

8.3.4 Metropolitan Junction Transmission System

At the end of 1992, there are more than 80 switching facilities, in the metropolitan area, which are connecting with PCM-30 systems, optical fiber systems and radio links. Most of the PCM-30 systems will be replaced with optical fiber systems by 2007. The contents of expansion facilities for the plan are shown in Table 8.3.4-1. Detail configuration of the area is shown in Appendix.

Table 8.3.4-1 Metropolitan Junction Transmission Facilities Expansion Plan

Installation	140 Mb/s	9 span	36 system
	34 Mb/s	20 span	80 system
Expansion	140 Mb/s	34 span	136 system
Multiplexer	140 Mb/s		110 units
	34 Mb/s		76 units
	8 Mb/s		163 units

In addition, digital transmission switching system will also be introduced to relieve the circuits, connecting between the important switching facilities similarly in long distance transmission routes. The configuration of metropolitan transmission network is shown in Figure 8.3.4-1.

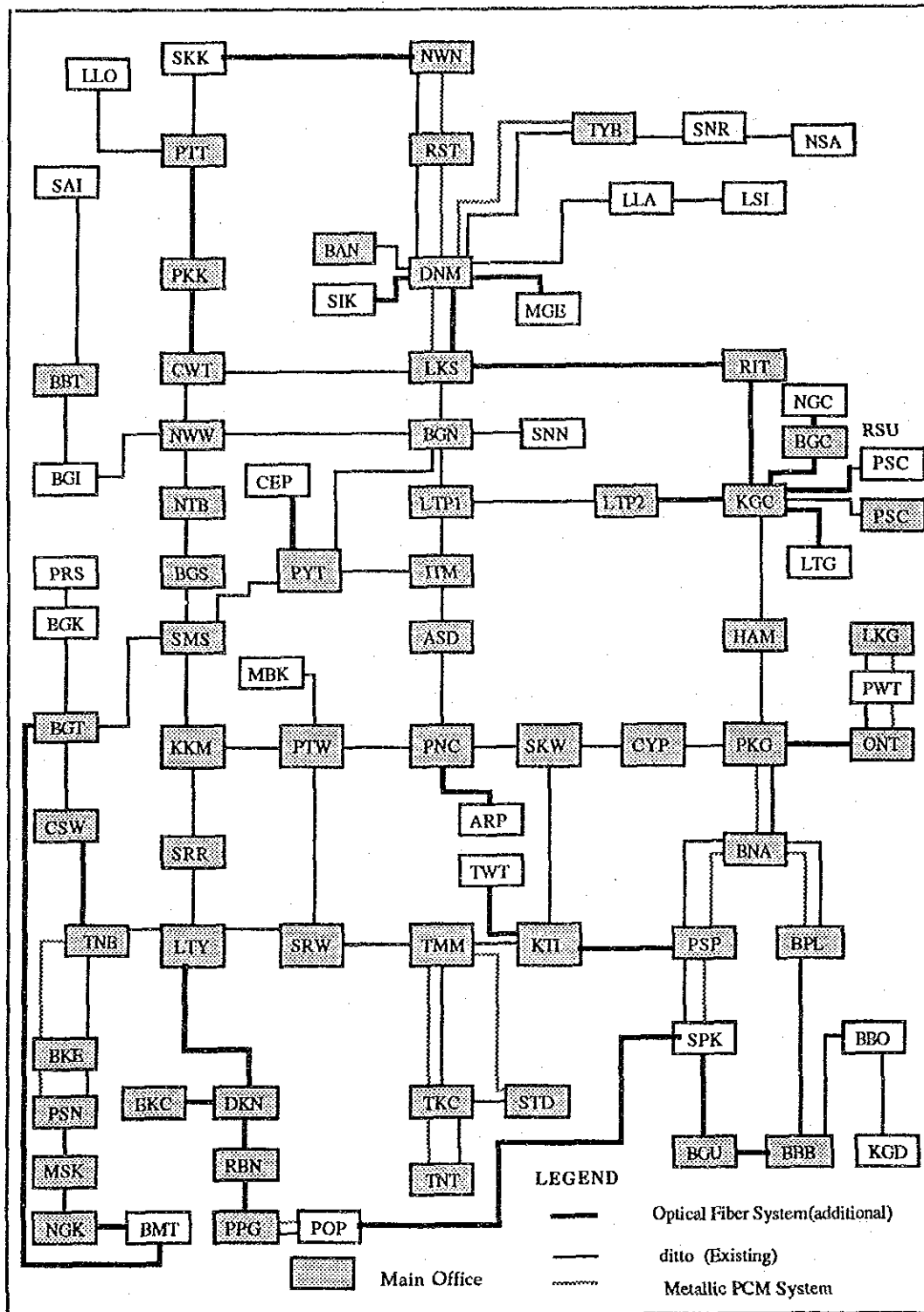


Figure 8.3.4-1 Metropolitan Junction Transmission Network Layout (End of 2007)

8.3.5 Satellite Communication System

1) Necessity of Satellite Communication System for TOT

Since the advent of satellite communications in the 1960's, Application of satellite communications has been enlarged in both international and domestic telecommunication services in many countries. On the basis of recent development of telecommunication technologies, satellite communications have become more and more convenient and inexpensive in comparison with terrestrial transmission systems for various domestic purposes even in a middle-sized countries like Thailand.

As described in the previous chapter, CAT has been operating its own domestic satellite communication system. Nevertheless, it is considered that TOT should also have its own satellite communication system because of the following reasons.

a) Communication Satellite Launching Plan

According to the information obtained during the study work, there was a plan to launch a communication satellite in Thailand a few years ago, under the sponsorship of the Ministry of Communications. That plan was not realized then, however, the plan has been restudied recently and is expected to become realized soon.

Today, a communication satellite is usually mounted with more than ten transponders. Therefore, TOT should embrace this opportunity to keep appropriate assignment of transponders for the purposes described in the following paragraphs in order to reinforce TOT's domestic telecommunication network in Thailand.

b) Television Signal Transmission

TOT has been offering a nationwide TV transmission network to the state-run TV broadcasting organization, Television of Thailand, through terrestrial microwave transmission system from Bangkok to Chiang Mai, Khon Kaen and Hat Yai.

Taking superannuation of the existing analog microwave system and expected cost reduction of satellite communication system in future into consideration, satellite communication system should be applied to replace present analog microwave system by stages in accordance with the TV broadcasting network expansion programs of the organizations concerned.

c) Enhancement of Network Reliability

In the telecommunication network design procedure, duplication of transmission route is essential to enhance network reliability in order to cope with natural disasters such as earthquakes floods etc. Since satellite communication system is less vulnerable to such natural disasters than multi-hop terrestrial radio relay systems or cable systems, it is desirable to proceed with network duplication with satellite communication system for TOT.

Especially for southern region of this country, it is considered very useful to provide duplicated transmission routes with satellite communication system taking account of the special geographical situations.

d) Provision of a Common Detour Circuit Group

Moreover, in order to reinforce the public switched telephone network economically, application of 64 kb/s satellite circuit group as a common alternative route will preferably be introduced to provide common detour circuits with Demand Assigned Time Division Multiple Access (DA-TDMA) function for all the TCs and the SCs in the PSTN.

When terrestrial circuits to be connected between a certain TC (or SC) and another TC (or SC) are all engaged, one of this satellite circuits can be applied to convey the overflow traffic through the said section.

e) Provision of High-Speed Digital Transmission for New Enhanced Services

As described in the previous chapters, ISDN will have been introduced and extended from the metropolitan area to the major cities in provincial areas during the Master Plan period. Accordingly, it is considered appropriate to apply the satellite communication system for the purpose of providing flexible high-speed nationwide transmission with some selectable bit rates (from 64 kb/s to 8 Mb/s or so) about in the Phase-2 period.

2) Introduction and Extension Plan

a) Installation Period

For the satellite communication system of TOT, installation period for the introduction stage is provisionally selected as FY 1996 to 1997 in Phase-1. When the communication satellite launching plan in Thailand is decided, however, the introduction plan of TOT's satellite

communication system should be adjusted to the launching plan for effective utilization of the transponders assigned to TOT.

For two extension projects, installation periods are provisionally set in Phase-2 and Phase-3 respectively, as described in the following paragraphs.

b) Introduction Plan

i) Frequency Band and System Composition

The frequency band is to be selected taking the following matters into consideration.

- Radio frequency assignment plan in Thailand.
- Evaluation of radio interference with the terrestrial microwave transmission systems.
- Evaluation of radio propagation loss caused by precipitation.

The satellite communication system in the initial stage will be composed of a master station, 10 local stations and 5 transportable stations. The system capacity for the initial stage will be prepared corresponding to three transponders having a 36 MHz bandwidth respectively, one for TV transmission, another for telephone circuits and the other for standby or temporary transmission.

ii) Master Earth Station

A master earth station is to be located in appropriate place in the metropolitan area or its peripheral area. According to the recent tendency, the master station may preferably be located on the top of the existing or a new building belonging to TOT (including TOT's new Headquarters building, now under construction) if enough space is available.

The master station will be a standard A station with antenna diameter of about 17 meters if the assigned frequency band is C band (6/4 GHz). If the assigned frequency band is Ku band (14/11 GHz), the master station will be a standard C station with antenna diameter of about 11 meters.

iii) Local Earth Stations

In the introduction period, local earth stations will be installed in the following 11 cities taking account of TV transmission (FM) and some telephone circuits transmission with DA TDMA function for a common detour circuit group and also a relief measure when terrestrial transmission system becomes out of order.

Nakhon Ratchasima, Phitsanulok, Surat Thani (TCs), Udon Thani, Khon Kaen, Ubon Ratchathani, Chiang Mai, Lampang, Hat Yai, Nakhon Si Thammarat, Chon Buri (SCs) as shown in Figure 8.3.5-1. These local stations will be standard B stations having about 13 meter diameter antenna if the assigned frequency band is C band, or standard D-2 stations having 12 meter diameter antenna if the assigned frequency band is Ku band.

Locations of the local stations should be selected near to the telephone offices above mentioned, or preferably at the top of the telephone office buildings if enough space is available.

iv) Transportable Earth Stations

In the introduction plan, five transportable earth stations will be equipped for temporary or emergency use in the case of terrestrial transmission system failure etc., two in the metropolitan area, and the other three at regional TCs, namely, Nakhon Ratchasima, Phitsanulok and Surat Thani, respectively (refer to Figure 8.3.5-1).

The capacity of this system is about 60 ch. both-way telephone communication to any fixed stations or a one-way TV signal transmission toward the master station. In this case, frequency modulation will be applied for the both kinds of signal.

c) First Expansion Plan

The period of the first expansion plan of the satellite communication system is provisionally selected in the latter two years of the Phase-2, namely, FY 2001 to FY 2002. This expansion plan will include capacity extension of the master station and four local stations located in Chon Buri, Chiang Mai, Khon Kaen and Hat Yai for high-speed digital transmission, and also new installation at the five following cities with SC; Phetchaburi, Prachin Buri, Nakhon Sawan, Yala, Phuket, as shown in Figure 8.3.5-2.

d) Second Expansion Plan

The period of the second expansion plan of the satellite communication system is provisionally selected in the latter two years of the Phase-3, namely, FY 2006 to FY 2007. This expansion plan will consist of installation of local stations at the following four cities with SC; Ayutthaya, Saraburi, Nakhon Pathom, Chanthaburi, as shown in Figure 8.3.5-3.

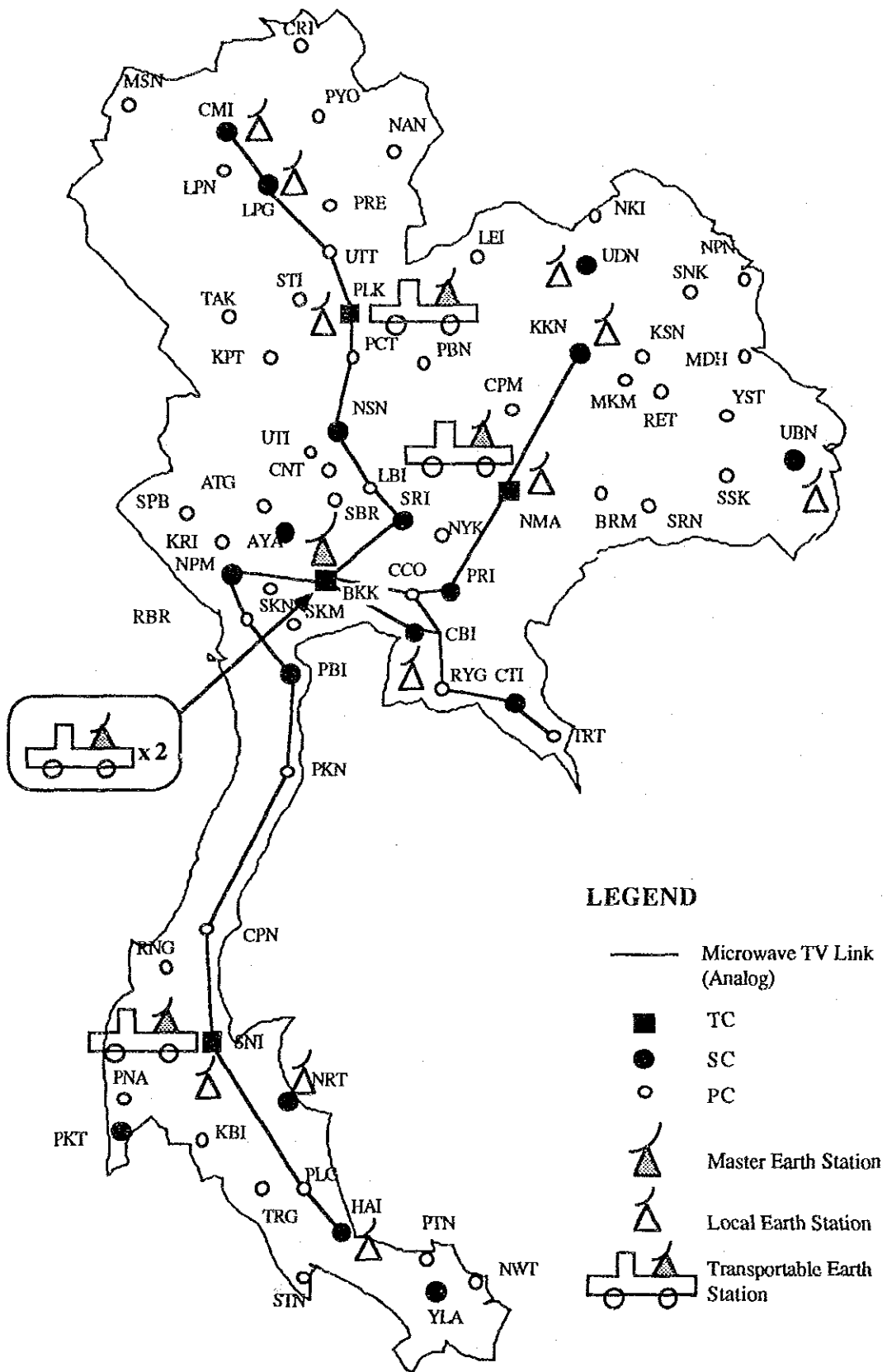


Figure 8.3.5-1 The Introduction Plan of Satellite Earth Station (End of 1997)

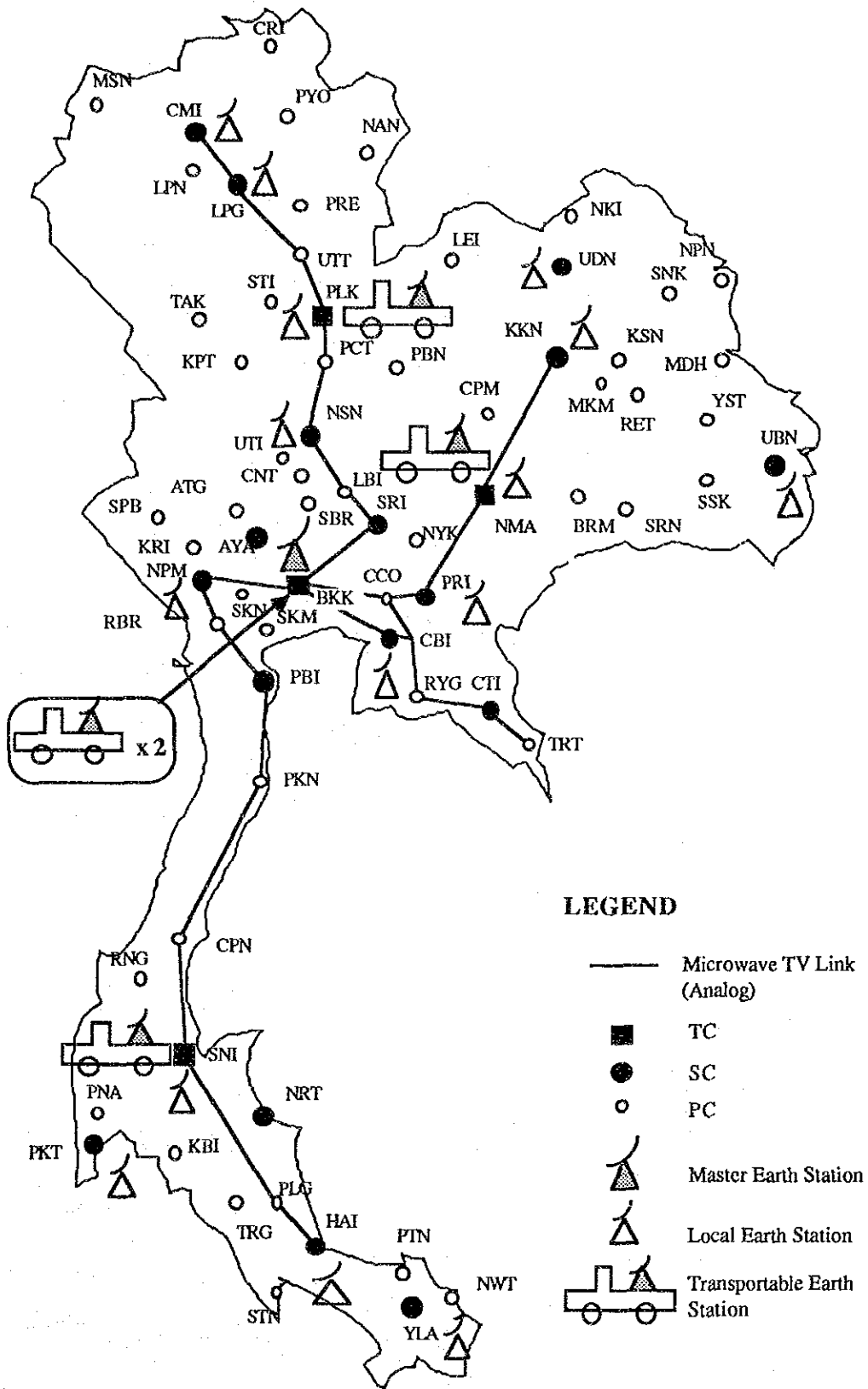


Figure 8.3.5-2 The Location Plan of Earth Station (End of 2002)

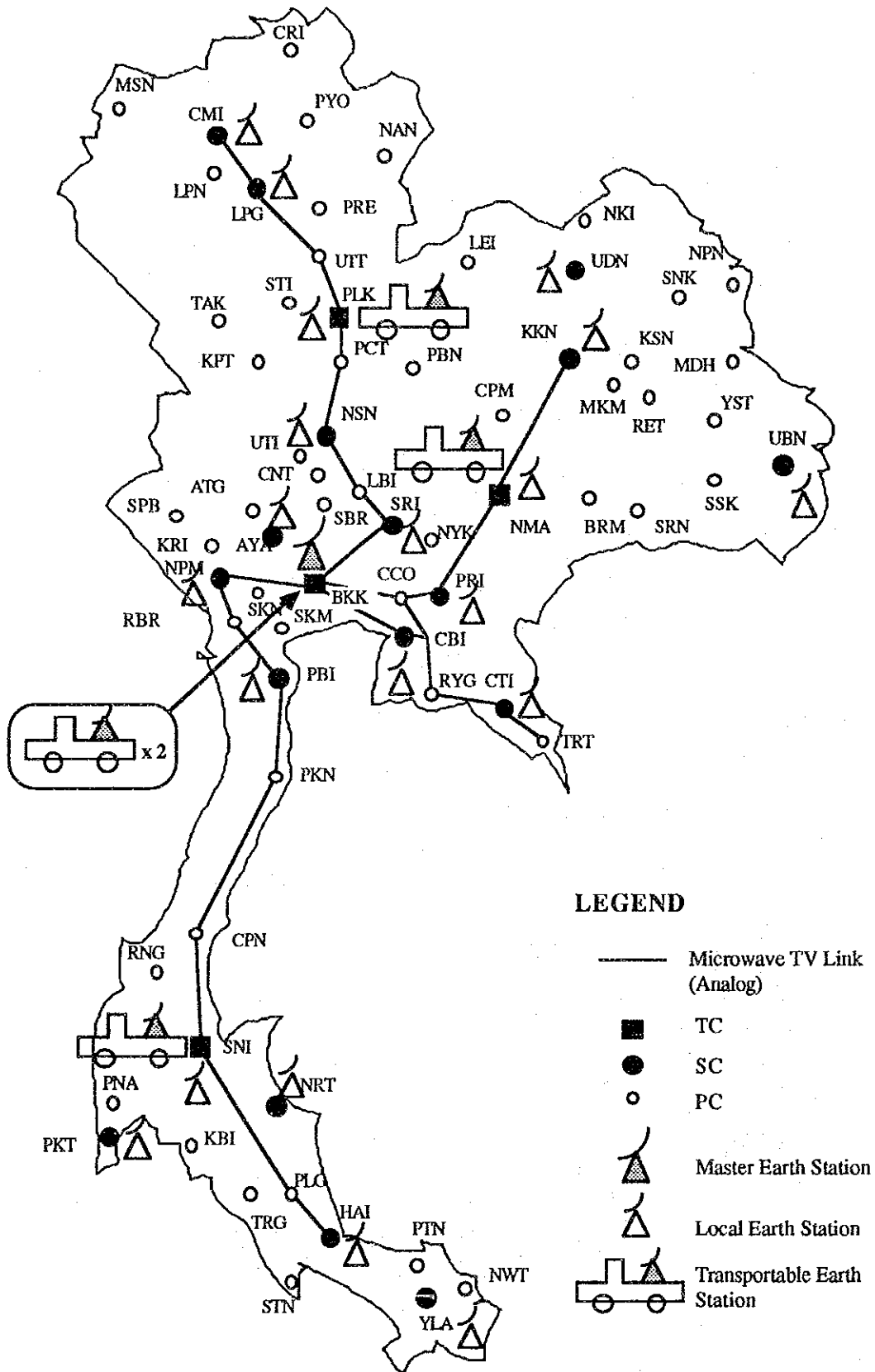


Figure 8.3.5-3 The Result of 2nd Expansion Plan of Satellite Earth Station (End of 2007)

8.3.6 Enhancement of Network Reliability

For promoting the reliability of the transmission network, it will be planned to install several transmission routes and to introduce of transmission switching systems. As mentioned before, the satellite communication system is introduced also for this purpose.

1) Duplicated and Looped Transmission System

Necessity of duplication and looping of transmission route is described in the previous sections 8.3.2 and 8.3.4. Through execution of the expansion plan, duplicated and looped route ratio in the long distance routes will be improved from 47 percent to 89 percent in the period as shown in Table 8.3.6-1.

Table 8.3.6-1 State of Looped or Duplicated Transmission Route
(1/2)

	Office Name	Station Code	State of looped or duplicated transmission			
			End of 1992	End of 1997	End of 2002	End of 2007
1	Bangkok	BBK	○	○	○	○
2	Prachin Buri	PRI	○	○	○	○
3	Nakhon Nayok	NYK				
4	Chon Buri	CBI	○	○	○	○
5	Rayong	RYG			○	○
6	Chachoengsao	COO	○	○	○	○
7	Chanthaburi	CTI			○	○
8	Trai	TRT				
9	Nakhon Ratchasima	NMA	○	○	○	○
10	Buri Ram	BRM	○	○	○	○
11	Chaiyaphun	CPM	○	○	○	○
12	Ubon Rachathani	UBN	○	○	○	○
13	Si Sa Ket	SSK	○	○	○	○
14	Surin	SRN	○	○	○	○
15	Yasothon	YST	○	○	○	○
16	Udon Thani	UDN	○	○	○	○
17	Loei	LEI	○	○	○	○
18	Nong Khai	NKI				○
19	Sakon Nakhon	SNK				○
20	Nakhon Phanom	NPN				○
21	Mukdahan	MDH				○
22	Khon Kaen	KKN	○	○	○	○
23	Roi Et	RET	○	○	○	○
24	Maha Sarakham	MKM	○	○	○	○
25	Kalasin	KSN				
26	Phitsanulok	PLK	○	○	○	○
27	Tak	TAK				○
28	Kamphaeng Phet	KPT				○
29	Sukhothai	STI				
30	Uttaradit	UTT	○	○	○	○
31	Nakhon Sawan	NSN	○	○	○	○
32	Phetchabun	PBN				
33	Chai Nat	CNT	○	○	○	○
34	Uthai Thani	UTI	○	○	○	○
35	Phichit	PCT	○	○	○	○
36	Chiang Mai	CMI		○	○	○
37	Lamphun	LPN				○
38	Mae Hong Son	MSN				

Table 8.3.6-1 State of Looped or Duplicated Transmission Route
(2/2)

39	Chiang Rai	CRI				0
40	Lampang	LPG		0	0	0
41	Phayao	PYO				0
42	Phrae	PFE				0
43	Nan	NAN				0
44	Phetchaburi	PBI	0	0	0	0
45	Prachuap Khiri Khan	PKN	0	0	0	0
46	Rachaburi	RBF	0	0	0	0
47	Nakhon Pathom	NPM	0	0	0	0
48	Kanchanaburi	KRI				0
49	Samut Sakhon	SKN				0
50	Samut Songkhram	SKM				0
51	Nakhon Si Thammarat	NRT	0	0	0	0
52	Trang	TRG				0
53	Krabi	KRB				0
54	Phuket	PKT			0	0
55	Phangnga	PNA				0
56	Srat Thani	SNI	0	0	0	0
57	Ranong	RNG				0
58	Chumphon	CPN	0	0	0	0
59	Yala	YLA			0	0
60	Narathiwat	NWT				0
61	Pattani	PTN				0
62	Hat Yai	HYI		0	0	0
63	Satun	STN				0
64	Phatthalung	PLG			0	0
65	Ayutthaya	AYA	0	0	0	0
66	Suphan Buri	SPB				0
67	Ang Thong	ATG	0	0	0	0
68	Saraburi	SRI	0	0	0	0
69	Lop Buri	LPI				0
70	Sing Buri	SBR	0	0	0	0
	Total		33	36	41	62
	Rate		0.471	0.514	0.586	0.886

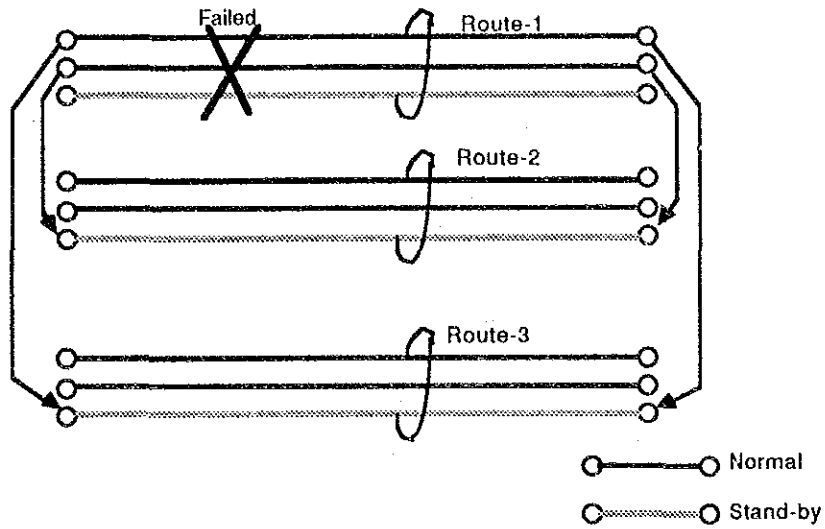
Note: Phangnga and Ranong are included in PC.

2) Transmission Switching System

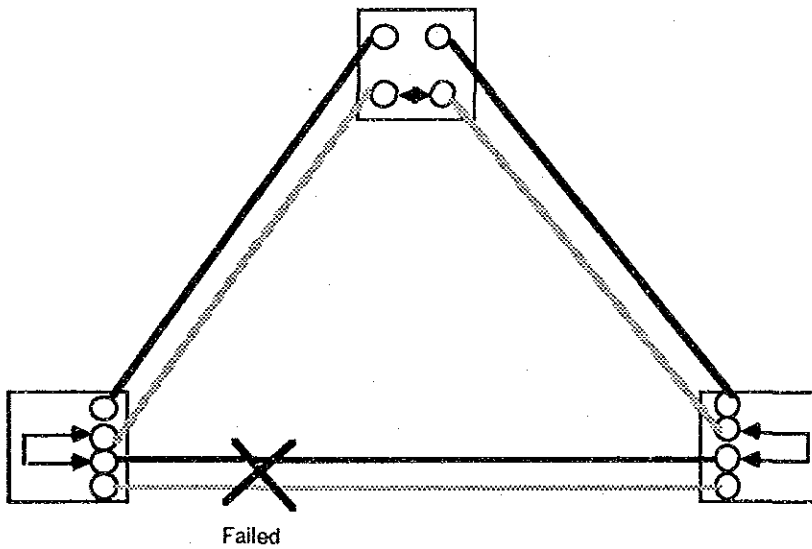
a) Transmission Network Switching System Concept

Microwave transmission systems have the standby radio channel to ensure overall system reliability. This is a typical intra-route-switching security method and is also applicable to other transmission systems.

When there are several transmission routes between two switching facilities, inter-route-switching is more effective than intra-route-switching. Moreover, in inter-route system, there are two switching methods in the looped transmission network, namely direct-route-switching and detour-route-switching, as shown in Figure 8.3.6-1.



a) Direct-route switching



b) Detour-route switching

Figure 8.3.6-1 Transmission Switching System Concept

In an actual transmission network security system, these two concepts are jointly adopted to realize an efficient standby network configuration. And the capacity of a standby network is decided by number of normal circuits. Figure 8.3.6-2 shows a configuration of transmission switching system in Thailand.

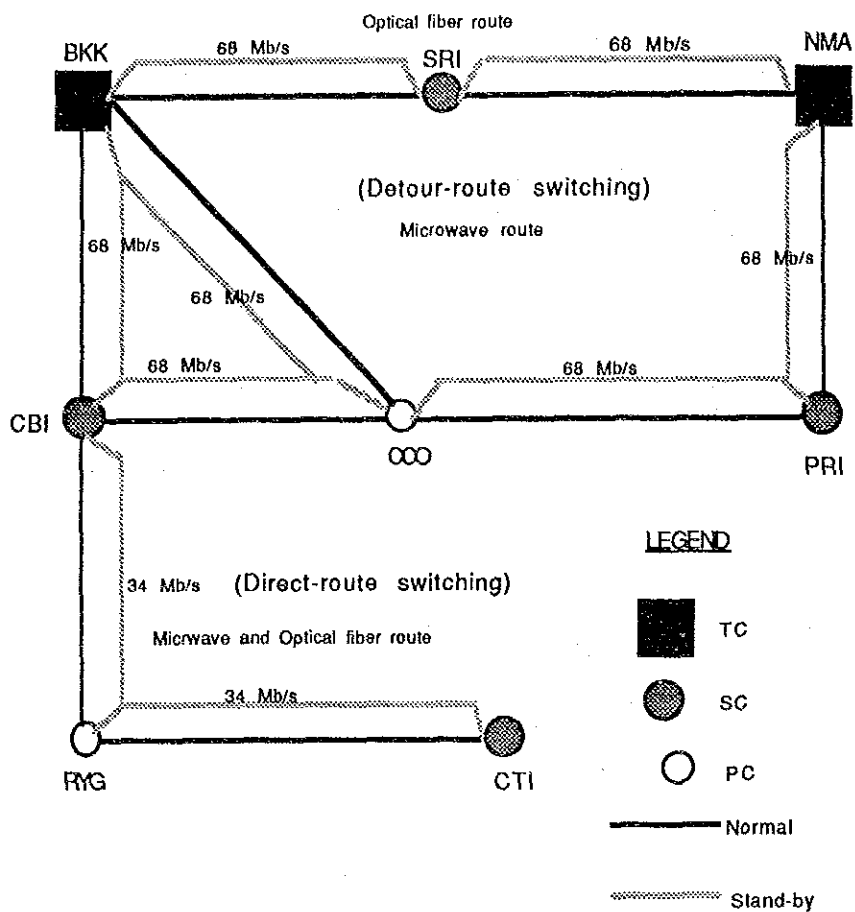


Figure 8.3.6-2 Configuration of the Transmission Switching System

b) Introduction of Transmission Switching System

In the long distance transmission system, it will be introduced among all the TCs and SCs in Phase-2, as shown in Figure 8.3.6-3. In the standby network, 68 Mb/s groups will be used in main routes among TCs, and 34 Mb/s used in the route among SCs according to the number of circuits.

In the metropolitan junction transmission system, it will mainly be introduced into special important routes (e.g. among tandem switching offices), as shown in Figure 8.3.6-4. In these routes, 68 Mb/s will mostly be used for the standby network.

4) Introduction of Satellite Communication System

At the end of the Master plan, 8 PCs are impossible to connect the other PCs through looped or duplicated routes as shown in Table 8.3.6-2.

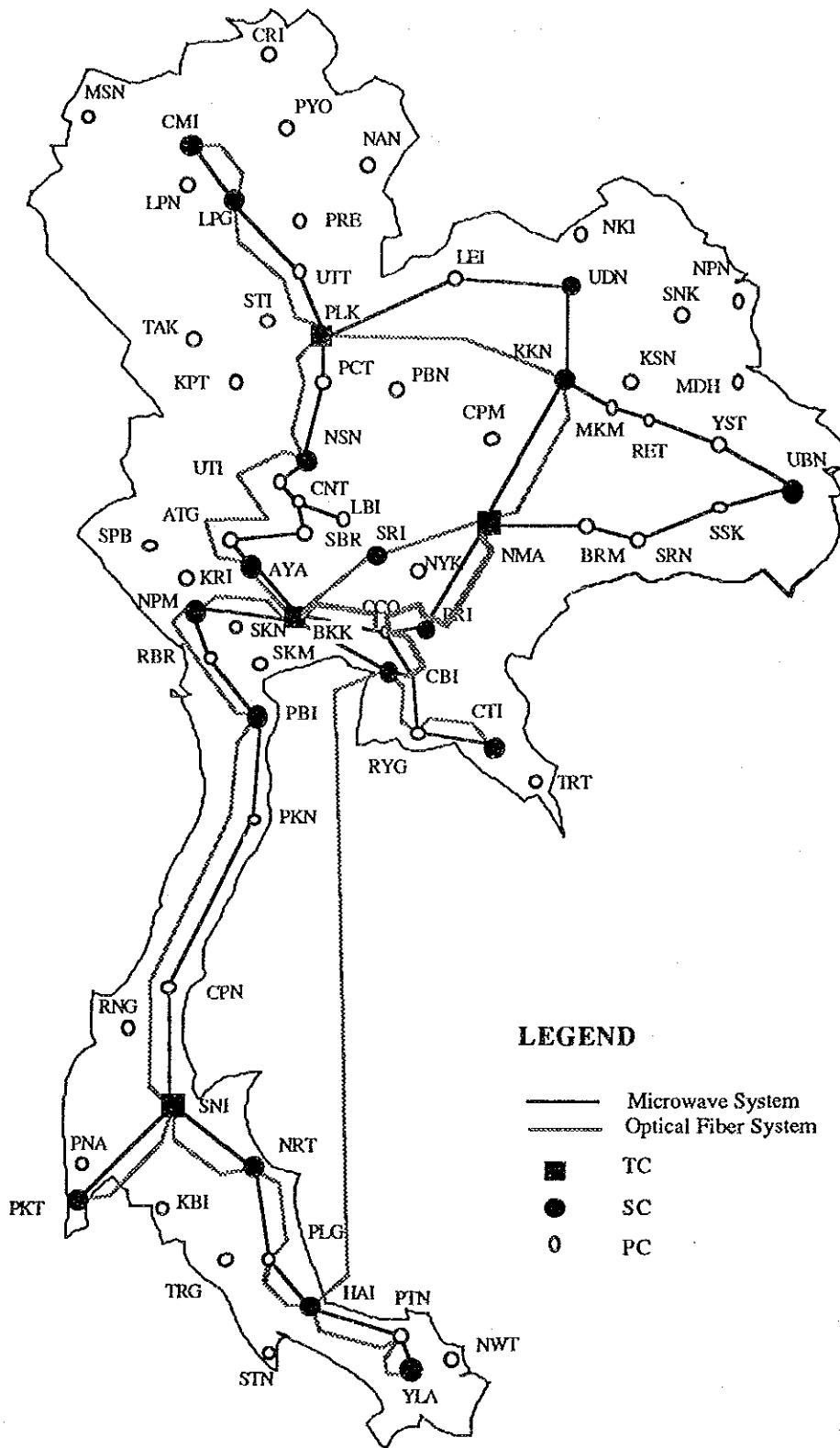


Figure 8.3.6-3 Long Distance Transmission System Introduced Digital Switching System

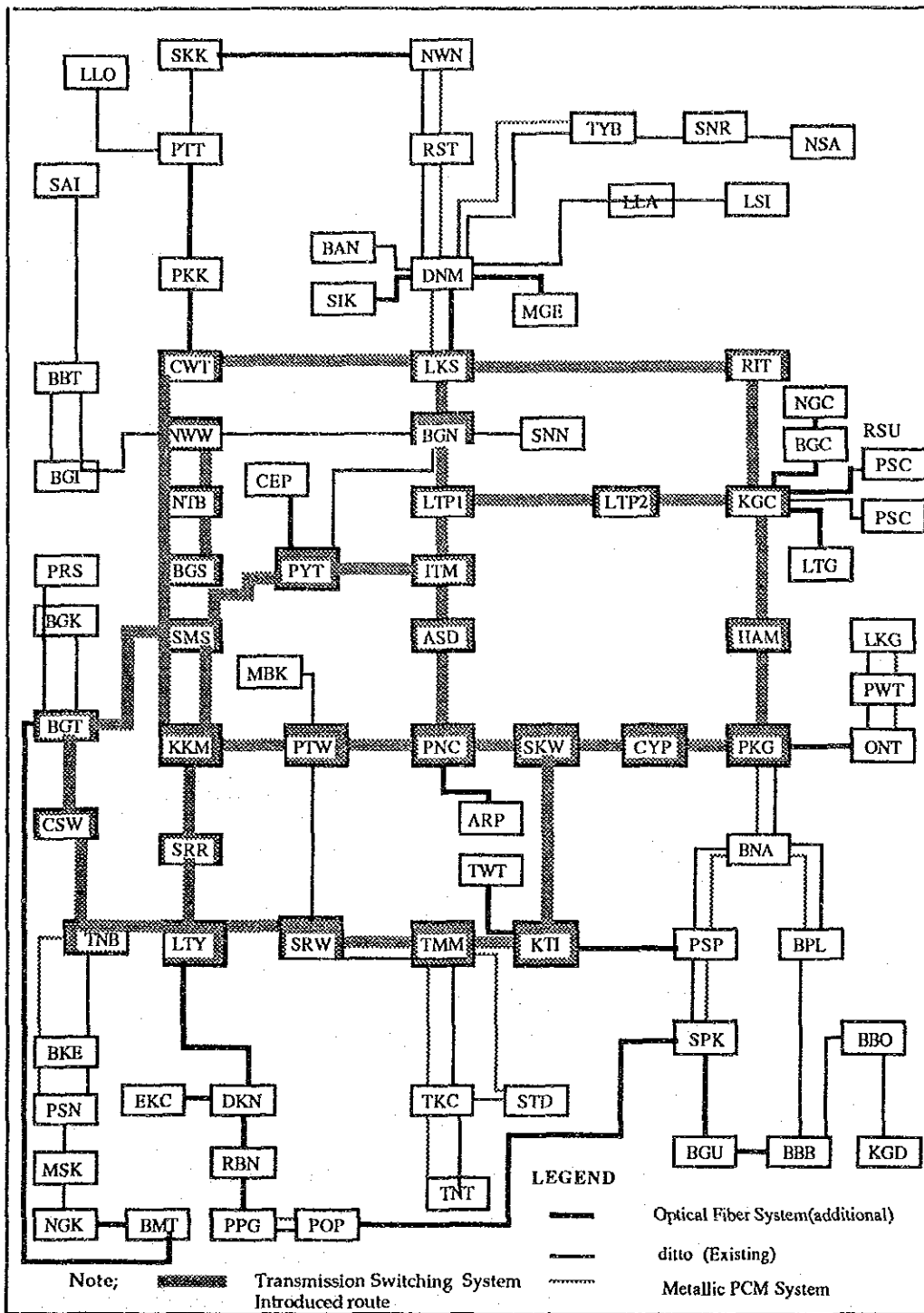


Figure 8.3.6-4 Metropolitan Junction Transmission Network Introduced with Transmission Switching System

Table 8.3.6-2 Feature of PCs Connected to Others with One Route

ZONE	No. of PC	Name of PC	Name of TC
East	1	NYK (Nakhon Nayok)	BKK
Northeast	1	KSN (Kalasin)	NMA
North	4	MSN, STI, PBN, LPI	PLK
South	2	RNG (Ranong), PNA (Phanganga)	SNI
Total	8		

Note: MSN (Mae Hong Son), PRE(Phrae), STI (Sukhothai), PBN (Phetchabun)
LPI (Lop Buri), BKK (Bangkok), NMA (Nakhon Ratchasima),
PLK(Phitsanulok), SNI(Surat Thani)

When a transmission route connecting to these PCs is interrupted, the transportable satellite station will be sent from the TC to the PC to relieve the communication.

3) Installation of Alternative Routes

As alternative routes, three transmission routes will be planned as shown in Table 8.3.6-3.

Table 8.3.6-3 Alternative Routes

Span	Distance (Km)	System	Capacity (Mb/s)	No. of System
PLK-KKN	300.0	Fiber	565	2
KKN-NMA	193.9	Fiber	565	2
CBI-HYI	650.0	Fiber	280	2
NMA-PRI	162.8	Fiber	565	2
PRI-CCO	66.4	Fiber	565	2
CCO-CBI	36.8	Fiber	565	2
CCO-BKK	68.2	Fiber	565	2
Total	1478.1			14

a) Phitsanulok - Khon Kaen - Nakhon Ratchasima

An optical fiber system will be planned as an additional transmission system for enhancement of the network reliability. This section has already been connected with the microwave system via Loei and Udon Thani, however, new route is shorter than the microwave route about 150 kilometers. Furthermore, the existing microwave route will be fully occupied with circuits in operation by the end of 2007 as shown in Appendix.

Therefore, it is considered that new route is appropriate as alternative route in view of the total cost. An optical fiber system is proposed as the new route for the present, however, it should be compared the fiber and the microwave in the implementation.

b) Submarine Optical Fiber Cable System

A submarine optical fiber system will also be planned as an alternative route between Chon Buri and Hat Yai, in order to connect Bangkok and the southern area in Phase-3. There are three reasons to support this plan as follows.

First, as the both microwave and optical fiber routes, which connect the southern area to Bangkok now, go through Nakhon Pathom, if this point is suffered from a big trouble such as fires etc., the southern area will not be able to communicate with Bangkok. Second, introduction of this route is considered to be very useful to enhance network reliability because it can avoid the trouble caused by natural disasters such as floods or typhoons in southern area. And finally, this route can be utilized for carrying international traffic toward southern countries in future.

c) Nakhon Ratchasima - Prachin Buri - Chon Buri - BKK Optical Fiber Route

As described in Chapter 3, economic impact of the Eastern Seaboard Development are expected to spread over the areas around Nakhon Ratchasima and Prachin Buri, and the demand for telecommunications around there will increase rapidly. Furthermore, the existing microwave route for the above areas will be fully occupied with the circuits in operation by 2007 as shown in Appendix. Therefore, introduction plan of a new transmission route is proposed to connect the above cities with optical fiber systems.

8.3.7 Diversification of Services

1) General

In the view of transmission network, required facilities will be prepared for various services, like ISDN and so on. It means that digital transmission network will be introduced in the whole country for coping with the diversification of services in the period, as mentioned in the previous sections. Figure 8.3.7-1 shows these measures.

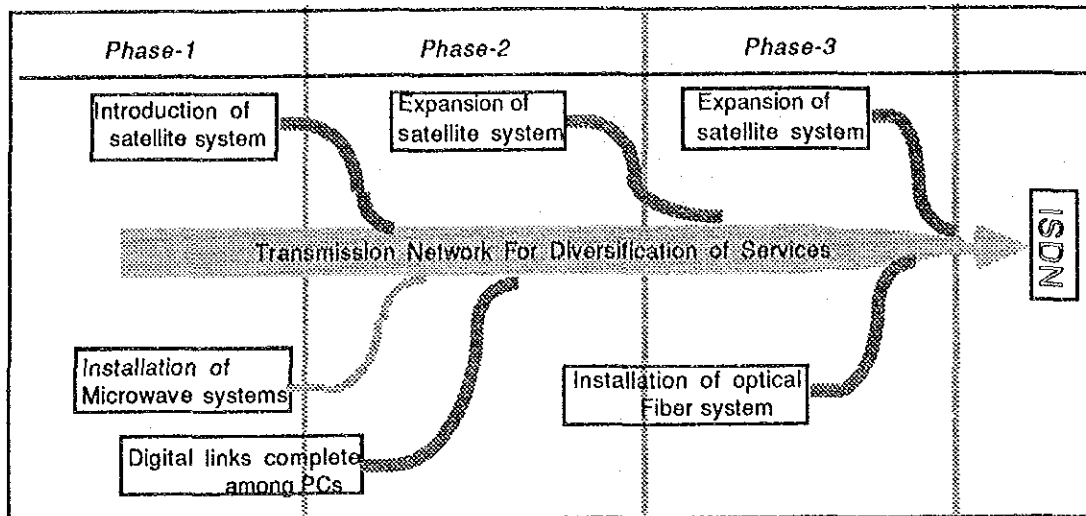


Figure 8.3.7-1 Transmission Network for Diversification of Services

In addition, some kind of facilities should be considered to prepare for new services. Some plans of them are shown in the following sections.

- 2) The Required Network
 - a) Television Broadcasting Network

A proposed configuration of television broadcasting network is shown in Figure 8.3.7-2.

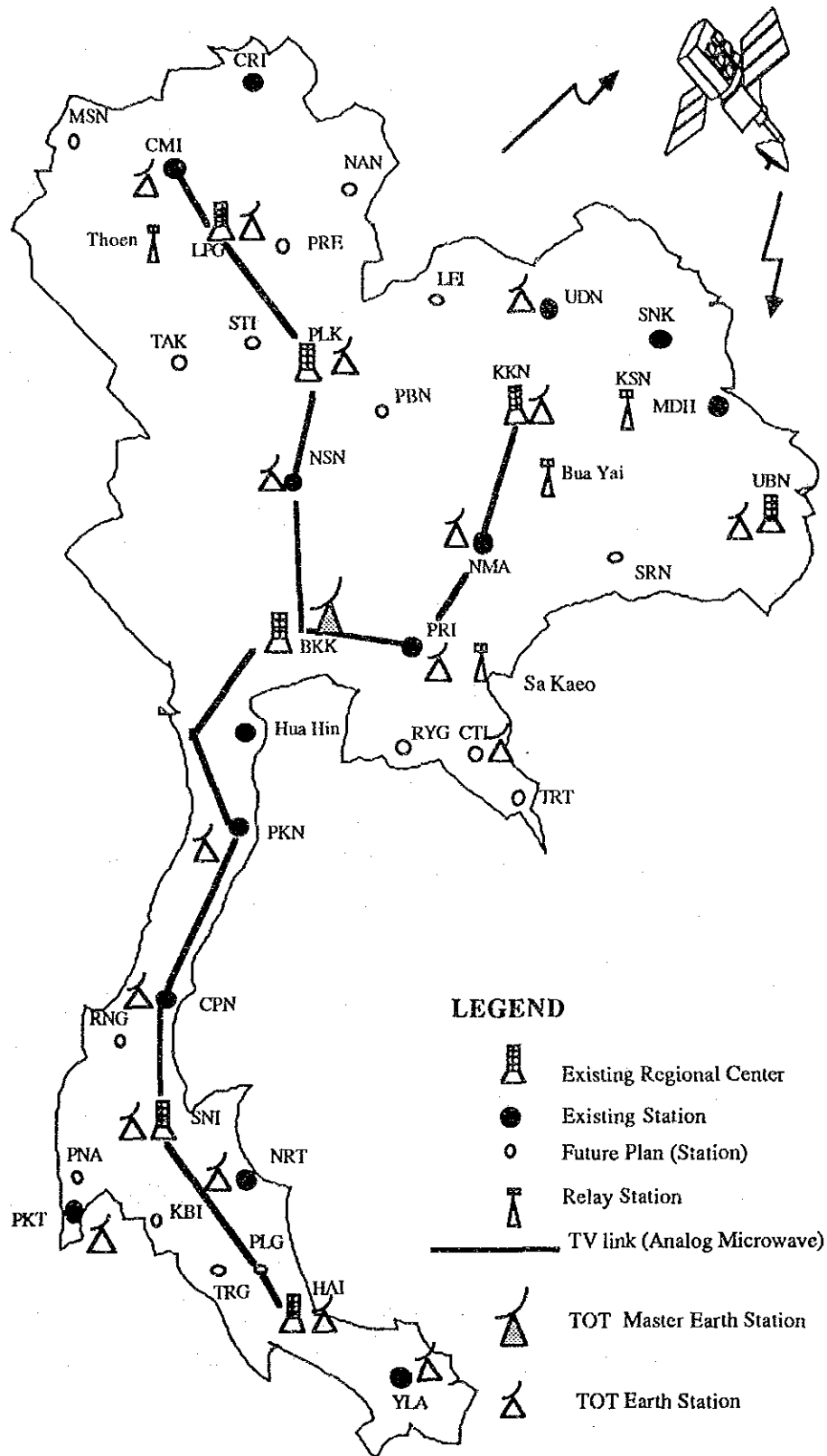


Figure 8.3.7-2 Configuration of TV Broadcasting Network

In this figure, the satellite communication system will be used for transmitting TV signal from Bangkok to the regional broadcasting main stations, and existing microwave routes will be used as standby network in future. As mentioned in Chapter 2, the customer had already a plan. Therefore, it should be considered to use satellite communication system for constructing television broadcasting network.

b) Radio Program Transmission Network

By the information from the user, AM (Amplitude Modulation) broadcasting network of the user has already completed, however, FM broadcasting network has not completed yet as shown in Figure 2.3.2-8.

Otherwise, FM program transmission network system is offered with monophonic program system, therefore, it should be studied to provide the facilities which can transmit stereophonic program. And the network should be built with them according to Figure 2.3.2-8.

8.3.8 Replacement of Existing Analog Facilities

1) General

Generally, the replacement of analog transmission facilities should be carried out in accordance with the plan of switching facilities. In this connection, the replacement of analog switching facilities in provincial areas are planned with the following program.

- Phase-1	5%
- Phase-2	42%
- Phase-3	34%
- After the Period	19%

Therefore, the replacement of transmission facilities in long distance routes will be planned in the same pace.

In the metropolitan area, transmission facilities having been operated are 4,000 PCM-30 systems and some optical fiber systems. So, it will be planned to replace the PCM-30 systems in the area independently.

2) Long Distance and Spur Route

At the end of FY 1988, 104 analog systems are used in the routes, and they have 8,208 kilometer length as shown in Table 8.3.8-1.

Table 8.3.8-1 The Contents of Analog Facilities (End of 1988)

Transmission System	Number of System	Route Length(Km)	Channel	
			Capacity	End Working
Radio System				
Analog Microwave				
2700 channel system	1	4.30	2,700	0
1800 channel system	9	2,355.11	16,200	11,817
960 channel system	15	1,831.00	14,400	2,304
* 300 channel system	52	3,241.13	15,600	3,715
240 channel system	1	50.40	240	
FDM Radio UHF	1	19.00	18	12
SUB TOTAL	79	7500.94	49,158	17,848
Cable System				
Coaxial Cable System				
2700 channel system	1	5.99	2,700	3,008
960 channel system	8	30.56	7,680	5,052
* 300 channel system	3	14.96	900	538
FDM Cable System	7	206.66	336	266
VF Cable	6	23.68	0	0
SUB TOTAL	25	281.85	11,616	8,864
TOTAL	104	7,783	60,774	26,712
Metropolitan Area PCM System	4,000			

Note: * Included Spur Route

According to the pace mention above, a replaced plan is shown in Table 8.3.8-2.

Table 8.3.8-2 The Facilities Replacement Plan

Analog Transmission to be Replaced	Phase-1	Phase-2	Phase-3	After Phase-3
Replaced Ratio(%)	5	42	34	19
Number of Channels	1,335	11,219	9,082	5,075
Route Length (km)	389	3,269	2,646	1,479

The replacing facilities will be only calculated for multiplexer, and the replacing terminal equipments will be provided by expansion plans. The analog facilities will be replaced by digital multiplexer in accordance with the number of analog channels. And they will be divided into each phase in accordance with Table 8.3.8-2.

3) Metropolitan Area

In this area, 23 percent analog switching facilities are working as of the end of 1992. According to this data, 2 Mb/s codecs will be considered to be replaced by optical fiber system in accordance with the switching replacement plan.

On the other hand, 77 percent transmission facilities, using for digital switching facilities, will be planned to be replaced also with the optical fiber systems independently.

The replacement plan of the junction transmission systems mentioned above, is summarized as shown in Table 8.3.8-3.

Table 8.3.8-3 PCM-30 Systems Replacement Plan

PCM-30 Systems to be replaced		Phase-1	Phase-2	Phase-3	After Phase-3	Total
Systems for Analog Switching Facilities	No. of Systems	212	359	258	91	920
	%	23	39	28	10	100
Systems for Digital Switching Facilities	No. of Systems	924	924	924	308	3,080
	%	30	30	30	10	100
Total Systems		1,136	1,283	1,182	399	4,000

8.4 Local Cable Facilities

The summary of local cable facilities long term plan in this long term plan is shown in Figure 8.4. As shown in this figure, larger amounts of expansion volume for local cable is given special emphasis in Phase-1.

8.4.1 Expansion Plan of Local Cable

1) Expansion Policies

The proposed policies for local cable capacity are as follows;

- a) The proposed number of cable pairs to be installed during the each phase period were estimated on the basis of the required number of primary cable pairs at the end of next phase.
- b) The number of leased circuit, test pair and other lines were estimated at 3% of whole connected lines. In this connection, the ratio of leased circuits is 1.15% in the metropolitan area and 1.11% in provincial areas at the end of 1987.
- c) The ratio of cable pair margin was estimated at 30% of whole primary cable pairs.

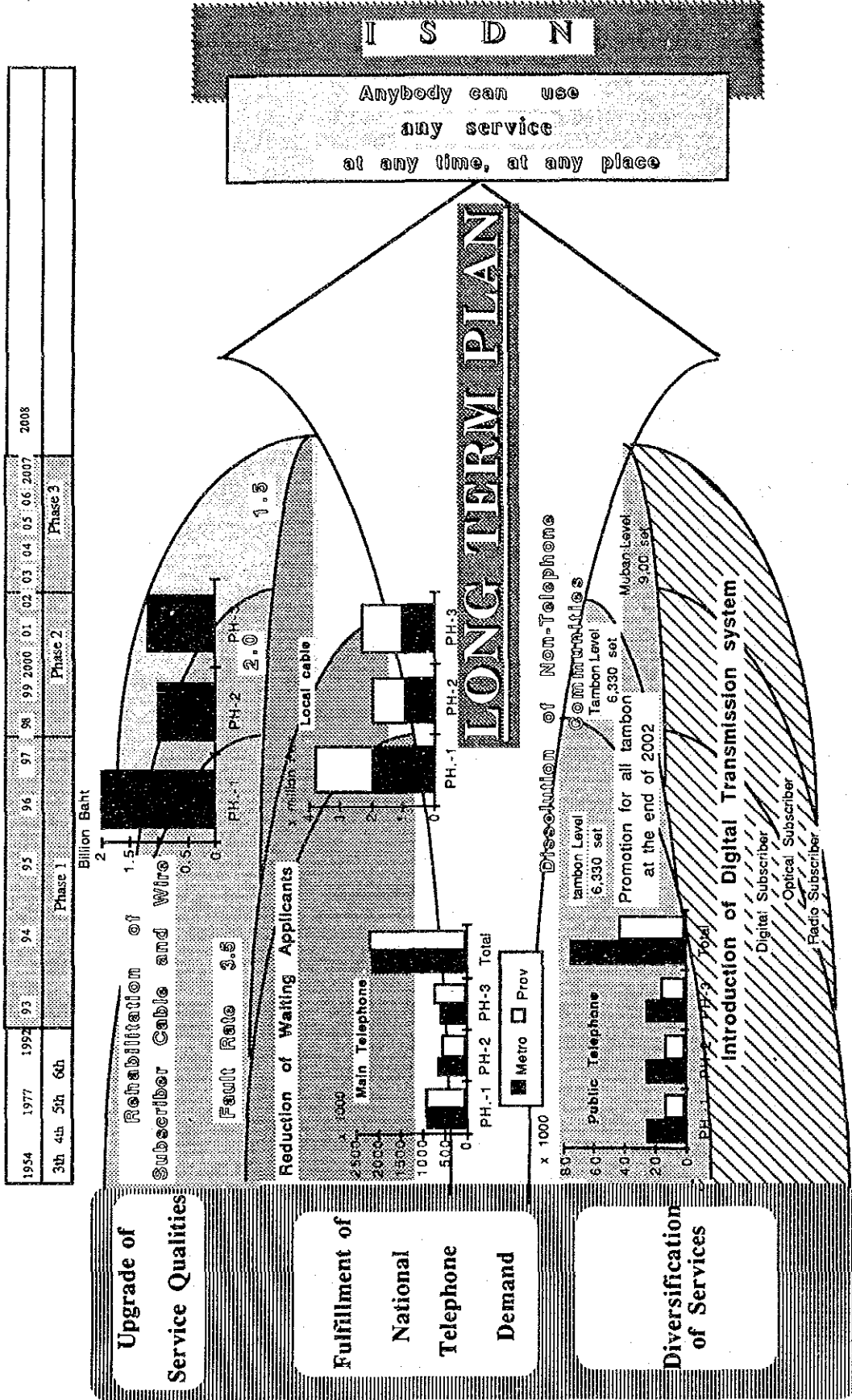


Figure 8.4 Summary of Outside Plant Expansion Plan

2) Expansion Plan for Primary Cable Pair

The total capacity of primary cable pairs in this long term plan was estimated as following procedure.

a) Existing Number of Cable Capacity

Table 8.4.1-1 shows total capacity of primary cable pairs at the end of 1992 including 5th project and 6th project as well as existing number of cable pairs.

Table 8.4.1-1 Total Capacity of Primary Cable

	End of FY 1987	5th Project	6th Project	Total
Total Capacity	1,535,000	1,486,000	254,000	3,275,000
Metropolitan Area	1,084,000	885,000	198,000	2,167,000
Provincial Area	451,000	601,000	56,000	1,108,000
Area 1	52,000	102,000	18,000	172,000
Area 2	47,000	55,000	10,000	112,000
Area 3	56,000	69,000	1,000	126,000
Area 4	61,000	60,000	1,000	122,000
Area 5	65,000	82,000	6,000	153,000
Area 6	52,000	87,000	6,000	145,000
Area 7	46,000	51,000	6,000	103,000
Area 8	34,000	52,000	1,000	87,000
Area 9	38,000	43,000	7,000	88,000

b) Number of Connected Line

The number of connected lines in each phase was calculated by the following formula.

$$\text{Number of Connected Lines} = \text{Number of Forecasted Demand} \times 1.03$$

The demand of the end of 2012 was estimated as the demand of 1.2 times in Metropolitan Area and 1.3 times in provincial areas respectively to the demand at the end of Phase-3.

Table 8.4.1-2 Number of Connected Line

	Phase-1	Phase-2	Phase-3	Next 5 years
Total Capacity	3,722,000	4,951,000	6,353,000	7,973,000
Metropolitan Area	2,183,000	2,852,000	3,478,000	4,166,000
Provincial Area	1,539,000	2,099,000	2,875,000	3,807,000
Area 1	302,000	418,000	551,000	710,000
Area 2	177,000	226,000	293,000	373,000
Area 3	177,000	219,000	272,000	337,000
Area 4	173,000	237,000	340,000	463,000
Area 5	167,000	224,000	315,000	424,000
Area 6	169,000	260,000	399,000	566,000
Area 7	152,000	205,000	269,000	346,000
Area 8	124,000	170,000	231,000	304,000
Area 9	98,000	140,000	205,000	284,000

c) Required Number of Cable Pairs

The required number of primary cable pairs at the end of each phase was calculated by the following formula.

$$\text{Required Line} = \text{Connected Line} / 0.7$$

0.7 means the ratio of limited value to be accommodated in primary cable.

Table 8.4.1-3 shows the required number of primary cable pairs.

Table 8.4.1-3 Required Number of Primary Cable Pair

	Phase-1	Phase-2	Phase-3	Next 5 years
Total Capacity	5,317,000	7,072,000	9,075,000	11,390,000
Metropolitan Area	3,119,000	4,074,000	4,968,000	5,951,000
Provincial Area	2,198,000	2,998,000	4,107,000	5,439,000
Area 1	432,000	597,000	787,000	1,014,000
Area 2	253,000	322,000	418,000	534,000
Area 3	253,000	312,000	389,000	481,000
Area 4	248,000	339,000	486,000	662,000
Area 5	238,000	320,000	449,000	605,000
Area 6	241,000	371,000	570,000	809,000
Area 7	216,000	293,000	385,000	495,000
Area 8	177,000	244,000	330,000	434,000
Area 9	140,000	200,000	293,000	405,000

d) Expansion Volume

The expansion volume in each phase was calculated on the bases of the required number of primary cable after 5 years as described in 8.4.1.1).a).

Table 8.4.1-4 shows the expansion volume of primary cables in each phase.

Table 8.4.1-4 Expansion Volume of Primary Cables

	Phase-1	Phase-2	Phase-3	Total
Total Capacity	3,770,000	2,003,000	2,315,000	8,088,000
Metropolitan Area	1,908,000	894,000	983,000	3,785,000
Provincial Area	1,862,000	1,109,000	1,332,000	4,302,000
Area 1	426,000	190,000	227,000	843,000
Area 2	210,000	96,000	116,000	422,000
Area 3	186,000	77,000	92,000	355,000
Area 4	216,000	147,000	176,000	539,000
Area 5	167,000	129,000	156,000	452,000
Area 6	206,000	199,000	239,000	644,000
Area 7	187,000	92,000	110,000	389,000
Area 8	156,000	86,000	104,000	346,000
Area 9	108,000	93,000	112,000	313,000

3) Intra-City Digital Microwave Subscriber System

As estimated above, a vast amount of installation work have to be carried out to cope with rapidly increasing telephone demand. Especially, the work will be concentrated in Bangkok Metropolitan Area.

In consideration of such condition, it is effective to introduce the Intra-city digital microwave subscriber system as a complementary system for the subscriber network. Basically, the construction cost of this system is higher than the average cost of subscriber cable system, however, especially for large scale of subscriber group, this cost is lower than that of subscriber cable system when civil work is required.

The application of this system is suitable for the following areas/applicants.

- a) Area where there are some difficulties in cable network construction and where a lot of waiting applicants are concentrated such as high-rise building.
- b) Developing areas where subscriber lines are required urgently.
- c) Applicants who require high reliability in telecommunication services.

d) Applicants who require digital subscriber services urgently.

Figure 8.4.1-1 shows the configuration of intra-city microwave subscriber system.

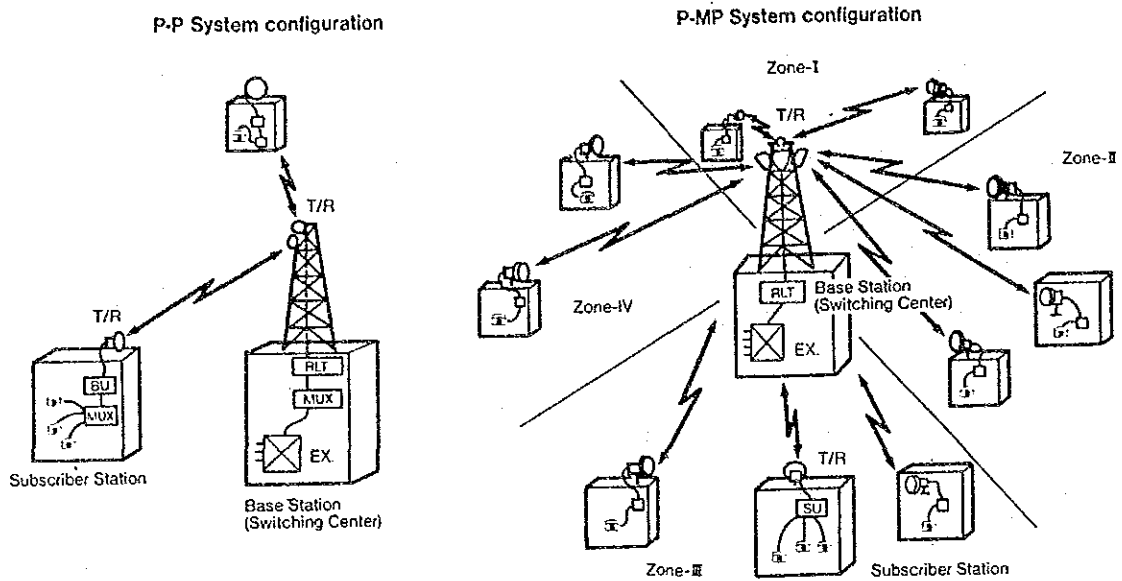


Figure 8.4.1-1 Configuration of Intra-City Microwave Subscriber System

8.4.2 Public Telephone

Public telephone were planned according to the installation schedule of public telephone as estimated in 8.1.2-2). The transmission system of rural public telephone applied TDMA system (Time Division Multiple Access system) which have been adopted to the Rural Long Distance Telephone Project in the ESDP.

Table 8.4.2-1 shows the installation plan of public telephone.

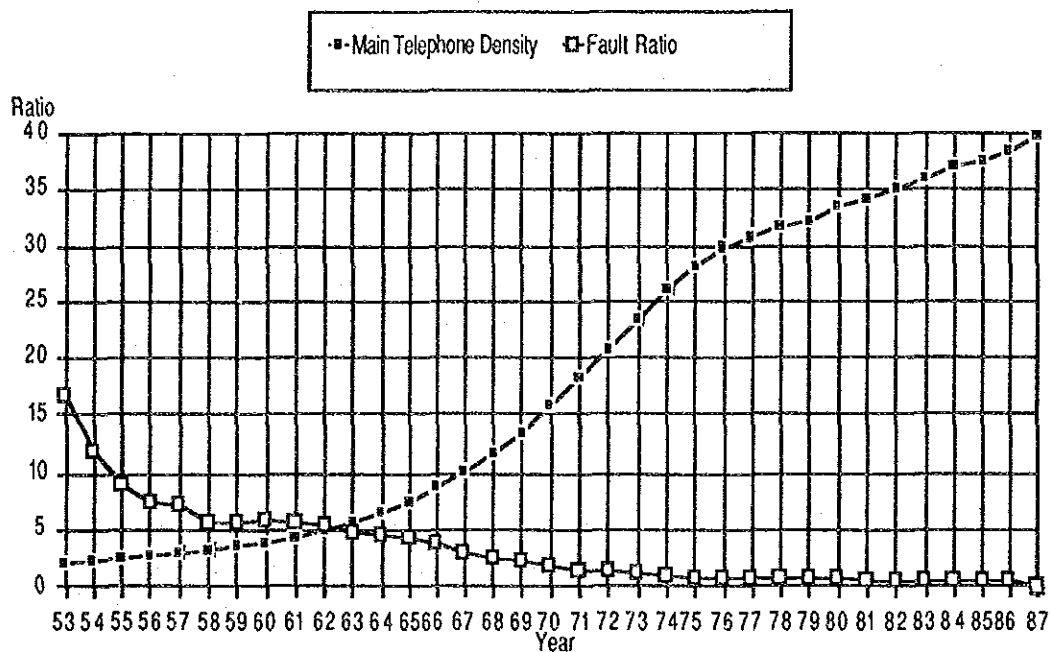
Table 8.4.2-1 Installation Plan of Public Telephone

	Phase-1	Phase-2	Phase-3	Total
Rural Telephone	6,330	6,330	9,000	21,660
Ordinary Telephone	31,370	32,247	32,182	95,799
Total	37,700	38,577	41,182	117,459

8.4.3 Rehabilitation Plan of Local Cable and Wire

1) Case in Japan

Figure 8.4.3-1 shows the relation with the density of main-telephone and the fault ratio during 35 years from 1953 to 1987, and Figure 8.4.3-2 shows the content of faults during about 30 years from 1953 to 1982 in Japan. During the past 35 years, telephone density has risen about 20 times, fault ratio, however, has been improved to become about one fourth from 16.70 to 0.42 per 100 subscribers per month.



Note: 1) Fault Ratio : per 100 Main-Telephone/Month
 2) Telephone Density : per 100 people

Figure 8.4.3-1 Comparison of Telephone Density and Fault Ratio in Japan

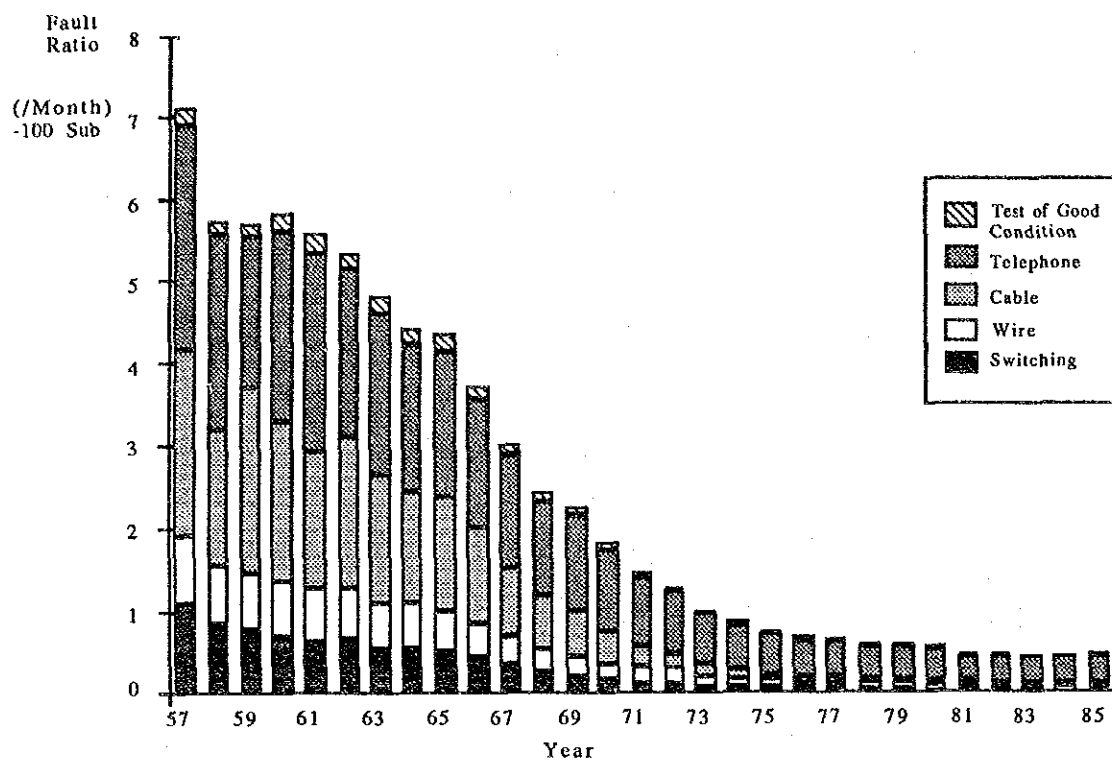


Figure 8.4.3-2 Contents of Faults in Japan

In order to make decreasing faults and to replace deteriorated facilities, about 7% of total construction cost have been invested for rehabilitation of telecommunication facilities, and also, free distribution system has been introduced for secondary cable with installation of color coded polyethilen cable.

As the result of these improvement plans, the fault ratio was improved at 0.48 per 100 subscriber per month. The ratio means that fault occur one times during 18 years for a subscriber.

2) Rehabilitation Plan

In this study, rehabilitation plan was settled aiming at the target that fault occurrence will be improved up to one third of 1987 which means 1.3 faults per month per 100 subscribers, at the end of Phase-3 taking Thai situation into consideration. In order to carry out the rehabilitation plan, the investment costs are estimated as for 7% of total investment cost in local cables. And also, the scrap value, which accrue with replacement of copper cables, of local cable facilities is estimated at 3% of rehabilitation investment cost for local cables.

Table 8.4.3-1 shows the target of fault ratio at the end of each phase.

Table 8.4.3-1 Target of Fault Ratio

	Phase-1	Phase-2	Phase-3
Target	3.5	2.0	1.3

Note: Fault Ratio is per month per 100 subscribers.

This plan should be carried out with introduction of maintenance control system, which is the bases of preventive maintenance activity that will be described in the latter chapter, and with establishment of local network management which bases on expansion of outside plant maintenance center (OPMC).

8.4.4 Digital Transmission System

As described in the previous section, in accordance with the commencement of ISDN, digitization of local network will be extended all over the country. In order to provide digital services, it needs to install DSU (Digital Service Unit) which is installed in a subscriber premises, or optical fiber cable to cope with the service level.

The facility plan for subscriber network is planned according to the progress of network digitization as described in the previous section.

8.4.5 Judgement of Installation Limit for Primary Cable

It is important to judge the installation limit of facilities in order to decide the best time when telecommunication facilities should be prepared for expansion of telecommunication services. The reason is that the time gives a big influence to budget for construction of facilities and especially the term of construction for outside plant needs longer than other plants.

It was approached by the following procedure for local cables as shown in Figure 8.4.5-1. The result is shown in Table 8.4.5-1.

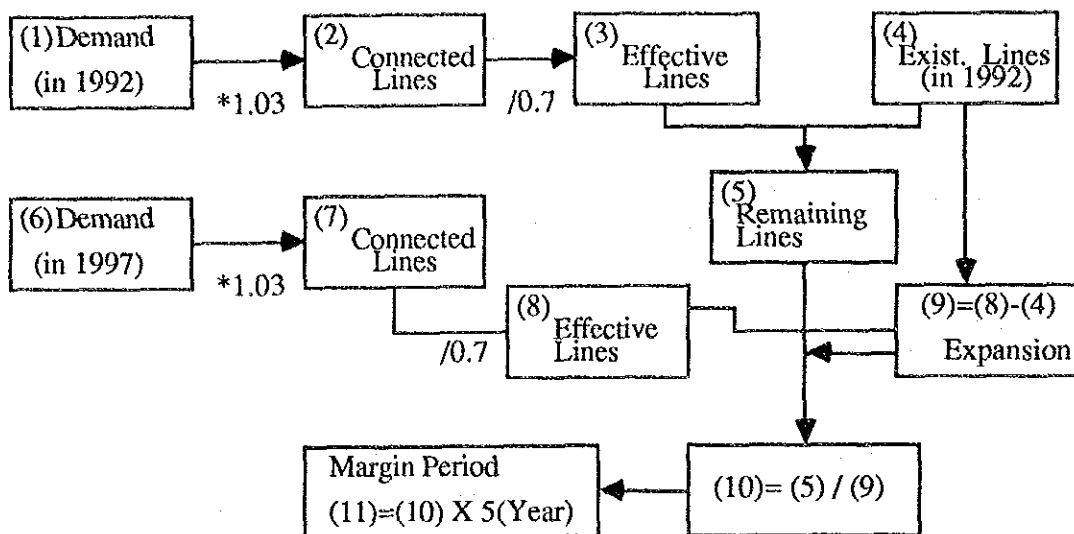


Figure 8.4.5-1 Flow Chart of Judgement Procedure

According to the result of this estimation, it is expected that the capacity of primary cable pairs will become fill up within the 1st year of Phase-1 (in 1993) in most areas if the telephone demand will be satisfied at the end of 1992.

As described above, this study was approached with each telecommunication area as a unit. In connection with this study, more detailed investigation should be carried out by local area taking distribution system of local network into consideration.

Table 8.4.5-1 Judgement of Installation Limit for Primary Cable

(1/3)

Telecom. Area	(1) Exist (in 1992)	(2) Demand (in 1992)	(3) Connected (3)=(2)x1.03	(4) Effective (4)=(3)/0.7
Metropolitan	2,166,421	1,340,898	1,381,125	1,973,036
Provincial 1	170,867	86,948	89,556	127,938
Provincial 2	112,469	60,342	62,152	88,789
Provincial 3	126,066	68,654	70,714	101,019
Provincial 4	122,483	65,241	67,198	95,997
Provincial 5	153,084	94,003	96,823	138,319
Provincial 6	144,882	80,068	82,470	117,814
Provincial 7	102,998	62,394	64,266	91,808
Provincial 8	87,907	48,243	49,690	70,986
Provincial 9	87,172	45,858	47,234	67,477
Total	3,274,349	1,952,649	2,011,228	2,873,184

(2/3)

Telecom. Area	(5) Remain 92 (5)=(1)-(4)	(6) Demand (in 1997)	(7) Connected (7)=(6)x1.03	(8) Effective (8)=(7)/0.7
Metropolitan	193,385	2,119,510	2,183,095	3,118,708
Provincial 1	42,929	293,389	302,191	431,701
Provincial 2	23,680	171,650	176,800	252,571
Provincial 3	25,047	171,663	176,813	252,590
Provincial 4	26,486	168,488	173,543	247,918
Provincial 5	14,765	162,070	166,932	238,474
Provincial 6	27,068	164,011	168,931	241,330
Provincial 7	11,190	147,181	151,596	216,566
Provincial 8	16,921	120,368	123,979	177,113
Provincial 9	19,695	94,915	97,762	139,661
Total	401,165	3,613,245	3,721,642	5,316,632

(3/3)

Telecom. Area	(9) Expansion (9)=(8)-(4)	(10)=(5)/(9)	Margin Period (11)=(10)x5
Metropolitan	1,145,672	0.17	0.84
Provincial 1	303,763	0.14	0.71
Provincial 2	163,782	0.14	0.72
Provincial 3	151,570	0.17	0.83
Provincial 4	151,921	0.17	0.87
Provincial 5	100,156	0.15	0.74
Provincial 6	123,516	0.22	1.10
Provincial 7	124,758	0.09	0.45
Provincial 8	106,127	0.16	0.80
Provincial 9	72,184	0.27	1.36
Total	2,443,448	0.16	0.82

8.5 Mobile Communication Facilities

Based on the result of demand forecast and traffic forecast as described in the previous chapters, the facility plans are formulated as described in the followings.

8.5.1 Cellular Mobile Facilities

1) Mobile Telephone Exchange (MTX)

According to the subscription demand forecast, the volume of demand is estimated as 204,000 in Bangkok metropolitan area and 209,000 in provincial area in the year of 2007, under the condition that one of the carriers (TOT or CAT) has the probability of satisfying the 60 % of total demands.

Since one MTX can accommodate 60,000 subscribers at maximum, 7 to 10 units of MTXs should be installed in Bangkok metropolitan area. To satisfy the demand of 209,000 subscribers for provincial areas taking account of the higher calling rate and the long range transmission, 8 to 11 MTXs should be installed in provincial areas.

Table 8.5.1-1 Expansion Plan of Cellular Mobile Service

Year	6th Plan	Future Expansion Plan			Total
	~ 1992	1993~1997 (Phase-1)	1998~2002 (Phase-2)	2003~2007 (Phase-3)	
No. of Capacity	59,023	62,000	138,000	154,000	413,023
Metropolitan	28,190	29,000	68,000	79,000	204,190
Provincial	30,833	33,000	70,000	75,000	208,833
No. of MTXs	5	2 - 4	4 - 6	4 - 6	15 - 21
Metropolitan	2	1 - 2	2 - 3	2 - 3	7 - 10
Provincial	3	1 - 2	2 - 3	2 - 3	8 - 11

2) Radio Base Station (RBS)

Up to the year of 1992, major cities and areas along main highways will almost be covered by RBSs. Further, expansion for all over the country should be completed by the end of 1997. The areas not covered by RBSs yet should be gradually incorporated and traffic channels between MTXs and RBSs should be reinforced to meet the growth of demands.

3) Application of 900 MHz Band

For the purpose of satisfying the demand for portable phone effectively, a new system adopting about 900 MHz frequency Band should be introduced, taking effective utilization of frequency Bands.

4) Preparation of Digital Mobile Telephone System

At the present stage, the cellular mobile service is operated through analog interface in the world. Besides, in the near future, the digital mobile service will surely be put into operation. The digital system gives some advantages as follows;

- Adjustable interface with the ISDN network,
- Capability of enhancing secrecy in communication,
- Capability of employing channels in higher efficiency,
- Adjustable connection to Time Division Multiple Access (TDMA).

The specifications are now being under study in some countries. With the introduction of digital system, the existing analog system will gradually be replaced after around the year of 1994.

8.5.2 Paging Facilities

The paging service is presently offered by CAT and his associated sector, and besides TOT seems to have a plan to commence this service. The formulation of the expansion plan is established under the conditions of the 50% share ratio of total demands. The result is shown in Table 8.5.2-1.

Table 8.5.2-1 Expansion Plan of Paging Service

Year	Future Expansion Plan			Total
	1993~1997 (Phase-1)	1998~2002 (Phase-2)	2003~2007 (Phase-3)	
No. of Capacities	35,000	45,000	60,000	140,000
Metropolitan	32,000	40,000	55,000	127,000
Provincial	3,000	5,000	5,000	13,000

8.6 Leased Circuit & Data Communication Facilities

8.6.1 Basic Transmission

Based on the result of demand forecast as described in the section 4.3.1, the facility expansion plan is formulated as shown in Table 8.6.1-1.

Table 8.6.1-1 Expansion Plan of Leased Circuit etc.

Year and Phase	Future Expansion Plan			Total
	1993~1997 (Phase-1)	1998~2002 (Phase-2)	2003~2007 (Phase-3)	
Leased Circuit				
Data Transmission up to 48 kb/s	26,000	25,000	2,000	53,000
Data Transmission over 48 kb/s	4,000	10,000	22,000	36,000
Telex Network Access	-2,800	-2,400	-4,800	-10,000
Packet Network Access	4,000	9,000	22,000	35,000
Voice Transmission	22,000	29,000	22,000	73,000
Video Transmission	500	1,000	1,000	2,500
Broadcast Program	300	500	500	1,300
Packet Switched Data Network				
Packet Switch Directly	4,000	9,000	22,000	35,000
Packet via Telephone	6,000	14,000	28,000	48,000

As regards the leased circuits, major parts of the required facilities are picked out from the existing facilities as classified into switching, transmission, local cable etc. In the near future of digital technologies era, the facilities will more and more be shared with other digital facilities through VPN (Virtual Private Network) or CUG (Closed User Group) function. Therefore, these expansion plans are taken into account in the previous sections i.e. local cable facility, transmission facility etc.

As regards the packet data network, the required switching facilities are independently installed at the present stage, however, the packet data service can be available on the ISDN network in the near future. Namely, the telephone service as well as the packet data service will be offered on the ISDN network. Therefore, these expansion plans are taken into account in the previous sections i.e. switching facility, transmission facility etc.

8.6.2 Message Handling System

This service offers the capabilities of storing and forwarding the messages for personal computers, word processors etc. As access method for terminals, the existing networks will be employed for the basic transmission. Accordingly, the additional required facilities are mainly composed of Gateway, Message Storage, Processor etc. from the viewpoint of telecommunication carriers.

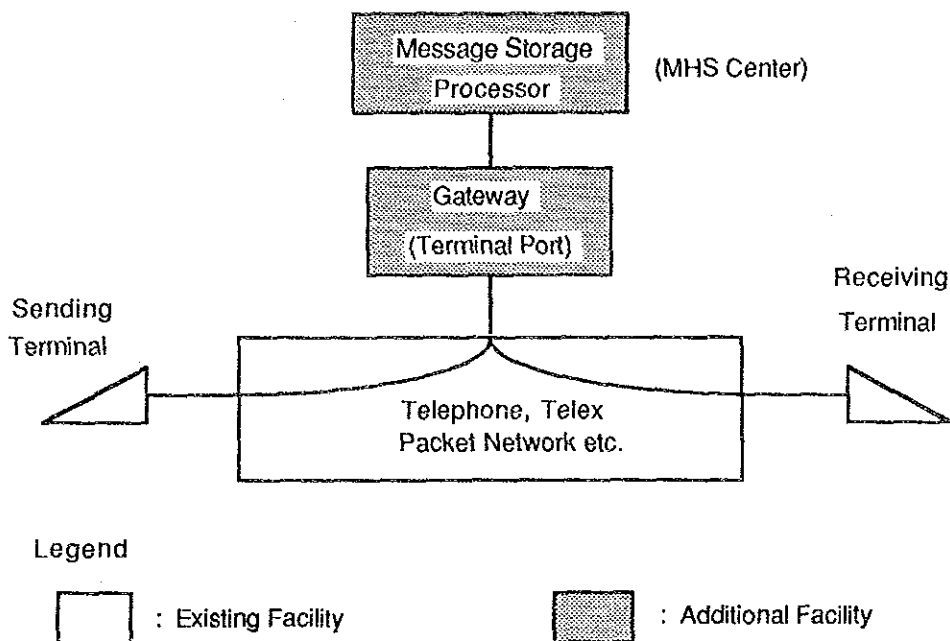


Figure 8.6.2-1 Additional Facility for Message Handling Systems

This service has already been offered on the telex and packet data network by CAT. Aiming at the market segments that have no subscription on the telex or packet data network, the gateway should be offered for the telephone network. By way of this gateway, lots of personal computers are easily capable of access to the MHS center.

Table 8.6.2-1 Development Plan for MHS etc.

Year	~ 1992	1993 ~ 1997 (Phase-1)	1998 ~ 2002 (Phase-2)	2003 ~ 2007 (Phase-3)
Message Handling System	Available on Telex & Packet Network	Incorporation with Telephone Network Introduction on Telephone Network	Expansion of Service	
Facsimile Store & Forward System	Planning Publicity Promotion of Service	Field Trial Service Feasibility Study	Commercial Service	
Voice Mail System	Planning Publicity Promotion of Service	Field Trial Service Feasibility Study	Commercial Service	

8.7 Other Facilities

8.7.1 Facsimile Store & Forward System

In similar to the above-mentioned message handling system, the stored function is also applicable for facsimile message transmission, voice message transmission etc. The concept is almost the same to MHS, accordingly, the development plan will be carried out taking the steps as shown in Table 8.6.2-1.

8.7.2 Videotex System

1) Role Assignment

This service will employ the existing network as access method and the terminals are connected to Information Provider Center by way of Gateway. The Gateway takes part in gathering charge information, distributing calls to the designating information provider etc.

There may be various forms for launching and operating Videotex service as shown in Figure 8.7.2-1. As one of the most reasonable forms, it is considered that the Gateway should be installed by the telecommunication carriers, while the Information Provider Centers should be established by themselves. Whichever forms is adopted, both sides should cooperate each other in promoting this service.

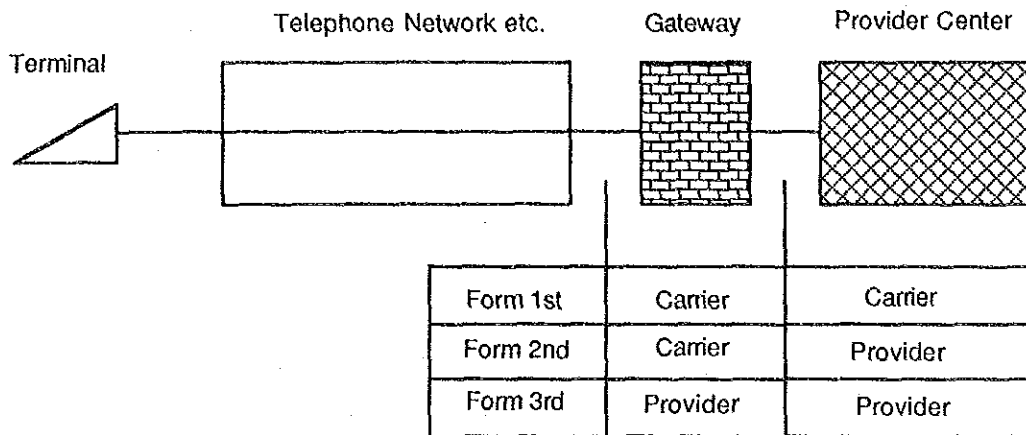


Figure 8.7.2-1 Additional Role Assignment for Videotex Service

2) Development Plan

As previously described in the section 4.5.1, the guideline for development is recommended once again, and the development schedule is shown in Table 8.7.2-1.

- The volume of demand is considered to be low, below 100 subscribers for the initial stage,
- The number of feasible information providers is considered to be low for the initial stage,
- The demand and information providers should positively be aroused by adopting promotion measures,
- Aiming at this specified class and the existing computerized systems, the preparation study should be carried out,
- The information providers should be cooperated by the telecommunication service providers,
- The field trials should be carried out at least for three to five years with feasibility study,

- The commercial service should be commenced after an elaborate study of the results of field trial.

Table 8.7.2-1 Development Plan for Videotex Service

Year	~ 1992	1993 ~ 1997 (Phase-1)	1998 ~ 2002 (Phase-2)	2003 ~ 2007 (Phase-3)
Preparation	<p>Schedule →▲</p> <p>Planning Establishment of Information Providers Promotion of Subscribers</p>			
Field Trial Basis	<p>▲← Schedule →▲</p> <p>Objects : Field Trials & Feasibility Study Targets : Specified Class Service : Still Picture Network: Telephone Network Region : Bangkok Center : Small Scale (if possible Shared Center)</p>			
Commercial Basis	<p>▲← Schedule →▲</p> <p>Objects : Commercial Service Targets : General Public Service : Still & Moving Picture Network: Telephone & ISDN Network Region : Bangkok & Major Cities Center : Large Scale (Exclusive)</p>			

CHAPTER 9

FINANCIAL ANALYSIS

CHAPTER 9. FINANCIAL ANALYSIS

9.1 Objective and Methodology of Financial Analysis

9.1.1 Introduction

The objective of this chapter is to analyze and examine profitability of the project from a financial point of view. The outputs of this chapter are estimates of future revenues (Financial In-Flow) and costs (Financial Out-Flow) of the project and FIRR of the Project. A financial analysis of an operating entity is provided in Chapter 11 FINANCIAL PLAN on the basis of the revenue and the cost estimates made in this chapter.

In order to analyze profitability, the analytical procedure is broken into the following steps:

- 1) identifying premises of the project,
- 2) estimating total revenues of the Project (financial in-flow),
- 3) estimating construction and operation costs of the Project (financial out-flow),
- 4) calculation of financial internal rate of returns (FIRR),
- 5) sensitivity analyses.

9.1.2 Identification of the Project

The long term development plan, which consists of three five-year intervals between the fiscal years of 1993 and 2007, is considered as one project in this study. The following are the basic premises of the financial analysis of the project.

1) Project Life

The project life is set to be 35 years from FY 1993. Fifteen years from FY 1993 to FY 2007 are regarded as the construction period of the project (Phase-1, Phase-2, and Phase-3). After completion of all the construction, additional 20 years will be assumed as a remaining operation period considering service lives of telecommunication facilities. The operation will start from the beginning of the project life, i.e., FY 1993.

The annual installation and supply volume is one-fifth of the total volume of each phase. It is assumed that construction of facilities will take one year.

For the service lives of telecommunications facilities, ten years for switching facilities, fifteen years for transmission facilities, and twenty years for outside plant facilities

are assumed. The facilities of which economic lives are shorter than the project life are to be replaced during the project life. When the facilities have remaining useful service life at the end of the project life, non-used value is recovered.

Scrap value is not taken into account since it is usually difficult to be evaluated over removal cost of facilities.

2) Exchange Rate

All revenues and costs are calculated in Thai Baht. In this Study, the following exchange rate is employed:

1 Baht = 5 Japanese Yen.

3) Sunk Cost

Sunk cost is not taken into account. In the case of an expansion project, the incremental internal rate of return, which results from accounting for the incremental investment, sales, and operating costs, is appropriate since it only takes account of incremental net benefits resulting from the incremental production of the expansion project. Therefore past expenses which were already borne is not taken into account.

On the other hand, future cost for rehabilitations and replacements of the existing facilities will be added to the total cost needed for the project implementation since existing facilities are indispensable for the expanded telecommunications network.

4) Inflation

The effect of inflation is not considered basically. Price changes are an important factor affecting projects throughout their implementation and economic life, with respect to capital and operating costs as well as revenues. If all prices increased at the same rate at home or abroad, their relative levels would not change. If, in case that all prices were deflated in order to correct for the general increase in nominal (or current) prices, "real" prices, i.e., prices expressed in constant value terms, would result.

In this case, the comparison of costs and benefits of a project for the purpose of calculating its economic and financial IRR should not be affected by changes in the general price level resulting from inflation¹.

However, prices of social services such as electricity, water supply, postal service, transportation, and telecommunication have some tendencies not to be so sensitive to catch up the inflation of the costs because they are usually controlled and regulated by the government. Thailand is now facing investment booms and especially prices of construction is increasing higher and higher recently. Therefore, we will consider this matter in a sensitivity analysis of the project evaluation.

5) Revenue and Cost Estimation

The present tariff system as of September 1989 is used as a basis of revenue estimation. For cost estimation, the historical data of the TOT expenses are taken into consideration.

6) Financial Loan

It is assumed that 75% of the investment funds will be debt-financed.

¹ J. Christian Duvigneau and Ranga N. Prasad, Guidelines for Calculating Financial and Economic Rates of Return for DFC Projects -WORLD BANK TECHNICAL PAPER NUMBER 33- (Washington, D.C.: The WORLD BANK, 1984), p. 15.

9.2 Revenue Estimation

TOT classifies telephone subscribers into the following five categories:

- 1) Business,
- 2) Residence,
- 3) Government,
- 4) TOT,
- 5) Public Telephone.

Revenues of the Project consists of the following charges:

- a) Installation Charge,
- b) Monthly Charge,
- c) Local Call Charge,
- d) Trunk Call Charge,
- e) Others (Relocation Charges, Leased Circuit Charges, etc).

We estimate revenues from installation charge, monthly charge, local call charge, and trunk call charge from business, residence, and government subscribers. Telephone lines for TOT's internal use is not taken into account for revenue estimation because they are free of charge and do not yield revenues.

In order to estimate the revenues from the project, we estimate the total revenue from the network at first. After that, the revenue from the project is divided according to the telephone line shares of the existing facilities and the future expanded facilities.

We estimate the revenue of the public telephone service separately because the revenue per line of the public telephone service is much higher than that of normal subscribers.

9.2.1 Telephone Installation Schedule

The telephone installation schedule is described in Chapter 8 (see 8.1.2 at page 8-2).

The annual growth rate of TOT's internal lines is set to be 2% considering expansion speed of TOT's services and staff.

Table 9.2.1 shows a summary of the installation schedule and the total number of main telephones.

Table 9.2.1 Summary of the Installation Schedule

Year	The Number of Lines Connected in the Whole Kingdom				The Number of Installation per Year (Net Increase)				
	Prv. + Govn.	Public Tel.	TOT	TOTAL	Actual	5th ESDP	6th Project	5th + 6th	Next Project
1976				236,818					
1977	255,655	2,207	2,944	260,806	23,988				
1978	289,580	3,154	2,900	295,634	34,828				
1979	323,739	4,670	3,175	331,584	35,950				
1980	356,683	5,758	3,453	365,894	34,310				
1981	378,560	6,863	3,815	389,238	23,344				
1982	412,786	8,721	4,172	425,679	36,441				
1983	449,336	9,426	4,469	463,231	37,552				
1984	503,622	10,886	4,983	519,491	56,260				
1985	606,576	14,322	5,600	626,498	107,007				
1986	773,902	17,720	7,290	798,912	172,414				
1987	873,247	20,112	8,263	901,622	102,710	93,000		93,000	
1988	975,774	20,636	9,462	1,005,872	104,250	117,000		117,000	
1989	1,127,881	29,340	9,651	1,166,872		161,000		161,000	
1990	1,269,984	38,044	9,844	1,317,872		151,000		151,000	
1991	1,500,083	46,748	10,041	1,556,872		189,000	50,000	239,000	
1992	1,756,178	55,452	10,242	1,821,872		150,000	115,000	265,000	
1993	2,106,708	62,992	10,447	2,180,147		80,000	26,400	106,400	251,875
1994	2,457,234	70,532	10,656	2,538,422		20,000		20,000	338,275
1995	2,807,756	78,072	10,869	2,896,696					358,275
1996	3,158,273	85,612	11,086	3,254,971					358,275
1997	3,508,786	93,152	11,308	3,613,246					358,275
1998	3,739,465	100,867	11,534	3,851,867					238,621
1999	3,970,140	108,583	11,765	4,090,487					238,621
2000	4,200,809	116,298	12,000	4,329,108					238,621
2001	4,431,475	124,014	12,240	4,567,728					238,621
2002	4,662,135	131,729	12,485	4,806,349					238,621
2003	4,925,912	139,965	12,735	5,078,612					272,263
2004	5,189,685	148,202	12,989	5,350,876					272,263
2005	5,453,452	156,438	13,249	5,623,139					272,263
2006	5,717,214	164,675	13,514	5,895,403					272,263
2007	5,980,971	172,911	13,784	6,167,666					272,263

Note: The number of lines connected between FY 1976 and 1988 are actual figures. The number from FY 1989 are the estimates made by this study.

9.2.2 Installation Charge and Monthly Charge

1) Installation Charge

In the present tariff system of TOT, the installation charge differs by the following three types:

- a) For a telephone purchased by the subscriber and installed by TOT 3,700 Baht,
- b) For a telephone purchased and installed by the subscriber3,350 Baht,
- c) For a telephone provided by TOT5,000 Baht.

In this Study, the installation charge is set to be 3,500 Baht per new installed line, which is approximately an average of a) and b) cases.

2) Monthly Charge

The monthly subscription fee for both residence and business users is 50 Baht for a rotary dial telephone line and 100 Baht for a push button telephone line. The number of push button telephone lines is increasing year by year and its share is now 60% in FY 1988 as shown in Table 9.2.2-1 and Figure 9.2.2-1.

Table 9.2.2-1 The Number of Rotary Dial and Push Button Telephone Lines

Year	Rotary Dial	Push Button	Total	Share of P.B.
1976	236,818	0	236,818	0%
1977	260,806	0	260,806	0%
1978	295,433	201	295,634	0%
1979	331,009	575	331,584	0%
1980	365,168	726	365,894	0%
1981	379,577	2,798	382,375	1%
1982	400,789	16,169	416,958	4%
1983	408,681	45,124	453,805	10%
1984	414,820	93,785	508,605	18%
1985	395,390	211,186	606,576	35%
1986	374,496	399,406	773,902	52%
1987	382,123	491,124	873,247	56%
1988	390,425	585,349	975,774	60%

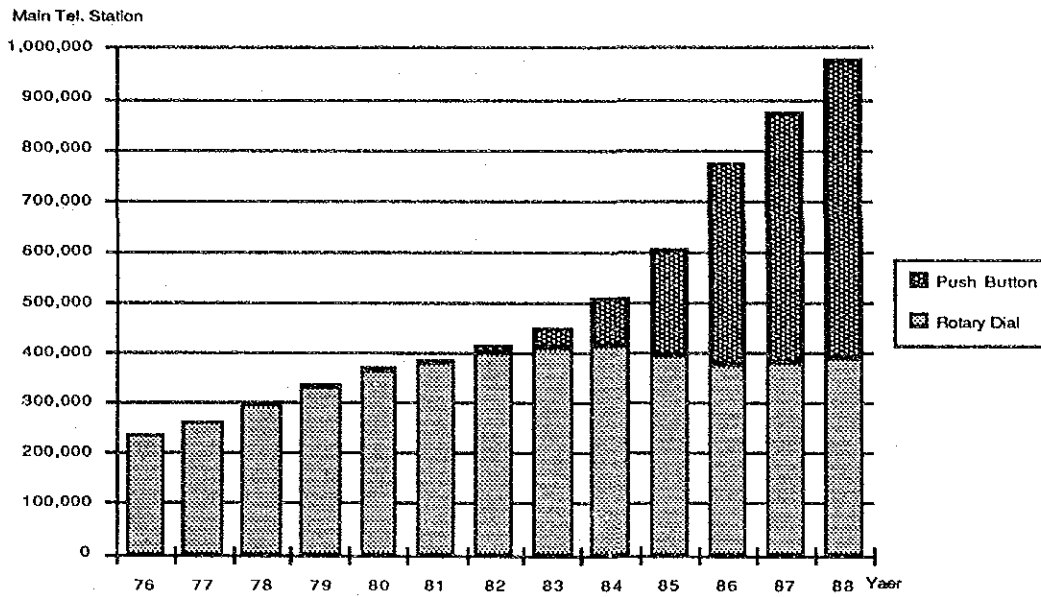


Figure 9.2.2-1 The Number of Telephones by Types

Table 9.2.2-2 shows the share of push button telephone lines of new installed telephone lines. In FY 1987, over 90% of the lines are push button type.

Table 9.2.2-2 The Share of Push Button Lines in Newly Installed Telephones

Year	Rotary Dial	Push Button	Total	Share of P.B.
1977	23,988	0	23,988	0%
1978	34,627	201	34,828	1%
1979	35,576	374	35,950	1%
1980	34,159	151	34,310	0%
1981	14,409	2,072	16,481	13%
1982	21,212	13,371	34,583	39%
1983	7,892	28,955	36,847	79%
1984	6,139	48,661	54,800	89%
1985	-19,430	117,401	97,971	120%
1986	-20,894	188,220	167,326	112%
1987	7,627	91,718	99,345	92%
1988	8,302	94,225	102,527	92%

TOT deregulated sales of telephone terminal sets in 1987. Subscribers can choose various types of terminal sets including out-pulse dial type telephones in the market. The out-pulse dial type uses normal dial telephone lines; therefore, subscribers do not need to pay 100 Baht of the subscription charge. It is not certain that the push button type keeps its high

share in the future. It can be expected that the number of push button lines will decrease and that of dial telephone lines will increase in the near future.

Therefore, the monthly subscription charge is set to be 75 Baht which is just an average of 50 Baht for a dial telephone and 100 Baht for a push button telephone in this Study.

9.2.3 Local Call Charge

1) Past Trend

In order to forecast future local call revenue, it is essential to investigate the past trend of the relationship between local telephone usages and the number of telephone lines.

Tables 9.2.3-1 ~ 9.2.3-12 show:

- a) the classified number of local telephone usage by type of subscribers,
- b) the number of main telephone stations by type of subscribers,
- c) the number of average main telephone stations by type of subscribers,
- d) the number of local telephone usages per average main telephone stations classified by type of subscribers, in the metropolitan area, provincial area, and the whole Kingdom.

In the tables, the average telephone lines are calculated by the following equation.

$$\text{Average main tel. line} = (\text{Main Tel. station at the beginning of the year} + \text{Main tel. station at the end of the year})/2$$

The number of local usages per line declined from FY 1983 to 1987, although it increased again from FY 1987 to 1988 in total.

Table 9.2.3-1 The Classified Number of Local Telephone Usage by Type of Subscribers in Metro.

Year	Business	Residence	Total Priv.	Government.			Priv. & Gov.	Public	TOT	TOTAL
				Office	Residence	Total				
1981	304,055	210,626	514,681	48,335	5,449	53,784	568,465	110,987		679,452
1982	314,603	244,103	558,706	64,951	5,049	70,000	628,706	132,706	1,477	762,889
1983	319,491	276,574	596,065	79,690	4,556	84,246	680,311	154,921	5,022	840,254
1984	332,619	307,979	640,598	84,428	4,941	89,369	729,967	168,473	5,609	904,049
1985	334,978	329,514	664,492	89,623	5,192	94,815	759,307	205,814	5,980	971,101
1986	362,127	389,957	752,084	104,230	5,757	109,987	862,071	306,665	9,854	1,178,590
1987	391,123	431,245	822,368	112,249	6,368	118,617	940,985	339,550	7,272	1,287,807
1988	451,932	508,382	960,314	120,626	6,584	127,210	1,087,524	368,353	8,058	1,463,935

Table 9.2.3-2 The Number of Main Telephone Stations by Type of Subscribers in Metro.

Year	Business	Residence	Total Priv.	Public	Govt.	TOT	TOTAL
1980	92,875	149,758	242,633	5,160	19,979	1,762	269,534
1981	96,368	160,980	257,348	5,950	22,004	1,788	287,090
1982	101,047	176,804	277,851	7,645	24,579	1,987	312,062
1983	105,610	196,683	302,293	8,176	26,906	2,135	339,510
1984	108,726	212,825	321,551	9,260	28,820	2,293	361,924
1985	123,732	263,328	387,060	11,298	31,972	3,187	433,517
1986	142,980	352,887	495,867	13,229	35,029	3,955	548,080
1987	155,521	403,191	558,712	14,435	36,962	4,598	614,707
1988	172,414	454,890	627,304	14,485	39,007	5,355	686,151

Table 9.2.3-3 The Number of Average Main Telephone Stations by Type of Subscribers in Metro.

Year	Business	Residence	Total Priv.	Public	Govt.	TOT	TOTAL
1981	94,622	155,370	249,992	5,556	20,992	1,776	278,315
1982	98,708	168,893	267,601	6,798	23,292	1,888	299,579
1983	103,329	186,744	290,073	7,911	25,743	2,062	325,789
1984	107,169	204,755	311,923	8,719	27,864	2,215	350,720
1985	116,230	238,077	354,307	10,280	30,397	2,741	397,723
1986	133,357	308,108	441,465	12,264	33,501	3,572	490,801
1987	149,251	378,040	527,291	13,833	35,996	4,277	581,396
1988	163,968	429,041	593,009	14,461	37,985	4,977	650,432

Table 9.2.3-4 The Number of Local Telephone Usages per Average Main Telephone Stations Classified by Type of Subscribers in Metro.

Year	Business	Residence	Total Priv.	Public	Govt.	TOT	TOTAL
1981	3,213	1,356	2,059	19,978	2,562	0	2,441
1982	3,187	1,445	2,088	19,521	3,005	782	2,547
1983	3,092	1,481	2,055	19,583	3,273	2,436	2,579
1984	3,104	1,504	2,054	19,324	3,207	2,533	2,578
1985	2,882	1,384	1,875	20,022	3,119	2,182	2,442
1986	2,715	1,266	1,704	25,005	3,283	2,759	2,401
1987	2,621	1,141	1,560	24,547	3,295	1,700	2,215
1988	2,756	1,185	1,619	25,473	3,349	1,619	2,251

Table 9.2.3-5 The Classified Number of Local Telephone Usage by Type of Subscribers in Province.

Year	Business	Residence	Total Priv.	Government.			Priv. & Gov.	Public	TOT	TOTAL
				Office	Residence	Total				
1981	86,053	28,838	114,891	9,746	517	10,263	125,154	5,111	-	130,265
1982	94,577	38,228	132,805	9,637	502	10,139	142,944	8,409	3,225	154,578
1983	99,468	44,881	144,349	16,563	546	17,109	161,458	10,311	7,920	179,689
1984	103,525	54,083	157,608	23,423	605	24,028	181,636	15,990	8,776	206,402
1985	107,783	70,941	178,724	31,311	349	31,660	210,384	31,658	9,338	251,380
1986	118,629	89,937	208,566	37,778	10	37,788	246,354	116,913	34,296	397,563
1987	127,070	106,230	233,300	41,345	0	41,345	274,645	53,885	10,452	338,982
1988	145,198	130,327	275,525	47,015	0	47,015	322,540	61,883	12,193	396,616

Table 9.2.3-6 The Number of Main Telephone Stations by Type of Subscribers in Province.

Year	Business	Residence	Total Priv.	Public	Govt.	TOT	TOTAL
1980	56,879	28,348	85,227	598	8,844	1,691	96,360
1981	58,362	31,282	89,644	913	9,564	2,027	102,148
1982	61,504	38,479	99,983	1,076	10,373	2,185	113,617
1983	64,433	44,401	108,834	1,250	11,303	2,334	123,721
1984	71,878	68,616	140,494	1,626	12,757	2,690	157,567
1985	79,447	93,746	173,193	3,024	14,351	2,413	192,981
1986	90,645	135,892	226,537	4,491	16,469	3,335	250,832
1987	97,709	162,030	259,739	5,677	17,834	3,665	286,915
1988	104,127	185,753	289,880	6,151	19,583	4,107	319,721

Table 9.2.3-7 The Number of Average Main Telephone Stations by Type of Subscribers in Province.

Year	Business	Residence	Total Priv.	Public	Govt.	TOT	TOTAL
1981	57,621	29,816	87,437	756	9,205	1,860	99,257
1982	59,934	34,881	94,815	995	9,969	2,107	107,885
1983	62,969	41,441	104,410	1,164	10,839	2,260	118,672
1984	68,156	56,509	124,665	1,439	12,031	2,513	140,647
1985	75,663	81,182	156,845	2,326	13,555	2,552	175,277
1986	85,047	114,820	199,866	3,758	15,411	2,875	221,909
1987	94,178	148,962	243,139	5,085	17,152	3,501	268,876
1988	100,919	173,892	274,811	5,915	18,709	3,887	303,321

Table 9.2.3-8 The Number of Local Telephone Usages per Average Main Telephone Stations Classified by Type of Subscribers in Province.

Year	Business	Residence	Total Priv.	Public	Govt.	TOT	TOTAL
1981	1,493	967	1,314	6,761	1,115	-	1,312
1982	1,578	1,096	1,401	8,451	1,017	1,531	1,433
1983	1,580	1,083	1,383	8,862	1,579	3,504	1,514
1984	1,519	957	1,264	11,116	1,997	3,493	1,468
1985	1,425	874	1,139	13,613	2,336	3,659	1,434
1986	1,395	783	1,044	31,110	2,452	11,931	1,792
1987	1,349	713	960	10,598	2,411	2,986	1,261
1988	1,439	749	1,003	10,463	2,513	3,137	1,308

Table 9.2.3-9 The Classified Number of Local Telephone Usage by Type of Subscribers in the Whole Kingdom

Year	Business	Residence	Total Priv.	Government			Priv. & Gov.	Public	TOT	TOTAL
				Office	Residence	Total				
1981	390,108	239,464	629,572	58,081	5,966	64,047	693,619	116,098		809,717
1982	409,180	282,331	691,511	74,588	5,551	80,139	771,650	141,115	4,702	917,467
1983	418,959	321,455	740,414	96,253	5,102	101,355	841,769	165,232	12,942	1,019,943
1984	436,144	362,062	798,206	107,851	5,546	113,397	911,603	184,463	14,385	1,110,451
1985	442,761	400,455	843,216	120,934	5,541	126,475	969,691	237,472	15,318	1,222,481
1986	480,756	479,894	960,650	142,008	5,767	147,775	1,108,425	423,578	44,150	1,576,153
1987	518,193	537,475	1,055,668	153,594	6,368	159,962	1,215,630	393,435	17,724	1,626,789
1988	597,130	638,709	1,235,839	167,641	6,584	174,225	1,410,064	430,236	20,251	1,860,551

Table 9.2.3-10 The Number of Main Telephone Stations by Type of Subscribers in the Whole Kingdom

Year	Business	Residence	Total Priv.	Public	Govt.	TOT	TOTAL
1980	149,754	178,106	327,860	5,758	28,823	3,453	365,894
1981	154,730	192,262	346,992	6,863	31,568	3,815	389,238
1982	162,551	215,283	377,834	8,721	34,952	4,172	425,679
1983	170,043	241,084	411,127	9,426	38,209	4,469	463,231
1984	180,604	281,441	462,045	10,886	41,577	4,983	519,491
1985	203,179	357,074	560,253	14,322	46,323	5,600	626,498
1986	233,625	488,779	722,404	17,720	51,498	7,290	798,912
1987	253,230	565,221	818,451	20,112	54,796	8,263	901,622
1988	276,541	640,643	917,184	20,636	58,590	9,462	1,005,872

Table 9.2.3-11 The Number of Average Main Telephone Stations by Type of Subscribers in the Whole Kingdom

Year	Business	Residence	Total Priv.	Public	Govt.	TOT	TOTAL
1981	152,243	185,185	337,427	6,311	30,196	3,635	377,569
1982	158,641	203,773	362,414	7,793	33,261	3,994	407,461
1983	166,298	228,184	394,482	9,074	36,581	4,321	444,458
1984	175,324	261,263	436,587	10,157	39,894	4,727	491,364
1985	191,892	319,258	511,150	12,605	43,951	5,292	572,997
1986	218,403	422,927	641,330	16,022	48,911	6,446	712,708
1987	243,428	527,001	770,429	18,917	53,148	7,777	850,270
1988	264,886	602,933	867,819	20,375	56,694	8,863	953,750

Table 9.2.3-12 The Number of Local Telephone Usages per Average Main Telephone Stations Classified by Type of Subscribers in the Whole Kingdom

Year	Business	Residence	Total Priv.	Public	Govt.	TOT	TOTAL
1981	2,562	1,293	1,866	18,396	2,121	0	2,145
1982	2,579	1,386	1,908	18,109	2,409	1,177	2,252
1983	2,519	1,409	1,877	18,209	2,771	2,995	2,295
1984	2,488	1,386	1,828	18,162	2,842	3,043	2,260
1985	2,307	1,254	1,650	18,840	2,878	2,895	2,133
1986	2,201	1,135	1,498	26,438	3,021	6,850	2,212
1987	2,129	1,020	1,370	20,799	3,010	2,279	1,913
1988	2,254	1,059	1,424	21,116	3,073	2,285	1,951

2) Local Call Revenue Forecasting

The present charge of a local call made within the same province from a subscriber's telephone is 3 Baht at present no matter how long it lasts. TOT has an intention to adopt a "time metering system" or "local timed calling plan" in the Bangkok Metropolitan Area near future. Local call revenue is calculated on the basis of the present tariff system in this Study, though local call traffic can be affected by a time metering system when it is put into practice.

Total local call traffic tends to increase in accordance with the number of main telephone lines. The relationship between the number of local calls and the number of main telephone lines is analyzed by linear regression models.

a) Metropolitan Area

Table 9.2.3-13 shows the number of local calls made by the private and governmental and their number of telephone lines in the metropolitan area for the past eight years.

Table 9.2.3-13 The Number of Local Calls in Metro.(Private + Government)

Year	Pulses(X10 ³)	Main Tel. Line	Ave. Main Tel.	Pulses/Ave.L.
1981	568,465	279,352	270,984	2,098
1982	628,706	302,430	290,893	2,161
1983	680,311	329,199	315,816	2,154
1984	729,967	350,371	339,787	2,148
1985	759,307	419,032	384,703	1,974
1986	862,071	530,896	474,966	1,815
1987	940,985	595,674	563,287	1,671
1988	1,087,524	666,311	630,993	1,724

The regression result is as follows:

Dependent Variable: Number of local pulses (10^3)

Independent Variable: Number of average main telephone line

Degree of Freedom: 7

Variable Name	Coefficient	Std. Err. Estimate	T Statistics	Probability of T
Constant	260439.4535	35105.0074	7.4189	0.000
Ave. Tel. Lines	1.2758	0.0821	15.5381	0.000

Coefficient of Determination (R^2) 0.9758

Adjusted Coefficient (R^2) 0.9717

Standard Error of Estimate 28972.2020

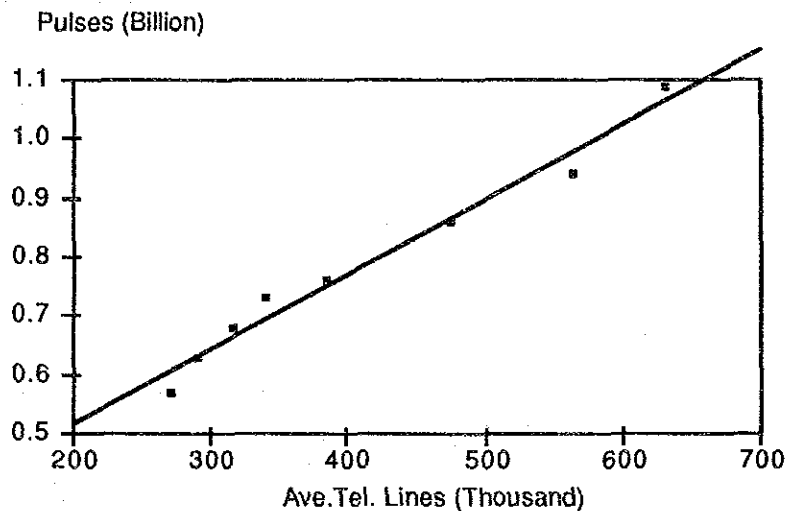


Figure 9.2.3-1 Trend of Local Calls in Metro.

The number of local calls in the future can be estimated by the following equation.

$$\text{Pulses}(10^3) = 1.2758 \times \text{Ave. Main Tel. Line} + 260439.4535 \text{ ----- (EQ-1)}$$

For the number of main telephone lines of the private and the government users increased in accordance with the installation schedule, the number of local pulses are estimated as shown in Table 9.2.3-14. Figure 9.2.3-2 shows the trend of the estimated number of pulses per average telephone line between FY 1989 and 2007.

Table 9.2.3-14 Estimated Local Calls in Metro. (Private + Government)

Year	Pulses/Ave.L.	Pulses(X10 ³)	Main Tel. Lines	Ave. Main Tel.
1988	1,689	1,065,460	666,311	630,993
1989	1,646	1,158,257	741,145	703,729
1990	1,613	1,244,484	801,484	771,315
1991	1,581	1,350,583	907,471	854,478
1992	1,547	1,487,682	1,016,407	961,940
1993	1,507	1,695,086	1,232,607	1,124,508
1994	1,471	1,963,865	1,437,757	1,335,182
1995	1,445	2,225,594	1,642,904	1,540,331
1996	1,425	2,487,319	1,848,049	1,745,477
1997	1,409	2,749,042	2,053,192	1,950,621
1998	1,399	2,959,474	2,177,933	2,115,563
1999	1,392	3,118,617	2,302,671	2,240,302
2000	1,386	3,277,757	2,427,407	2,365,040
2001	1,380	3,436,893	2,552,140	2,489,774
2002	1,375	3,596,026	2,676,871	2,614,506
2003	1,371	3,749,787	2,793,183	2,735,027
2004	1,367	3,898,176	2,909,492	2,851,338
2005	1,364	4,046,562	3,025,798	2,967,646
2006	1,360	4,194,944	3,142,102	3,083,951
2007	1,357	4,343,322	3,258,402	3,200,253

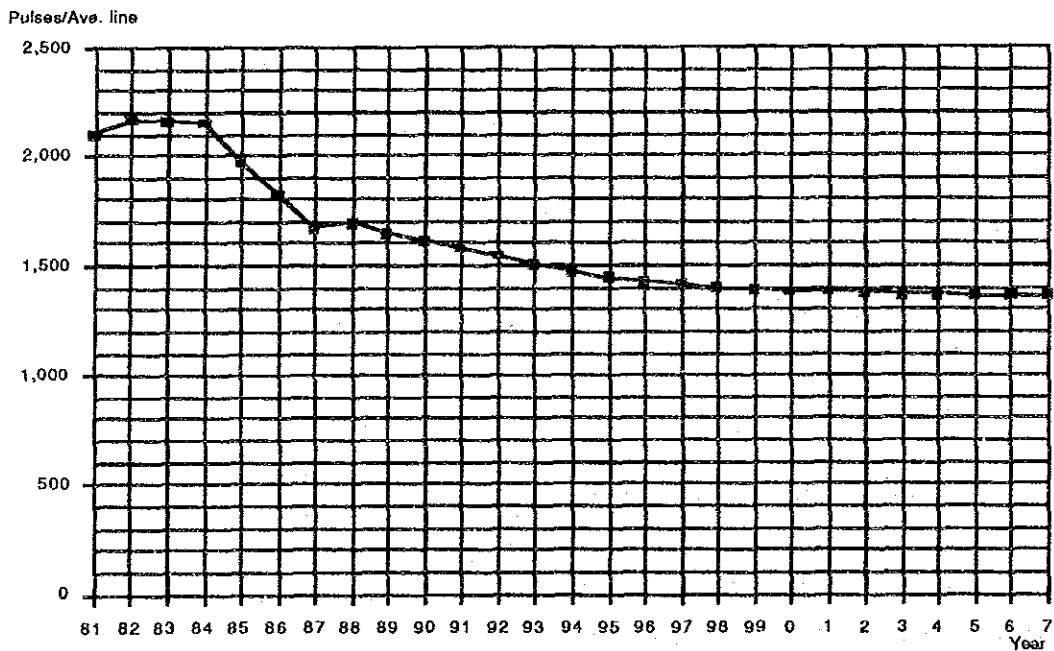


Figure 9.2.3-2 Estimated Local Calls per Telephone in Metro. (Private + Government)

b) Provincial Area

Table 9.2.3-15 shows the number of local calls and main telephone line of the private and the government users in provincial areas for the past eight years.

Table 9.2.3-15 The Number of Local Calls in Province. (Private + Government)

Year	Pulses(X10 ³)	Main Tel.	Ave. Main Tel.	Pulses/Ave.L.
1981	125,154	99,208	96,641	1,295
1982	142,944	110,356	104,784	1,364
1983	161,458	120,137	115,248	1,401
1984	181,636	153,251	136,696	1,329
1985	210,384	187,544	170,399	1,235
1986	246,354	243,006	215,277	1,144
1987	274,645	277,573	260,291	1,055
1988	322,540	309,463	293,519	1,099

The regression result of the relationship between the number of local pulses and average main telephone lines is as follows:

Dependent Variable: Number of local pulses (10³)

Independent Variable: Number of average Main telephone line

Degree of Freedom: 7

Variable Name	Coefficient	Std. Err. Estimate	T Statistics	Probability of T
Constant	49281.3963	8415.4309	5.8561	0.001
Ave. Tel. Lines	0.9124	0.0449	20.3407	0.000

Coefficient of Determination (R²) 0.9857

Adjusted Coefficient (R²) 0.9833

Standard Error of Estimate 8866.0025

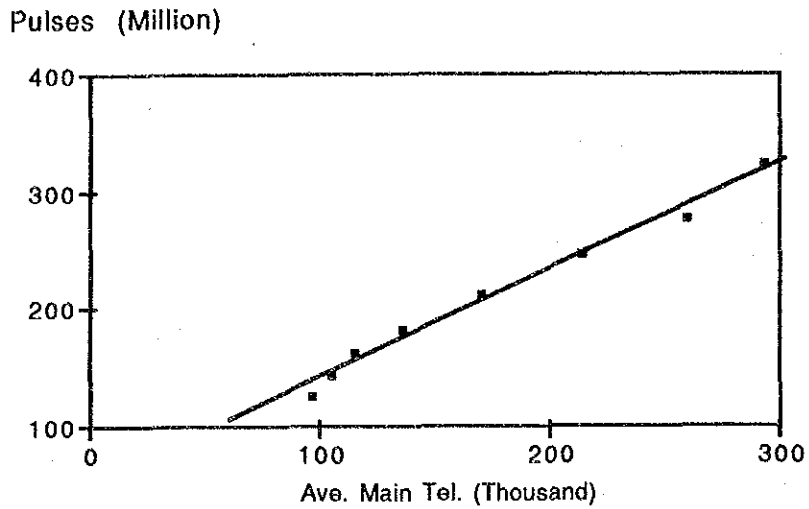


Figure 9.2.3-3 Trend of Local Calls in Province.(Private + Government)

The number of local calls in the future can be estimated by the following equation.

$$\text{Pulses}(10^3) = 0.9124 \times \text{Ave. Main Tel. Line} + 49281.3963 \text{ ----- (EQ-2)}$$

For the number of main telephone lines for private and government users increased in accordance with the installation schedule, estimated number of local pulses in the provincial area grow as shown in Table 9.2.3-16. Figure 9.2.3-4 shows the trend of the estimated number of pulses per line in the future.

Table 9.2.3-16 Estimated Local Calls in Province.(Private + Government)

year	Pulses/Ave.L.	Pulses(X10 ³)	Ave. Main Tel.	Main Tel.
1988	1,080	317,088	293,519	309,463
1989	1,054	366,888	348,100	386,735
1990	1,028	439,440	427,618	468,499
1991	1,005	533,361	530,556	592,611
1992	986	657,115	666,192	739,771
1993	973	785,530	806,936	874,101
1994	964	913,132	946,789	1,019,477
1995	958	1,045,772	1,092,165	1,164,851
1996	952	1,178,411	1,237,538	1,310,224
1997	948	1,311,048	1,382,909	1,455,594
1998	945	1,425,695	1,508,564	1,561,532
1999	943	1,522,352	1,614,501	1,667,468
2000	941	1,619,007	1,720,436	1,773,402
2001	939	1,715,660	1,826,369	1,879,334
2002	938	1,812,312	1,932,300	1,985,264
2003	936	1,927,911	2,058,998	2,132,730
2004	935	2,062,457	2,206,462	2,280,193
2005	933	2,197,001	2,353,924	2,427,654
2006	932	2,331,544	2,501,383	2,575,112
2007	931	2,466,084	2,648,841	2,722,568

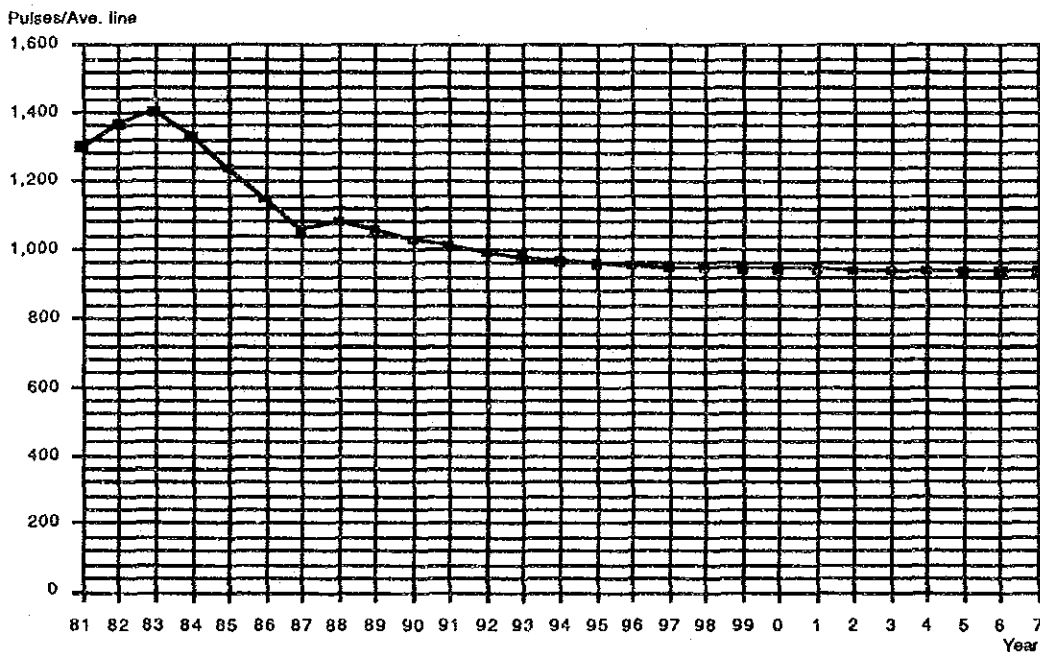


Figure 9.2.3-4 Estimated Local Calls per Telephone in Province. (Private + Government)

9.2.4 Trunk Call Revenue Estimation

This section presents estimates of trunk call revenues by private and government subscribers. The trunk public telephone revenue will be estimated separately later in this chapter. Table 9.2.4-2 and Table 9.2.4-3 show the number of trunk telephone lines and the trunk revenues of private and government subscribers in the metropolitan area and the provincial areas, which are used as the basic data for the future revenue estimation.

Table 9.2.4-1 shows the present tariff of internal trunk call.

Table 9.2.4-1 Tariff Table of Internal Trunk Call (as of June 1, 1989)

Rate	Within the Same Long Distance Code Number			Between Different Long Distance Code Number			Long Distance Public Telephone		
	7:00 ~ 18:00	18:00 ~ 22:00	22:00 ~ 7:00	7:00 ~ 18:00	18:00 ~ 22:00	22:00 ~ 7:00	7:00 ~ 18:00	18:00 ~ 22:00	22:00 ~ 7:00
0 - 50 km	3.00	1.50	1.00	3.00	1.50	1.00	3.00	1.50	1.00
51 - 100	6.00	3.00	2.00	6.00	3.00	2.00	6.00	3.00	2.00
over 101	9.00	4.50	3.00	-	-	-	-	-	-
101 - 200	-	-	-	9.00	4.50	3.00	8.00	4.00	2.67
201 - 350	-	-	-	12.00	6.00	4.00	12.00	6.00	4.00
351 - 500	-	-	-	15.00	7.50	5.00	15.00	7.50	5.00
over 501	-	-	-	18.00	9.00	6.00	20.00	10.00	6.67

(Baht/minute)

The future trunk revenue is estimated by regressing of trunk revenue on the number of telephone lines since the total trunk traffic increases in accordance with the increase of the number of main telephone lines.

Table 9.2.4-2 Trunk Telephone Service in Metro.

	1980	1981	1982	1983	1984
1. Main Tel.	269,134	287,090	312,062	339,510	361,924
2. Average Main Tel.	-	278,113	299,577	325,787	350,718
3. Pulse Metered (Thousand)	535,485	568,466	628,706	840,254	904,817
4. Trunk Call (Thousand)	3,744	9,031	12,190	14,545	16,524
5. Trunk Minutes (Thousand)					
6. Subsc. Fee & Call Charge (1000 Baht)	1,211,265	1,299,242	1,448,683	1,947,576	2,021,792
7. Trunk Service Revenue (1000 Baht)	138,744	303,248	377,168	435,422	502,007
8. Total Revenue (1000 Baht)	1,350,010	1,602,489	1,825,852	2,382,997	2,523,799
9. Total Public Revenue (1000 Baht)				136,182	145,422
9.1 Local Public Revenue (1000 Baht)				132,293	126,944
9.2 Trunk Public Revenue (1000 Baht)				3,889	18,478
10. Total Public Tel.		5,950	7,645	8,221	9,305
10.1 Local Public Tel.		5,950	7,645	8,076	9,070
10.2 Trunk Public Tel.	0	0	0	145	235
11. TOT Tel.	1,762	1,788	1,987	2,135	2,293
12. Trunk Tel. (1-10-11)	267,372	279,352	302,430	329,154	350,326
13. Ave. Trunk Tel.		273,363	290,892	315,793	339,741
14. Trunk Revenue (Excl. Public Tel.)	138,744	303,248	377,168	431,533	483,530
15. Ave. Trunk Rev./Trunk Tel. (Baht)	-	1,109	1,297	1,367	1,423
16. Growth Rate of 15			16.9%	5.4%	4.2%

	1985	1986	1987	1988
1. Main Tel.	433,517	548,080	614,707	686,151
2. Average Main Tel.	397,721	490,799	581,394	650,430
3. Pulse Metered (Thousand)	971,676	1,178,590	1,287,807	1,463,935
4. Trunk Call (Thousand)	19,122	22,826	27,567	35,129
5. Trunk Minutes (Thousand)		91,024	103,384	128,035
6. Subsc. Fee & Call Charge (1000 Baht)	2,171,583	3,100,827	3,884,519	4,435,907
7. Trunk Service Revenue (1000 Baht)	569,881	838,302	1,058,466	1,226,905
8. Total Revenue (1000 Baht)	2,741,464	3,939,128	4,942,985	5,662,812
9. Total Public Revenue (1000 Baht)	175,380	275,602	348,365	382,454
9.1 Local Public Revenue (1000 Baht)	152,518	240,283	309,054	335,789
9.2 Trunk Public Revenue (1000 Baht)	22,862	35,320	39,311	46,665
10. Total Public Tel.	11,306	13,229	14,435	14,485
10.1 Local Public Tel.	10,855	12,607	13,666	13,697
10.2 Trunk Public Tel.	451	622	769	788
11. TOT Tel.	3,187	3,955	4,598	5,355
12. Trunk Tel. (1-10-11)	419,024	530,896	595,674	666,311
13. Ave. Trunk Tel.	384,676	474,961	563,286	630,993
14. Trunk Revenue (Excl. Public Tel.)	547,020	802,982	1,019,155	1,180,240
15. Ave. Trunk Rev./Trunk Tel. (Baht)	1,422	1,691	1,809	1,870
16. Growth Rate of 15	-0.1%	18.9%	7.0%	3.4%

Table 9.2.4-3 Trunk Telephone Service in Province.

	1980	1981	1982	1983	1984
1. Main Tel.	96,360	102,148	113,617	123,721	157,567
2. Average Main Tel.	-	99,255	107,883	118,670	140,645
3. Pulse Metered (Thousand)	115,768	125,153	142,944	179,689	211,438
4. Trunk Call (Thousand)	10,173	21,623	29,217	35,599	40,074
5. Trunk Minutes (Thousand)	0	0	0	0	0
6. Subsc. Fee & Call Charge (1000 Baht)	282,297	308,056	355,907	429,891	507,033
7. Trunk Service Revenue (1000 Baht)	278,310	618,604	783,899	947,925	1,078,168
8. Total Revenue (1000 Baht)	560,608	926,661	1,139,806	1,377,816	1,585,202
9. Total Public Revenue (1000 Baht)	0	0	7,692	13,262	165,149
9.1 Local Public Revenue (1000 Baht)	0	0	7,692	11,149	9,677
9.2 Trunk Public Revenue (1000 Baht)	0	0	0	2,113	155,471
10. Total Public Tel.	598	913	1,843	2,078	2,542
10.1 Local Public Tel.	598	913	1,223	1,288	1,478
10.2 Trunk Public Tel.	0	0	620	790	1,064
11. TOT Tel.	1,691	2,027	2,185	2,334	2,690
12. Trunk Tel. (1-10-11)	94,071	99,208	109,589	119,309	152,335
13. Ave. Trunk Tel.		96,640	104,399	114,450	135,823
14. Trunk Revenue (Excl. Public Tel.)	278,310	618,604	783,899	945,812	922,697
15. Ave. Trunk Rev./Trunk Tel. (Baht)	-	6,401	7,509	8,264	6,793
16. Growth Rate of 15			17.30%	10.06%	-17.80%

	1985	1986	1987	1988
1. Main Tel.	192,981	250,832	286,915	319,721
2. Average Main Tel.	175,275	221,907	268,874	303,319
3. Pulse Metered (Thousand)	257,417	397,563	338,982	396,616
4. Trunk Call (Thousand)	45,820	52,911	62,578	78,384
5. Trunk Minutes (Thousand)	0	203,835	227,916	281,821
6. Subsc. Fee & Call Charge (1000 Baht)	624,897	969,872	1,205,924	1,420,183
7. Trunk Service Revenue (1000 Baht)	1,220,459	1,722,634	2,210,524	2,607,943
8. Total Revenue (1000 Baht)	1,845,356	2,692,507	3,416,448	4,028,126
9. Total Public Revenue (1000 Baht)	207,385	299,749	414,480	506,897
9.1 Local Public Revenue (1000 Baht)	27,486	60,650	78,714	92,671
9.2 Trunk Public Revenue (1000 Baht)	179,899	239,099	335,767	414,226
10. Total Public Tel.	3,147	4,579	5,709	6,183
10.1 Local Public Tel.	1,831	2,360	2,714	2,762
10.2 Trunk Public Tel.	1,316	2,219	2,995	3,421
11. TOT Tel.	2,413	3,335	3,665	4,107
12. Trunk Tel. (1-10-11)	187,421	242,918	277,541	309,431
13. Ave. Trunk Tel.	169,879	215,170	260,230	293,487
14. Trunk Revenue (Excl. Public Tel.)	1,040,559	1,483,536	1,874,758	2,193,717
15. Ave. Trunk Rev./Trunk Tel. (Baht)	6,125	6,895	7,204	7,475
16. Growth Rate of 15	-9.83%	12.56%	4.49%	3.75%

1) Metropolitan Area

Table 9.2.4-4 shows the trunk revenue and the number of main telephone lines for private and government users in the metropolitan area for the past eight years.

Table 9.2.4-4 The Trunk Revenue in Metro.(Private + Government)

Year	Trunk Revenue	Main Tel.	Ave. Tel.	Revenue/Ave.Tel.
1981	303,247,610	279,352	273,363	1,109
1982	377,168,350	302,430	290,892	1,297
1983	431,532,530	329,154	315,793	1,367
1984	483,529,611	350,326	339,741	1,423
1985	547,019,718	419,024	384,676	1,422
1986	802,981,843	530,896	474,961	1,691
1987	1,019,155,180	595,674	563,286	1,809
1988	1,180,240,165	666,311	630,993	1,870

The regression result is as follows:

Dependent Variable: Trunk Revenue

Independent Variable: Number of Average Main Telephone Line

Degree of Freedom: 7

Variable Name	Coefficient	Std. Err. Estimate	T Statistics	Probability of T
Constant	-342834611.5543	23096678.5898	-14.8435	0.000
Ave. Tel. Lines	2409.3681	54.0006	44.6175	0.000

Coefficient of Determination (R²) 0.9970

Adjusted Coefficient (R²) 0.9965

Standard Error of Estimate 19004723.3746

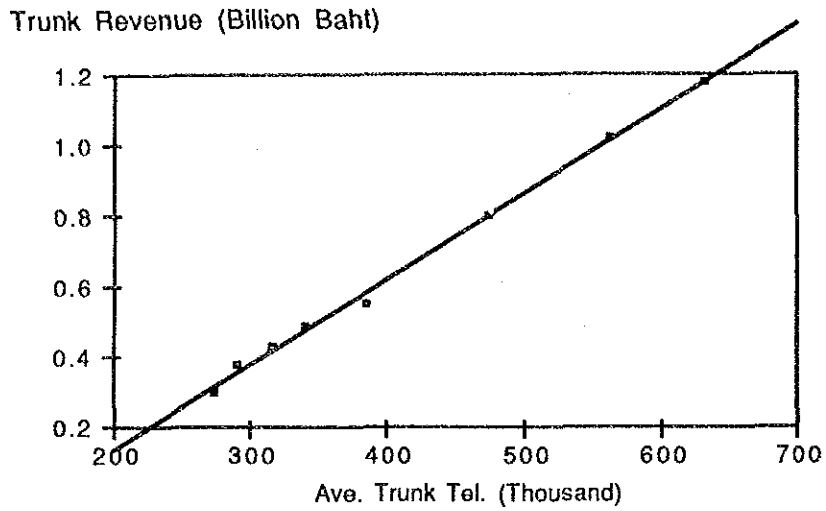


Figure 9.2.4-1 Trend of the Trunk Revenue in Metro. (Private + Government)

The trunk revenue in the future can be estimated by the following equation.

$$\text{Trunk Revenue} = 2409.3681 \times \text{Ave. Main Tel. Line} - 342834611.5543 \text{----- (EQ-3)}$$

Table 9.2.4-5 shows the estimated trunk revenues in the metropolitan area for the number of main telephone lines of the private and the government increased in accordance with the installation schedule. Figure 9.2.4-2 shows the trend of the estimated trunk revenues per line in the future.

Table 9.2.4-5 Estimated Trunk Revenue in Metro.(Private + Government)

Year	Trunk Rev./line	Main Tel.Line	Avc. Tel.Line	Trunk Rev(10 ³)
1988	1,870	666,311	630,993	1,180,240
1989	1,912	741,145	703,729	1,345,833
1990	1,953	801,484	771,315	1,506,656
1991	1,995	907,471	854,478	1,704,544
1992	2,038	1,016,407	961,940	1,960,250
1993	2,087	1,232,607	1,124,508	2,347,082
1994	2,133	1,437,757	1,335,182	2,848,387
1995	2,166	1,642,904	1,540,331	3,336,541
1996	2,191	1,848,049	1,745,477	3,824,690
1997	2,211	2,053,192	1,950,621	4,312,833
1998	2,224	2,177,933	2,115,563	4,705,314
1999	2,233	2,302,671	2,240,302	5,002,134
2000	2,241	2,427,407	2,365,040	5,298,948
2001	2,247	2,552,140	2,489,774	5,595,756
2002	2,254	2,676,871	2,614,506	5,892,557
2003	2,259	2,793,183	2,735,027	6,179,340
2004	2,264	2,909,492	2,851,338	6,456,103
2005	2,269	3,025,798	2,967,646	6,732,859
2006	2,273	3,142,102	3,083,951	7,009,608
2007	2,277	3,258,402	3,200,253	7,286,351

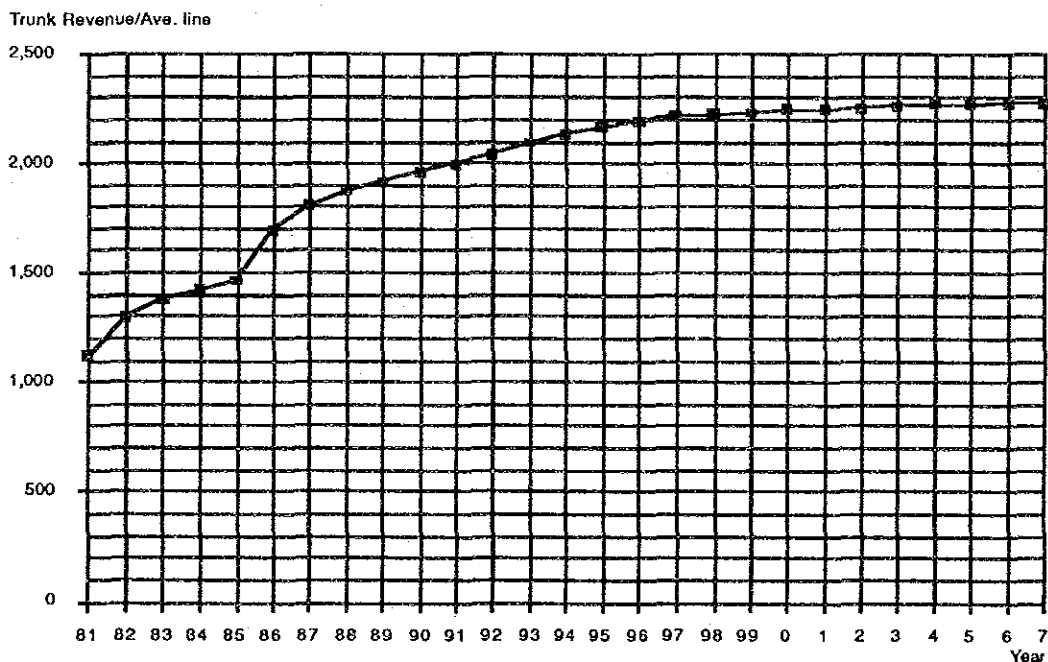


Figure 9.2.4-2 Estimated Trunk Revenue per Telephone in Metro.(Private + Government)

2) Provincial Area

Table 9.2.4-6 shows the trunk revenues and the main telephone lines in the provincial area for the past eight years.

Table 9.2.4-6 The Trunk Revenue and Telephone Lines in Province.
(Private + Government)

Year	Trunk Revenue	Main Tel.	Ave. Tel.	Trunk Rev./Ave. Tel.
1981	618,604,468	99,208	96,640	6,235
1982	783,898,910	109,589	104,399	7,153
1983	945,812,342	119,309	114,450	7,927
1984	922,696,919	152,335	135,823	6,057
1985	1,040,559,317	187,421	169,879	5,552
1986	1,483,535,504	242,918	215,170	6,107
1987	1,874,757,850	277,541	260,230	6,755
1988	2,193,717,264	309,431	293,487	7,475

The regression result is as follows:

Dependent Variable: Trunk Revenue
 Independent Variable: Number of Average Main Trunk Telephone Line
 Degree of Freedom: 7

Variable Name	Coefficient	Std. Err. Estimate	T Statistics	Probability of T
Constant	-46123432.0875	98702755.6757	-0.4673	0.657
Ave. Tel. Lines	7361.1587	526.8404	13.9723	0.000

Coefficient of Determination (R²) 0.9702
 Adjusted Coefficient (R²) 0.9652
 Standard Error of Estimate 104384592.0137

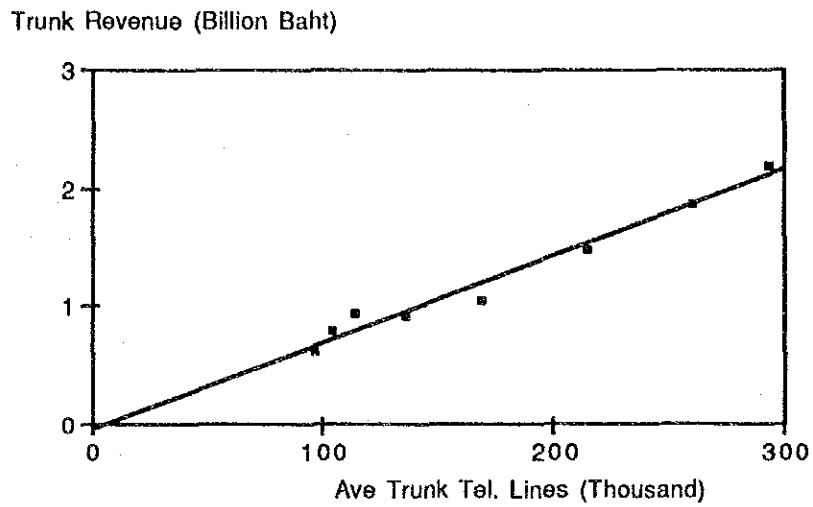


Figure 9.2.4-3 Trend of the Trunk Revenue in Province.

The trunk revenue in the future can be estimated by the following equation.

$$\text{Trunk Revenue} = 7361.1587 \times \text{Ave. Trunk Tel. Line} - 46123432.0875 \text{----- (EQ-4)}$$

Table 9.2.4-7 shows the estimated trunk revenues in the provincial areas for the number of trunk main telephone line increased in accordance with the installation schedule. Figure 9.2.4-4 shows the trend of the estimated trunk revenues per line in the future.

Table 9.2.4-7 Estimated Trunk Revenue in Province.

Year	Trunk Rev./Ave.line	Main Tel.Line	Ave. Tel.Line	Trunk Rev. (10 ³ B)
1988	7,475	309,431	293,487	2,193,717
1989	7,229	386,735	348,084	2,516,176
1990	7,253	468,499	427,618	3,101,639
1991	7,274	592,611	530,556	3,859,383
1992	7,292	739,771	666,192	4,857,820
1993	7,304	874,101	806,936	5,893,864
1994	7,312	1,019,477	946,789	6,923,344
1995	7,319	1,164,851	1,092,165	7,993,474
1996	7,324	1,310,224	1,237,538	9,063,590
1997	7,328	1,455,594	1,382,909	10,133,693
1998	7,331	1,561,532	1,508,564	11,058,654
1999	7,333	1,667,468	1,614,501	11,838,474
2000	7,334	1,773,402	1,720,436	12,618,278
2001	7,336	1,879,334	1,826,369	13,398,068
2002	7,337	1,985,264	1,932,300	14,177,843
2003	7,339	2,132,730	2,058,998	15,110,484
2004	7,340	2,280,193	2,206,462	16,195,991
2005	7,342	2,427,654	2,353,924	17,281,482
2006	7,343	2,575,112	2,501,383	18,366,956
2007	7,344	2,722,568	2,648,841	19,452,414

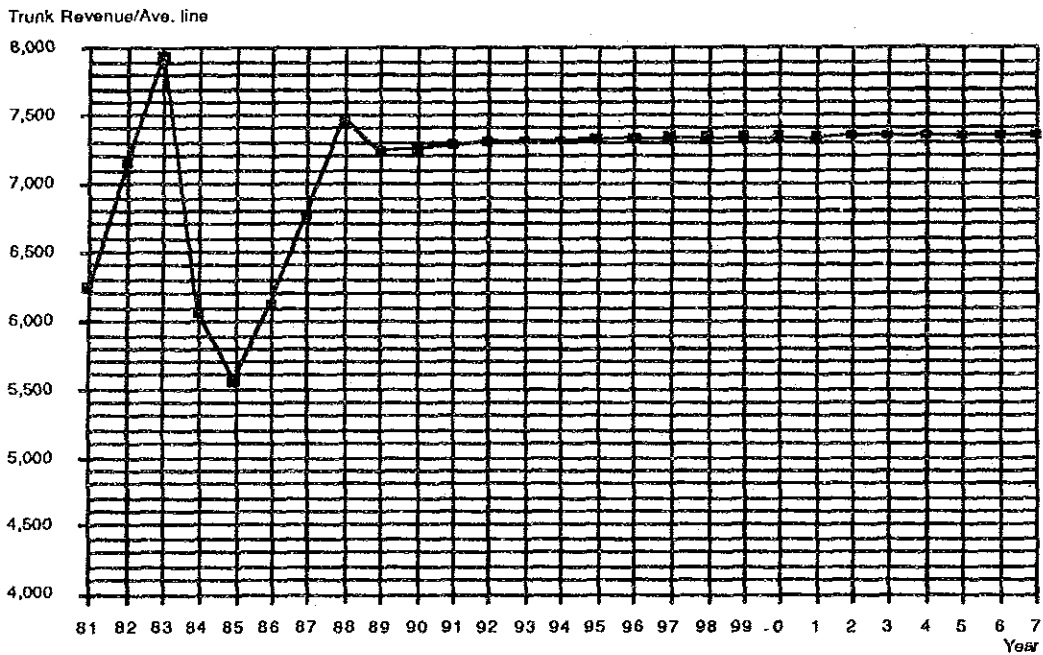


Figure 9.2.4-4 Estimated Trunk Revenue per Telephone in Province.(Private + Government)

9.2.5 Other Revenues

Besides local call and trunk call revenues, there are other revenues such as leased circuit charges, relocation charges, revenue from advertising in the directory. A weighted average share of these revenues to the total telephone revenue in the past eight years is 10.61%. In this revenue estimation, 10% of the total telephone revenue is assumed for other revenues.

9.2.6 Deposit

A subscriber must deposit 3,000 Baht when he applies for a telephone line. His deposit will be refunded upon his termination of the service, if no telephone bill is left unpaid. Therefore, deposit is not counted as the revenue but a source of funds. From the view point of cash flow of the Project, deposit is to be taken into Cash Inflow and refunded at the end of the Project period.

9.2.7 Public Telephone Revenue

Table 9.2.7-1 and Table 9.2.7-2 show the average revenues per local public telephone in the metro and the provinces respectively in the past five years.

Table 9.2.7-1 The Revenue per Average Local Public Telephone in Metro.

Year	Revenue(1000B)	Local P.T.	Ave. Local P.T.	Revenue/AVE.
1983	132,293	8,076	7,861	16,829
1984	126,944	9,070	8,574	14,807
1985	152,518	10,855	9,963	15,308
1986	240,283	12,607	11,732	20,482
1987	309,054	13,666	13,137	23,525
1988	335,789	13,697	13,682	24,542

Table 9.2.7-2 The Revenue per Average Local Public Telephone in Province

Year	Revenue(1000B)	Local P.T.	Ave. Local P.T.	Revenue/AVE.
1983	11,149	1,288	1,256	8,877
1984	9,677	1,478	1,384	6,995
1985	27,486	1,831	1,655	16,608
1986	60,650	2,360	2,096	28,936
1987	78,714	2,714	2,538	31,020
1988	92,671	2,762	2,739	33,840

Table 9.2.7-3 and Table 9.2.7-4 show the average revenue per trunk public telephone in the metro and the provinces respectively in the past five years.

Table 9.2.7-3 The Revenue per Average Trunk Public Telephone in Metro.

Year	Revenue(1000B)	Trunk+Rural	AVE. Tel.	Rev./Ave.
1983	3,889	145	73	53,274
1984	18,478	235	191	96,997
1985	22,862	451	344	66,556
1986	35,320	622	537	65,773
1987	39,311	769	696	56,481
1988	46,665	788	779	59,904

Table 9.2.7-4 The Revenue per Average Trunk Public Telephone in Province.

Year	Revenue(1000B)	Trunk+Rural	AVE. Tel.	Rev./Ave.
1983	2,113	790	396	5,343
1984	155,471	1,064	928	167,624
1985	179,899	1,316	1,191	151,112
1986	239,099	2,219	1,768	135,237
1987	341,514	2,995	2,608	130,974
1988	414,226	3,421	3,209	129,103

The present local public telephone is used only for local calls and the present long distance public telephone is used only for trunk (long distance) calls. All newly installed public telephones by the Project can be used for both local and trunk calls.

In order to estimate the revenue from the public telephone service, the following average revenue figures in FY 1988 is employed:

- a) Local Public Telephone Service
 - Metropolitan Area25,000 Baht/year
 - Provincial Area34,000 Baht/year
- b) Long -distance & Rural long-distance Public Telephone Service
 - Metropolitan Area60,000 Baht/year
 - Provincial Area 130,000 Baht/year
- c) Combination Type
 - Metropolitan Area27,000 Baht/year
 - Provincial Area85,000 Baht/year

The combination type public telephone service is not available in Thailand except for the rural long-distance public telephone service. Therefore, the unit revenues of the combination type in the metro and provincial areas are estimated from the total revenue of the public telephone in 1988.

Table 9.2.7-5 The Revenue from Public Telephone Service

Year	1983	1984	1985	1986	1987	1988
1. Revenue from Public Tel. Service (Thousand Baht)						
Local Public Telephone Service	143,442	140,795	180,004	300,932	387,768	428,460
Metro.	132,293	126,944	152,518	240,283	309,054	335,789
Province	11,149	13,851	27,486	60,649	78,714	92,671
Long-distance Public Tel. Service	N.A.	173,949	202,761	274,419	384,315	460,891
Metro.	N.A.	18,478	22,862	35,320	42,801	46,665
Province	N.A.	155,471	179,899	239,099	341,514	414,226
Rural Long-distance Public Tel. Service						
Metro.						
Province						
Total	143,442	314,744	382,765	575,351	772,083	889,351
2. No. of Public Telephone						
Local Type	9,364	10,548	12,686	14,967	16,380	16,459
Metro.	8,076	9,070	10,855	12,607	13,666	13,697
Province	1,288	1,478	1,831	2,360	2,714	2,762
Long-distance Type	710	977	1,632	1,949	2,352	2,791
Metro.	145	235	451	622	752	770
Province	565	742	1,181	1,327	1,600	2,021
Rural Long-distance Type	225	322	135	892	1,412	1,418
Metro.	0	0	0	0	17	18
Province	225	322	135	892	1,395	1,400
Total Public Telephone	10,299	11,847	14,453	17,808	20,144	20,668
Metro.	8,221	9,305	11,306	13,229	14,435	14,485
Province	2,078	2,542	3,147	4,579	5,709	6,183
3. Average No. of Public Telephone						
Local Type	9,117	9,957	11,618	13,827	15,674	16,420
Metro.	7,861	8,574	9,963	11,732	13,137	13,682
Province	1,256	1,384	1,655	2,096	2,538	2,739
Rural + Long Distance Type	574	1,118	1,534	2,305	3,304	3,988
Metro.	74	191	344	537	696	779
Province	706	928	1,191	1,768	2,608	3,209
4. Average Revenue per Public Tel. (Baht)						
Local Public Telephone Service	15,733	14,141	15,494	21,764	24,740	26,094
Metro.	16,829	14,807	15,308	20,482	23,525	24,542
Province	8,877	10,012	16,608	28,936	31,020	33,840
Long+ Rural Public Tel. Service	N.A.	155,589	132,178	119,054	116,336	115,584
Metro.	N.A.	96,997	66,556	65,773	61,496	59,904
Province	N.A.	167,624	151,112	135,237	130,974	129,103
Total Metro Rev		145,422	175,380	275,603	351,855	382,454
Ave. Total Metro. Tel		8,764	10,306	12,268	13,833	14,461
Total Rev/ Ave. Public Tel. in Metro.		16,594	17,017	22,465	25,437	26,448
Total Prov. Rev		169,322	207,385	299,748	420,228	506,897
Ave. Total Prov. Tel		2,311	2,845	3,864	5,145	5,947
Total Rev/ Ave. Public Tel. in Province		73,284	72,895	77,585	81,685	85,243

Note : The revenue of long distance public telephone service includes the rural long-distance public telephone revenue.

9.2.8 Total Revenue Estimation

Table 9.2.8-1 and Figure 9.2.8-1 show the future total operating revenue estimates. Table 9.2.8-2 shows the future operating revenue estimates of the project.

The local call revenue from the Project is estimated by the following steps:

- 1) The local call revenue from the total main telephone lines (existing lines with 5th & 6th ESDP installation plus the installation by the next Project) is estimated by EQ-1 and EQ-2.
- 2) The local call revenue from the next Project is calculated as a portion of the total according to the share percentage of telephone lines.

The trunk revenue of the Project is estimated as following steps:

- 1) The trunk revenue from the total main trunk telephone line (existing lines with 5th & 6th ESDP installation plus the installation by the next Project) is estimated by EQ-3 and EQ-4.
- 2) The trunk revenue from the Project is calculated as a portion of the total by the share percentage of telephone lines.

Figure 9.2.8-2 shows the shares of the total revenue estimation of the project. Table 9.2.8-3 shows the details of the project revenue estimation.

Table 9.2.8-1 Total Operating Revenue Estimation

(Unit: Million Baht)

Yaer	Subscriber Telephone	Public Telephone	Other Service	Total
1989	9,800.9	1,145.1	980.1	11,926.0
1990	11,122.8	1,579.6	1,112.3	13,814.6
1991	13,156.4	2,015.5	1,315.6	16,487.5
1992	15,506.1	2,451.3	1,550.6	19,508.0
1993	18,544.8	2,847.8	1,854.5	23,247.1
1994	21,586.5	3,204.8	2,158.6	26,949.9
1995	24,649.4	3,561.9	2,464.9	30,676.3
1996	27,712.4	3,918.9	2,771.2	34,402.5
1997	30,775.3	4,276.0	3,077.5	38,128.8
1998	32,915.0	4,636.5	3,291.5	40,843.0
1999	34,970.3	5,000.6	3,497.0	43,467.9
2000	37,025.7	5,364.6	3,702.6	46,092.8
2001	39,080.9	5,728.6	3,908.1	48,717.7
2002	41,136.2	6,092.7	4,113.6	51,342.4
2003	43,505.7	6,479.1	4,350.6	54,335.4
2004	45,957.6	6,888.0	4,595.8	57,441.4
2005	48,409.5	7,297.0	4,840.9	60,547.4
2006	50,861.3	7,705.9	5,086.1	63,653.3
2007	53,313.1	8,114.8	5,331.3	66,759.2

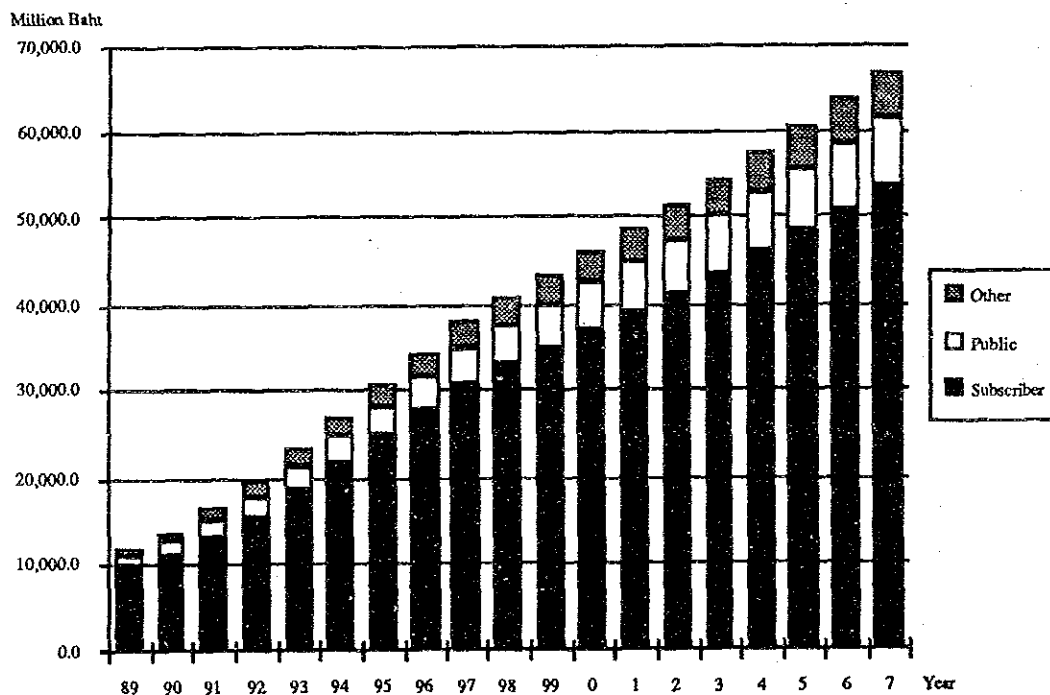


Figure 9.2.8-1 Total Operating Revenue Estimation

Table 9.2.8-2 Operating Revenue Estimation of the Project

(Unit: Million Baht)

Yaer	Subscriber Telephone	Public Telephone	Other Service	Total
1993	1,952.6	125.6	195.3	2,273.4
1994	4,805.9	419.6	480.6	5,706.1
1995	7,895.5	766.7	789.6	9,451.8
1996	10,993.2	1,123.8	1,099.3	13,216.3
1997	14,083.6	1,480.8	1,408.4	16,972.7
1998	16,241.4	1,841.3	1,624.1	19,706.9
1999	18,308.7	2,205.4	1,830.9	22,344.9
2000	20,374.6	2,569.4	2,037.5	24,981.5
2001	22,439.5	2,933.4	2,244.0	27,616.9
2002	24,503.4	3,297.5	2,450.3	30,251.2
2003	26,880.5	3,684.0	2,688.0	33,252.5
2004	29,339.0	4,092.9	2,933.9	36,365.8
2005	31,797.0	4,501.8	3,179.7	39,478.5
2006	34,254.5	4,910.7	3,425.5	42,590.7
2007	36,711.6	5,319.6	3,671.2	45,702.4

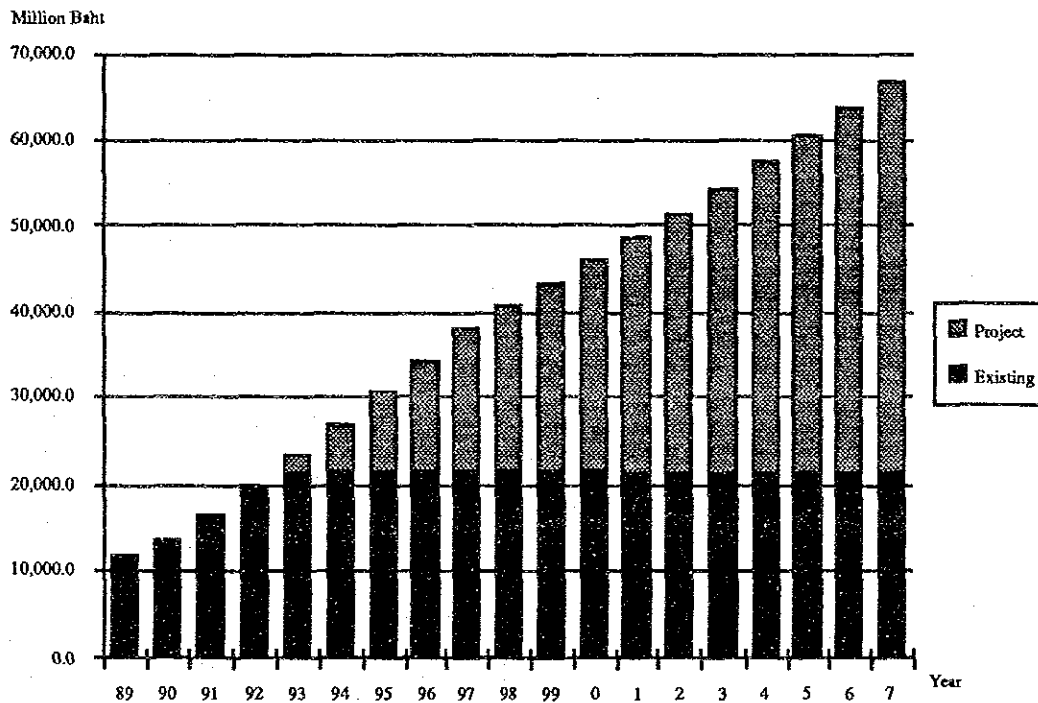


Figure 9.2.8-2 Operating Revenue Estimation of the Project

Table 9.2.8-3 Details of the Project Revenue Estimation

(Unit: Million Baht)

Year	Instl. Charge	Monthly Charge	Local Charge	Trunk Charge	Other Revenue	Public Tel. Revenue	Operating Revenue	Deposit	Total Inflow
1993	862.5	110.9	474.4	504.8	195.3	125.6	2,273.4	739.3	3,012.7
1994	1,158.4	370.7	1,548.7	1,728.1	480.6	419.6	5,706.1	992.9	6,699.0
1995	1,226.8	677.4	2,783.3	3,208.0	789.6	766.7	9,451.8	1,051.6	10,503.3
1996	1,226.8	992.9	4,033.6	4,740.0	1,099.3	1,123.8	13,216.3	1,051.6	14,267.8
1997	1,226.8	1,308.3	5,269.8	6,278.7	1,408.4	1,480.8	16,972.7	1,051.5	18,024.3
1998	807.4	1,569.9	6,280.3	7,583.9	1,624.1	1,841.3	19,706.9	692.0	20,399.0
1999	807.4	1,777.5	7,071.0	8,652.8	1,830.9	2,205.4	22,344.9	692.0	23,037.0
2000	807.3	1,985.1	7,859.3	9,723.0	2,037.5	2,569.4	24,981.5	692.0	25,673.5
2001	807.3	2,192.7	8,645.4	10,794.1	2,244.0	2,933.4	27,616.9	692.0	28,308.9
2002	807.3	2,400.3	9,429.7	11,866.2	2,450.3	3,297.5	30,251.2	692.0	30,943.2
2003	923.2	2,622.8	10,252.8	13,081.7	2,688.0	3,684.0	33,252.5	791.3	34,043.8
2004	923.2	2,860.2	11,115.0	14,440.7	2,933.9	4,092.9	36,365.8	791.3	37,157.1
2005	923.2	3,097.6	11,976.0	15,800.2	3,179.7	4,501.8	39,478.5	791.3	40,269.8
2006	923.2	3,334.9	12,836.2	17,160.3	3,425.5	4,910.7	42,590.7	791.3	43,382.0
2007	923.1	3,572.3	13,695.4	18,520.7	3,671.2	5,319.6	45,702.4	791.3	46,493.6
2008		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2009		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2010		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2011		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2012		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2013		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2014		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2015		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2016		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2017		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2018		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2019		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2020		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2021		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2022		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2023		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2024		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2025		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2026		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6		46,242.6
2027		3,691.0	14,124.7	19,201.1	3,701.7	5,524.1	46,242.6	-12,303.4	33,939.2

9.3 Cost Estimation

The Costs of this Project are composed of the following items:

- 1) Installation Cost:
 - a) Initial investment cost (facilities, equipment, land and building, civil work, vehicles, construction and installation, consultant fee, reserve fund),
 - b) Replacement and rehabilitation cost (facilities and equipment which are to be replaced during a project life),
- 2) Working Capital:

Current assets which correspond to fund in hand, inventory, uncollected revenue, etc.,
- 3) Working Cost:

Manpower cost, maintenance and repair cost, operation and administration cost,
- 4) Tax:

Remittance to the Treasury,
- 5) Financial Cost:

Interest payment and amortization for loan.

9.3.1 Installation Cost Estimation

Installation cost of switching facilities, outside plant, and transmission facilities is examined and estimated in Chapter 8. Existing facilities at the end of the year of FY 1992 require replacements and rehabilitations when their economic lives end. We also estimate costs of rehabilitations and replacements of the existing facilities besides future expansion investment cost. The total project investment cost includes these two costs:

- 1) Expansion project installation cost,
- 2) Rehabilitations and replacements costs of existing facilities.

In order to construct a telephone network, the following cost items must be included, too.

- a) Vehicle cost,
- b) Miscellaneous work and equipment cost,
- c) Consultant Fee,
- d) Contingency fund,
- e) Others.

From the budget of the 5th EDP Project (1984-1992), the percentage share of the total budget of these 5 cost items on the total amount of inside plant cost, outside plant cost, and transmission equipment cost is calculated as 8.69%. Therefore, 9% of installation cost is estimated as the figure of the above 5 cost items.

The facilities of which economic lives are shorter than the project life are to be replaced during the project life. In this case, replacement cost of each facility is estimated as the same way first installation cost was calculated.

When the facilities have remaining useful life time at the end of the project life, non-used values at the end of the project life will be recovered.

Scrap value is not taken into account because it is difficult to evaluate scrap value of facilities which passed durable periods as over removal cost.

Figure 9.3.1-1 and Table 9.3.1-1 show the total installation cost estimated on the above mentioned premises.

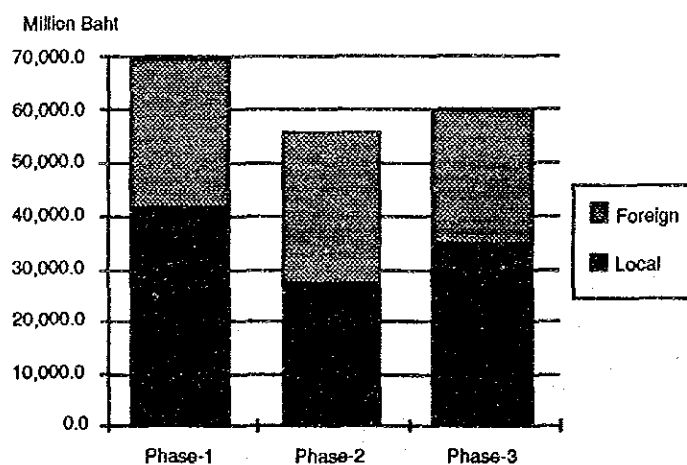


Figure 9.3.1-1 Foreign and Local Portion of the Total Installation Cost

Table 9.3.1-1 The Total Installation Cost

(Unit: Million Baht)

Future Expansion Project	Phase 1			Phase 2			Phase 3		
	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total
Land & Building	498.0		498.0	521.4		521.4	950.0		950.0
Switching	8,224.5	12,414.4	20,638.9	5,853.5	8,835.5	14,689.1	6,109.8	9,222.3	15,332.1
Outside Plant	22,125.3	6,998.1	29,123.4	8,529.2	7,044.1	15,573.3	14,029.3	4,469.3	18,498.6
Transmission	3,037.7	1,336.6	4,374.3	3,760.5	1,654.6	5,415.1	4,981.0	2,191.7	7,172.7
Public Telephone	1,077.0	2,106.2	3,183.2	1,094.7	2,132.5	3,227.3	1,279.7	2,622.1	3,901.8
Sub Total	34,962.5	22,855.3	57,817.8	19,759.4	19,666.8	39,426.2	27,349.9	18,505.3	45,855.2

Rehabilitation for Existing Network	Phase 1			Phase 2			Phase 3		
	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total
Land & Building									
Switching	1,457.3	2,199.7	3,657.0	4,005.8	6,046.4	10,052.2	3,062.0	4,621.9	7,683.9
Outside Plant	1,470.4	483.4	1,953.8	769.1	252.9	1,022.0	883.0	290.3	1,173.3
Transmission	145.7	331.1	476.8	218.3	496.2	714.5	190.1	432.1	622.3
Public Telephone									
Sub Total	3,073.4	3,014.2	6,087.6	4,993.2	6,795.5	11,788.7	4,135.2	5,344.3	9,479.5

Total Project	Phase 1			Phase 2			Phase 3		
	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total
Land & Building	498.0	0.0	498.0	521.4	0.0	521.4	950.0	0.0	950.0
Switching	9,681.8	14,614.1	24,295.9	9,859.3	14,882.0	24,741.3	9,171.8	13,844.2	23,016.0
Outside Plant	23,595.7	7,481.5	31,077.2	9,298.3	7,296.9	16,595.2	14,912.3	4,759.6	19,671.9
Transmission	3,183.4	1,667.7	4,851.1	3,978.8	2,150.8	6,129.6	5,171.2	2,623.8	7,795.0
Public Telephone	1,077.0	2,106.2	3,183.2	1,094.7	2,132.5	3,227.3	1,279.7	2,622.1	3,901.8
Sub Total	38,035.9	25,869.5	63,905.4	24,752.6	26,462.2	51,214.8	31,485.1	23,849.7	55,334.7
Vehicle Cost	268.4		268.4	215.1		215.1	232.4		232.4
Miscellaneous Work & Equip	38.3		38.3	30.7		30.7	33.2		33.2
Implementation Expenses	587.9		587.9	471.2		471.2	509.1		509.1
Consultant Fee	337.4	1,349.7	1,687.1	270.4	1,081.7	1,352.1	292.2	1,168.7	1,460.8
Contingencies	1,886.6	1,283.1	3,169.7	1,227.7	1,312.5	2,540.3	1,561.7	1,182.9	2,744.6
Total	41,154.6	28,502.3	69,656.9	26,967.8	28,856.4	55,824.2	34,113.6	26,201.3	60,314.8
* Out Side + Public Tel.	24,672.7	9,587.7	34,260.4	10,393.0	9,429.5	19,822.5	16,192.1	7,381.7	23,573.7

The annual installation and supply volume is one-fifth of the total volume of each phase. The installation cost will appear in cash flow calculation one year before each 5 year period. Table 9.3.1-2 shows annual investment cost between FY 1992 and 2007.

Table 9.3.1-2 Annual Investment Cost

(Unit: Million Baht)

	Year	1.Switching	2.Outside Plant with Public Tel.	3.Transmission	4. Land & Building	Replace-ment	Others	Residual Values	Investment Cost Total
0	1992	4,859.2	6,852.1	970.2	99.6	0.0	1,150.3		13,931.4
1	1993	4,859.2	6,852.1	970.2	99.6	0.0	1,150.3		13,931.4
2	1994	4,859.2	6,852.1	970.2	99.6	0.0	1,150.3		13,931.4
3	1995	4,859.2	6,852.1	970.2	99.6	0.0	1,150.3		13,931.4
4	1996	4,859.2	6,852.1	970.2	99.6	0.0	1,150.3		13,931.4
5	1997	4,948.3	3,964.5	1,225.9	104.3	0.0	921.9		11,164.8
6	1998	4,948.3	3,964.5	1,225.9	104.3	0.0	921.9		11,164.8
7	1999	4,948.3	3,964.5	1,225.9	104.3	0.0	921.9		11,164.8
8	2000	4,948.3	3,964.5	1,225.9	104.3	0.0	921.9		11,164.8
9	2001	4,948.3	3,964.5	1,225.9	104.3	0.0	921.9		11,164.8
10	2002	4,603.2	4,714.7	1,559.0	190.0	4,859.2	1,433.4		17,359.5
11	2003	4,603.2	4,714.7	1,559.0	190.0	4,859.2	1,433.4		17,359.5
12	2004	4,603.2	4,714.7	1,559.0	190.0	4,859.2	1,433.4		17,359.5
13	2005	4,603.2	4,714.7	1,559.0	190.0	4,859.2	1,433.4		17,359.5
14	2006	4,603.2	4,714.7	1,559.0	190.0	4,859.2	1,433.4		17,359.5
15	2007					5,918.5	532.7		6,451.1
16	2008					5,918.5	532.7		6,451.1
17	2009					5,918.5	532.7		6,451.1
18	2010					5,918.5	532.7		6,451.1
19	2011					5,918.5	532.7		6,451.1
20	2012					17,540.4	1,578.6		19,119.0
21	2013					17,540.4	1,578.6		19,119.0
22	2014					17,540.4	1,578.6		19,119.0
23	2015					17,540.4	1,578.6		19,119.0
24	2016					17,540.4	1,578.6		19,119.0
25	2017					10,471.8	942.5		11,414.2
26	2018					10,471.8	942.5		11,414.2
27	2019					10,471.8	942.5		11,414.2
28	2020					10,471.8	942.5		11,414.2
29	2021					10,471.8	942.5		11,414.2
30	2022					15,147.3	1,363.3		16,510.6
31	2023					15,147.3	1,363.3		16,510.6
32	2024					15,147.3	1,363.3		16,510.6
33	2025					15,147.3	1,363.3		16,510.6
34	2026					15,147.3	1,363.3		16,510.6
35	2027					13,026.3	1,172.4	-90,668.5	-76,469.9

9.3.2 Working Capital

Working capital is the current assets which correspond to fund in hand, inventory, uncollected revenue, and so forth. Table 9.3.2-1 shows the percentage ratio of the current assets to the total revenue in the past seven years of TOT.

Table 9.3.2-1 The Share of Current Assets to Total Revenue in TOT

(Unit: Million Baht)

Year	1. Current Assets	2. Total Revenue	Share (1/2)
1982	4,628	3,948	117.24%
1983	4,257	4,320	98.55%
1984	4,821	4,978	96.83%
1985	6,277	5,505	114.02%
1986	5,158	8,105	63.64%
1987	4,226	9,553	44.24%
1988	5,283	11,291	46.79%

Table 9.3.2-2 shows the details of the current assets. The amount of the accounts receivable is quite large.

Table 9.3.2-2 Detail of Current Assets

(Unit: Million Baht)

Year	Cash & Deposits	Accounts Receivable	Inventory	Others
1982	1,799 (38.87)	1,535 (33.17)	1,117 (24.14)	177 (3.82)
1983	978 (22.97)	1,632 (38.33)	1,452 (34.12)	195 (4.58)
1984	1,343 (27.86)	1,403 (29.11)	1,906 (39.53)	169 (3.50)
1985	2,411 (38.41)	1,283 (20.44)	2,429 (38.70)	153 (2.44)
1986	1,059 (20.52)	1,766 (34.23)	2,101 (40.73)	233 (4.52)
1987	545 (12.89)	1,948 (46.09)	1,482 (35.06)	252 (5.95)
1988	1,182 (22.37)	2,207 (41.78)	1,588 (30.06)	306 (5.79)

Note: Figures in parentheses are the percentage shares to the total current assets.

For the future estimation, the amount of working capital is set to be 50% of the total revenue.

9.3.3 Working Cost Estimation

Working cost is the expenses which are indispensable to operation and maintenance of a telecommunication network. This cost is composed of manpower cost, operation and administration cost, and maintenance and repair cost.

1) Manpower Cost Estimation (Staff Remuneration)

Manpower cost of this Project is calculated by the following equation:

$$\text{Manpower cost} = [\text{Number of employees increased by the Project}] \times [\text{Average total manpower cost per employee}]$$

The number of employees increased with the project is calculated by the share of the number of main telephone lines increased by the Project to the total main telephone lines.

The required number of employees as a whole in the future is analyzed and estimated in Chapter 12. In this Study, the total number of employees is set to increase 2% per year as one of management targets. It seems that 2% increment per year is too efficient in the view of the number of lines per employee in the year of 2007 as 235 lines per employee.

Table 9.3.3-1 shows the average total manpower cost per employee of last 4 years. The total manpower expense is calculated by the total of "1.2 Staff Remuneration Expenses" and "1.3 Welfare Expenses" in Table 9.3.3-2. In this Study, the average total manpower cost per employee is fixed to be 90 thousand Baht as an assumption.

Table 9.3.3-1 Average Manpower Cost per Employee

(Unit: Thousand Baht)

Year	1985	1986	1987	1988
1. Manpower Cost (1.2+1.3)	1,264,701	1,318,721	1,459,478	1,576,800
2. Number of Employee	16,926	17,399	17,746	17,956
3. Average Cost per Employee (1/2)	74.7	75.8	82.2	87.8
4. Cost per Employee Growth Rate	-	1.44%	8.51%	6.78%

Table 9.3.3-2 Past Detailed Expenses of TOT

(Unit: Thousand Baht)

Year	1985	1986	1987	1988
1. Administrative Expenses	1,773,739	1,920,744	2,213,480	2,464,982
1.1 No Cost Code	84	0	0	0
1.2 Staff remuneration Expenses	1,103,644	1,141,696	1,249,422	1,354,181
1.3 Welfare Expenses	161,057	177,025	210,056	222,583
1.4 Other Expenses on Employee	76,862	67,437	49,512	65,120
1.5 Expenses on Vehicle	9,142	9,125	9,424	8,929
1.6 Rent	73,982	93,636	97,930	107,678
1.7 Ceremonies Expenses	842	1,436	1,259	1,661
1.8 Consultants	56,284	104,616	209,994	316,639
1.9 Insurance Premium	1,155	601	621	614
1.10 Advertisement	1,835	2,724	2,722	3,900
1.11 Turnkey Contracts	16,837	19,880	24,599	25,978
1.12 Instruments Equipment and Office Equipments	57,385	59,272	84,746	75,964
1.13 Inventory Expenses	0	3,104	2,438	0
1.14 Public Utilities	185,465	199,321	229,577	229,635
1.15 Miscellaneous	25,300	26,291	31,967	46,251
1.16 Petty Expenses	0	9,250	4,327	0
1.17 Work Order Cost	590	1,000	466	438
1.18 Land and Property Taxes	3,275	4,329	4,419	5,411
2. Depreciation	687,283	971,017	1,714,215	1,656,110
3. Royalty of Thai-Malaysia Submarine Cable System International Circuit Use	0	0	0	13,655
4. Bad Debt Expenses	34,328	9,108	19,213	28
5. Repair and Maintenance Expenses	261,458	349,480	358,367	362,895
6. Interest Payment	1,127,148	1,425,721	1,812,182	1,970,618
7. Other Expenses	1,283,116	666,027	931,607	1,566,287
• Loss from Currency Exchange	1,205,677	594,312	718,743	1,086,872
8. Prior Period Adjustment	0	0	0	528,596
Grand Total	5,167,073	5,342,097	7,049,064	8,563,170

2) Operation and Administration Costs Estimation

In general, working cost increases in accordance with increase of facilities and services. In order to estimate future working cost, we use the result from a regression analysis between working cost and the number of subscribers. Table 9.3.3-3 shows the past operating expenses of TOT.

Table 9.3.3-3 Past Operating Expenses of TOT

(Unit: Million Baht)

Year	Line Connected	Number of Employee	Operating Expenses				Total Operating Expenses	Remittance to the Treasury
			Staff Remuneration	Depreciation	Maintenance Expenses	Operation & Administration		
1980	365,894	10,898	622.5	327.3	105.7	207.4	949.8	400.0
1981	389,238	11,228	713.1	390.7	152.8	280.3	1,103.8	460.0
1982	425,679	12,123	894.1	410.8	129.8	260.4	1,304.9	750.0
1983	463,231	13,257	1,018.1	442.0	208.2	400.2	1,460.1	585.0
1984	519,491	15,415	1,115.0	468.2	212.2	414.9	1,583.2	850.0
1985	626,498	16,926	1,264.7	687.3	261.5	543.4	1,952.0	370.0
1986	798,912	17,399	1,323.8	971.0	349.5	606.0	2,294.8	1,105.0
1987	901,622	17,746	1,459.5	1,714.2	358.4	773.2	3,173.7	751.3
1988	1,005,872	17,956	1,576.8	1,656.1	362.9	888.2	3,232.9	818.5

Figure 9.3.3-1 shows the past trend of the relationship between the number of telephone lines connected and the operation costs.

Operation Cost (Unit: Billion Baht)

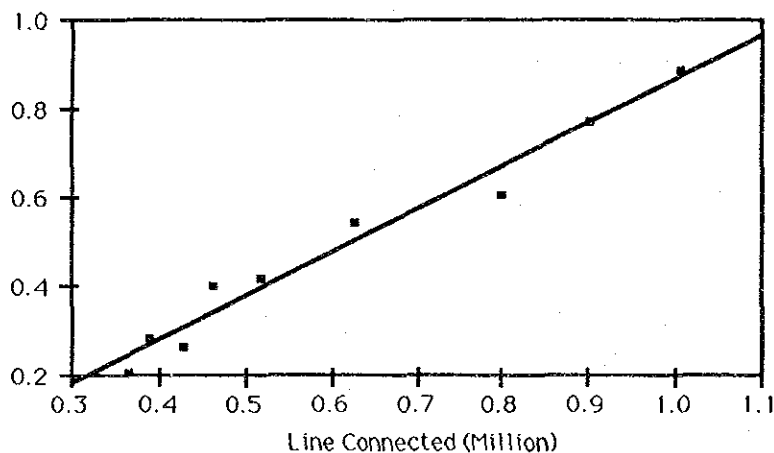


Figure 9.3.3-1 Operation Cost and The Number of Telephone Line Connected

The results of the linear regression is as follows:

Dependent Variables: Operation Cost

Independent Variable: Line Connected

Degree of Freedom: 8

Variable Name	Coefficient	Std. Err. Estimate	T Statistic	Probability of T
Constant	-112324.5574	42596.8926	-2.6369	0.064
Line Connected	0.9797	0.0655	14.9576	0.000

Coefficient of Determination (R²) 0.9697

Adjusted Coefficient (R²) 0.9653

Standard Error of Estimate 43925.7244

The operation cost in the future can be estimated by the following equation:

$$\text{Operation cost (Thousand Baht)} = 0.9797 \times \text{Line connected} - 112324.5574$$

3) Maintenance and Repair Costs

Figure 9.3.3-2 shows the past trend of the relationship between the number of telephone lines connected and the maintenance and repair cost.

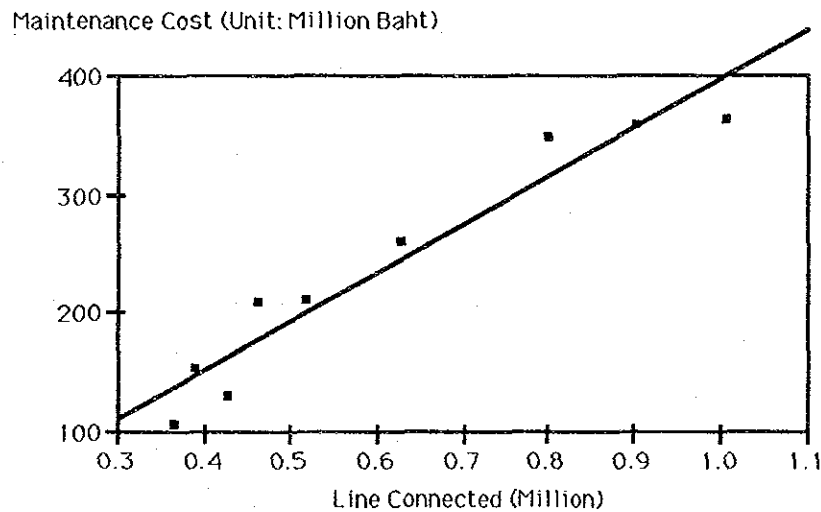


Figure 9.3.3-2 Maintenance Cost and The Number of Telephone Line Connected

The regression results is as follows:

Dependent Variables: Maintenance Cost

Independent Variable: Line Connected

Degree of Freedom: 8

<u>Variable Name</u>	<u>Coefficient</u>	<u>Std. Err. Estimate</u>	<u>T Statistic</u>	<u>Probability of T</u>
Constant	-11644.6053	28433.0031	-0.4095	0.694
Line Connected	0.4086	0.0437	9.3452	0.000

Coefficient of Determination (R²) 0.9258

Adjusted Coefficient (R²) 0.9152

Standard Error of Estimate 29319.9852

The maintenance cost in the future can be estimated by the following equation:

$$\text{Maintenance cost (Thousand Baht)} = 0.4086 \times \text{Line connected} - 11644.6053$$

9.3.4 Tax Estimation

Though TOT does not have to pay the business tax, it is an obligation for TOT as a state owned enterprise to pay the remittance to the Treasury when net profit is positive. The present remittance rate is 30% of net income. In this Study, the net income will be estimated in Chapter 11, though it has some variations for the future estimated income statements. Therefore, we apply a simple estimation in this chapter on the remittance to the Treasury.

The remittance to the Treasury is assumed to be 10% of the total revenue as a simple estimation in this Study.

The amount of the remittance to the Treasury and the total revenue of past 12 years is shown in Table 9.3.4. The weighted average share of the remittance to the total revenue in last three years is 9.6%.

Table 9.3.4 Remittance to the Treasury

(Unit: Million Baht)

Year	Remittance	Total Revenue	Share (%)
1976	80.6	905.1	8.91
1977	0.0	1,040.4	0.00
1978	0.0	1,270.4	0.00
1979	31.0	1,702.5	1.82
1980	400.0	2,337.3	17.11
1981	460.0	3,073.6	14.97
1982	940.0	3,947.7	23.81
1983	585.0	4,319.7	13.54
1984	850.0	4,978.3	17.07
1985	370.0	5,505.0	6.72
1986	1,105.3	8,105.3	13.64
1987	751.3	9,553.4	7.86
1988	818.5	11,290.8	7.25

9.4 Financial Cash Flow

9.4.1 Financial Cash Flow without Borrowing

Table 9.4.1 shows the cash flow of this Project without borrowings. The financial internal rate of return without borrowings is calculated as 13.87%, which indicates that this Project is profitable by itself on the basis with those assumptions described in the previous sections.

In order to construct and operate the Project, it is necessary to consider how much funds should be prepared for the Project. At FY 1992, the amount of the required fund is approximately 14 billion Baht, which will be almost 74% of the total operating revenue of the same year (See Table 9.2.8-1).

Figure 9.4.1 shows net cash flow trend from FY 1992 until 2007. Negative accumulated net cash flow will keep increasing until 1996 and reaches approximately 51 billion Baht. This amount will be almost 148% of the total operating revenue of the same year. From FY 1997, total cash in-flow will start exceeding total cash out-flow and negative accumulated net cash flow will begin to decrease.

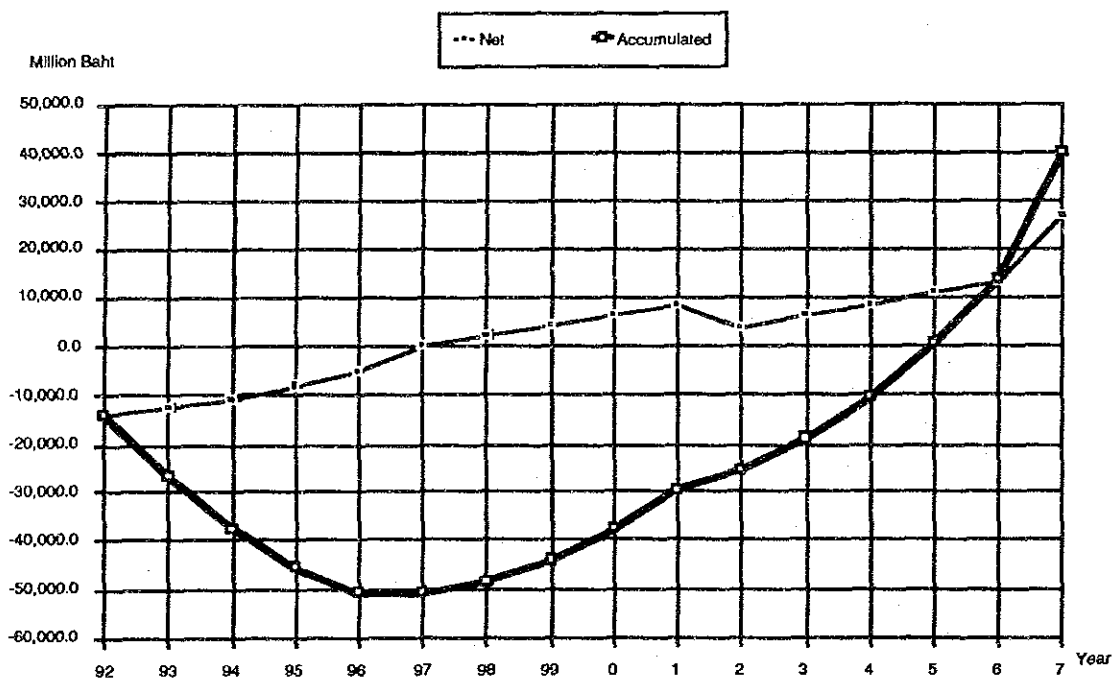


Figure 9.4.1 Net Cash Flow and Accumulated Net Cash Flow without Borrowings

Figure 9.4.1 indicates that accumulated net cash flow will be negative until FY 2004 and then turn to be positive. The next main issue is how to provide funds for the project through these periods.

Table 9.4.1 The Cash Flow of the Project without Borrowings

(Unit: Million Baht)

	Year	IN-FLOW			OUT-FLOW			Net In-Out	Accumulated In-Out
		Operating Revenue	Deposit	IN-Flow Total	Construction	Working Cost	OUT-Flow Total		
0	1992	0	0	0	13,931	0	13,931	-13,931	-13,931
1	1993	2,273	739	3,013	13,931	1,906	15,837	-12,824	-26,756
2	1994	5,706	993	6,699	13,931	3,501	17,432	-10,733	-37,489
3	1995	9,452	1,052	10,503	13,931	4,702	18,633	-8,130	-45,618
4	1996	13,216	1,052	14,268	13,931	5,728	19,660	-5,392	-51,010
5	1997	16,973	1,052	18,024	11,165	6,720	17,885	140	-50,871
6	1998	19,707	692	20,399	11,165	6,893	18,058	2,341	-48,529
7	1999	22,345	692	23,037	11,165	7,515	18,680	4,357	-44,172
8	2000	24,982	692	25,674	11,165	8,181	19,346	6,328	-37,844
9	2001	27,617	692	28,309	11,165	8,844	20,009	8,300	-29,544
10	2002	30,251	692	30,943	17,359	9,504	26,864	4,079	-25,464
11	2003	33,252	791	34,044	17,359	10,436	27,795	6,248	-19,216
12	2004	36,366	791	37,157	17,359	11,249	28,608	8,549	-10,667
13	2005	39,478	791	40,270	17,359	12,004	29,363	10,906	239
14	2006	42,591	791	43,382	17,359	12,757	30,117	13,265	13,504
15	2007	45,702	791	46,494	6,451	13,510	19,961	26,533	40,037
16	2008	46,243	0	46,243	6,451	12,278	18,729	27,513	67,551
17	2009	46,243	0	46,243	6,451	12,008	18,459	27,784	95,334
18	2010	46,243	0	46,243	6,451	12,008	18,459	27,784	123,118
19	2011	46,243	0	46,243	6,451	12,008	18,459	27,784	150,901
20	2012	46,243	0	46,243	19,119	12,008	31,127	15,116	166,017
21	2013	46,243	0	46,243	19,119	12,008	31,127	15,116	181,133
22	2014	46,243	0	46,243	19,119	12,008	31,127	15,116	196,249
23	2015	46,243	0	46,243	19,119	12,008	31,127	15,116	211,364
24	2016	46,243	0	46,243	19,119	12,008	31,127	15,116	226,480
25	2017	46,243	0	46,243	11,414	12,008	23,422	22,821	249,301
26	2018	46,243	0	46,243	11,414	12,008	23,422	22,821	272,121
27	2019	46,243	0	46,243	11,414	12,008	23,422	22,821	294,942
28	2020	46,243	0	46,243	11,414	12,008	23,422	22,821	317,762
29	2021	46,243	0	46,243	11,414	12,008	23,422	22,821	340,583
30	2022	46,243	0	46,243	16,511	12,008	28,518	17,724	358,307
31	2023	46,243	0	46,243	16,511	12,008	28,518	17,724	376,031
32	2024	46,243	0	46,243	16,511	12,008	28,518	17,724	393,755
33	2025	46,243	0	46,243	16,511	12,008	28,518	17,724	411,479
34	2026	46,243	0	46,243	16,511	12,008	28,518	17,724	429,203
35	2027	46,243	-12,303	33,939	-76,470	-11,113	-87,583	121,523	550,726

FIRR= 13.87%

9.4.2 Financial Cash Flow with Borrowings

In order to provide for the Project's initial investment cost, we consider a long term loan from outside sources.

As a premise, we set the following terms and conditions considering Thailand's present and future economic situations:

- 1) The operating organization is able to borrow 75% of the initial investment cost,
- 2) Interest rate is 11.5% and interest payment begins from the end of the first year when borrowed,
- 3) Grace period is 5 years and repayment period is 10 years.

On this assumption, a loan schedule is planned that the 75% of initial investment is borrowed from FY 1992 until 2006.

Table 9.4.2-1 shows the loans and repayment schedule of the project.

Table 9.4.2-1 Loans and Repayment Schedule

(Unit: Million Baht)

Year	Initial Investment Cost	Borrowing 75%	Amortization	Long Term Debt	Interest Payment 11.50% (Interest R.)
1992	13,931.4	10,448.5	0.0	10,448.5	1,201.6
1993	13,931.4	10,448.5	0.0	20,897.1	2,403.2
1994	13,931.4	10,448.5	0.0	31,345.6	3,604.7
1995	13,931.4	10,448.5	0.0	41,794.1	4,806.3
1996	13,931.4	10,448.5	0.0	52,242.7	6,007.9
1997	11,164.8	8,373.6	1,044.9	59,571.4	6,850.7
1998	11,164.8	8,373.6	2,089.7	65,855.3	7,573.4
1999	11,164.8	8,373.6	3,134.6	71,094.4	8,175.9
2000	11,164.8	8,373.6	4,179.4	75,288.6	8,658.2
2001	11,164.8	8,373.6	5,224.3	78,438.0	9,020.4
2002	12,063.0	9,047.2	6,061.6	81,423.6	9,363.7
2003	12,063.0	9,047.2	6,899.0	83,571.8	9,610.8
2004	12,063.0	9,047.2	7,736.4	84,882.7	9,761.5
2005	12,063.0	9,047.2	8,573.7	85,356.2	9,816.0
2006	12,063.0	9,047.2	9,411.1	84,992.3	9,774.1
2007	0.0	0.0	9,270.9	75,721.4	8,708.0
2008	0.0	0.0	9,130.8	66,590.6	7,657.9
2009	0.0	0.0	8,990.7	57,599.9	6,624.0
2010	0.0	0.0	8,850.6	48,749.3	5,606.2
2011	0.0	0.0	8,710.4	40,038.9	4,604.5
2012	0.0	0.0	7,873.1	32,165.8	3,699.1
2013	0.0	0.0	7,035.7	25,130.1	2,890.0
2014	0.0	0.0	6,198.3	18,931.8	2,177.2
2015	0.0	0.0	5,361.0	13,570.8	1,560.6
2016	0.0	0.0	4,523.6	9,047.2	1,040.4
2017	0.0	0.0	3,618.9	5,428.3	624.3
2018	0.0	0.0	2,714.2	2,714.2	312.1
2019	0.0	0.0	1,809.4	904.7	104.0
2020	0.0	0.0	904.7	0.0	0.0

Table 9.4.2-2 summarizes estimated total cash flow with borrowings. The financial internal rate of return with 75% borrowings is calculated as 14.89%.

Table 9.4.2-2 The Cash Flow of the Project with 75% Borrowings

(Unit: Million Baht)

year	IN-FLOW				OUT-FLOW					Net IN-OUT	Accu. IN-OUT
	Revenue	Deposit	Borrowing	Total	Const- ruction	Working Cost	Interest	Amorti- zation	Total		
0 1992	0	0	10,449	10,449	13,931	0	1,202	0	15,133	-4,684	-4,684
1 1993	2,273	739	10,449	13,461	13,931	1,906	2,403	0	18,240	-4,779	-9,463
2 1994	5,706	993	10,449	17,148	13,931	3,501	3,605	0	21,037	-3,889	-13,352
3 1995	9,452	1,052	10,449	20,952	13,931	4,702	4,806	0	23,440	-2,488	-15,840
4 1996	13,216	1,052	10,449	24,716	13,931	5,728	6,008	0	25,668	-951	-16,791
5 1997	16,973	1,052	8,374	26,398	11,165	6,720	6,851	1,045	25,780	618	-16,174
6 1998	19,707	692	8,374	28,773	11,165	6,893	7,573	2,090	27,721	1,052	-15,122
7 1999	22,345	692	8,374	31,411	11,165	7,515	8,176	3,135	29,990	1,420	-13,701
8 2000	24,982	692	8,374	34,047	11,165	8,181	8,658	4,179	32,183	1,864	-11,837
9 2001	27,617	692	8,374	36,683	11,165	8,844	9,020	5,224	34,253	2,429	-9,408
10 2002	30,251	692	9,047	39,990	17,359	9,504	9,364	6,062	42,289	-2,299	-11,707
11 2003	33,252	791	9,047	43,091	17,359	10,436	9,611	6,899	44,305	-1,214	-12,921
12 2004	36,366	791	9,047	46,204	17,359	11,249	9,762	7,736	46,106	98	-12,823
13 2005	39,478	791	9,047	49,317	17,359	12,004	9,816	8,574	47,753	1,564	-11,259
14 2006	42,591	791	9,047	52,429	17,359	12,757	9,774	9,411	49,302	3,127	-8,132
15 2007	45,702	791	0	46,494	6,451	13,510	8,708	9,271	37,940	8,554	422
16 2008	46,243			46,243	6,451	12,278	7,658	9,131	35,518	10,725	11,147
17 2009	46,243			46,243	6,451	12,008	6,624	8,991	34,074	12,169	23,316
18 2010	46,243			46,243	6,451	12,008	5,606	8,851	32,916	13,327	36,643
19 2011	46,243			46,243	6,451	12,008	4,604	8,710	31,774	14,469	51,112
20 2012	46,243			46,243	19,119	12,008	3,699	7,873	42,699	3,544	54,655
21 2013	46,243			46,243	19,119	12,008	2,890	7,036	41,052	5,190	59,845
22 2014	46,243			46,243	19,119	12,008	2,177	6,198	39,502	6,740	66,585
23 2015	46,243			46,243	19,119	12,008	1,561	5,361	38,048	8,194	74,780
24 2016	46,243			46,243	19,119	12,008	1,040	4,524	36,691	9,552	84,331
25 2017	46,243			46,243	11,414	12,008	624	3,619	27,665	18,577	102,909
26 2018	46,243			46,243	11,414	12,008	312	2,714	26,448	19,794	122,703
27 2019	46,243			46,243	11,414	12,008	104	1,809	25,336	20,907	143,610
28 2020	46,243			46,243	11,414	12,008	0	905	24,327	21,916	165,526
29 2021	46,243			46,243	11,414	12,008	0	0	23,422	22,821	188,346
30 2022	46,243			46,243	16,511	12,008	0	0	28,518	17,724	206,070
31 2023	46,243			46,243	16,511	12,008	0	0	28,518	17,724	223,795
32 2024	46,243			46,243	16,511	12,008	0	0	28,518	17,724	241,519
33 2025	46,243			46,243	16,511	12,008	0	0	28,518	17,724	259,243
34 2026	46,243			46,243	16,511	12,008	0	0	28,518	17,724	276,967
35 2027	46,243	-12,303		33,939	-76,470	-11,113	0	0	-87,583	121,523	398,490
Total	1,294,763	0	139,347	1,434,110	403,283	340,754	152,236	139,347	1,035,620	398,490	

FIRR= 14.89%

Figure 9.4.2-1 shows net cash flow trend from FY 1992 until 2007 with borrowings. Accumulated net cash flow, which is in minus value, will keep increasing until FY 1996 and reaches approximately 16.8 billion Baht. This amount will be almost 49% of the total operating revenue of the same year. The annual cash balance at FY 1992 will be approximately minus 4.7 billion Baht, which is almost 24% of the total operating revenue of

the same year. Figure 9.4.2-2 shows net present value of the Project with 75% borrowings with the FIRR conditions from 5% to 20%.

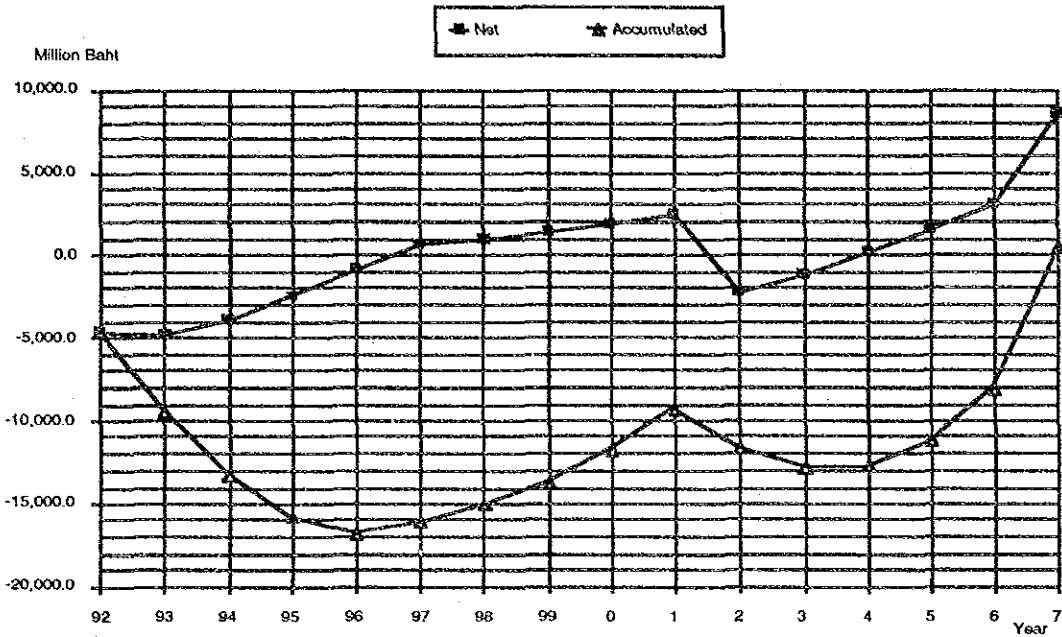


Figure 9.4.2-1 Net Cash Flow and Accumulated Net Cash Flow with 75% Borrowings

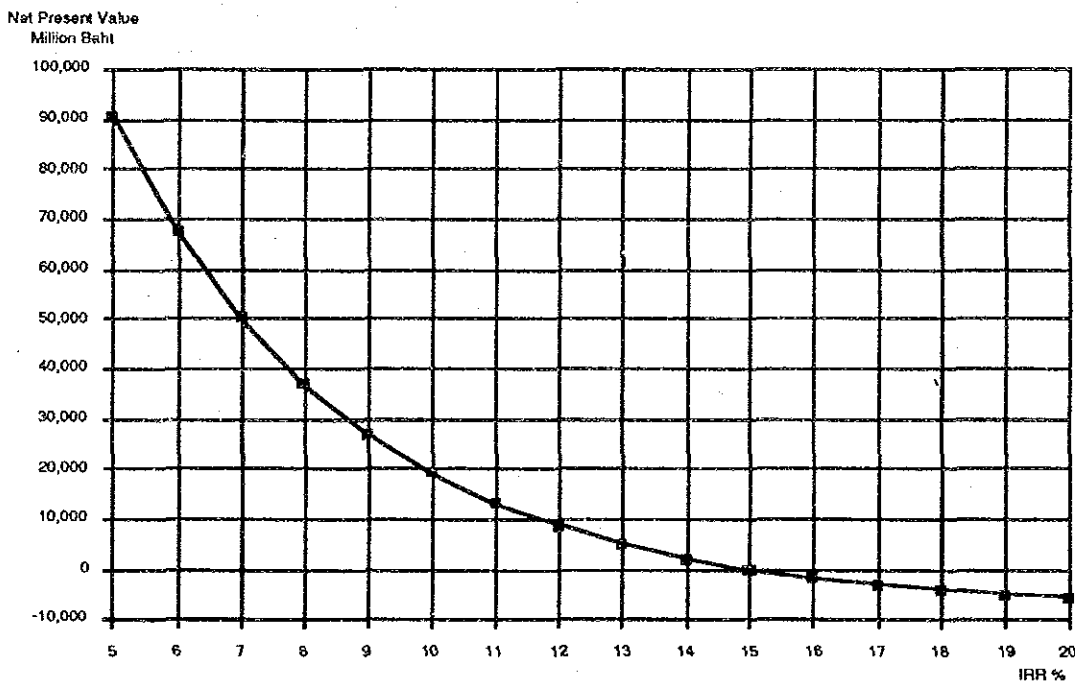


Figure 9.4.2-2 Net Present Value with 75% Borrowings