ϕ12mm iron bars

elded around the conduit (steel pipe) in order to increase the moment of inertia.

If the interval between the supporting points of the conduit is less than 7m, the welding of iron bars around the conduit is not necessary.

The calculation of deflection to determine the type of bridge is given below.

Calculation of Deflection of less than 7.0m

a. Design Conditions

i) Kind of Pipe ..... ϕ4" GIP Unit weight: W_P=12.4 kg/m

ii) Kind of Cable .... 0.4-2400P Unit weight: W_C=8.7 kg/m

iii) D: Outer diameter of pipe

Max = 114.9mm Min = 113.3mm

iv) d: Inner diameter of pipe

Max = 105.9mm Min = 104.3mm

v) Allowable deflection ..... Y = ℓ/300cm

vi) E: Modulus of elasticity ... 2,100,000 = 2.1 x 10^6

b. Moment of Inertia of Pipe, Ix(cm^4)

$Ix = 0.049\ (D^4 - d^4)$

For outer and inner diameters of pipe, the mean value between maximum and minimum values is used.

$$D = \frac{114.9 + 113.3}{2} = 114.1\text{mm}$$

$$d = \frac{105.9 + 104.3}{2} = 105.1\text{mm}$$

$Ix = 0.049(11.41^4 - 10.51^4) = 232.6\text{cm}^4$

Note: Ix of the jointed portion of pipe is 70%.

c. Deflection

$$y = \frac{5w\ell^4}{384EIx}$$

Weight of pipe: W_P = 12.4 kg/m ℓ = 7.0m = 700cm

Weight of cable: W_C = 8.7 kg/m

$W_P + W_C$ = 0.211 kg/m

$$y = \frac{5 \times 0.211 \times 700^4}{384 \times 2.1 \times 10^6 \times 232.6 \times 0.7} = 1.82$$

$$1.82\text{cm} < \frac{\ell}{300} = \frac{700}{300} = 2.33\text{cm}$$

Therefore, in the case of deflection of less than 7.0m, the pipe without iron bars welded around it ensures full safety.

CHAPTER 3. METHOD OF INTEGRATION

3.1 Total Work Processes

(1) Total work processes were counted on the basis of TOT's aseembly units.

(2) Work processes are divided into primary cable work process and secondary cable work process. Civil work process is included in primary cable work process.

(3) Jelly filled cable assembly unit abbreviation has not yet been determined. Therefore, jelly filled cable is entered as AP-FSF Cable in the Remarks column.

(4) The type of cross-connecting cabinet to be newly installed is still undecided. Therefore, the total number of stub cable splicing works has not yet been counted.

3.2 Quantities of Materials Required

For materials required in primary cable work, the quantities of main materials only were counted, because the work is scheduled to be performed on contract basis.

For jelly filled cable splicing materials, the quantities required according to the shapes of splicing points were counted. This is because the standard splicing practice has not yet been established.

For the counting of materials required in secondary cable work, TOT's work materials records were used. This was in compliance with TOT's request.

Civil work materials are excluded from the total quantities required because the work is to be performed on contract basis. However, the quantities of cable racks and hooks to be provided in the manholes were counted.

PART IV DETAILED DESIGN OF EACH EXCHANGE

CHAPTER 1. PLOENCHIT TELEPHONE EXCHANGE

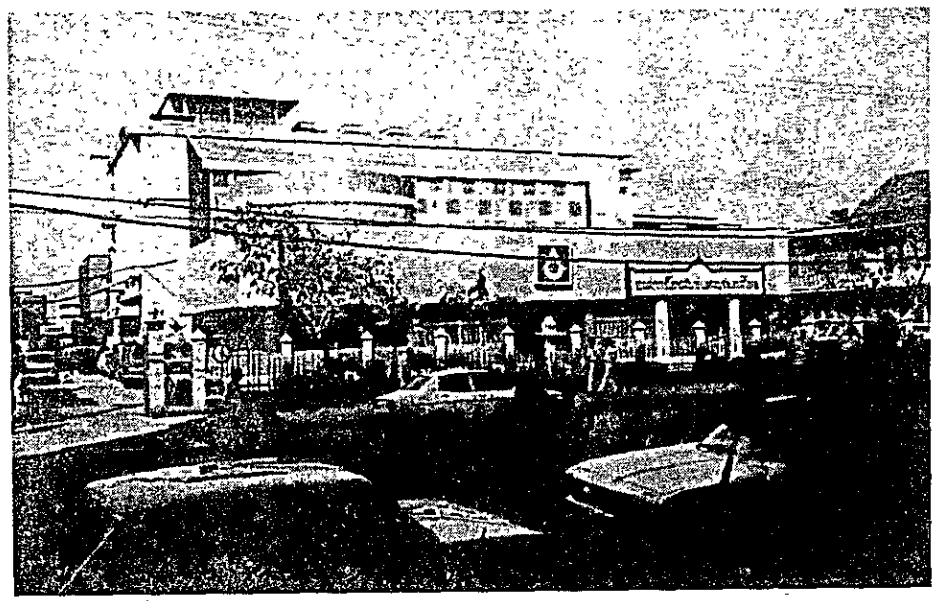
CONTENTS

CHAPTER 1. PLOENCHIT TELEPHONE EXCHANGE

1.1 Service Area

The Ploenchit Telephone Exchange is located in the central part of Bangkok City. The northern boundary of its service area is the Thai National Railways' Bangkok-Aranyaprathet line. On the east the service area adjoins that of the Sukhumvit Telephone Exchange (at present, the Chaiyapruk Telephone Exchange). On the south is the Rama IV Road which is the boundary with the service area of the Thung Mahamek Telephone Exchange, and on the west is the Phyathai Road which is the boundary with the service area of the Pathumwan Telephone Exchange.

The Pathumwan Telephone Exchange is scheduled to come into service in 1979 and the Sukhumvit Telephone Exchange is to be opened in the Package I, Phase II, work.



Ploenchit Exchange

1.2 Demand Potential and Locational Features

The Ploenchit area is an area with the highest demand density in the city of Bangkok though it comprises several low demand density sectors. Among those low demand density sectors are the high grade residential quarters along the Sukhumvit Road, the green belt zones including Lumpini Park and Horse Race Ground, and such public institutions as Chulalongkorn University and Chulalongkorn Hospital.

However, the high grade residential quarters are being rebuilt into tall apartment houses in many places. Schools and hospitals, though each is a limited area with low demand density, belong to the special demand area where large capacity entrance cables are required.

In full consideration of such high density and low density special demands, the demand distribution map was formulated and, based on this demand distribution, the future demand potential was forecasted. The general demand forecast is given in Table 4.1.1 and the special demand forecast in Table 4.1.2.

Table 4.1.1 General Demand Forecast

	1981	1986	1991
Demand	18,622	35,650	59,500
Growth rate	100.0	191.4	319.5

Table 4.1.2 Special Demand Forecast

Name of Building or Location	Numerical Demand Evaluation			Remarks
	Present (1981)	Intermediate (1986)	Ultimate (1991)	
Siam Mansion	24	24	24	
B & P Building	20	30	50	
Firestone Building	10	15	20	
Chavalit Hotel	30	37	45	
Ambassador Hotel	50	60	70	
Federal Hotel	13	17	20	
Chan House	7	13	15	

(to be cont'd)

Name of Building or Location	Numerical Demand Evaluation Present (1981)	Intermediate (1986)	Ultimate (1991)	Remarks
Bangkok Bank	10	15	20	
555 Hotel	12	15	20	
Krung Thep Sahakol Co.	30	40	50	
Park Hotel	20	33	30	
Nai Lerd Building	80	100	125	
Fortuna Hotel	40	45	50	
Thaweesuk Hotel	10	18	25	
Grace Hotel	20	25	30	
Pakistan Embassy	12	18	25	
The Fellowship of Buddhist	10	13	15	
Piyatham Court	55	60	70	
Uthai Court	20	30	40	
Imperial Hotel	22	30	40	
Ruam Rudee Houses	15	20	30	
Kian Guan Building	120	150	200	
B.O.A.C.	50	70	100	
Co-operative Store	61	70	100	
Rajdamri Arcade	473	550	600	
Bangkok Bazaar Arcade	70	260	300	
Bangkok Bazaar Arcade	89	280	355	
Dentist Chula University	11	61	70	
Siam Center	500	600	600	
Bangkok Apartment	10	20	30	
Indonesia Embassy	10	20	25	
Thai Commercial Bank (HO)	55	150	200	
Pratunam Trade Center	0	500	500	
Pechburi Trade Center				
President Hotel	62	82	100	
Policy Hospital	27	47	60	
Race Course	15	25	30	
Pharmacy Party (Chula Univ.)	4	14	20	
Srinakarinviroj University	5	30	50	

(to be cont'd)

Name of Building or Location	Numerical Demand Evaluation Present (1981)	Intermediate (1986)	Ultimate (1991)	Remarks
Sumisho Development (Thailand) Co., Ltd.	57	67	100	
A.U.A.	8	10	20	
Shell Building	120	220	300	
General Finance Corporation	15	25	50	
Residence (Wireless Rd.)	0	34	50	
Nava Vechkij Hospital	12	22	50	
Town House	0	30	50	
Bank of Ayuthya (HO)	200	300	350	
Shopping	50	150	200	
Building	0	21	30	
Oska Apartment	3	13	20	
Bankgok Sahakol Building	18	28	30	
U.S. Embassy	61	81	100	
Court (Wireless Rd.)	13	15	20	
Nana Hotel	12	22	30	
Raja Hotel	15	55	65	
New House (Sukhumvit #6)	0	12	20	
New Shopping (Sukhumvit #9)	0	52	60	
Chulalongkorn Hospital	69	89	100	
The Thai Red Cross Society	10	15	15	
High School (Phyathai Rd.)	11	25	30	
Housing (Sukhumvit #4)	0	17	20	
Voratin Technology Institute (Phyathai Rd.)	2	10	30	
New Imperial Hotel	13	33	50	
V.S. Apartment (Sukhumvit (Sukhumvit #6)	12	28	30	
New Shopping (Pechburi Rd.)	0	50	65	
House Police	6	64	70	
Thai Army	0	20	50	
Thailand Tobacco Monopoly (Rama IV)	21	45	70	

(to be cont'd)

Name of Building or Location	Numerical Demand Evaluation Present (1981)	Intermediate (1986)	Ultimate (1991)	Remarks
ETO Office	15	20	30	
Boxing Stadium	5	10	20	
Christiani & Nielson (Thai) Co., Ltd.	15	20	25	
Siam Hotel	19	23	25	
Japanese Embassy	25	35	50	
Diethelm Co., Ltd.	15	20	25	
B. R. Building	18	20	30	
Donbosco Technical School	5	7	10	
B. Grimm & Co.	15	17	25	
3M Company	57	60	70	
Prince Hotel	6	20	25	
Vimol Court	19	22	26	
Crown Bowl	9	12	16	
Railway Hospital	7	10	15	
Kai Check Chon Building	11	15	100	
Government Bank	8	10	15	
Villa Apartment	37	37	37	
International School	10	15	20	
Ratana Court	16	16	16	

1.3 Primary Cable Network Design

1.3.1 Entrance Cable

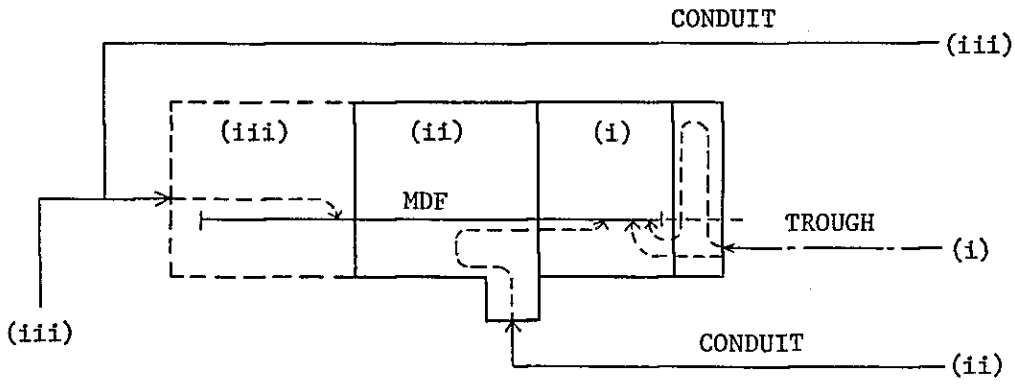
(1) Existing and New Entrance Cables

The Ploenchit Exchange entrance cables are to be installed in three directions.

(i) Lead-in by trough at the initial stage, i.e., at the time of the exchange service-in.

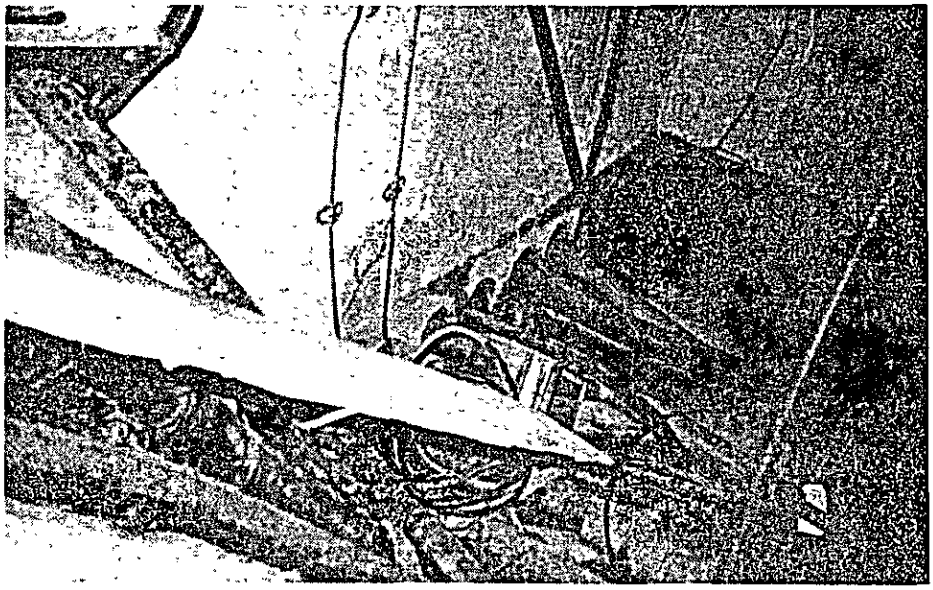
(ii) Lead-in by duct into the cable vault of the new exchange building at the time of the transfer to the crossbar system.

(iii) Lead-in by duct into the cable vault of the exchange building annex to be built in the current project.

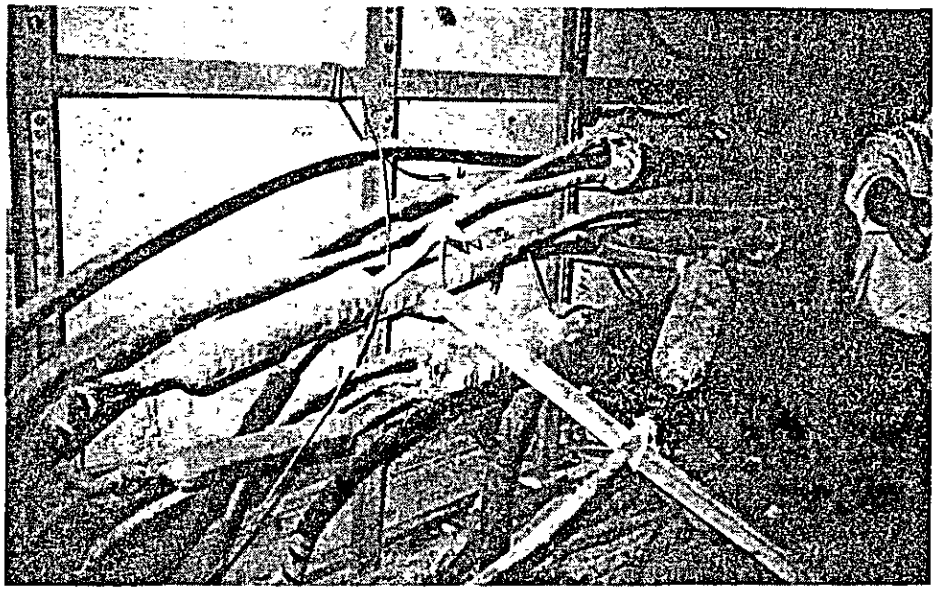


The trough cable referred to in (i) above was installed a long time ago so that the number of pairs is small and the gas pressurization for maintenance is not carried out. Therefore, this trough cable is to be replaced with the multipair duct cable in the current design. However, the existing conduit in the direction of Rama I Road is completely occupied and the new cable route excavation is also impracticable, so that the trough cable installed in this section is to be replaced when the new/additional conduit will be built in the future.

With regard to the lead-in by duct as per (ii) above, cables are congested in the neighborhood of the duct entrance so that the laying of new cable is difficult. (Refer to Table 4.1.3) Therefore, in this design, the new cable is to be led into the new cable vault as per (iii) above and terminated at MDF in the exchange building annex.



Old entrance cables lead-in by trough



Small size trough cables is to be replaced
in this project

Table 4.1.3 Number of Pairs of Entrance Cables

Type of Cable		Number of Cable Lines				Remarks
		Existing	Newly Laid	Withdrawn	Total	
3000-.4 ASP		5			5	
3000-.4 AP-FSF			3		3	
2700-.4 ASP		1			1	
2400-.4 ASP		2			2	
2400-.4 AP-FSF			1		1	
1800-.4 ASP		4			4	
1500-.4 ASP		3			3	
1200-.4 ASP		3		2	1	Lead-in by trough
900-.4 ASP		1		1	0	"
600-.65 ASP		1		1	0	"
300-.4 ASP		1			1	
300-.4 AP		1			1	
300-.4 LTJ		1		1	0	Lead-in by trough
200-.4 AP		1		1	0	Aerial lead-in
200-.9 LTJ		1			1	
100-.4 AP		3		3	0	Aerial lead-in
Total	No. of Cable Lines	28	4	9	23	
	No. of Pairs	40,900	11,400	4,700	47,600	

(2) Method of Subscriber Re-Accommodation to Primary Cable

For the immediate future, it is desirable to so arrange that the existing cables do accommodate the subscribers with the existing exchange codes of 251XXXX and 252XXXX and the newly laid cables do accommodate the subscribers of the new switching equipment to be additionally installed this time. Considering, however, that by the cut-over of the newly laid cables (30, 31, 32 and 33) the existing subscribers will be accommodated in the newly installed MDF, it becomes necessary to avoid the congestion of jumper wires to connect the existing circuits to the existing exchange MDF, and, for this

purpose, the tie cables are to be installed between the existing and new exchanges instead of changing the telephone numbers.

(3) Type of MDF

The existing MDF consists of the combined distribution frame. It uses 258R terminal blocks in the lower six steps and 600 pairs per vertical are terminated at these terminal blocks.

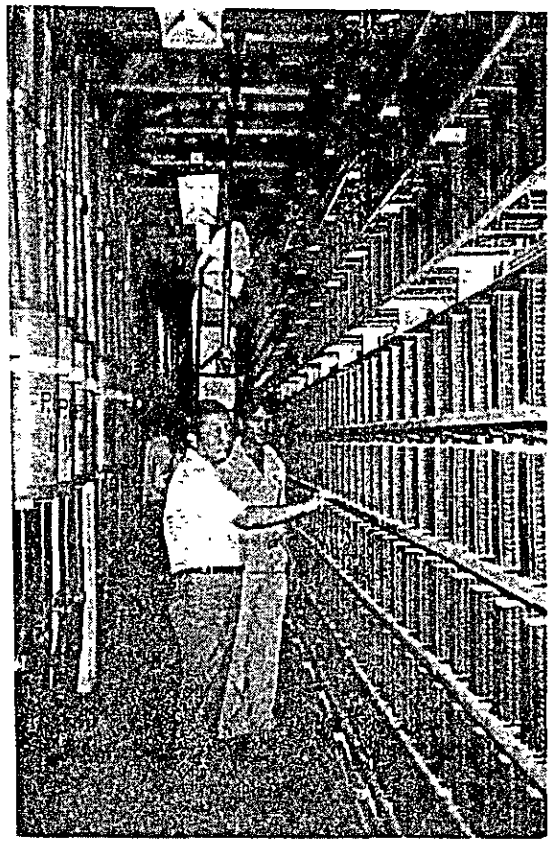
The type of MDF to be used in the new exchange cannot be specified because the type of switching equipment to be installed has not yet been decided. In this design, it is premised that the same combined distribution frame as the existing facility that terminates 600 pairs per vertical will be adopted.

(4) Number of Pairs of Tie Cable

The existing circuits to be accommodated in the newly laid cables by the cut-over referred to in the foregoing paragraph (2) number approximately 4,800. If the existing telephone numbers are used without change on these circuits, the tie cables have to be installed between the existing and new MDFs.

In this design, the 6,000-pair tie cables are to be installed in consideration of the abovementioned existing circuits and the circuits to be accommodated in the new exchange by way of the existing exchange.

However, if all the circuits cut over to the newly laid cables are to be accommodated in the switching equipment of the new exchange, only a small quantity of tie cables will be required to cater for miscellaneous circuits.



MDF investigation

1.3.2 New Cable Laying in Various Directions

(1) General

The outside plant in the Ploenchit Exchange service area is to be increased in the 1972-1979 project, but the start of installation work is being delayed. This design is for additional outside plant installation after the 1972-1979 project.

After the completion of the said 1972-1979 project, there will be no need for additional cable laying to a great extent.

This design is for additional cable laying in the directions of Sukhumvit Road, New Phetchaburi Road and Rajadamri Road. Furthermore, the lead sheathed cables (Nos. 04, 07, 08, 09 and 26) installed on the Sukhumvit Road sidewalks will be replaced with multipair cables in the current project.

(2) Rama 1 Road Direction

Cabling work in the direction of Rama 1 Road will be carried out, using Nos. 02, 15 and 16 cables installed in the direction of the Pathumgwan Exchange, contiguous to the Ploenchit Exchange, with the opening of that exchange.

However, the conduit route in this direction will have spare ducts decreased after the installation of junction lines, so that No. 15 cable (2100-.4 ASP) laid between No. 081 and No. 084 manholes will be withdrawn.

(3) Rajadamri Road Direction

The six-line conduit on Rajadamri Road is completely occupied at present. Feeder cables in the direction of Rajadamri Road are installed by troughs on sidewalks and temporary aerial line from the rear gate of the TOT Building besides the main conduit.

In this design, a conduit is to be newly built on the private road in front of the rear gate of the TOT Building and this conduit is to be connected to Rajadamri Road. In this conduit, one cable line of 3,000 pairs will be laid to provide cabling for the shopping quarters centering upon Thai Daimaru.

By this arrangement the aerial cable and the trough cables can be withdrawn.

(4) Sukhumvit Road Direction

The telephone demand increase is expected in the direction of Sukhumvit Road. Therefore, in this design, 5,400 pairs are to be additionally installed. New cabling will be

performed separately on the northern and southern sides of Sukhumvit Road.

a. On the northern side of Sukhumvit Road, 2,400 pairs of No. 30 cable are to be newly installed and the trough cable on the sidewalk is to be withdrawn.
b. On the southern side of Sukhumvit Road, 3,000 pairs of No. 32 cable are to be newly installed in order to cater for the demand in this direction.

(5) New Phetchaburi Road Direction

In the direction of Thidolom Road, there is only one idle conduit. To cope with this situation, the existing No. 17 cable of 900 pairs will be withdrawn and No. 33 cable of 3,000 pairs will be newly installed.

1.3.3 Selection of Aerial Cable Route

In the small-pair sections of the primary cable area or in the places where the road surface excavation is impossible, the aerial cable route will be established.

(1) Phetchaburi Road CAB No. 223 (300 pairs)

The road is concrete paved so that the excavation is impossible. Aerial cable will be installed, using the MEA poles.

(2) Soi Langsuan (Rama 1 Road) CAB No. 217 (600 pairs)

The sidewalk is narrow so that the road excavation is impossible. The existing aerial cable of 300 pairs will be replaced with 600 pairs for feeder to CAB Nos. 147 and 217.

(3) Ploenchit Road CAB No. 219 (300 pairs)

Aerial cable will be installed, using the MEA poles.

(4) Sukhumvit Road CAB No. 220 (300 pairs)

The number of pairs is small and the shared use of MEA poles is possible, so that aerial cable will be installed.

1.3.4 Line Loss and DC Resistance

For all subscribers in the Ploenchit Exchange service area, the line loss and the d.c. resistance are within the limit values prescribed in the transmission sheet.

1.4 Design of Underground Conduit

1.4.1 Design of TOT's Internal Facilities

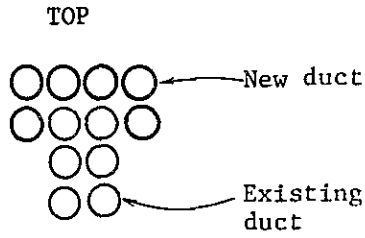
(1) The design of cable vault and entrance manhole of the new exchange building was made by TOT.

(2) To connect the direct buried primary cable to the cross-connecting cabinets Nos. 080 and 081 through the entrance manhole, the pulling box No. 182 is to be established.

1.4.2 Rajadamri Road Direction

(1) The Rajadamri Road conduit expansion will be made by connecting the newly installed conduit from the rear gate of the TOT premises to the new manhole No. 107 to be established between manholes Nos. 033 and 034.

The existing conduit is shallowly buried so that the new conduit should be arranged as illustrated below.



(2) The pulling box No. 050 is of JUF-6 type and is not fit to accommodate newly laid cables so that it is to be remodelled to JUF-11 type.

1.4.3 New Phetchaburi Road Direction

The conduit is to be extended from the pulling box No. 174 on the sidewalk at the northern side of New Phetchaburi Road and to be connected to the pulling box No. 031.

The conduit crossing the railway below it is to be laid by the pushing method. For the portion of conduit crossing the railway, the GIP pipe is to be used. (4 ducts, 24m)

There is a plan to construct a highway along the railway. Although this highway is an elevated highway, the position of piers does not adversely affect the position of conduit to be newly laid by this design.

1.4.4 Sukhumvit Road Direction

In order to withdraw in this project the trough cables on the sidewalk at the northern side of Sukhumvit Road, it is so designed that the pulling box will be newly established in the neighborhood of each cross-connecting cabinet and each pulling box will embrace the trough cable.

In this case, the number of conduit lines between the pulling box and the cross-connecting cabinet is four according to the standard design. However, at the locations specified below, where the existing stub cable poses difficulty to the conduit lead-in, the number of conduit lines is set at two.

PB No. 190 - CAB No. 158
PB No. 191 - CAB No. 168
PB No. 192 - CAB No. 169
PB No. 194 - CAB No. 176

1.5 Design of Gas Pressurization Facilities

1.5.1 General

(1) Beginning with this project, jelly filled cable will be used as the conduit cable. There is no cable to be newly gas-pressurized this time.

(2) To the gas cable to be connected to the newly installed jelly filled cable, gas must be supplied from the existing gas pressurized cable by use of the bypass valve.

1.5.2 Design of Internal Gas Pressurization Facilities

Jelly filled cables Nos. 32 and 33 have the existing stalpeth cable connected to them in their terminal portion.

The alarm circuits of these pressurized cables are to be accommodated on the alarm panel in the exchange, using the conductors of those jelly filled cables.

1.5.3 Design of Outside Gas Pressurization Facilities

(1) Fixing of Bypass Valve

The existing stalpeth cable to be connected to the newly installed jelly filled cable must be gas-pressurized.

In order to supply gas to such stalpeth cable in the manhole or the pulling box from other gas-pressurized cable, the bypass valve is to be established and connected to the stalpeth cable by the gas pipe.

(2) Establishment of Moisture-Proof Gas Dam

At the point where the plastic-insulated cable and the paper-insulated cable are connected, the moisture-proof gas dam must be established.

This time, it is so designed that, in case the stalpeth cable is branched from the jelly filled cable, the branch stub cable of the jelly filled cable will be taken out from the main cable and the stalpeth cable will be connected to such branch stub cable.

1.6 Secondary Cable Network Design

(1) General

This design is for cable network expansion based on the evaluation of network performance after the completion of the 1972-1977 project.

(2) Design of CAB Nos. 199, 200, 221 and 203 Area

In this area, the construction of large-scale commercial quarters is planned. This design is a desk design based on that construction plan.

When the commercial quarters construction work has been completed and, as the result, the cable work execution period has been advanced, TOT will carry out the cable work in accordance with this design.

(3) CAB Nos. 107 and 216 near the Ploenchit Exchange were scheduled to be newly established in the 1972-1977 project, but the plan was suspended. Therefore, the establishment of these cross-connecting cabinets is taken up anew in this design.

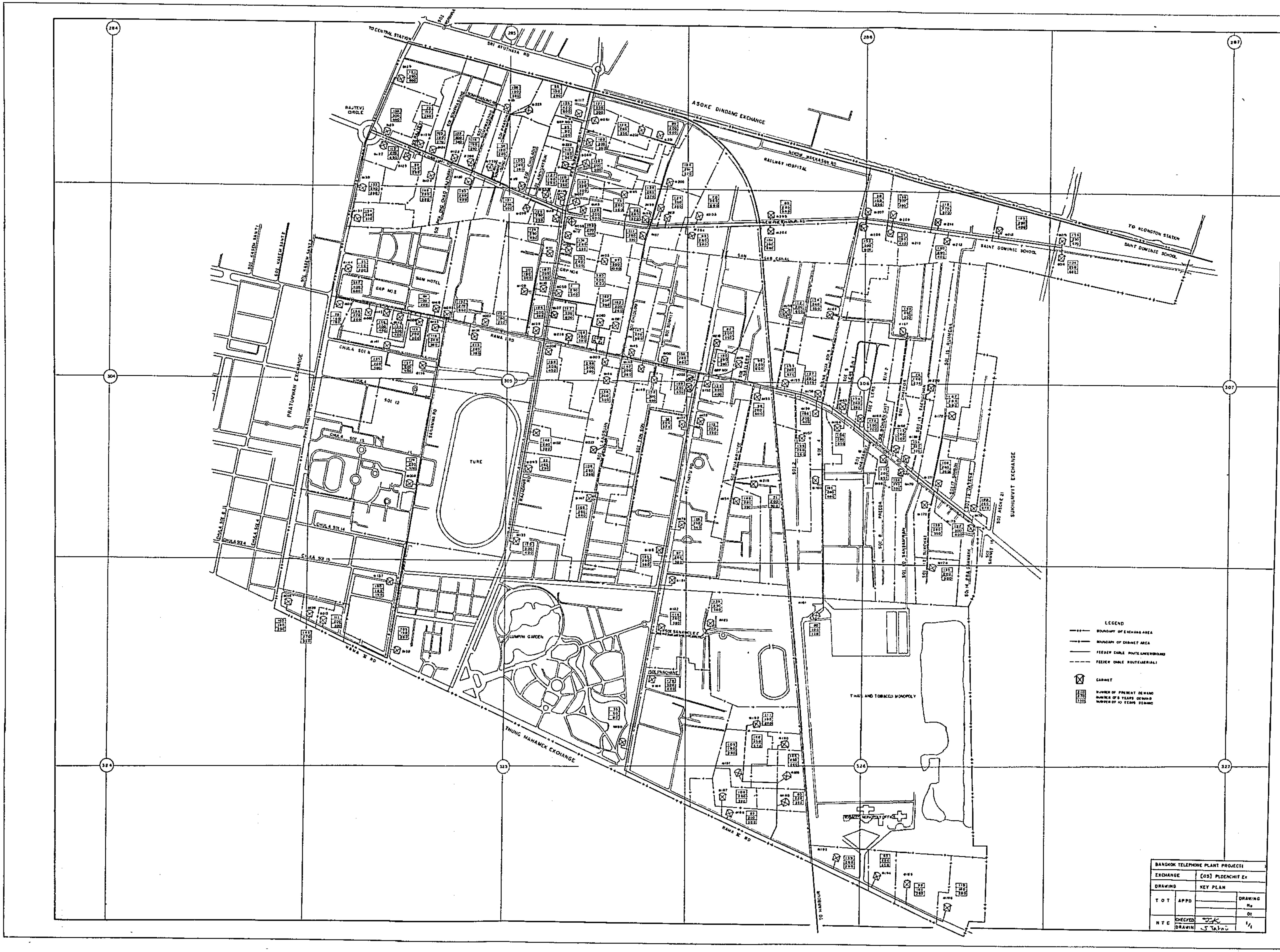
1.7 Amount of Construction Work

AMOUNT OF CONSTRUCTION WORK

SECTION	DESIGNATION	UNIT	QUANTITY			REMARKS
			PRIMARY	SECONDARY	TOTAL	
A	A - 8	ea	2	1	3	
B	B1BS	ea	3	4	7	
	B1CS	"	2		2	
	B1FS	"	1	7	8	
	Section "B" Total	"	6	11	17	
C	C5A2B	ea	5	11	16	
E	E 25 · 4 A2	100m		5.7	5.7	
	E 50 · 4 A2	"		5.5	5.5	
	E 100 · 4 A2	"		8.6	8.6	
	E 200 · 4 A2	"		7.6	7.6	
	E 300 · 4 A2	"	11.7	4.7	16.4	
	E 600 · 4 A2	"	3.7		3.7	
	Section "E" Total	"	15.4	32.1	47.5	
F	F 100 · 4	100m		0.4	0.4	AP-FSF Cable
	F 300 · 4	"		0.4	0.4	
	Section "F" Total	"		0.8	0.8	
G	G 300 · 4	100m	2.8		2.8	AP-FSF Cable
	G 600 · 4	"	13.9		13.9	"
	G 900 · 4	"	6.7		6.7	"
	G1200 · 4	"	4.9		4.9	"
	G1500 · 4	"	0.4		0.4	"
	G1800 · 4	"	13.4		13.4	"
	G2400 · 4	"	13.9		13.9	"
	G3000 · 4	"	19.7		19.7	"

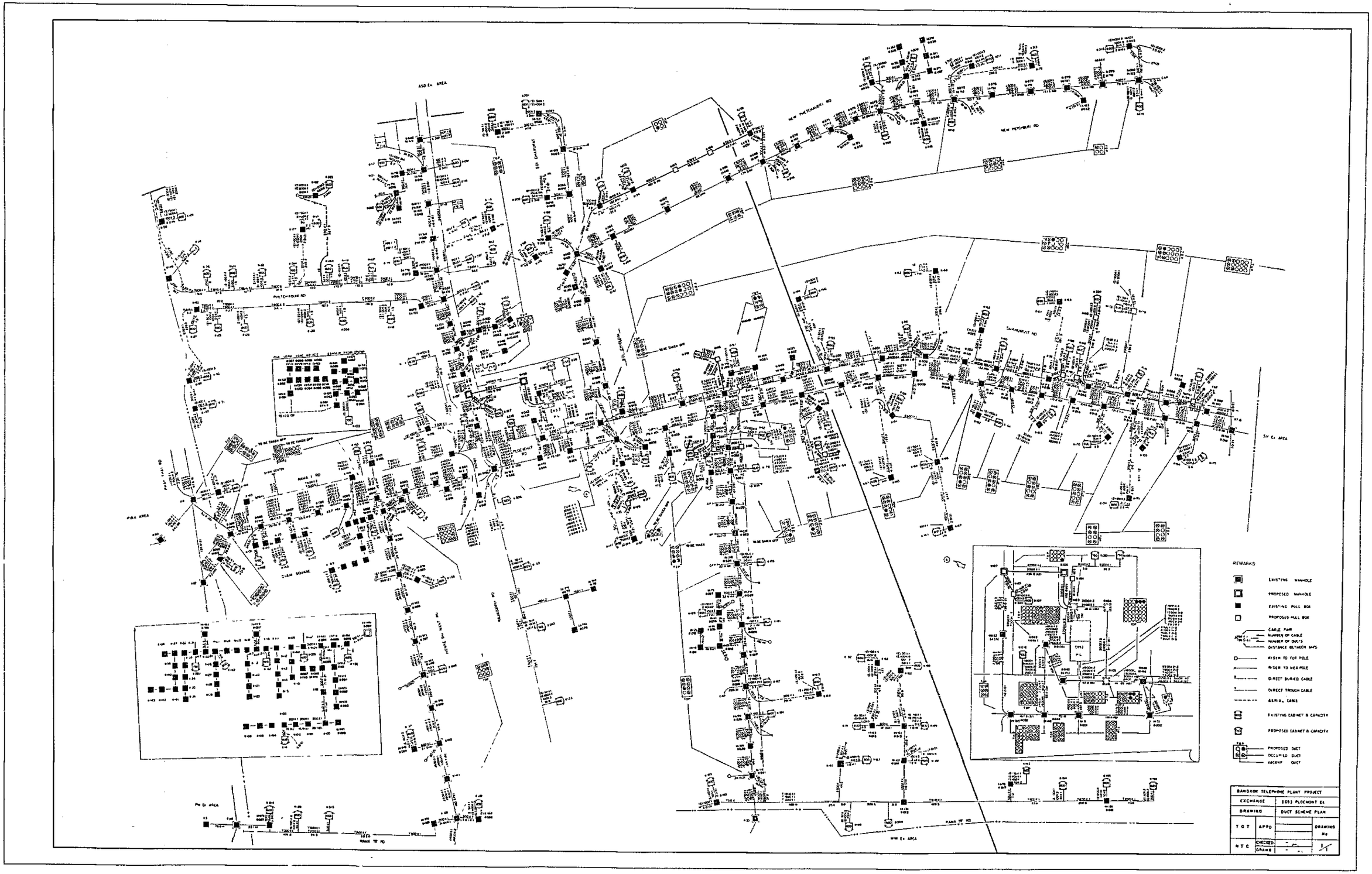
SECTION	DESIGNATION	UNIT	QUANTITY			REMARKS
			PRIMARY	SECONDARY	TOTAL	
G	G 50 · 4 A2	100m		0.2	0.2	
	G 100 · 4 A2	"		1.0	1.0	
	G 200 · 4 A2	"		0.7	0.7	
	G 300 · 4 A2	"	0.5	0.3	0.8	
	G 400 · 4 A2	"		0.2	0.2	
	G 600 · 4 B1	"	0.3		0.3	
	Section "G" Total	"	76,5	2.4	78.9	
J	J 300 · 5 P3	10m	18.8		18.8	
K	KA11G2	ea		67	67	
	KE12	"		1	1	
	KE15	"		1	1	
	KE20	"		1	1	
	Section "K" Total	"		70	70	
L	L 900	ea	9		9	
	L 750	"	1		1	
	L 50 B1	"	15		15	
	L 100 B1	"	10		10	
	L 50 B2	"	3	2	5	
	L 100 B2	"	9	2	11	
	L 50 B2	"		1	1	For new type cabinet
	L 100 B2	"	19	32	51	"
	Section "L" Total	"	66	44	110	
M	M1Ap	ea		23	23	
	M1BP	"	5	31	36	
	M2BP	"	1		1	
	M3AP	"		7	7	
	M3BP	"	75	16	91	
	M3CP	"	76		76	

SECTION	DESIGNATION	UNIT	QUANTITY			REMARKS
			PRIMARY	SECONDARY	TOTAL	
M	M4AP	ea		3	3	
	M4BP	"	6	1	7	
	M4CP	"	3		3	
	Section "M" Total	"	166	81	247	
N	N	100 pairs	1404	109	1513	
O	O 4		7		7	
	O 8		2		2	
	O 9		10		10	
	Section "O" Total		19		19	
P	PV12B	100m	3		3	
	PP4A	"	0.3		0.3	
	PV2AV2A	"	0.1		0.1	
	PV6BV6B	"	1.5		1.5	
	PV2A	"	0.3		0.3	
	PV4A	"	11.0		11.0	
	PV2A	"	1.3		1.3	Riser to pole
	PV2A	"	0.1		0.1	Riser to cabinet
	PV4A	"	0.3		0.3	"
	Section "P" Total	"	17.9		17.9	
Q	QL-2	ea	1		1	
	QT-3	"	1		1	
	QJUF-11	"	18		18	
	Section "Q" Total	"	20		20	


TO CENTRAL STATION
SRI AYUTHAYA RD
RAJTEVI CIRCLE
ASOKE DINDANG EXCHANGE
RAILWAY HOSPITAL
TO KLONGTON STATION
SAINT DOMINIC SCHOOL
SIAM HOTEL
GRP NO 3
GRP NO 4
RAMA I RD
CHULA SOI 6
CHULA SOI 12
CHULA SOI 15
CHULA SOI 16
PRATUNNAM EXCHANGE
TURF
SUKHUMVIT EXCHANGE
LUMPINI GARDEN
THUNG MAHAMEK EXCHANGE
RAMA IV RD
THAI AND TOBACCO MONOPOLY
TO HARBOUR
LEGEND
BOUNDARY OF EXCHANGE AREA
BOUNDARY OF CABINET AREA
FEEDER CABLE ROUTE (UNDERGROUND)
FEEDER CABLE ROUTE (AERIAL)
CABINET
NUMBER OF PRESENT DEMAND
NUMBER OF 5 YEARS DEMAND
NUMBER OF 10 YEARS DEMAND
BANGKOK TELEPHONE PLANT PROJECT I
EXCHANGE (05) PLOENCHIT Ex
DRAWING KEY PLAN
T O T APPD
DRAWING No 01
N T C CHECKED DRAWN
1/1

(05)
PLOENCHIT
TOT

BANGKOK TELEPHONE PLANT PROJECT(1977-1984)		
EXCHANGE	(05) PLOENCHIT Ex	
DRAWING	PRIMARY CABLE GENERAL PLAN	
TOT APPD		DRAWING No 03
NTC CHECKED		
DRAWN	J. Tokes	1


REMARKS
EXISTING MANHOLE
PROPOSED MANHOLE
EXISTING PULL BOX
PROPOSED PULL BOX
CABLE PAIR
NUMBER OF CABLE
NUMBER OF DUCTS
DISTANCE BETWEEN MHS
RISER TO TOT POLE
RISER TO MEA POLE
DIRECT BURIED CABLE
DIRECT TROUGH CABLE
AERIAL CABLE
EXISTING CABINET & CAPACITY
PROPOSED CABINET & CAPACITY
PROPOSED DUCT
OCCUPIED DUCT
VACANT DUCT
BANGKOK TELEPHONE PLANT PROJECT
EXCHANGE
1093 PLOENCHIT EX
DRAWING
DUCT SCHEME PLAN
T.O.T
APPD
DRAWING No
N.T.C
CHECKED
DRAWN

CHAPTER 2. CHANGWATANA TELEPHONE EXCHANGE

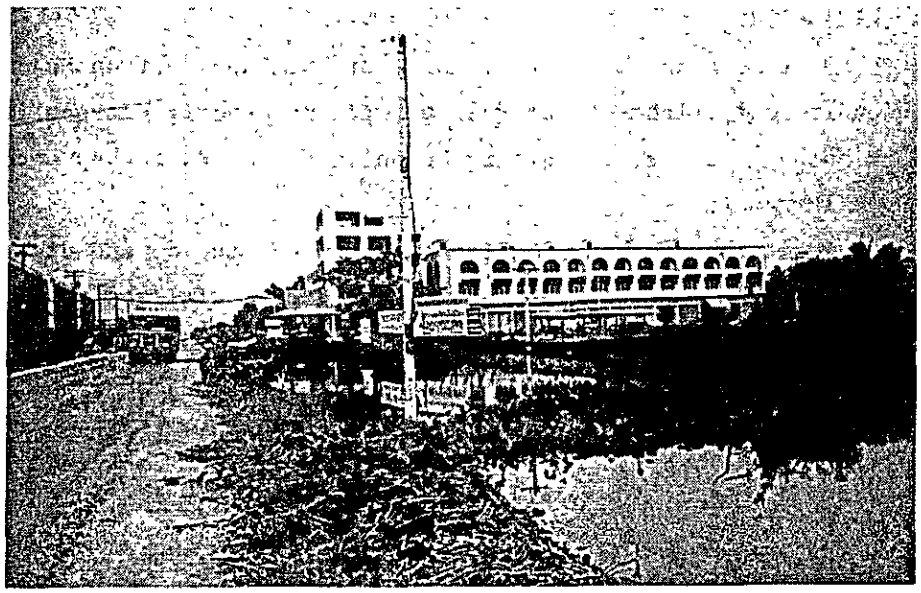
CONTENTS

CHAPTER 2. CHAENGWATANA TELEPHONE EXCHANGE

2.1 Service Area

The service area of the Chaengwatana Telephone Exchange is located in the northwestern part of the city of Bangkok. This exchange is to be branched from the Ngamwongwan Telephone Exchange in this project.

The northern part of the service area is the swampy land and adjoins the service area of the Don Muang Telephone Exchange. On the east is the Mittaphap Road which is a super-highway. The southern part abuts on the service area of the Ngam Wongwan Telephone Exchange and the western part borders the service area of the Pakkret Telephone Exchange. These northern, southern and western service area boundaries are subject to change since the residential land development work is making rapid progress. The whole service area embraces approximately 3,050 hectares.



Chaengwatana Exchange Building Site (recommended)

2.2 Demand Potential and Locational Features

The service area of the Chaengwatana Telephone Exchange was once the source of supply of vegetables to the Metropolitan sector of Bangkok. These days, however, the construction of residential houses is in progress in many parts of the area. While the relatively high-grade houses are being built by the private developers, the single-house residences are also being constructed by the National Housing Authority.

The Chaengwatana Road traverses almost the middle part of the service area. The combined business-residential structures are being constructed along this road. General stores and restaurants are open.

The telephone demand for-cast required the well founded prediction with respect to the expected period of completion of the housing construction. In view of the recent trend that even after the completion of sales by lots of the developed residential lands the housing construction did not make progress in many cases, it was difficult, in spite of being extremely important, to know precisely when the demand would build.

In the vast area on the southern side of the Chaengwatana Road are such public establishments as Police Training School, Metropolitan Water Work Authority, Postal Training School and Army Barracks, each occupying a large site.

In consideration of these locational features, the demand distribution map was formulated and the future demand potential was forecasted. The general demand forecast are given in Table 4.2.1.

Table 4.2.1 General Demand Forecast

	1981	1986	1991
Demand	3,730	8,920	12,370
Growth rate	100.0	239.1	331.6

2.3 Primary Cable Network Design

2.3.1 Selection of Exchange Building Site

After the demand estimation, the cable network plan was formulated and the network center was selected. In the case of the Chaengwatana Exchange, the cable network center was located at the intersection of Chaengwatana Road and the entrance road to the Mung Thong Housing Complex.

With regard to the exchange land acquisition, TOT was advised to select the site located along the Chaengwatana Road and near the intersection mentioned above.

2.3.2 Design of MDF

(1) MDF is to be the same type as in other existing exchanges, i.e., the combined distribution frame type.

(2) On the line side, the 258R terminal board of 600 pairs per vertical is to be installed.

(3) At MDF, the junction cables are to be terminated firstly and then the local cables are to be terminated.

2.3.3 Number of Pairs of Entrance Cable

To be newly installed:

2400-.4 AP-FSF	3 lines
1800-.4 AP-FSF	1 line
Total 9,000 pairs	4 lines

When the Kosum Village (in the direction of CAB No. 012) housing plan is completed in the future, a large demand will be generated; however, the period cannot be known definitely. In this design, the new feeder cable installation to cater for the demand in that area is withheld. Therefore, this cable installation plan must be formulated, timed with the completion of the said housing project.

2.3.4 New Cable Installation in Various Directions

(1) In the direction of CAB No. 023 on Chaengwatana Road

This conduit route is to be newly installed in the junction cable network project, so that the feeder cable to CAB No. 023 will be of 600 pairs inclusive of spare 300 paris.

(2) In the direction of Pracha Ni Wet-2

At present, the aerial cable line (total 900 pairs) is established from the Ngamwongwan Exchange. In this design, 2,400 pairs will be supplied from Chaengwatana Road. By this arrangement, the existing aerial primary cable is to be withdrawn.

(3) In the direction east of Chaengwatana Road

a. Kosum Village

In this area, a large housing complex is planned. However, it will still be some time before the completion of this housing project.

This design covers the cable work for the sector where the housing construction has been completed. For the sector where the housing construction has not yet been completed, it is so arranged that the new cable installation (1,800 pairs) will be carried out after the completion of the housing construction.

The cable route from the eastern side, i.e., the railway side, is already laid. On this route, however, primary cable requires loading. When the route from the Mung Thong Housing Complex, i.e., the western side, is laid in the future, the cable distance can be reduced to a great extent and this is advantageous to the cable work.

b. The area on the southern side of Chaengwatana Road to the boundary with the Ngamwongwan Exchange service area is to be used by the governmental offices and the Army. Therefore, in this area, there will be no marked change in the demand outlook.

(4) Mung Thong Housing Complex (Soi Samakkee)

The construction of a large scale housing complex is in progress along Soi Samakkee so that, in this design, 2,400 pairs are allocated to this area. When the road to the Kosum Village housing complex from this Mung Thong housing complex is opened in the future, the Soi Samakkee conduit will be used.

2.3.5 Selection of Aerial Feeder Cable Route

(1) Soi Serisakol Turakit (leading to Kosum Village)

Primary cable beyond CAB No. 010 will be installed as aerial cable, using the MEA poles. In the event of additional primary cable installation to the Kosum Village housing complex in the future, the installation by underground conduit is to be studied.

(2) The terminal portion of less than 600 pairs of all underground cable lines extending in various directions will be installed as the aerial line.

2.3.6 Line Loss and DC Resistance

For all subscribers in the Chaengwatana Exchange service area, the line loss and the d.c. resistance are within the limit values prescribed in the transmission sheet.

2.4 Design of Underground Conduit

(1) The design of the Chaengwatana Road conduit was made by TOT in order to be timed with the road expansion work.

(2) The entrance manhole design is withheld because the exchange building site has not yet been decided. This design will be made by TOT after the exchange building site has been decided.

(3) The manhole No. 061 is to have the branch conduit established in the direction of Soi Samakkee by this design. Therefore, its A-1 type is to be changed to the L-2 type.

For the conduit to be newly installed in the direction of Soi Klongsuay, six lines out of the existing eight lines are to be extended. The remaining two lines are to be capped as spare lines.

(4) Out of the existing six-line branch conduit from the manhole No. 025, four lines are to be connected to the newly installed conduit. The remaining two lines are to be capped as spare lines.

(5) For the crossing of Klongsuay between the manholes Nos. 061 and 063, the crossing by an ad hoc TOT bridge (four pipe lines) is designed.
The bridge strength calculation formulas are refer to Appendixes.

2.5 Cut-over Design

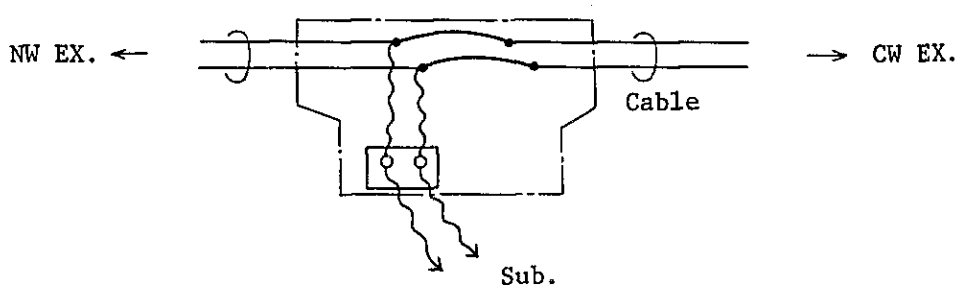
The Chaengwatana Telephone Exchange is to be branched from the Ngamwongwan Telephone Exchange and will take over the subscribers in four cross-connecting cabinet areas belonging to CAB Nos. 004, 016, 017 and 018 of the Ngamwongwan Exchange.

These four areas are distantly located from the Ngamwongwan Exchange so that the loop resistance exceeds the limit value. Therefore, the multiple cut-over is necessary for all circuits in these areas.

(1) Cut-over of 01 Cable

a. Secondary cable (021-01:1-100) in the newly installed CAB No. 021 is to be multi-connected on the riser pole to the existing cable (12-01:1-100). In the cross-connecting cabinet, the secondary cable terminal (021-01: 1-100) and the primary cable terminal (46-03:1-100) are to be jumpered.
By this arrangement, the multiple cut-over of subscribers located between CAB Nos. 021 and 017 can be realized.
Subscribers located between CAB No. 021 and MEA pole No.

65 will have the cable conductors T-connected. The end part of these cables is already cut off in the ready access.



b. In the pulling box No. 031, the existing cable (12-01: 2101-2250) and the newly laid cable (46-03:1501-1650) are to be multi-connected.

c. In the pulling box No. 030, the existing cable (12-01: 2251-2400) and the newly laid cable (46-03:1801-1950) are to be multi-connected.

d. By the above arrangements, approximately 330 subscriber circuits accommodated in 01 cable can be realized.

(2) Cut-over of 02 Cable

In the pulling box No. 025, the existing cable (12-02:1201-1350) and the newly laid cable (46-02:901-1050) are to be multi-connected.

By this arrangement, the multiple cut-over of 140 working circuits in 02 cable can be realized.

(3) Cut-over of 05 Cable

a. In the pulling box No. 010, the existing cable (12-05: 1-400) and the newly laid cable (46-04:1801-2200) are to be multi-connected.
By this arrangement, the multiple cut-over of 386 working circuits in 05 cable can be realized.

b. After the exchange service-in, the cable conductor (46-04: 2101-2200) is to be freed from the multi-connection and is to be reserved as spare cable in the pulling box No. 010.

(4) Cut-over of 06 Cable

In the pulling box No. 025, the existing cable (12-06:1-50) and the newly laid cable (46-02:1051-1100) are to be multi-connected.
By this arrangement, the multiple cut-over of 32 working circuits of 06 cable can be realized.

(5) After the exchange service-in, all multi-connections are to be restored to the normal connections.

2.6 Secondary Cable Network Design

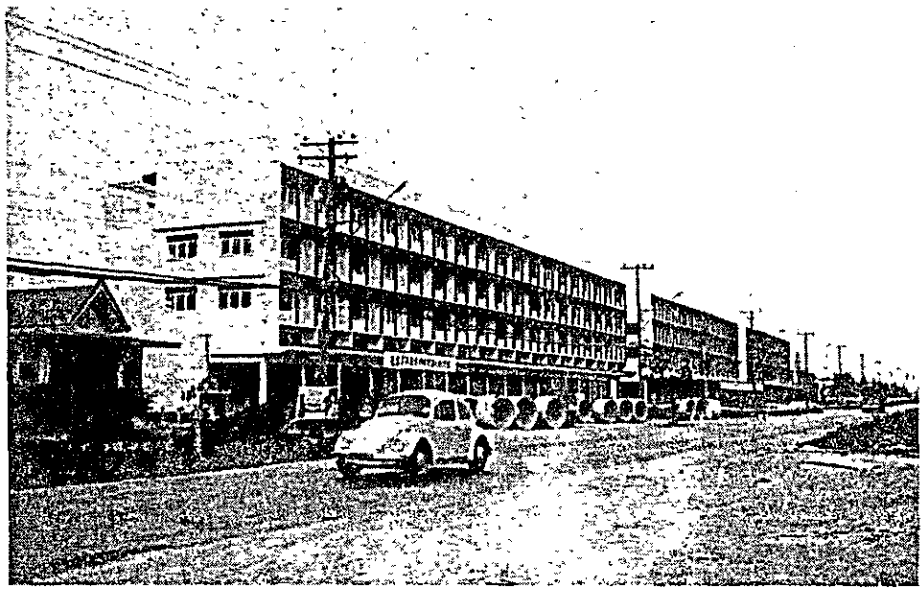
(1) In the CAB Nos. 010, 011 and 012 areas, a large scale housing complex (Kosum Village) construction is planned. At present, a part of construction has been completed.
This design presents the cable plan for the completed housing group only. The cable plan for the rest of the area is withheld.

(2) The Chaengwatana Road expansion is planned. The design of aerial cable route on the northern side of the road is based on MEA's pole erection drawing related to the road expansion plan. On the southern side of the road, the existing MEA poles are to be moved to the new road edge at the same spans as at present. In this design, the existing pole locations are used.
The related cabinets are those numbered 001, 007, 008, 013, 014, 022 and 023.

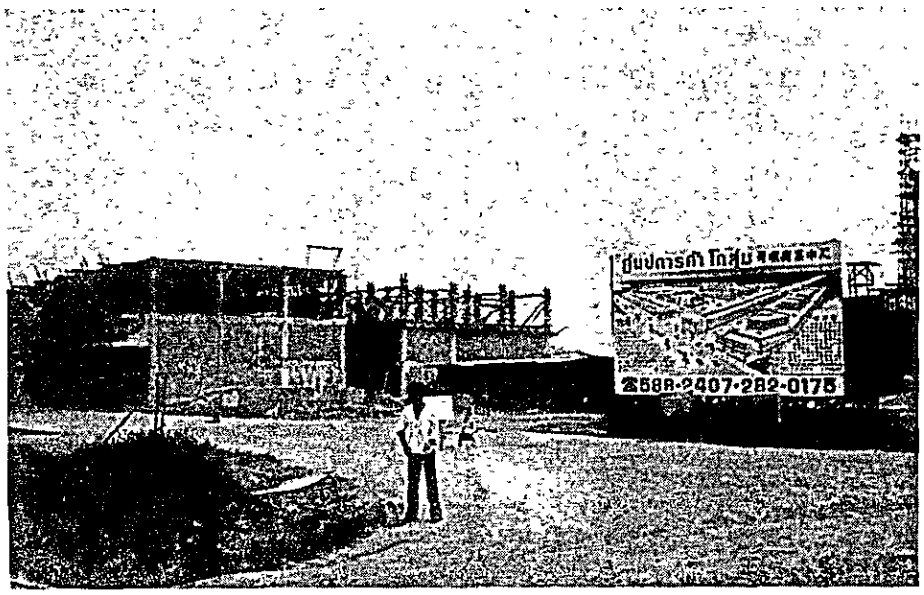
(3) Striding over CAB Nos. 007 and 008 areas, the Kosum Housing construction is in progress at present. Considering that the applications for subscriber telephones have begun to be filed with TOT, it may be assumed that the demand will appear at an early period. For this reason, the cable work design is a desk design based on the housing plan.

(4) Cable distribution to the Police Training Center is to utilize the MEA route along the super-highway so that the cable work

is to be carried out from CAB No. 008. When the cable line crosses the railway, the siphon type conduit is to be adopted.



New building underconstruction along the Chaengwatana Road



Kosum Housing Complex

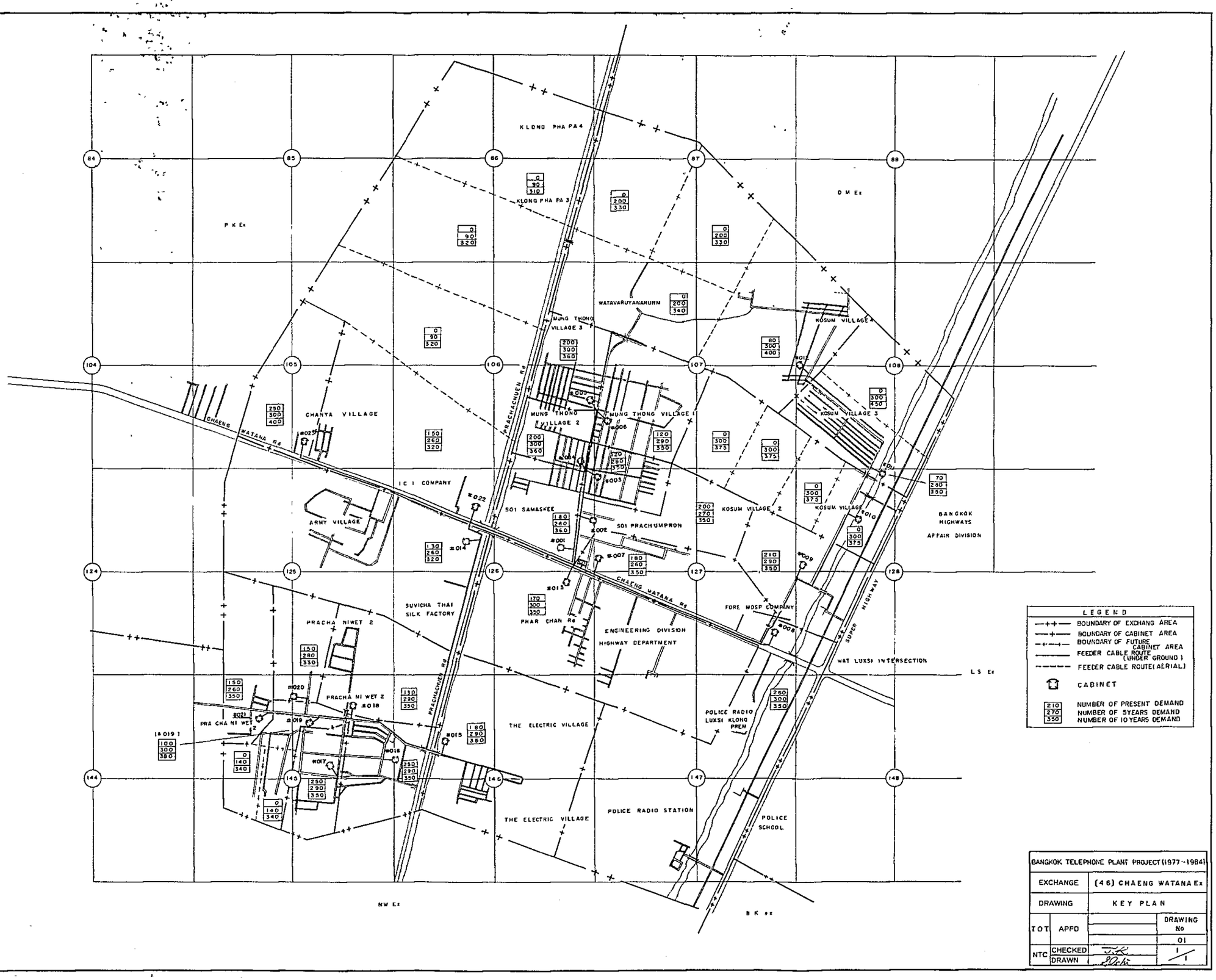
2.7 Amount of Construction Work

AMOUNT OF CONSTRUCTION WORK

SECTION	DESIGNATION	UNIT	QUANTITY			REMARKS
			PRIMARY	SECONDARY	TOTAL	
A	A - 8	ea	7	87	94	
B	B1BS	"	10	221	231	
	B1CS	"	9		9	
	B1FS	"		23	23	
	B2B	"		51	51	
	Section "B" Total	"	19	295	314	
C	C5A2B	"	18	244	262	
E	E 10 · 4 A2	ea		13.3	13,3	
	E 25 · 4 A2	"		226.9	226,9	
	E 50 · 4 A2	"		104.3	104,3	
	E 100 · 4 A2	"		37.0	37.0	
	E 200 · 4 A2	"		37,0	37.0	
	E 300 · 4 A2	"	1.9	50.0	51.9	
	E 400 · 4 A2	"		10.0	10,0	
	E 600 · 4 A2	"	5,2		5.2	
	E 10 · 5 A2	"		1.3	1.3	
	E 25 · 5 A2	"		27.3	27,3	
	E 50 · 5 A2	"		5.8	5.8	
	E 100 · 5 A2	"		13,0	13.0	
	E 200 · 5 A2	"		5.2	5.2	
	E 300 · 5 A2	"	21.9	4.8	26.7	
	E 400 · 5 A2	"		0.9	0.9	
	E 600 · 5 A2	"	4.4		4.4	
	E 25 · 65 A2	"		5.1	5.1	
	E 50 · 65 A2	"		3.6	3.6	
	E 100 · 65 A2	"		6.8	6.8	
	E 200 · 65 A2	"		14.3	14.3	
	Section "E" Total	"	33,4	566.6	600.0	

SECTION	DESIGNATION	UNIT	QUANTITY			REMARKS
			PRIMARY	SECONDARY	TOTAL	
G	G 300 · 4	100m	2.7		2.7	AP-FSF Cable
	G 600 · 4	"	19.3		19.3	"
	G1200 · 4	"	3.6		3.6	"
	G1800 · 4	"	15.7		15.7	"
	G2400 · 4	"	57.2		57.2	"
	G 600 · 5	"	0.5		0.5	"
	G 900 · 5	"	12.7		12.7	"
	G1200 · 5	"	6.2		6.2	"
	G 50 · 4 A2	"		0.9	0.9	
	G 100 · 4 A2	"		2.2	2.2	
	G 200 · 4 A2	"		0.8	0.8	
	G 300 · 4 A2	"	0.1	0.6	0.7	
	G 600 · 4 A2	"	0.1		0.1	
	G 100 · 5 A2	"		0.1	0.1	
	G 300 · 5 A2	"	0.6		0.6	
	G 400 · 4 A2	"		0.3	0.3	
	Section "G" Total	"	118.7	4.9	123.6	
J	J 300 · 5 P3	10m	15.2		15.2	
K	KA11G2	ea		2	2	
	KB12	"		577	577	
	Section "K" Total	"		579	579	
L	L 900	ea	19		19	
	L 50 B2	"	1		1	
	L 100 B2	"	3		3	
	L 50 B2	"		6	6	}For new type CAB.
	L 100 B2	"	57	73	130	
	Section "L" Total	"	80	79	159	

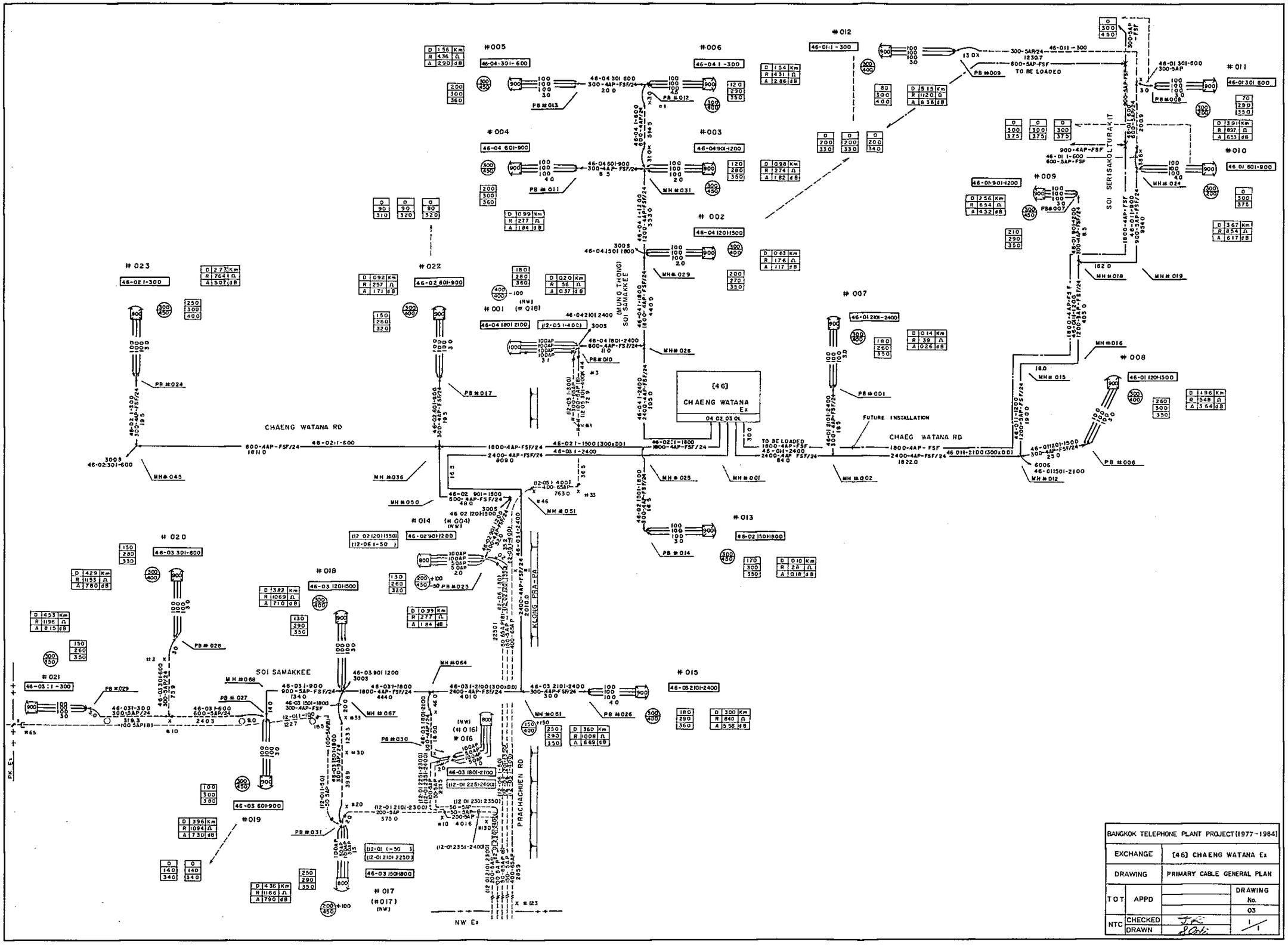
SECTION	DESIGNATION	UNIT	QUANTITY			REMARKS
			PRIMARY	SECONDARY	TOTAL	
M	M1AP	ea		90	90	
	M1BP	"	3	96	99	
	M1CP	"	3		3	
	M3AP	"	1	19	20	
	M3BP	"	39	21	60	
	M3CP	"	61		61	
	Section "M" Total	"	107	226	333	
N	N	100 pairs	1384	222	1606	
P	PP4B	100m	0.3		0.3	
	PV4B	"	35.3		35.3	
	PV6B	"	20.1		20.1	
	PP4A	"	0.5		0.5	Riser to pole
	PV4A	"	0.5		0.5	"
	PP2A	"	1.0		1.0	Riser to cabinet
	PV2A	"	2,8		2,8	"
	PV4A	"	0.5		0,5	"
	Section "P" Total	"	61.0		61,0	
Q	QA-1	ea	27		27	
	QL-2	"	5		5	
	QJUF-11	"	7		7	
	Section "Q" Total	"	39		39	



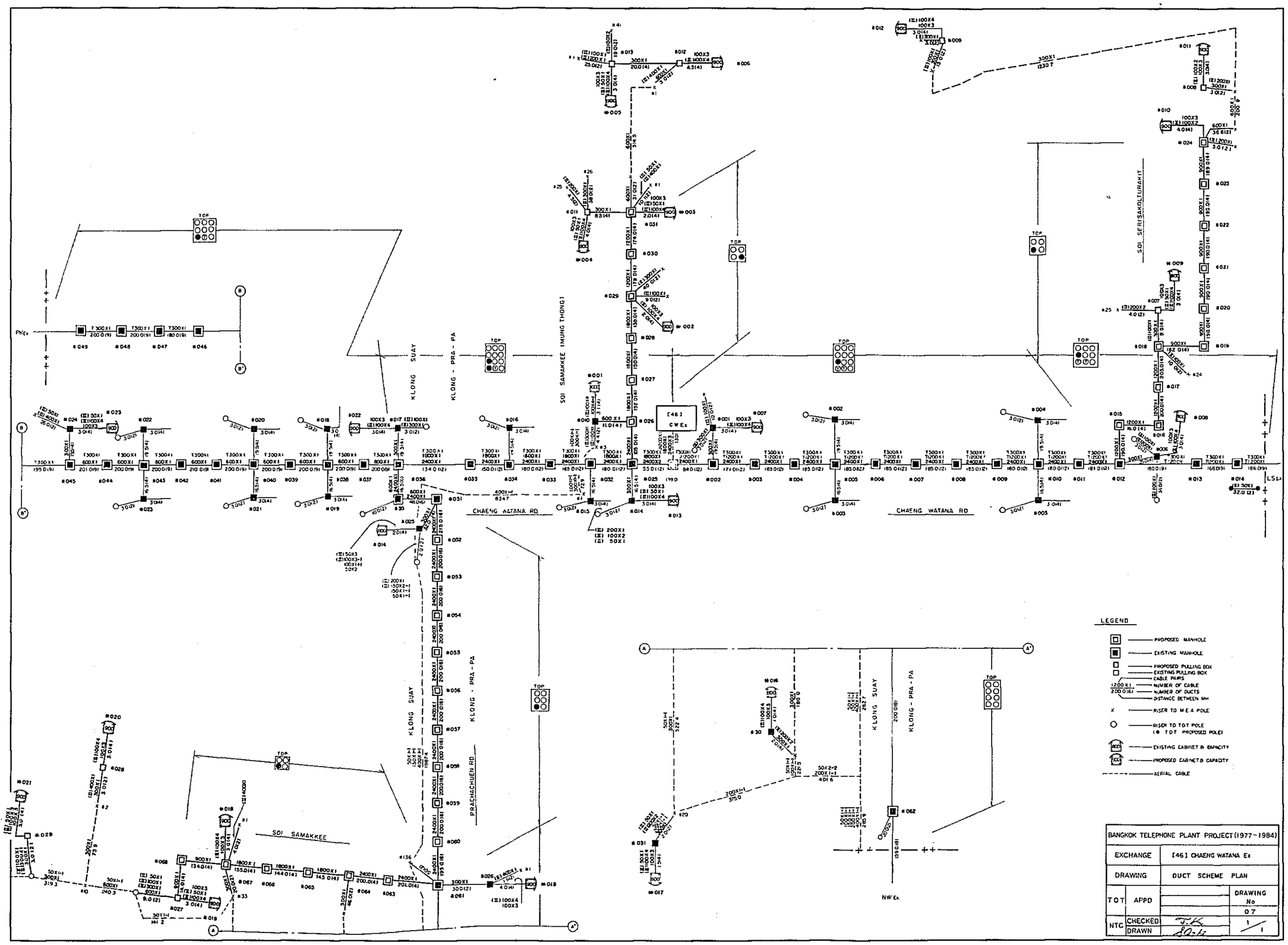
LEGEND

- BOUNDARY OF EXCHANG AREA
- BOUNDARY OF CABINET AREA
- BOUNDARY OF FUTURE CABINET AREA
- FEEDER CABLE ROUTE (UNDER GROUND)
- FEEDER CABLE ROUTE (AERIAL)
- CABINET
- NUMBER OF PRESENT DEMAND
- NUMBER OF 5YEARS DEMAND
- NUMBER OF 10YEARS DEMAND

BANGKOK TELEPHONE PLANT PROJECT (1977 - 1984)			
EXCHANGE		(46) CHAENG WATANA Ex	
DRAWING		KEY PLAN	
TOT	APPD		DRAWING No
			01
NTC	CHECKED		1 / 1
	DRAWN		



BANGKOK TELEPHONE PLANT PROJECT (1977-1984)			
EXCHANGE		{46} CHAENG WATANA Ex	
DRAWING		PRIMARY CABLE GENERAL PLAN	
TOT	APPD		DRAWING No. 03
NTC	CHECKED		1 / 1
	DRAWN		



BANGKOK TELEPHONE PLANT PROJECT (1977~1984)			
EXCHANGE		[46] CHAENG WATANA Ex	
DRAWING		DUCT SCHEME PLAN	
TOT	APPD		DRAWING No 07
NTC	CHECKED		1 / 1
	DRAWN		

CHAPTER 3. PAKKRET TELEPHONE EXCHANGE

CONTENTS

CHAPTER 3. PAKKRET TELEPHONE EXCHANGE

3.1 Service Area

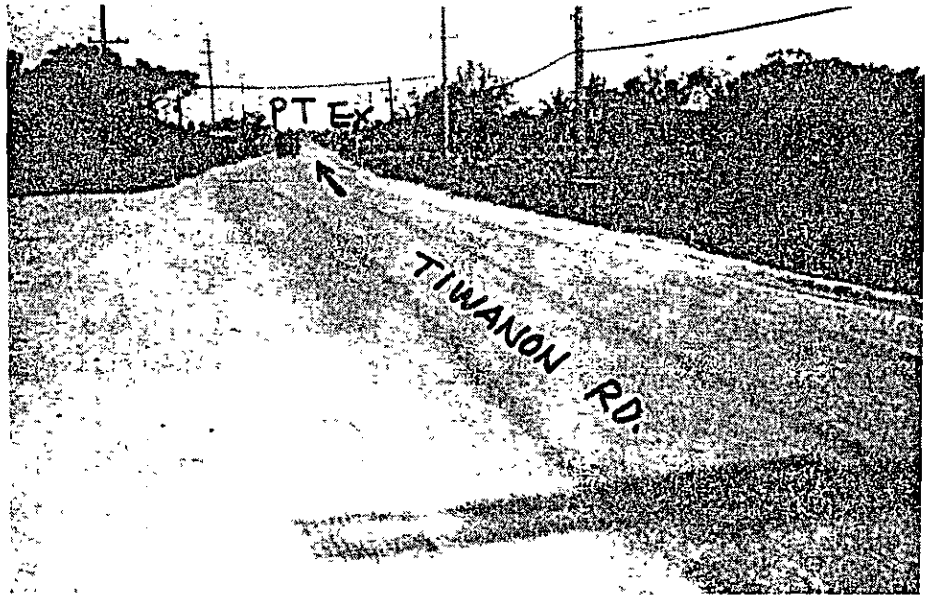
The service area of the Pakkret Telephone Exchange occupies the northwestern part of the Metropolitan area of Bangkok. The telephone circuits themselves belong to the local cable network of Bangkok, but the administrative version of this service area is the Pakkret District of the Nontaburi Province.

On the north this service area adjoins the service area of the Pathumthani Telephone Exchange in the Pathumthani Province. On the east lies the boundary with the service area of the Chaengwatana Exchange.

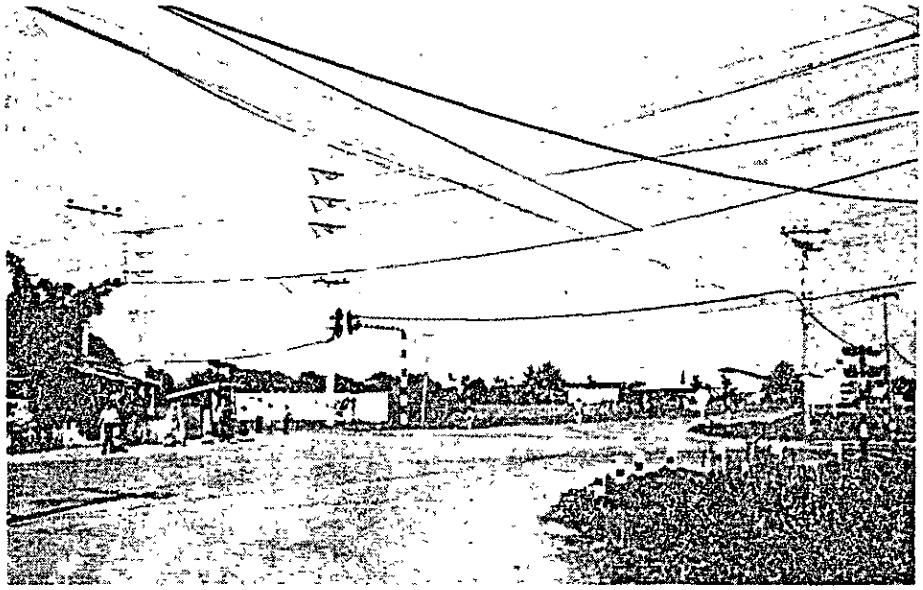
On the south of this service area is that of the Ngamwongwan Exchange which is the parent exchange of the Pakkret Exchange. On the west is the Chao-Phraya River that provides the boundary with the service area of the Bangbuathong Exchange.

The telephone demand on the other side of the Chao-Phraya River is essentially to be covered by the Bangbuathong Exchange. However, no suitable cable route exists at present to serve that area from the Bangbuathong Exchange, so that, in this design, the Pakkret Exchange cables are to be extended to that area.

The Pakkret Exchange service area occupies approximately 4,300 hectares.



Pakkred Exchange Building Site



Intersection, Chaengwatana Road & Tiwanon Road

3.2 Demand Potential and Locational Features

The service area of the Pakkret Exchange is a strip of land extending from north to south along the Chao-Phraya River. The intersection of Chaengwatana Road and Tiwanon Road in the south and its vicinity constitute the center of commercial activities, as well as water and land traffic, of this service area. This area was once the source of supply of agricultural products to the Metropolitan area of Bangkok but is now changing into the residential area.

The field survey was carried out to identify the progress of the local development plans, especially the housing plan, and, based on the findings, the telephone demand distribution map was formulated. The demand forecast is as follows:

Table 4.3.1 General Demand Forecast

	1981	1986	1991
Demand	1,920	2,830	4,520
Growth rate	100.0	147.4	235.4

3.3 Primary Cable Network Design

3.3.1 Selection of Exchange Building Site

The land where the Pakkret Exchange is to be constructed has already been expropriated by TOT. However, the land is located too far south in the whole service area, so that it is not a favorable site for local cable distribution.

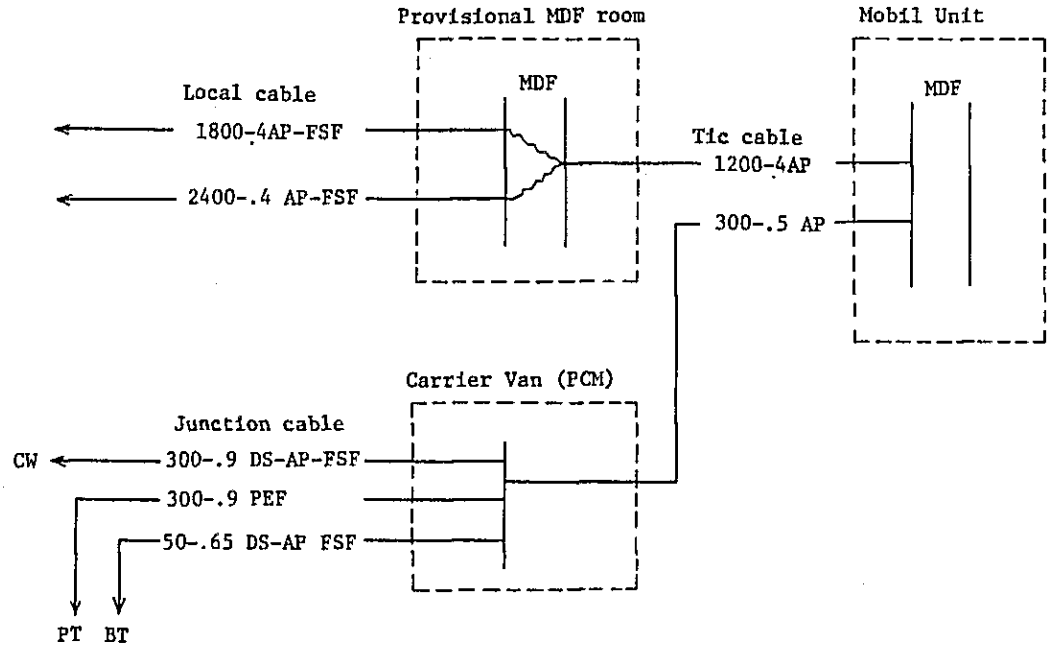
3.3.2 Design of MDF

The Pakkret Exchange is to be branched from its parental Ngamwongwan Exchange as a mobile system with initial capacity of 1,000 switching lines. The MDF of this mobile system lacks capacity for the number of pairs of junction cables and subscriber cables to be terminated this time. Therefore, the MDF Room is to be newly established where to terminate the entrance cables.

Between the MDF and the mobile system the tie cable is to be installed.

Since the junction cables comprise a part of PCM circuits, the carrier van is to be established in order that the junction cables can be terminated at the distribution frame of the van. The junction cables will be connected to the mobile system by the tie cable.

MDFs in the MDF Room are designed to hold 1,000 pairs per vertical.



3.3.3 Number of Pairs of Entrance Cable

To be newly installed:

2400-.4 AP-FSF	1 line
1800-.4 AP-FSF	1 line
Total 4,200 pairs	2 lines

3.3.4 Design of Subscriber Cable Loading

The service area of the Pakkret Exchange lies long from north to south and the exchange site is located too far south as previously mentioned. Therefore, the cabling distance on Tiwanon Road and in CAB Nos. 005 and 006 area in the north becomes rather too long.

The remedy is to load the cable on this route in order to do with fine cable conductors and thereby economize the initial investment. The particulars of this cable loading follow:

Type of loading	D66
Inductance	66 mH
Standard coil spacing (So)	1,380m
Standard half-coil spacing ($\frac{So}{2}$)	690m
Mean coil spacing (S)	1,378.42m
Maximum deviation section (Si)	1,354.6m

$$\frac{So - S}{So} \times 100 = \frac{1,380 - 1,378.42}{1,380} \times 100 = 0.12\% < 3\%$$

$$\frac{S - Si}{S} \times 100 = \frac{1,378.42 - 1,354.6}{1,378.42} \times 100 = 1.73\% < 2\%$$

The loaded circuit is to be used as specified below.

a. The loading coil LP No. 5 of the loaded circuit (43-01: 301-500) for CAB No. 005 is for cabling to the Manawan housing complex. When the cabinet area is divided in the future, all circuits must be assigned to the housing complex.

b. The loading coils LP Nos. 6 (006-01:1-100), 7 (006-01: 1-30) and 7' (006-01:51-70) of CAB No. 006 are for the farthest subscribers in the cabinet area. For the subscribers near the cabinet, 101-200 are used.

c. For further details, refer to the secondary cable design drawing.

3.3.5 New Cable Laying in Various Directions

(1) Chaengwatana Road Direction

The underground conduit is to be newly estalibshed on Chaengwatana Road in the junction cable work, so that CAB No. 008 feeder cable of 600 pairs is designed to be the underground cable.

(2) Southern Tiwanon Road Direction

The establishment of new underground conduits farther than the manhole No. 058 is being planned by TOT in accordance with the road expansion work.
In this design, the conduit between the manhole No. 058 and CAB No. 009 is to be the underground cable.

(3) The feeder cable to CAB Nos. 011 and 012 is to be the underground cable though this cable is of small number of pairs. This is because the conduit in this area is to be newly installed in the junction cable work.

(4) For the feeder cable to CAB Nos. 005 and 006, the underground conduit is to be extended to the manhole No. 032 in consideration of the scheduled PT Exchange junction lines. Beyond the manhole No. 032, the aerial route is to be adopted.

3.3.6 Line Loss and DC Resistance

For all subscribers in the Pakkret Exchange service area, the line loss and the d.c. resistance are within the limit values prescribed in the transmission sheet.

3.3.7 Replacement of Cross-Connecting Cabinet

CAB No. 001/1 is to be replaced with CAB No. 010 in this project because the former is an obstacle to the Chaengwatana Road expansion work.

3.4 Design of Underground Conduit

(1) The entrance manhole and the entrance duct will be designed by TOT.
Out of the 30 ducts, three will be led into the MDF room and four into the carrier van. The rest will be capped as spares to be led into the main exchange building in the future.

(2) The Chaengwatana Road conduit will be designed by TOT in accordance with the road expansion work.

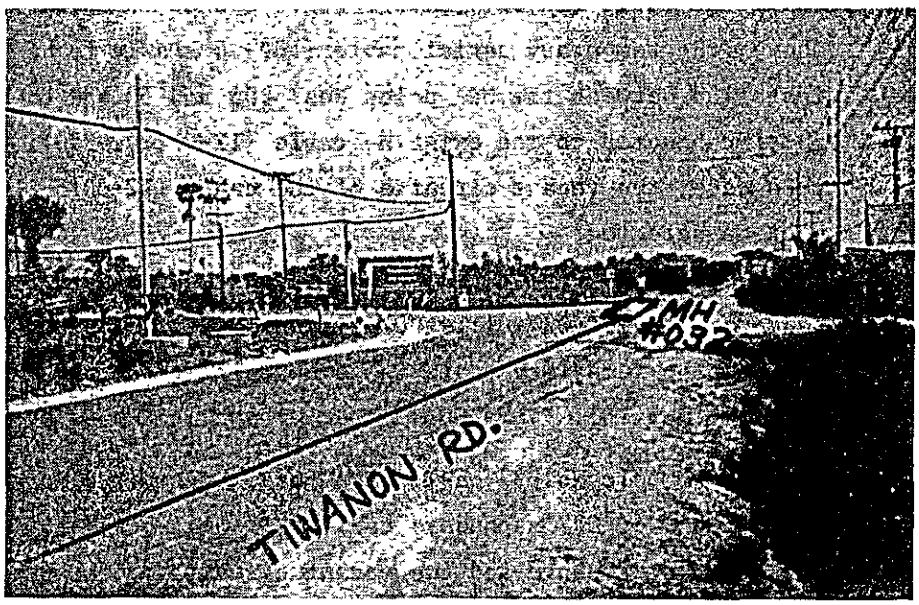
(3) The design of conduit crossing the Chao-Phraya River and extending beyond the manhole No. 055 will be made by TOT in conjunction with the Bangbuathong Exchange junction cable work.

Using this conduit, the secondary cable distribution to the opposite side of the Chao-Phraya River will be carried out.

(4) For the waterway crossing at Klong Bang Pood and Klong Bang Buo, the crossing by bridge is planned. However, the period of this bridge replacement work has not yet been decided so that the design of the bridge section of conduit is withheld this time. This design will be made later by TOT.

(5) The conduit extension beyond the Tiwanon Road manhole No. 059 is planned, timed with the road expansion work. However, since the road expansion design drawing has not yet been completed, the conduit extension is not considered in this design. TOT will make the design later.

(6) Six take-out ducts will be newly installed in the direction of Pathumthani from the Tiwanon Road manhole No. 032, in consideration of the underground conduit construction expected in the future.



Tiwanon Road, near MH #032

3.5 Subscriber Cut-over Design

The Pakkret Exchange, which is to be branched from the Ngamwongwan Exchange, will take over the subscribers in the CAB Nos. 001, 001/1 and 027 areas. The multiple cut-over will be carried out for all working circuits that number approximately 440.

The subscriber cut-over is to be made in the following order:

(1) In the pulling box No. 001, the existing cable (12-02:1-200) and the newly laid cable (43-01:1201-1400) are to be multi-connected. At the same time, the newly laid stub cable is to be connected to the cable (43-01:1401-1500).

(2) In CAB No. 001, the newly installed terminals (43-01:1401-1500) and the existing terminals (12-02:501-600) are to be multi-connected with jumper wires.

(3) In CAB No. 009, the secondary cable terminals are to be installed and, on the riser pole, to be multi-connected to 200 pairs (12-02:301-500) of the 300-pair cable (12-02:301-600). In the cabinet, the primary side terminals and the secondary side terminals are to be multi-connected by jumper wires to the working circuits.

(4) Using the cable (12-02:301-600) multi-connected as per (3) above, the temporary aerial cable (100-.4 AP) is to be installed between the MEA poles Nos. 206 and 50 and to be multi-connected to the existing cable (12-02:201-250). In this case, the vacant circuits of the cable (12-02:301-600) must be selected.

In the same way, the vacant circuits of the CAB No. 027 secondary cable (027-01:1-100) are also to be selected and to them the temporary cable is to be multi-connected on the MEA pole No. 181.

(5) On the MEA pole No. 37 on Tiwanon Road, the working circuits of the CAB No. 027 secondary cable (027-01:1-100) of Ngamwongwan Exchange and the vacant circuits of the existing cable (12-02:1-200) multi-connected as per (1) above are to be multi-connected.

(6) The CAB No. 008 secondary cable (008-01:1-200) is to be laid in advance and, to this secondary cable, the secondary cables (NW 004-01:1-25) and (NW 004-02:1-50) from the direction of Ngamwongwan Exchange are to be multi-connected on the MEA poles Nos. 325 and 333, respectively.

(7) By the foregoing arrangements, all working circuits can be accommodated by multi-connection in the new exchange. After the exchange service-in, the multi-connection is to be restored to the normal connection.

3.6 Secondary Cable Network Design

(1) CAB No. 001

Using the existing cross-connecting cabinet (800 pairs), the cable distribution area is established. In the future, the Sahakorn Krung Thep housing complex will make one distribution area so that, in this design, 200 pairs out of the existing 800 pairs are assigned to that housing complex.

(2) CAB No. 002

The most part of demand in this cable distribution area derives from the Muang Tong Ni-Wech housing complex.
In order to avoid the duplication of MEA's and TOT's pole erection plans, the decision has been made to wait for the completion of the MEA plan. In this design, the cable plan for that housing complex is withheld because the housing construction period cannot be known definitely.

(3) CAB No. 005

In this cable distribution area exist the Air Force residences and the Manawan housing complex. When the telephone demand actually builds in the Manawan housing complex in the future, an independent distribution area will be formed by this housing complex.

(4) CAB No. 006

For the Siam Vattana housing complex in this cable distribution area, the construction period has not yet been decided. Therefore, in this design, the cable plan for this area is withheld.

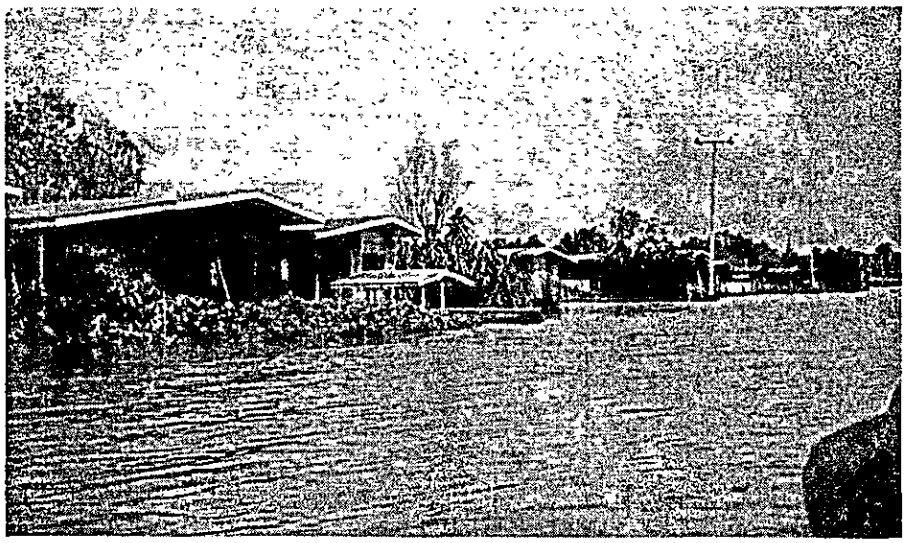
(5) CAB Nos. 007, 008

For the aerial cable line to be newly installed on the northern side of Chaengwatana Road, the MEA poles are scheduled to be erected during the road expansion work. Since the detail design of this pole erection plan is not yet available, the type of cable required and the cable distance are illustrated in this design.

(6) CAB No. 012

In order to cater for the demand on the other side of the Chao-Phraya River, the submarine cable (100-.4 AP-FSF SUB) will be laid between the Chaengwatana Road manholes Nos. 057 and 058.

This cable distribution area essentially belongs to the Bangbuathong Exchange service area. However, since the cable distance from that exchange is too long and economically disadvantageous, this design includes this area in the service area of Pakkret Exchange.



Premise houses on the other side of the river

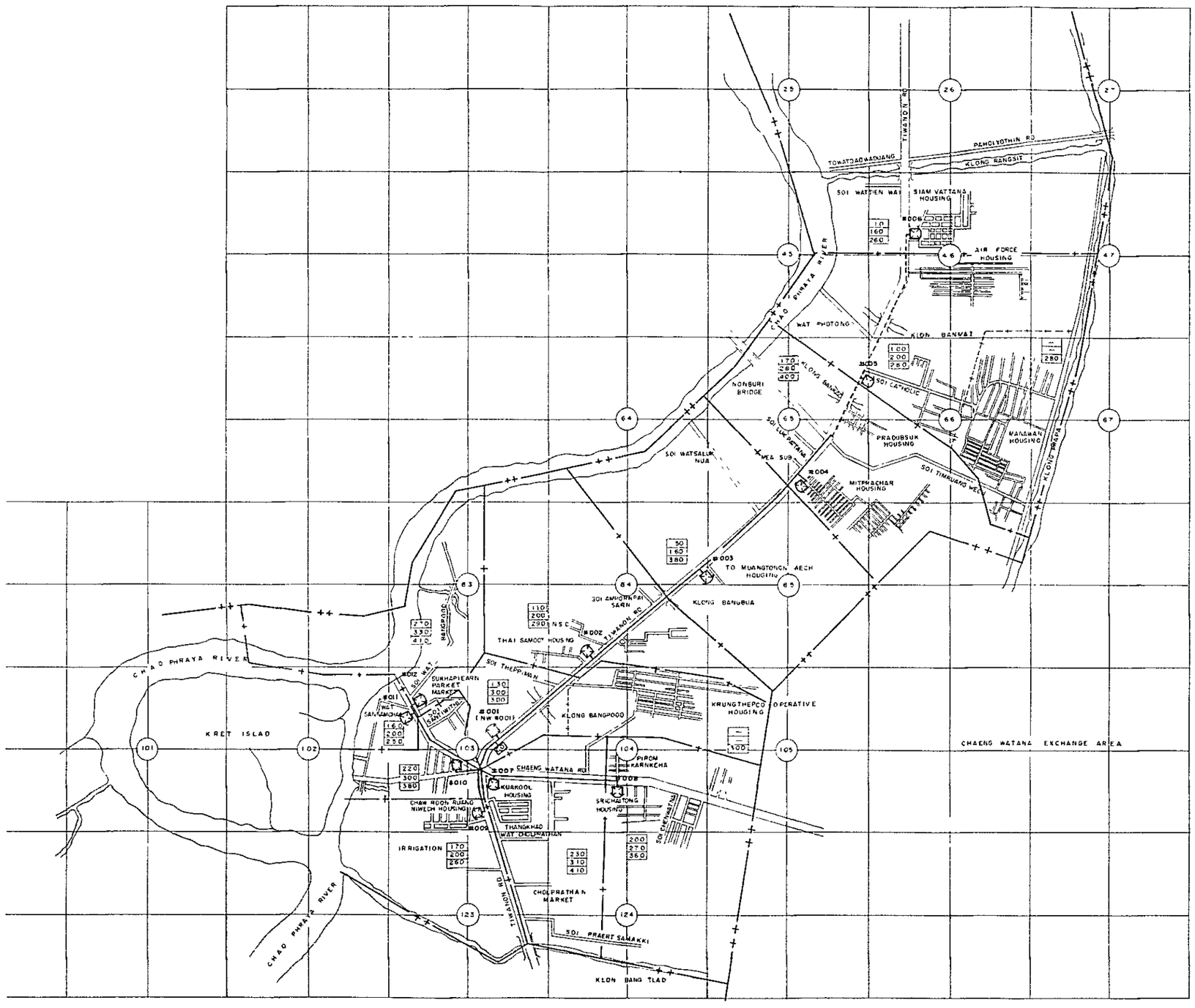
3.7 Amount of Construction Work

AMOUNT OF CONSTRUCTION WORK

SECTION	DESIGNATION	UNIT	QUANTITY			REMARKS
			PRIMARY	SECONDARY	TOTAL	
A	A - 8	ea	16	82	98	
B	B1BS	ea	2	118	120	
	B1CS	"	9		9	
	B2B	"	2	9	11	
	Section "B" Total	"	13	127	140	
C	C5A2B	"	11	118	129	
E	E 10 . 4 A2	100m		4.1	4.1	
	E 25 . 4 A2	"		47.7	47.7	
	E 50 . 4 A2	"		89.4	89.4	
	E 100 . 4 A2	"		49.1	49.1	
	E 200 . 4 A2	"		26.0	26.0	
	E 10 . 65 A2	"		11.2	11.2	
	E 25 . 65 A2			16.5	16.5	
	E 50 . 65 A2	"		32.8	32.8	
	E 100 . 65 A2	"		3.7	3,7	
	E 200 . 65 A2	"		20.8	20,8	
	E 300 . 65 A2	"	15.6	3.0	18,6	
	E 600 . 65 A2	"	9.8		9,8	
	E 25 . 9 A2	"		36.1	36.1	
	E 50 . 9 A2	"		14.7	14.7	
	E 100 . 9 A2	"		7.4	7.4	
	Section "E" Total	"	25.4	362.5	387.9	
F	F 100 . 4 SUB			0.3	0.3	Submarine cable

SECTION	DESIGNATION	UNIT	QUANTITY			REMARKS
			PRIMARY	SECONDARY	TOTAL	
G	G 100 . 4	100m		5.2	5.2	AP-FSF cable
	G 300 . 4	"	5.2		5.2	"
	G 600 . 4	"	25.8		25.8	"
	G1800 . 4	"	0.6		0.6	"
	G2400 . 4	"	2.6		2.6	"
	G1200 . 5	"	35.9		35.9	"
	G 600 . 65	"	5.4		5.4	"
	G 900 . 65	"	12.5		12.5	"
	G 50 . 4 A2	"		0.2	0.2	
	G 100 . 4 A2	"		0.3	0.3	
	G 200 . 4 A2	"		1.1	1.1	
	G 300 . 4 A2	"	0.6	0.7	1.3	
	G 50 . 5 A2	"		0.4	0.4	
	G 100 . 5 A2	"		1.0	1.0	
	G 200 . 5 A2	"		0.9	0.9	
	Section "G" Total	"	88.6	9.8	98.4	
J	J 300 . 5 P3	10m	10		10	
	J 100 . 5 P3	"	2		2	
	Section "J" Total	"	12		12	
K	KA11G2	ea		73	73	
	KB12	"		177	177	
	KE10	"		8	8	
	KE11	"		8	8	
	KE12	"		1	1	
	Section "K" Total	"		267	267	
L	L 900	ea	11		11	
	L 100 B2	"	1		1	
	L 50 B2	"		7	7	For new type cabinet
	L 100 B2	"	27	34	61	"
	Section "L" Total	"	39	41	80	

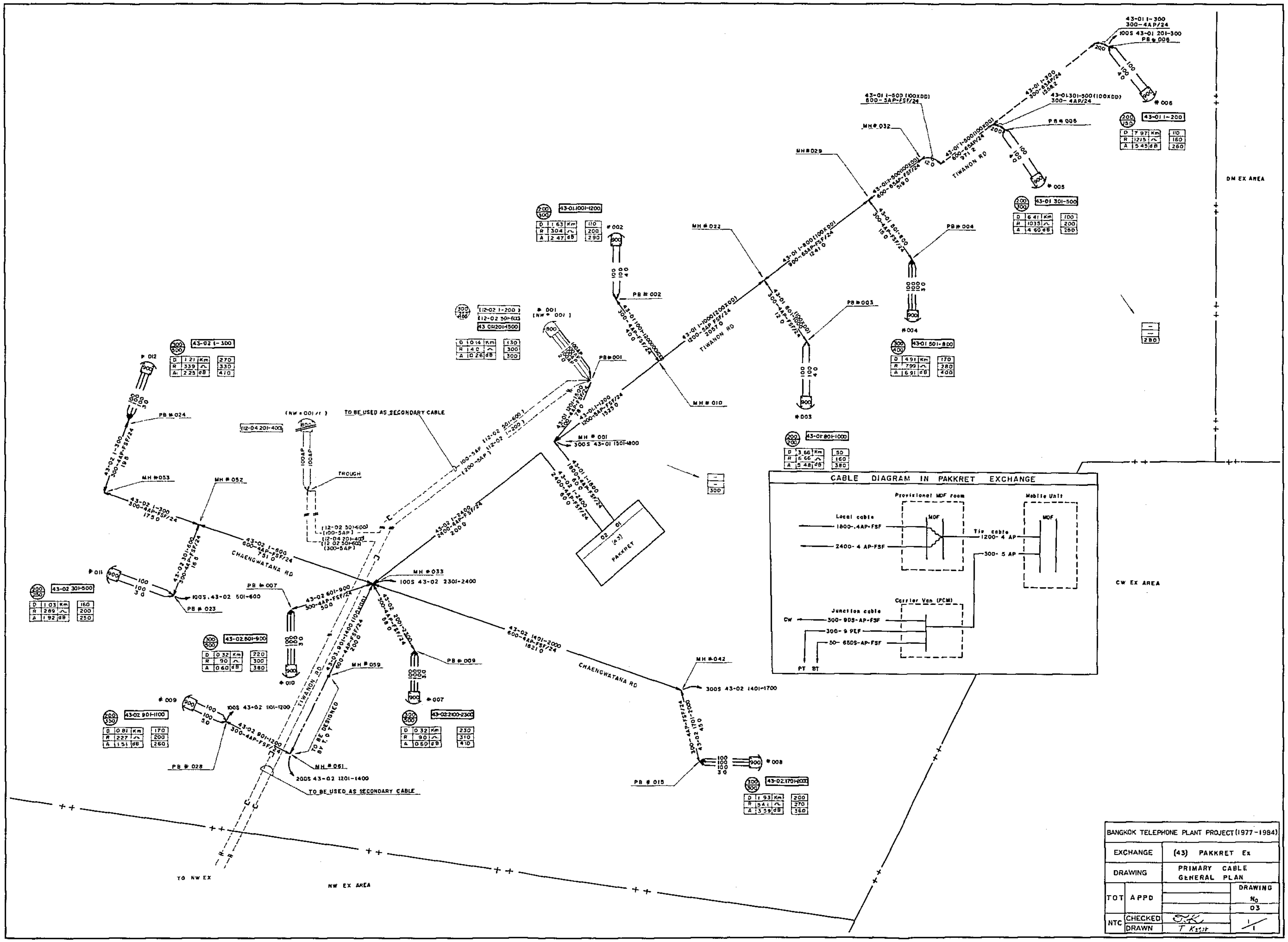
SECTION	DESIGNATION	UNIT	QUANTITY			REMARKS
			PRIMARY	SECONDARY	TOTAL	
M	M1Ap	ea		64	64	
	M1BP	"	7	53	60	
	M1CP	"	5	8	13	
	M3AP	"		15	15	
	M3BP	"	31	13	44	
	M3CP	"	35		35	
	Section "M" Total	"	78	153	231	
N	N	100 pairs	530	126	656	
P	PX6B	100 m	53.7		53.7	
	PP4A	"	0,3		0,3	
	PV4A	"	1,3		1,3	
	PP2A	"	0.3		0.3	Riser to pole
	PV2A	"	3.7		3.7	"
	PV4A	"	0,3		0,3	Riser to cabinet
	Section "P" Total	"	59,6		59,6	
Q	AQ-2	ea	30		30	
	QL-3	"	1		1	
	QJUF-11	"	6		6	
	Section "Q" Total	"	37		37	
S	S 20	ea		1	1	
	S 30	"		1	1	
	S 100	"	1		1	
	S 400	"	5		5	
	Section "S" Total	"	6	2	8	



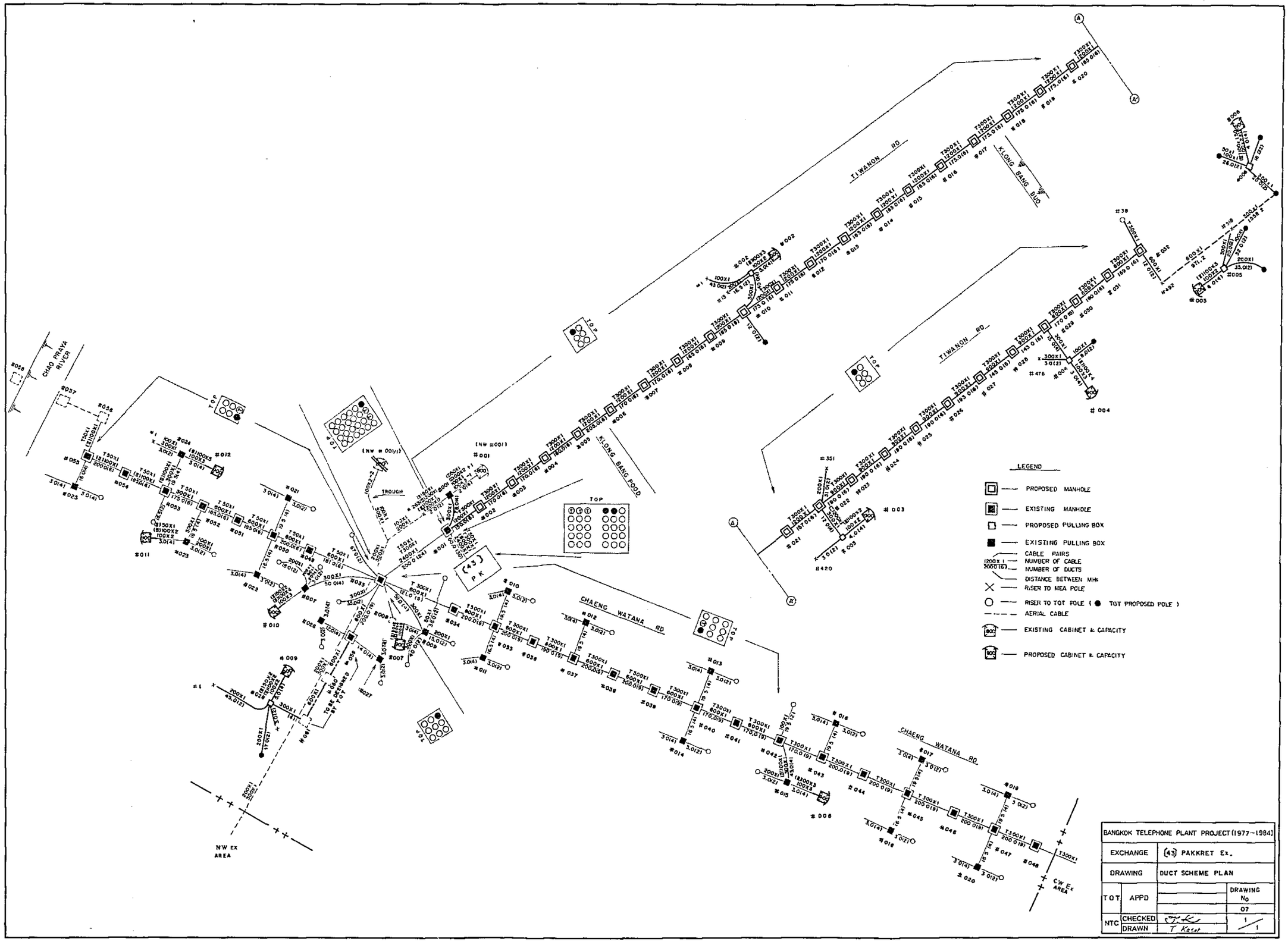
LEGEND

- BOUNDARY OF EXCHANGE AREA
- BOUNDARY OF CABINET AREA
- BOUNDARY OF FUTURE CABINET AREA
- FEEDER CABLE ROUTE (UNDERGROUND)
- FEEDER CABLE ROUTE (AERIAL)
- CABINET
- XXX NUMBER OF PRESENT DEMAND
- XXX NUMBER OF 5 YEARS DEMAND
- XXX NUMBER OF 10 YEARS DEMAND

BANGKOK TELEPHONE PLANT PROJECT (1977-1984)			
EXCHANGE		(43) PAKKRET E.	
DRAWING		KEY PLAN	
TOT	APPD		DRAWING No 01
NTC	CHECKED	S.K.	1
	DRAWN	T. Azzah	1



BANGKOK TELEPHONE PLANT PROJECT (1977-1984)
EXCHANGE
(43) PAKKRET Ex
DRAWING
PRIMARY CABLE
GENERAL PLAN
TOT APPD
DRAWING No
03
NTC CHECKED
DRAWN
1/1
CABLE DIAGRAM IN PAKKRET EXCHANGE
Provisional MDF room
Mobile Unit
MDF
Local cable
1800-4AP-FSF
2400-4 AP-FSF
Tie cable
1200-4 AP
300-5 AP
Carrier Van (PCM)
Junction cable
300-9DS-AP-FSF
300-9 PEF
50-650S-AP-FSF
CW
PT
BT
DM EX AREA
CW EX AREA
NW EX AREA
TO NW EX
CHAENGWATANA RD
TIWANON RD
TO BE USED AS SECONDARY CABLE
TROUGH
TO BE DESIGNED BY O.T
PAKKRET
MH # 001
MH # 010
MH # 022
MH # 029
MH # 032
MH # 033
MH # 042
MH # 052
MH # 053
MH # 059
MH # 061


TIWANON RD
KLONG BANG BUO
CHAENG WATANA RD
TROUGH
CHAO PRAYA RIVER
NW EX AREA
CW EX AREA
TOP
LEGEND
PROPOSED MANHOLE
EXISTING MANHOLE
PROPOSED PULLING BOX
EXISTING PULLING BOX
CABLE PAIRS
NUMBER OF CABLE
NUMBER OF DUCTS
DISTANCE BETWEEN MHs
RISER TO MEA POLE
RISER TO TOT POLE (● TOT PROPOSED POLE)
AERIAL CABLE
EXISTING CABINET & CAPACITY
PROPOSED CABINET & CAPACITY
BANGKOK TELEPHONE PLANT PROJECT (1977-1984)
EXCHANGE (43) PAKKRET Ex.
DRAWING DUCT SCHEME PLAN
TOT APPD
NTC CHECKED
DRAWN T Kaset
DRAWING No 07
1/1

CHAPTER 4. RAMINDRA TELEPHONE EXCHANGE

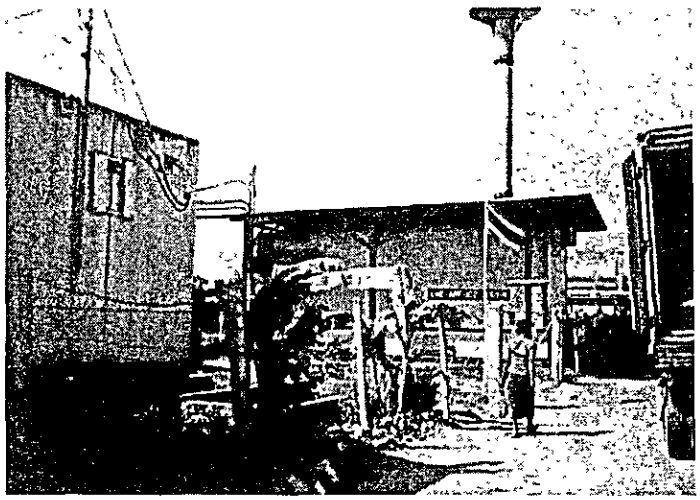
CONTENTS

CHAPTER 4. RAMINDRA TELEPHONE EXCHANGE

4.1 Service Area

The service area of the Ramindra Telephone Exchange lies in the northeastern part of the city of Bangkok. This service adjoins those of the Bangshun, Laksi and Klongchan Telephone Exchanges on the east, west and south, respectively. In this project, the Ramindra Exchange is to take over the Klongchan Exchange CAB Nos. 070, 072, 023 and 014 areas.

The whole service area covers approximately 4,500 hectares.



Ramindra Exchange Site (Mobile System)

4.2 Demand Potential and Locational Features

The service area of the Ramindra Telephone Exchange was once the swampy land. However, since the opening of the Ramindra Road and Sukapiban-1 Road in the middle part, the residential land development has been making rapid progress in this area. Now, the area is being transformed into the high grade residential quarters.

The build-and-sell type houses are occupied immediately after the completion of their construction and the telephone demand is generated

from among the residents. However, in case the land only is sold by lots, the construction of houses is delayed in many cases so that the telephone demand forecast is difficult.

In the Ramindra Exchange service area, the housing complexes have already been completed or are under construction at approximately 30 locations.

There is no possibility of special demand which has to be taken into account in the demand forecast.

In due consideration of these locational features, the field survey was carried out and, as the result, the demand distribution map was formulated on the topographical map. The demand forecast thus attained is as follows:

General Demand Forecast

	1981	1986	1991
Demand	5,190	8,100	12,700
Growth rate	100.0	156.1	244.7

4.3 Primary Cable Network Design

4.3.1 Selection of Exchange Building Site

The existing Ramindra Exchange is operating as a mobile system (type: ARF 102) with capacity of 1,000 switching lines. The new exchange with initial capacity of 10,000 switching lines is to be constructed in this project. For the new exchange site, the adjacent land to the existing exchange is scheduled to be expropriated. After the new exchange service-in, the mobile system will be discontinued.

4.3.2 Design of MDF

a. MDF is to be the same type as in other existing exchanges, i.e., the combined distribution frame type.
b. On the line side, the 258R terminal blocks with 600 pairs per vertical are to be installed.
c. At MDF, the junction cables are to be terminated firstly and then the local cables are to be terminated.

4.3.3 Number of Pairs of Entrance Cable

To be newly installed:

2400-.4 AP-FSF		3 lines
1800-.4 AP-FSF		1 line
1200-.5 AP-FSF		1 line
Total	10,200 pairs	5 lines

The cables accommodated in the mobile system are to be removed after the new exchange service-in.

4.3.4 New Cable Installation in Various Directions

(1) Sukapiban-1 Road Direction

The housing construction is active in this direction. After the construction work progress study, a part of cable work has been withheld.
The total demand five years later is estimated at 860 circuits. The spare circuits reserved in the conduit cables total 1,100 circuits.

(2) Ramindra Road Direction

a. The existing CAB Nos. 002 and 003 are to be disused because they will be an obstacle to the road improvement work in the future. In this design, they are to be replaced at new locations.

b. To cater for the demand expected in the area beyond CAB No. 018 where the residential land development is being carried out by the Thailand Housing Co., a total of 400-pair spare circuits are to be reserved in the manhole No. 037 and the pulling box No. 017.

c. Between the manholes Nos. 018 and 029 the conduit is to be newly installed in the junction cable related work, so that the underground cable is to be laid in this section though this cable is of a small number of pairs (300 pairs).

d. At the end part of each cable route the aerial line is designed for less than 600 pairs.

4.3.5 Line Loss and DC Resistance

For all subscribers in the Ramindra Exchange service area the line loss and the d.c. resistance are within the limit values prescribed in the transmission sheet.

4.4 Subscriber Cut-Over Design

This work is to cut-over a part of the mobile system and Klongchan Exchange subscribers.

(1) Cut-over of Mobile System Subscribers

a. Between the mobile system and the new exchange MDF the tie cable (1200-.4 AP-FSF) is to be laid for the purpose of multiple cut-over of subscribers.

b. On the mobile system side, the tie cable is to be multi-connected to the terminal in the outside terminal box.

c. On the new exchange side, the tie cable is to be terminated at an vacant frame of the MDF.

(2) Cut-over of Laksi Exchange Subscribers

The Ramindra Road CAB No. 015 secondary cable (015-01:1-300) is to be laid in advance and the ready access is to be fixed on the MEA pole No. 217 in order to multi-connect with jumper wires the working circuits of the existing Laksi Exchange cables.

(3) Cut-over of Klongchan Exchange Subscribers

a. Using the newly laid 05 cable, the 600-pair multi-connection is to be made on the MEA pole No. 133-1 for the purpose of multiple cut-over of CAB Nos. 025, 026 and 027 subscribers.

b. The cable (36-05:1-200) multi-connected as per a above is to be multi-connected to the existing cable (21-07: 201-400) in the pulling box No. 033 for the purpose of multiple cut-over of CAB No. 032 subscribers.

(4) After the new exchange service-in, the tie cable is to be withdrawn and the multi-connections are to be restored to the normal connections.

4.5 Design of Underground Conduit

(1) The entrance manhole and entrance duct design is to be made by TOT after the completion of the exchange building design. The manhole is of Type V-3.

(2) According to the standard design, the manhole of Type A-1 is to be used between the pulling boxes Nos. 026 and 027. However, the sidewalk is narrow and, however, the drain pipe is an obstacle so that, in this design, Type JUF-11 pulling box with a special depth of 1.3m is adopted.

(3) The following types of bridges are to be designed at the following locations:

i) Between manholes Nos. 001 and 002
   Number of pipe lines: 24 (6 lines in 4 steps)
   Bridge length: 21.0m with 3 spans

ii) Between manholes Nos. 003 and 004
   Number of pipe lines: 24 (4 lines in 6 steps)
   Bridge length: 36.0m with 4 spans

iii) Between manholes Nos. 006 and 007
   Number of pipe lines: 9 (3 lines in 3 steps)
   Bridge length: 28.0m with 5 spans

iv) Between manholes Nos. 033 and 034
   Number of pipe lines: 6 (2 lines in 3 steps)
   Bridge length: 18.6m with 3 spans

v) Between manholes Nos. 043 and 044
   Number of pipe lines: 9 (3 lines in 3 steps)
   Bridge length: 24.0m with 3 spans

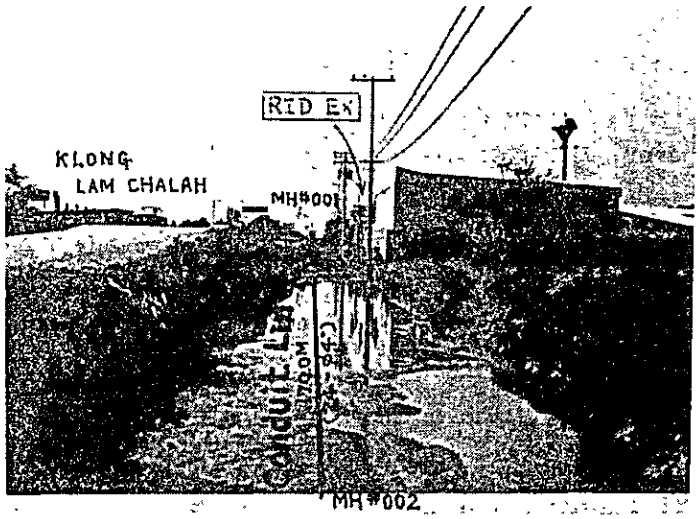
vi) Between manholes Nos. 054 and 055

Number of pipe lines: 9 (3 lines in 3 steps)

Bridge length: 26.0m with 3 spans

Note: The arrangement of pipe lines of the bridge between the manholes Nos. 001 and 002 should essentially be four lines in six steps. However, in the road expansion work in the future, the bridge pier position will become higher than the sidewalk level. Hence the arrangement of six lines in four steps.

(4) The bridge strength calculations are refer to appendixes.



New Conduit Route in front of Exchange

4.6 Secondary Cable Network Design

(1) CAB Nos. 009, 010

For the Chorake Bou market area, there is the MEA pole erection plan, but the detail design has not yet been completed. Therefore, in order to avoid the duplication of TOT poles with MEA poles, the cable distribution plan is withheld.

(2) CAB No. 015

In the National Housing Authority's housing complex, the demand density is low. (The residents in this housing complex are the low income earners.) Therefore, one cable terminal is to be installed in front of each building. (One building: 56 households. Demand density: 0.1)

(3) CAB No. 016

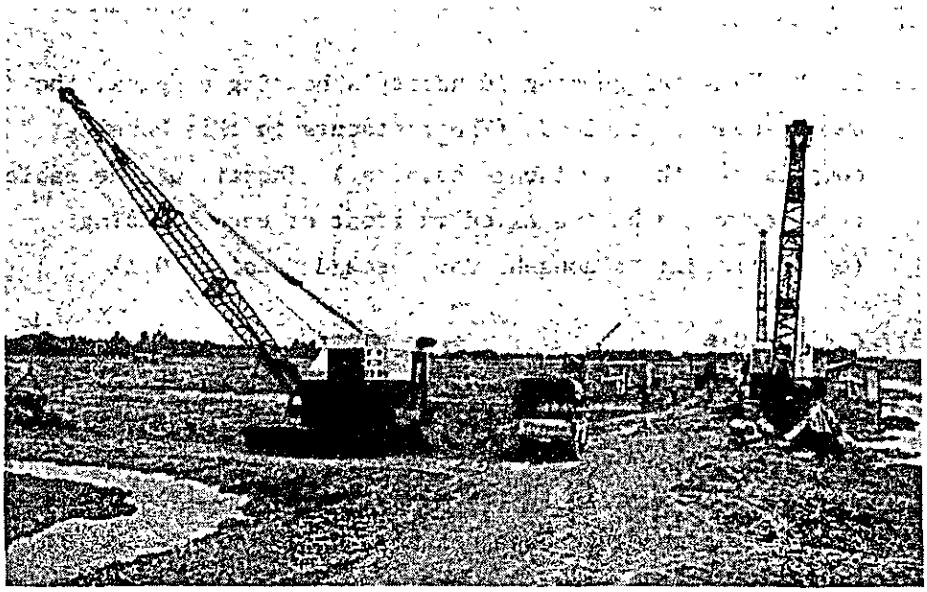
In this area exists the National Housing Authority's housing complex for high income earners. Therefore, the demand density is high. In this design, the demand is estimated at the rate of one telephone per household.

(4) CAB Nos. 018, 019, 020

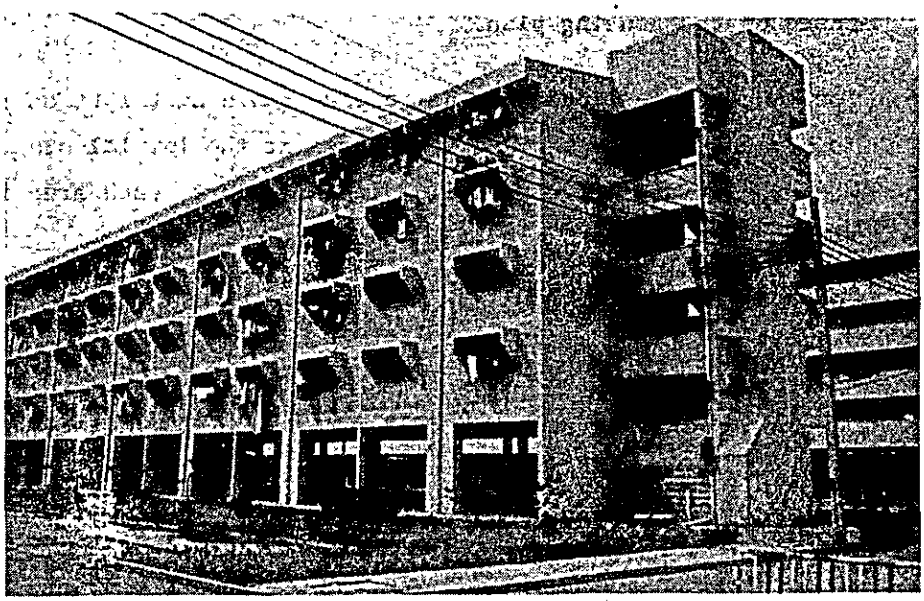
This area comprises the housing complex planned by the Thailand Housing Co. The cable work design is a desk design based on the housing plan.

(5) For the undermentioned cabinet areas, cable distribution is to be made for the whole of each area at the initial stage. When the demand actually builds in the future, each area is to be divided as required.

CAB No. 005 area
CAB No. 022 area
CAB No. 023 area
CAB No. 024 area
CAB No. 029 area
CAB No. 031 area
CAB No. 032 area



Housing Complex underconstruction



National Housing Authority's Housing Complex

4.7 Amount of Construction Work

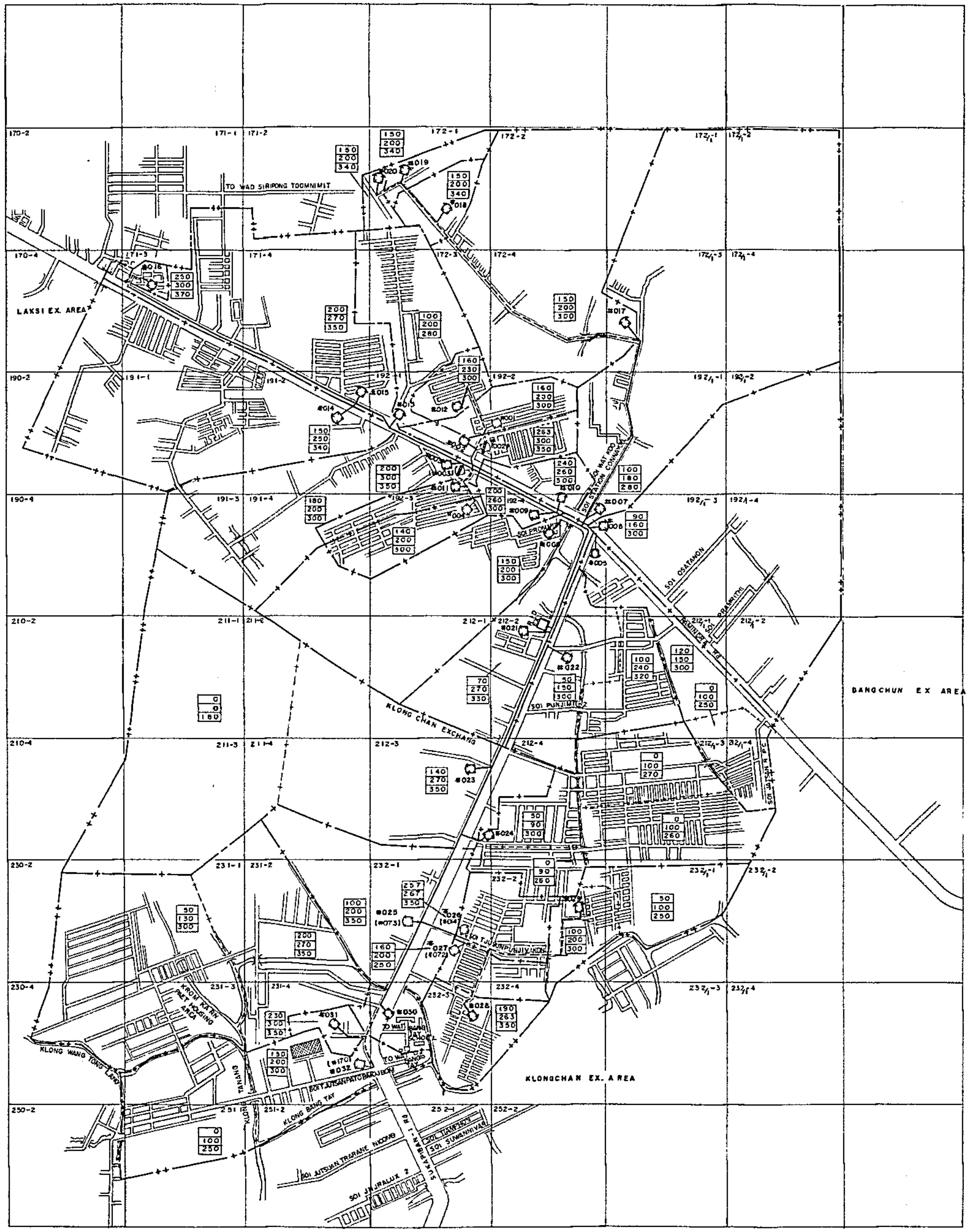
AMOUNT OF CONSTRUCTION WORK

SECTION	DESIGNATION	UNIT	QUANTITY			REMARKS
			PRIMARY	SECONDARY	TOTAL	
A	A - 8	ea	12	8	20	
B	B1BS	"	20	322	342	
	B1CS	"	13		13	
	B2B	"		3	3	
	Section "B" Total	"	33	325	358	
C	C5A2B	ea	33	322	355	
E	E 10 . 4 A2	100m		0.9	0.9	
	E 25 . 4 A2	"		88.9	88,9	
	E 50 . 4 A2	"		39,9	39,9	
	E 100 . 4 A2	"		51.7	51,7	
	E 200 . 4 A2	"	2.3	62.3	64.6	
	E 300 . 4 A2	"	14,4	23.0	37.4	
	E 400 . 4 A2	"		8.0	8.0	
	E 25 . 5 A2	"		97.2	97,2	
	E 50 . 5 A2	"		34.6	34.6	
	E 100 . 5 A2	"		25.4	25.4	
	E 200 . 5 A2	"	5,2	42.2	47.4	
	E 300. 5 A2	"	9.6	19.9	29.5	
	E 400 . 5 A2	"	6.8	0.8	7.6	
	E 600 . 5 A2	"	25.0		25.0	
	E 200 . 65 A2	"		9,7	9.7	
	E 300 . 65 A2	"	2.6		2.6	
	Section "E" Total	"	65.9	504.5	570.4	

SECTION	DESIGNATION	UNIT	QUANTITY			REMARKS
			PRIMARY	SECONDARY	TOTAL	
G	G 300 . 4	100m	7.0		7.0	AP-FSF cable
	G 600 . 4	"	3.0		3.0	"
	G 900 . 4	"	1.9		1.9	"
	G1200 . 4	"	25.6		25.6	"
	G1800 . 4	"	19.3		19.3	"
	G2400 . 4	"	35.3		35.3	"
	G 300 . 65	"	19.8		19.8	"
	G 900 . 5	"	3.8		3.8	"
	G1200 . 5	"	48.6		48.6	"
	G 100 . 4 A2	"		0.6	0.6	
	G 200 . 4 A2	"	0.9	1.6	2.5	
	G 300 . 4 A2	"	0.3	1.1	1.4	
	G 400 . 4 A2	"		1.0	1.0	
	G 100 . 5 A2	"		0.1	0.1	
	G 200 . 5 A2	"	0.3		0.3	
	G 300 . 5 A2	"	0.2	0.6	0.8	
	G 400 . 5 A2	"	0.2		0.2	
	Section "G" Total	"	166.2	5.0	171.2	
J	J 300 . 5 P3	10m	16.4		16.4	
K	KA11G2	ea		110	110	
	KB12	"		469	469	
	Section "K" Total	"		579	579	
L	L 900	ea	26		26	
	L 100 B2	"		3	3	
	L 50 B2	"	3		3	For new type cabinet
	L 100 B2	"	64	99	163	"
	Sectional "L" Total	"	93	102	195	

SECTION	DESIGNATION	UNIT	QUANTITY			REMARKS
			PRIMARY	SECONDARY	TOTAL	
M	M1AP	ea		69	69	
	M1BP	"	16	119	135	
	M1CP	"	5		5	
	M3AP	"	1	7	8	
	M3BP	"	51	33	84	
	M3CP	"	82		82	
	Section "M" Total	"	155	228	383	
N	N	100 pairs	1612	335.6	1947.6	
P	PP4B	100m	0.2		0.2	
	PP6B	"	0.3		0.3	
	PP9B	"	1.1		1.1	
	PP24B	"	0.8		0.8	
	PV4B	"	3.6		3.6	
	PV6B	"	0,7		0,7	
	PV9B	"	1.3		1.3	
	PV15B	"	1.0		1.0	
	Px6B	"	18.2		18.2	x: TOT determined
	Px9B	"	64,8		64.8	
	Px24B	"	6.0		6.0	
	PP2A	"	0.8		0.8	Riser to pole
	PP2A	"	4.2		4.2	"
	PV4A	"	0.9		0.9	Riser to cbinet
	Section "P" Total	"	103.9		103.9	

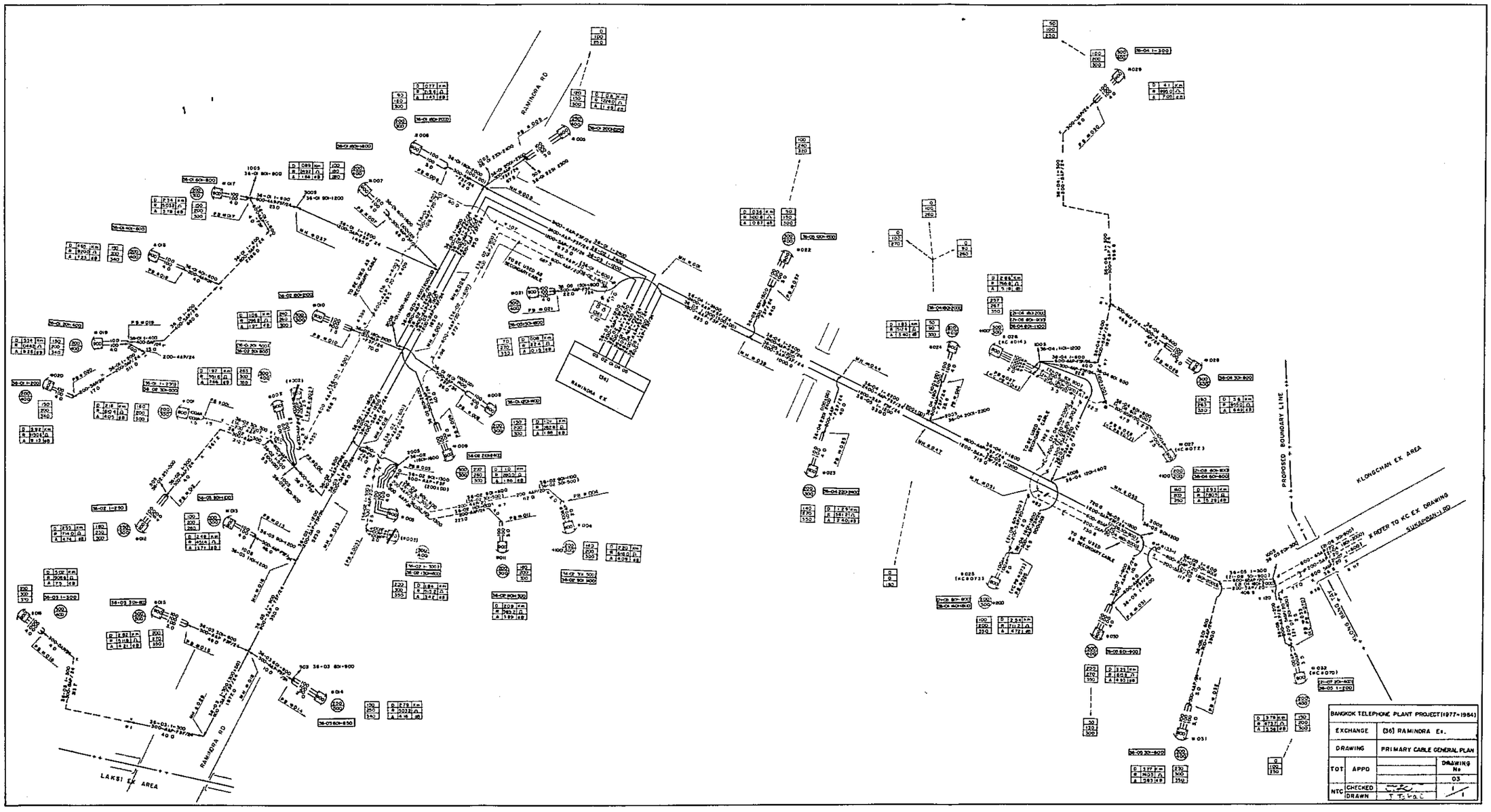
SECTION	DESIGNATION	UNIT	QUANTITY			REMARKS
			PRIMARY	SECONDARY	TOTAL	
Q	QA-1	ea	8		8	
	QA-2	"	39		39	
	QA-3	"	3		3	
	QL-3	"	2		2	
	QV-3	"	1		1	
	"MH" Total	"	53		53	
	QJUF-11	"	26		26	
	QJUF-11	"	2		2	Special
	"PB" Total	"	28		28	

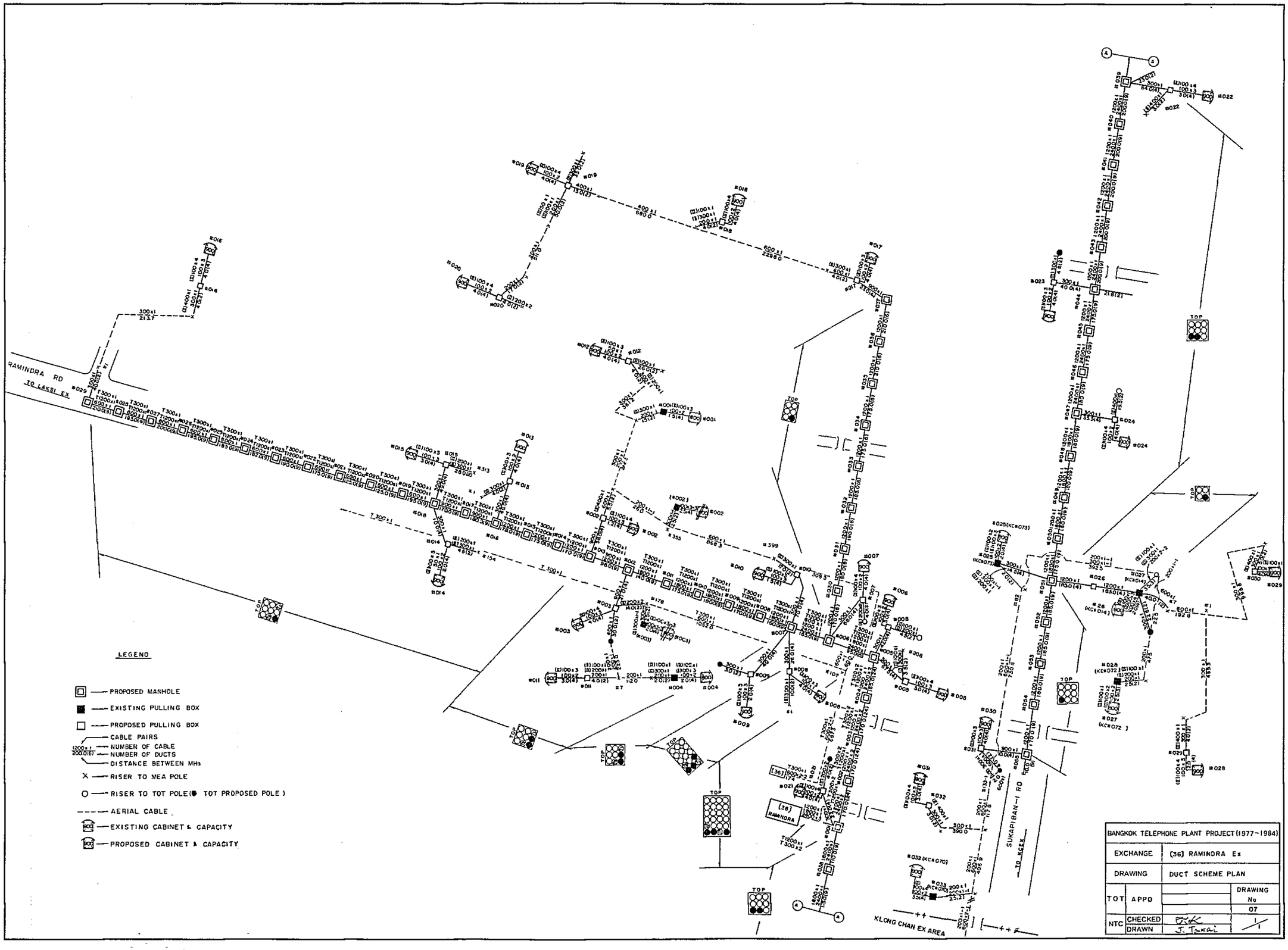


LEGEND

- BOUNDARY OF EXCHANGE AREA
- BOUNDARY OF CABINET AREA
- BOUNDARY OF FUTURE CABINET AREA
- FEEDER CABLE ROUTE (UNDER GROUND)
- FEEDER CABLE ROUTE (AERIAL)
- CABINET
- 210 NUMBER OF PRESENT DEMAND
- 270 NUMBER OF 5YEARS DEMAND
- 350 NUMBER OF 10YEARS DEMAND

BANGKOK TELEPHONE PLANT PROJECT (1977~1984)			
EXCHANGE		(36) RAMINDRA Ex	
DRAWING		KEY PLAN	
TOT	APPD		DRAWING No 01
NTC	CHECKED	T.K	1/1
	DRAWN	J Takai	


RAMINDRA RD
RAMINDRA EX
LAKSI EX AREA
KLONGCHAN EX. AREA
PROPOSED BOUNDARY LINE
SUKAPIBAN-1 RD
TO BE USED AS SECONDARY CABLE
BANGKOK TELEPHONE PLANT PROJECT(1977-1984)
EXCHANGE (36) RAMINDRA Ex.
DRAWING PRIMARY CABLE GENERAL PLAN
DRAWING No 03


RAMINDRA RD
TO LAKSI EX
LEGEND
PROPOSED MANHOLE
EXISTING PULLING BOX
PROPOSED PULLING BOX
CABLE PAIRS
NUMBER OF CABLE
NUMBER OF DUCTS
DISTANCE BETWEEN MHs
RISER TO MEA POLE
RISER TO TOT POLE(TOT PROPOSED POLE)
AERIAL CABLE
EXISTING CABINET & CAPACITY
PROPOSED CABINET & CAPACITY
[36] RAMINDRA
SUKAPIBAN-I RD
TO KEEX
KLONG CHAN EX AREA
BANGKOK TELEPHONE PLANT PROJECT (1977-1984)
EXCHANGE
(36) RAMINDRA Ex
DRAWING
DUCT SCHEME PLAN
TOT APPD
NTC CHECKED
NTC DRAWN
J. Takai
DRAWING No
07