Table 4.4-2 DOMSAT Facilities

(July 1992)

Earth Control Station	Earth Station		
Antipolo	Davao,	Iriga,	Zamboanga,
	Laoag,	Cebu,	Cagayan de Oro,
	Tacloban,	Tuguegarao,	Bacolod,
	Palawan (Puerto Princesa),		Iligan (for mobile use)

Source: DOMSAT

(2) VSAT

Four operators are providing telecommunication services in rural areas by using very small aperture terminal (VSAT) technology. Table 4.4-3 lists the VSAT operators.

PLDT was authorized to install, operate, and maintain VSAT earth stations to upgrade its transmission capabilities.

CAPWIRE was authorized in 1992 to install, operate, and maintain 86 earth stations to provide domestic satellite telecommunications in the Philippines. The memorandum of agreement with the DOTC specifies that the DOTC will provide all of the imported 56 earth stations.

A project is underway to develop a large-scale satellite system that will enable the government to respond more quickly to disasters and calamities. The system will have a central station in Metro Manila and 30 satellite stations around the country.

Table 4.4-3 VSAT Operators

(December. 1992)

Operator	Number of VSAT Stations
PLDT	No Data
Globe Telecom	180
International Communication Corp. (ICC)	15 (1991)
Liberty Broadcasting Network, Inc. (LBNI)	No Data
Capitol Wireless (CAPWIRE)	Implementation On-going

Source: NTC Annual Report

4.5 Leased Line Service

Dedicated point to point circuits are used for private voice and data network. Their transmission speeds range from 50 bauds to 2 Mb/s and they have bandwidths from 4 KHz to 4 MHz. While the NTC reported that in 1991, digital leased lines handled about 230 circuits and analog lines handled about 60 circuits, more leased lines are thought to have existed.

CHAPTER 5

PRESENT STATUS
OF
TELEPHONE NETWORK

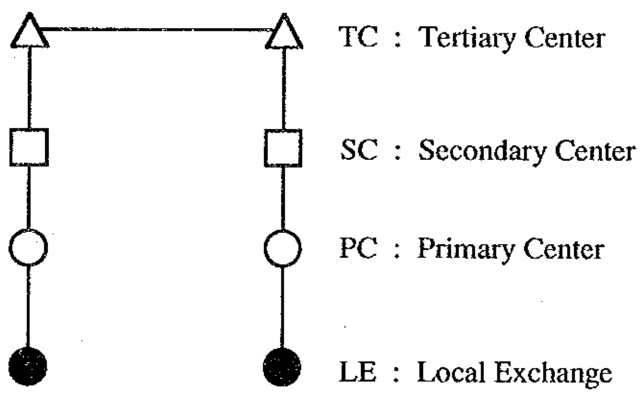
CHAPTER 5 PRESENT STATUS OF TELEPHONE NETWORK

5.1 Fundamental Network

5.1.1 Network Structure

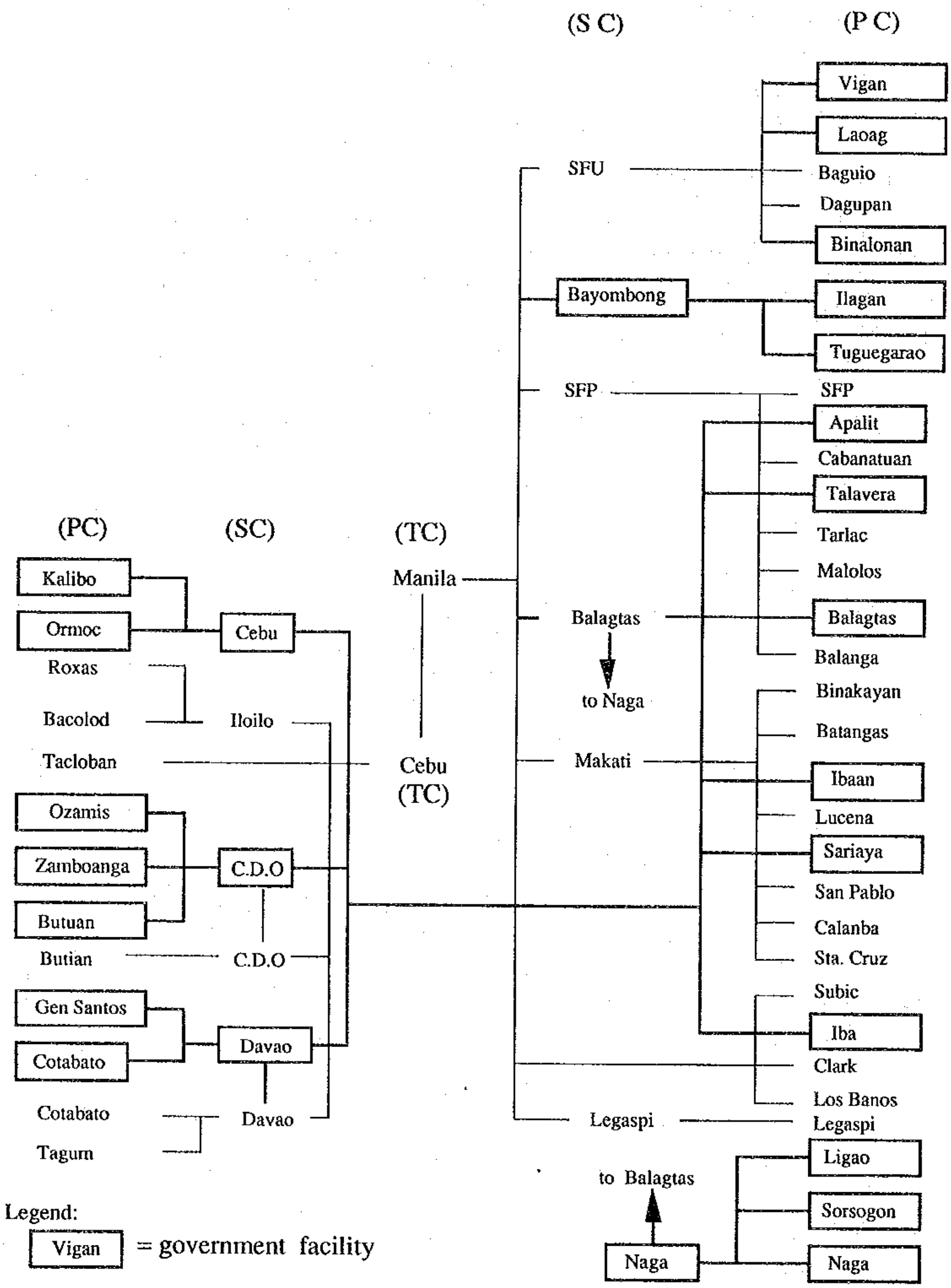
The Philippine telephone network consist of tertiary centers (TC), secondary centers (SC), primary centers (PC) and local exchanges (LE). They are structured so that every local exchange can be connected to any other local exchange or an international gateway, either directly or through the network hierarchy. The present network hierarchy and homing plan are shown in Figures 5.1-1 and 5.1-2, respectively.

Figure 5.1-1 Network Hierarchy



The routing plan is in compliance with the network requirements for the introduction of direct distance dialing (DDD), and a digital toll network. The routing plan establishes a network hierarchy whereby traffic can be routed through various concentration nodes.

Figure 5.1-2 Homing Plan in the Philippines



5.1.2 Numbering Plan

The current telephone numbering plan is as follows:

(1) "0" is used for the National Trunk Prefix.
(2) "00" is used for the International Prefix.
(3) The configuration of the National Significant Number is:

Trunk Prefix "0" + Area Code + Subscriber Number

|← National Significant Number →|

(The national significant number, in accordance with ITU Blue Book. Fascicle II.2 - Rec. E.163, p.129, para. 2.2, is equal to (12-n), where "n" is the number of digits in the country code. It is equal to 10 when the Philippines country code (63, n=2) is used.)

(a) Area code

Each digit of the area code is indicated as follows:

- The first digit is assigned to regions.
- The second digit corresponds to the numbering plan area (hereinafter referred to as NPA), which comprises one or more provinces.

(b) Subscriber number

A subscriber number consists of an exchange code and a local number as follows :

Digit	Exchange Code		Local Number
5 Digits	#	-	XXXX
5 Digits	##	-	XXX
6 Digits	##	-	XXXX
7 Digits	###	-	XXXX

The first one , two or three digits of the subscriber number indicate the local exchange and the following three or four digits are individually assigned to each subscriber.

The allocated area code are shown in Table 5.1-1.

Table 5.1-1 Area Code Allocation (1992)

(1/2)

Area Code	Area (Province)
2	Metro Manila
32	Cebu
33	Iloilo
34	Negros Occidental
35	Negros Oriental, Siquijor
36	Capiz, Aklan
37	Antique
38	Bohol
42	Quezon, Marinduque
43	Batangas
44	Nueva Ecija, Aurora
45	Pampanga, Tarlac
46	Occ. Mindoro, Or. Mindro, Romblon
47	Zambales, Bataan
48	Palawan
52	Albay, Catanduanes, Burias Is.
53	Leyte, South Leyte
54	Camarines Norte, Camarines Sur
55	Northern Samar
56	Sorsogon, Masbate
57	Western Samar
58	Eastern Samar
62	Western Zamboanga del Norte, Western Zamboanga del Sur, Basilan
63	Lanao del Norte, Lanao del Sur
64	Maguindanao, Western North Cotabato, Western Sultan Kudarat
65	Eastern Zamboanga del Norte, Misamis Occ.
66	Eastern Zamboanga del Sur
67	Eastern North Cotabato, Eastern Sultan Kudarat
68	Sulu, Tawi - tawi
72	La Union
73	Nueva Vizcaya, Ifugao

(2/2)

Area Code	Area (Province)
74	Benguet, Mt. Province
75	Pangasinan
76	Isabela, Quirino
77	Ilocos Norte, Ilocos Sur, Abra
78	Cagayan, Batanes
79	Kalinga- Apayao
82	Davao del Sur, Samal Is.
83	South Cotabato
84	Davao del Norte
85	Agusan del Norte, Agusan del Sur
86	Surigao del Norte, Surigao del Sur
87	Davao Oriental
88	Misamis Or., Bukidnon, Camiguin
92	Laguna
96	Cavite
97	Bulacan

(4) Special Service Code

The special service codes, including subscriber special service codes, access codes, and special maintenance codes, are shown in Table 5.1-2.

Table 5.1-2 Special Service Code

Special Code	Action
112	DDD/ISD Inquiry
114	Directory Assistance
167	CAPCOM/ Metrodicom
173	Repair/Complaints
174	Repair Dispatch
175	Installer Dispatch
176	Inspector (test) / Wire Chief
170	Dial Speed Test
199	Supervision Test
105	Autodirect Collect Calls
108	Operator Assistance-Overseas
109	Operator Assistance- Domestic
100	Reverting Call

5.1.3 Signaling

The Philippine telephone network uses mainly MFC-R2 for register signaling and the common channel signaling No. 7 (CCS No. 7) for international and national networks.

(1) Register Signaling

(a) Decadic Pulse Signaling

Decadic pulse signaling is used on trunk circuits inter-connected with TELOF exchanges and private company exchanges.

(b) MFC Signaling

MFC signaling is used on all trunk circuits between XB and SPC switching systems that are based on the ITU R-2 signaling system for inter-register signaling.

(2) Common Channel Signaling No. 7

CCS No. 7 is the signaling system recommended by the ITU for international and national networks. For economical operation of the CCS system, signaling transfer points are intermediately provided for dynamic routing of signaling traffic.
PLDT's CCS No. 7 network consisted of 21 toll switching centers and 16 local exchanges. The 21 toll switching centers are listed in Table 5.1-3.

Table 5.1-3 PLDT's Toll Switching Centers Using CCS No. 7

No. of Points	Name of Toll Switching Centers
STP (6)	Sampaloc, Makati, Cebu-Jones, SFP, SFU, Cagayan de Oro
SEP (21)	Luzon; Sampaloc (x 2), Makati, SFP, SFU, Subic, Cabanatuan, Tarlac, Dagupan, Malolos, Batangas, Lucena, San Pablo Visayas and Mindoro; Cebu-Jones, Cagayan de Oro, Iloilo, Bacolod, Legaspi, Cotabato, Zamboanga, Davao,

Note STP: Signaling Transfer Point
SEP: Signaling End Point

5.1.4 Synchronization

It is essential to synchronize the clock cycle of the digital signals in a nationwide digital network for the network to function accurately. PLDT synchronizes its nationwide network by using a three-level master slave hierarchy with the following characteristics (Figure 5.1-3).

(a) The national reference clock has an accuracy of 1×10^{-11} and uses a triplicated cesium clock located at the international gateway.

(b) The minimum requested values for the digital exchange clock parameters to meet national slips rate objectives are shown in Table 5.1-4.

Table 5.1-4 Minimum Values for Clock Parameters

Clock Hierarchy	Accuracy	Stability
level 1	1×10^{-11}	3×10^{-12}/day
level 2	1×10^{-10}	1×10^{-9}/day
level 3	1×10^{-8}	2×10^{-8}/day

Source: PLDT

(c) Security and high reliability are achieved by using redundant reference sources and synchronization links.

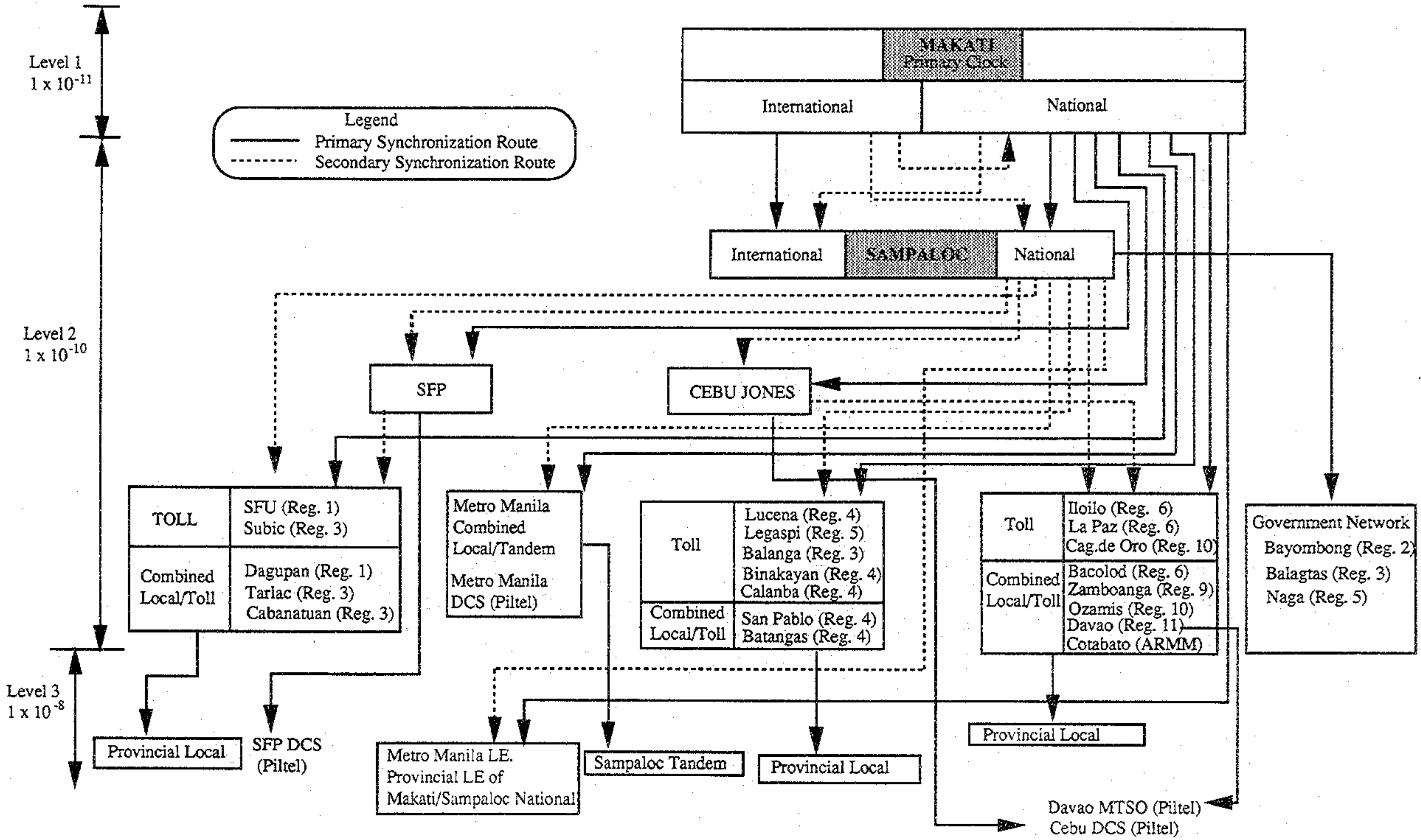
(d) Secondary reference clocks act as masters clocks in defined areas to avoid dividing the network into plesiochronous sub-networks in case the national reference clock and/or synchronization links fail.

5.1.5 Technical Standard

NTC has issued a national standard (NTC MC No. 10-16-90: Telecommunications Standards), that specifies service quality.

(a) Accuracy of transmitting information ------------- Transmission standard
(b) Connection time and rate ---------------------------- Switching standard
(c) Stability of services ---------------------------------- Stability standard

Figure 5.1 - 3 Network Synchronization Plan (as of 1992)



MC No. 10-16-90 is composed of a main statement and annexes A to H which contain concrete technical standards. The abstract for a national long distance connection call is as follows:

(1) Transmission Quality Standard

The present condition and the gradual evolution of the network to a fully digital network is taken into consideration.

(a) Transmission Loss (ITU Rec. G.111)

(i) Analog and mixed analog network

The maximum loss for the national connection------------- 39 dB Max
The sending CRE -- 16 dB
The receiving CRE--- 5 dB
The national long distance circuit CRE ---------------------- 18 dB
(CRE: Corrected Reference Equivalents)

(ii) Digital network

The loss of the links connecting two local exchanges shall have a fixed value of 7 dB to improve the over all CRE to 28 dB maximum.

(b) Transmission Delay (ITU Rec. G.114)

(i) Analog and mixed analog network

0-150 ms:	acceptable
15-400 ms:	essential echo control device
more than 400 ms:	should avoid

(ii) Digital network

the mean one-way propagation time shall not exceed
(3 + (0.004 x distance in km)) ms

Other terms specified are noise ratio, echo, error ratio, slip rate in digital transmission networks. The introduction of ISDN has already been considered.

(2) Connection Quality Standard

(a) Grade of service of exchange
Grade of service is shown in Table 5.1-5.

Table 5.1-5 Exchange Grade of Service

	Busy hour	10% Overload	20% Overload
Local call:	0.005	0.01	0.025
RSU-LE:	0.01	0.02	0.05
LE-PC link:	0.005	0.01	0.025
PC link-SC link:	0.005	0.01	0.025
SC link-TC link:	0.005	0.01	0.025
International blocking:	0.001	0.003	0.01
PABX trunk:	0.01	0.02	0.05
Common Equipment:	0.001	0.002	0.005

(b) Connection Delay

Dial tone delay: 95% within 3 seconds
Post dialing delay: 99% within 2 seconds

(3) Others

MC 10-16-90 also specified following terms.

(a) Signaling
(b) Numbering
(c) Routing
(d) Synchronization
(e) Charging
(f) Outside plant facilities

MC No. 9-7-93: "Implementing guidelines on the interconnection of authorized public telecommunications carriers" issued by NTC is ordering all operating companies to comply with this technical standard.

5.2 Interconnection

EO (Executive Order) No. 59 "Mandating Interconnection" and Memorandum Circular No. 9-7-93, "Implementing Guidelines on the Interconnection of Authorized Public Telecommunications Carriers" were promulgated. The interconnection problems comes to another stage. There are, however, still some interconnection problems remaining. In this section, interconnection situation is discussed.

5.2.1 Current Situation

(1) Isolated exchanges

As of July 1993, 30 local telephone exchanges were still isolated from PSTN (Table 5.2-1). They are expected to be interconnected with the completion of Tranche 1-1, 1-2, and 1-3 of the NTP.

(2) Memorandum Circular (MC) No. 9-7-93

The Implementing Guidelines on the Interconnection of Authorized Public Telecommunications Carriers (MC No. 9-7-93) states that the start of a negotiation shall be from the time the party requesting interconnection submits to the other party the complete data or information, to wit:

(a) Copy of the CPCN/PA and the franchise
    CPCN: Certificate of Public Convenience and Necessity
    PA: Provisional Authority
(b) System or network configuration
(c) Proposed point of connection
(d) Trunk requirements
(e) Proposed traffic routing
(f) Traffic forecast and assumptions used (at least five years)
(g) Traffic types and services covered
(h) Proposed compensation/settlement
(i) Proposed interface
(j) Proposed implementation schedule

Table 5.2-1 List of Isolated Exchanges

(July, 1993)

Province	Municipality	Operating Company	Type of Switch	Capacity	Project to Interconnect
Bulacan	Pandi	TELOF	SXS	450	Tr 1-1
Bulacan	San Jose D.M	Digitel	M	150	Tr 1-1
Nueva Ecija	Santa Rosa	TELOF	XB	300	Tr 1-1
Zambales	Iba	TELOF	SXS	600	Tr 1-1
Batangas	Ibaan	TELOF	SXS	200	Tr 1-1
Mindoro Occ.	Mamburao	TELOF	SXS	300	Tr 1-1
Mindoro Occ.	San Jose	TELOF	XB	300	Tr 1-1
Mindoro Or.	Calapan	Calapan Tel	EPABX	1300	Tr 1-1
Camarines S.	Buhi	TELOF	SXS	450	Tr 1-1
Catanduanes	Virac	TELOF	XB	300	Tr 1-1
Sorsogon	Sorsogon	TELOF	XB	300	Tr 1-1
Aklan	Kalibo	TELOF	XB	800	Tr 1-2
Antique	San Jose D.B	TELOF	SXS	300	Tr 1-2
Bohol	Tagbilaran	TELOF	XB	1000	Tr 1-2
Negros Or.	Guihulngan	TELOF	SXS	200	Tr 1-2
E. Samar	Borongan	TELOF	XB	300	Tr 1-2
E. Samar	Guian	TELOF	SXS	200	Tr 1-2
N. Leyte	Baybay	TELOF	XB	300	Tr 1-2
Leyte	Dulag	TELOF	XB	450	
N. Samar	Catarman	TELOF	XB	300	Tr 1-2
N. Samar	Maasin	TELOF	XB	300	Tr 1-2
W. Samar	Catbalogan	TELOF	XB	300	Tr 1-2
Sulu	Jolo	Nationwide Tel	M	300	
Zemboanga DN.	Ipil	Ipil Tel	XB	150	
Bukidnon	Maramag	TELOF	SXS	450	Tr 1-3
S. Cotabato	Koranadal	Marvel Tel	XB	400	Tr 1-3
Lamao DN	Tandag	Mario Serra	XB	100	
Lanao Sur	Marawi	TELOF	XB		Tr 1-3
N. Cotabato	Kidapawan	Kidapawan	SXS	300	Tr 1-3
N Cotasbao	Tacurong	TELOF	XB	450	Tr 1-3

Tr: Tranche

Source: NTC

Both parties shall provide each other basic information, such as:

Both parties shall provide each other basic information, such as:

(a) Description of existing and future network relevant to interconnection.
(b) List of exchanges (existing and planned) suitable for interconnection, including number of lines available.

In its Technical/Operational Requirements orders both parties to comply with the provisions of NTC MC No. 10-17-90 (Service Performance Standards) and NTC MC No. 10-16-90 (Technical Standards).

Interconnection parties shall exchange traffic and facility forecasts on a semi-annual basis to facilitate allocation of facilities to meet future requirements.

Interconnection parties shall provide additional circuits based on traffic measurements and studies to be conducted over a period of 30 days separately but simultaneously by both parties. The parties shall compare study results and agree on the number of circuits to be added.

The inter-exchange carrier shall provide interconnecting facilities up to the main distribution frame (MDF) of local exchange carriers with 5000 exchange lines or less in a local area.

5.2.2 Interconnection Problems

After interconnection, three categories of problems still remain: technical, financial, and political.

The study team sent questionnaires to the 43 local telephone operating companies. Nine responses were received.
Reported interconnection problems included:

(a) insufficient number of interconnection circuits (almost all respondents),
(b) circuits are sometimes out of order and sometimes no circuits are available,
(c) noise in the interconnection circuit,
(d) difficulty in completing dial connections, especially for incoming calls, due to using old PABX equipment as a local switching system, and
(e) insufficient financing to introduce new exchange facilities.

Of these problems, insufficient circuits is the biggest. The others are not so big. Technical issues, such as the interface between the networks, signaling, transmission speed, pulse voltage, etc., are not serious. They are able to meet the MC 10-16-90 and ITU standards.

5.3 Traffic

5.3.1 Calling Rate

Tables 5.3-1 and 5.3-2 show the calling rate per subscriber line for originating (Table 5.3-1) and terminating (Table 5.3-2) telephone traffic by region. Figures for NCR and Region VII, which have the major cities Metro Manila and Cebu, respectively, are higher than the other regions.

Table 5.3-1 Originating Calling Rate Per Line

Region	No. of Subs.	Local [erl.]	Toll [erl.]	Major Cities
NCR	543,706	0.0727	0.0039	Metro Manila
I	8,254	0.0538	0.0121	Baguio
II	2,117	0.0528	0.0083	
III	18,911	0.0519	0.0161	Palayan
IV	40,793	0.0454	0.0118	Batangas, Lucena
V	N.A.	N.A.	N.A.	Legaspi
VI	28,071	0.0892	0.0119	Roxas, Bacolod
VII	48,148	0.1085	0.0071	Cebu
VIII	N.A.	N.A.	N.A.	Tacloban
IX	5,675	0.0791	0.0094	Pagadian
X	1,528	0.0564	0.0094	Cagayan De Oro
XI	12,756	0.0965	0.0138	Davao
XII	3,213	N.A.	N.A.	Cotabato

source: PLDT

Table 5.3-2 Terminating Calling Rate Per Line

Region	No. of Subs.	Local [erl]	Toll [erl]	Major Cities
NCR	543,706	0.0702	0.0045	Metro Manila
I	8,254	0.0466	0.0101	Baguio
II	2,117	0.0441	0.0057	
III	18,911	0.0379	0.0086	Palayan
IV	40,793	0.0357	0.0077	Batangas, Lucena
V	N.A.	N.A.	N.A.	Legaspi
VI	28,071	0.0708	0.0079	Roxas, Bacolod
VII	48,148	0.0860	0.0071	Cebu
VIII	N.A.	N.A.	N.A.	Tacloban
IX	5,675	0.0606	0.0065	Pagadian
X	1,528	0.0453	0.0031	Cagayan De Oro
XI	12,756	0.0544	0.0102	Davao
XII	3,213	N.A.	N.A.	Cotabato

Source: PLDT

5.3.2 Traffic Distribution Conditions

Traffic distribution by category (local and toll) is shown in Tables 5.3-3 and 5.3-4. The ratio for local traffic in NCR and Region VII is higher than the other regions, because the ratios for local traffic and toll traffic, especially that of local traffic, increases with the number of local subscribers.

Table 5.3-3 Distribution of Originating Traffic

Region	No. of Subs.	Local [%]	Toll [%]	Major Cities
NCR	543,706	94.86	5.14	Metro Manila
I	8,254	81.68	18.32	Baguio
II	2,117	86.42	13.58	
III	18,911	76.28	23.72	Palayan
IV	40,793	79.39	20.61	Batangas, Lucena
V	N.A.	N.A.	N.A.	Legaspi
VI	28,071	88.20	11.80	Roxas, Bacolod
VII	48,148	93.87	6.13	Cebu
VIII	N.A.	N.A.	N.A.	Tacloban
IX	5,675	89.38	10.62	Pagadian
X	1,528	85.71	14.29	Cagayan De Oro
XI	12,756	87.46	12.54	Davao
XII	3,213	N.A.	N.A.	Cotabato

Source: PLDT

Table 5.3-4 Distribution of Terminating Traffic

Region	No. of Subs.	Local [%]	Toll [%]	Major Cities
NCR	543,706	93.93	6.07	Metro Manila
I	8,254	82.18	17.82	Baguio
II	2,117	88.56	11.44	
III	18,911	81.53	18.47	Palayan
IV	40,793	82.21	17.79	Batangas, Lucena
V	N.A.	N.A.	N.A.	Legaspi
VI	28,071	89.92	10.08	Roxas, Bacolod
VII	48,148	92.36	7.64	Cebu
VIII	N.A.	N.A.	N.A.	Tacloban
IX	5,675	90.36	9.64	Pagadian
X	1,528	93.62	6.38	Cagayan De Oro
XI	12,756	84.24	15.76	Davao
XII	3,213	N.A.	N.A.	Cotabato

Source: PLDT

CHAPTER 6

PRESENT STATUS
OF
TELEPHONE FACILITIES

CHAPTER 6 PRESENT STATUS OF TELEPHONE FACILITIES

6.1 Switching

PLDT, TELOF, and other local operators provide telecommunication services through networks composed of switching center as follows:

Tertiary Centers	(TC)	2
Secondary Centers	(SC)	8
Primary Centers	(PC)	37
Tandem Exchanges	(TDM)	5
Local Exchanges	(LE)	282

The coverage areas of the toll switching center, (excluding the NCR) are shown in Table 6.1-1. In NCR, there are 5 local tandem exchanges: Sampaloc, Makati, Quezon, Garnet (Ortegas) and Las Pinas.

Table 6.1-1 Coverage Areas of Toll Switching Center

Region	TC Name	SC Name	PC Name
I		SFU	(Vigan), (Laoag), (Binalonan), Buguio, Dagupan
II		(Bayombong)	(Ilagan), (Tuguegarao)
III		SFP	Cabanatuan,Tarlac, Malolos, Balanga
IV and NCR	Sampaloc	Makati	Binakayan, Batangas, Lucena, San Pablo, Calamba,Sta Cruz, Clark, Subic, Los Banos
V		Legaspi	Legaspi
VI		Iloilo	Bacolod, Roxas
VII	CEBU		
VIII			Tacloban
IX			Zamboanga
X		Cagayan De Oro	Ozamis, Butuan
XI		Davao	Cotabato
XII			

Note: ( ) government switching center

6.1.1 Toll Switching

PLDT has 32 toll switching centers, providing digital pure toll switching, digital local combined switching, and analog toll switching system. The TELOF has five switching centers, providing digital local and toll combined switching system (Table 6.1-2). A complete listing of the toll switching center is shown in Table 6.1-3.

Table 6.1-2 Number of Toll Switching Center

Operator	Switching Type		No. of Switching Center
PLDT	Analog	SXS . XB	10
	Digital	Toll	12
		Local / Toll	10
TELOF	Analog		0
	Digital	Local / Toll	5
Total			37

Note:
Toll : digital pure toll switching system
Local / Toll : digital local and toll combined switching system

Table 6.1-3 PLDT and TELOF Toll Switching Center

PLDT

Switching Center Name	Type	Switching Center Name	Type	Switching Center Name	Type
Bacolod	Local /Toll	Cotabato	Local /Toll	Sampaloc	Toll
Baguio	Toll	Dagupan	Local /Toll	San Pablo	Local /Toll
Balanga	SXS	Davao	Local /Toll	SFP	Toll
Batangas	Local /Toll	Iloilo	Toll	SFU	Toll
Binakayan	EMD	Legaspi	Toll	Sta. Cruz	SXS
Butuan	XB	Los Banos	EMD	Subic	Toll
Cabanatuan	Local /Toll	Lucena	Toll	Tacloban	XB
Cagayan De Oro	Toll	Makati	Toll	Tagum	XB
Calamba	CXP-5	Malolos	Local /Toll	Tarlac	Local /Toll
Cebu-Jones	Toll	Ozamis	SXS	Zamboanga	Local /Toll
Clark	Toll	Roxas	EMD		

TELOF

Switching Center Name	Type	Switching Center Name	Type	Switching Center Name	Type
Vigan	Local /Toll	Laoag	Local /Toll	Ilagan	Local /Toll
Tuguegarao	Local /Toll	Bayombong	Local /Toll		

Source: Information on telecommunication networks prepared by PLDT (yearend 1992)

6.1.2 Local Switching

There are about 1600 municipalities in the Philippines, but only 329 have telephone service. There were a total of 323 local switching systems in the whole country, 54 in the NCR and 269 in the provincial areas as of December 1992 (Table 6.1-4).

Table 6.1-4 Number of Local Switching Systems

As of December 1992

	NCR	Provincial	Total
Digital	26	69	95
Analog	28	187	215
Manual	0	13	13
Total	54	269	323

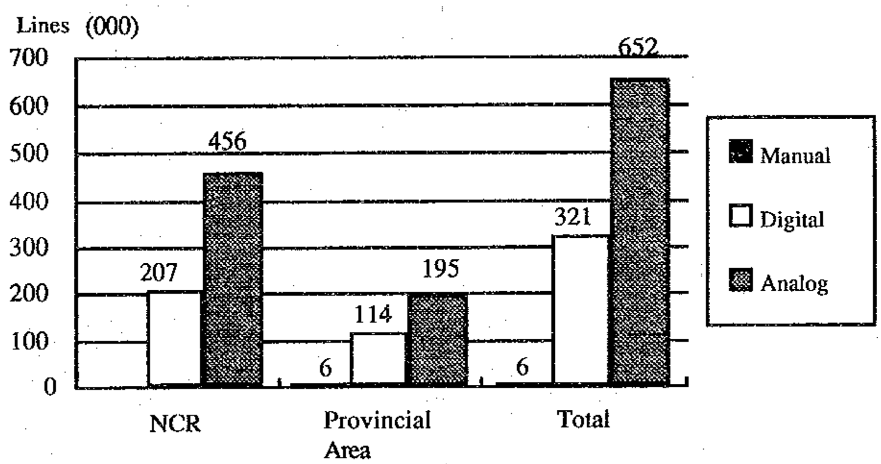
PLDT and other operators have begun introducing digital switching systems. Around 31% of the local exchanges in the NCR are digital and about 36% in the provincial areas (Table 6.1-5). Figure 6.1-1 shows switching capacity by type in the NCR and the provinces.

Table 6.1-5 Switching Capacity

	NCR	%	Provincial Area	%	Total	%
Digital	207,240	31	114,140	36	321,380	32
Analog	456,805	69	195,812	62	652,617	67
Manual	0	0	6,180	2	6,180	1
Total	664,045	100	316,132	100	980,177	100

Source: Information on telecommunication networks prepared by PLDT (yearend 1992)
List of telephone facilities prepared by NTC (As of March 12, 1993)

Figure 6.1-1 Switching Capacity



Source: Information on telecommunication networks prepared by PLDT (yearend 1992)
List of telephone facilities prepared by NTC (As of March 12, 1993)

PLDT provides 88% of the switching capacity in the whole country, all of the switching capacity in the NCR.

Table 6.1-6 shows the switching capacity for each operators. The list of local provincial operators is shown in Table 6.1-7.

Table 6.1-6 Switching Capacity by Operator

Entire Country			
Operator Name	No. of Local Exchanges	Switching Capacity (lines)	Ratio (%)
PLDT	166	858,437	87.6
TELOF	27	10,700	1.1
RTDP (Digitel)	27	17,910	1.8
PILTEL	8	16,830	1.8
OTHERS	95	76,300	7.7
Total	323	980,177	100

Provinces			
Operator Name	No. of Local Exchanges	Switching Capacity (lines)	Ratio (%)
PLDT	112	194,392	61.5
TELOF	27	10,700	3.4
RTDP (Digitel)	27	17,910	5.6
PILTEL	8	16,830	5.3
OTHERS	95	76,300	24.2
Total	269	316,132	100

Source: Information on telecommunication networks prepared by PLDT (yearend 1992)
List of telephone facilities prepared by NTC (As of March 12, 1993)

Table 6.1-7 List of Local Operators

As of July 1993

Operator	Switching Capacity	No. of Local Exchanges	Operator	Switching Capacity	No. of Local Exchanges
Balagtas Tel Co.	320	1	Midsayap Co.	500	1
Basilan Tel	600	1	Mis. Oriental	14,800	2
BATTLEX	200	1	N. Camarines Tel.	500	1
Bicol TPN & TGP	1,000	3	Naga Tel Co.	3,200	3
Calapan Tel Sys.	1,300	1	Nationwide Tel.	300	1
Calauag Tel Sys.	400	2	Northern Tel Co.	600	6
Calbayog Tel Sys.	500	1	Ormoc City Tel Co.	1,100	1
Cruz Tel Co.	8,120	10	Pampanga Tel Co.	800	2
Dancar Ind. Tel Co	300	1	PILTEL	16,830	8
Datelcom Co.	5,800	6	PLDT	194,392	112
DIGITEL	2,000	1	R,C YULO Tel Sys.	700	2
E.Visayas Tel Co.	5,400	4	Radio City Tel Co.	2,850	4
Evangelista Tel Co.	7400	1	RTDP(Digitel)	17,910	27
General Tel Sys.	3,500	6	Rural Tel Co.	500	1
Independent	1,350	1	San Carlos Tel Sys.	460	2
Ipil Tel Co.	150	1	San Carlos City Tel	800	1
Iriga Tel Co.	300	2	San Jose Tel Sys.	100	1
Labo Tel Sys.	100	1	Sarigan Tel	150	1
Maranao Tel Co.	2,600	2	Southern Tel Co	1,500	7
Marbel Tel Sys.	400	1	TELOF	10,700	27
Mario Serr	100	1	TLCOM MGM	200	1
Mati Tel Sys.	600	1	Victorias Tel Sys.	100	1
Mayon Tel Corp.	3,100	4	W. Batangas Tel.	1,300	3
Met. Kidapawan Tel	300	1	Total	316,132	269

Detailed data on telephone operators, switching capacities and exchange numbering plan is shown in Appendix 6 -1.

Switching capacity by region is shown in Table 6.1-8.

Table 6.1-8 Switching Capacity by Region

Region	Switching Capacity
I	31,010
II	6,910
III	48,856
IV	63,060
V	10,586
VI	31,700
VII	58,740
VIII	9,150
IX	10,250
X	20,470
XI	17,900
XII	9,500
NCR	664,045
Total	980,177

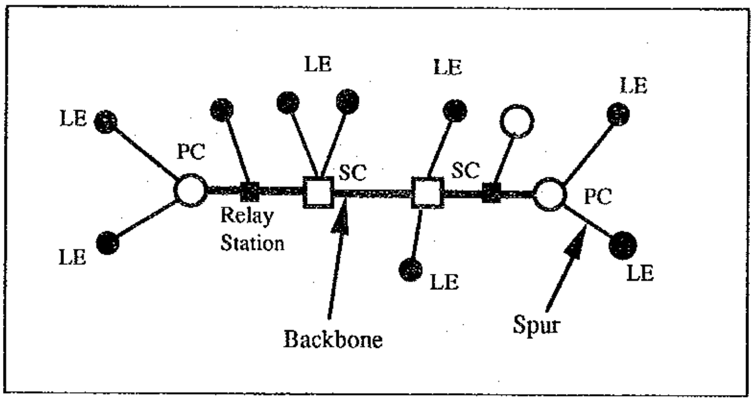
6.2 Transmission

long distance telephone networks in the Philippines. One is operated by the PLDT and the other is owned by the government.

The government network is divided into four areas by project: the RTDP for Regions 1 and 2, NTP 1-1 for Regions 3 to 5, NTP 1-2 for Regions 6 to 8, and NTP 1-3 for Regions 9 to 12. Only the RTDP network is operated by DIGITEL (private company). NTP1-1, 1-2, and 1-3 are under construction and NTP 1-2 and 1-3 have pilot projects.

The structure of both (PLDT and government) long distance networks is tree type, which consist of backbone connecting toll exchanges and spur links connecting primary centers to local exchanges. Spur links are star networks (Figure 6.2-1).

Figure 6.2-1 Long Distance Network Structure



6.2.1 PLDT Network

PLDT network is divided into three types of networks:

- a backbone network for toll service,
- local networks for the provincial areas, and a
- NCR junction network.

(1) Backbone Network for Toll Service

The backbone network has three components: backbone network, secondary backbone network, and spur links.

(a) Backbone network

The backbone network is the high capacity (i.e., channel capacity greater than 1920) portion of the communication transmission network interconnecting toll exchanges. It is composed of five systems: north, east, southwest, southeast and south (Appendix 6-2) and PLDT's backbone network route map is shown in Figure 6.2-2.

(b) Secondary backbone network

The secondary backbone network is the medium capacity (i.e., up to 480 channels) transmission network providing interconnection for exchanges and spur stations not reachable by the backbone network. It will include the Eastern Visayas route and the Eastern Mindanao route, both being constructed under the X5-C project.

(c) Spur links

These links interconnect rural exchanges with the PLDT toll stations, which are almost all analog transmission facilities with 72-channel analog radio systems.

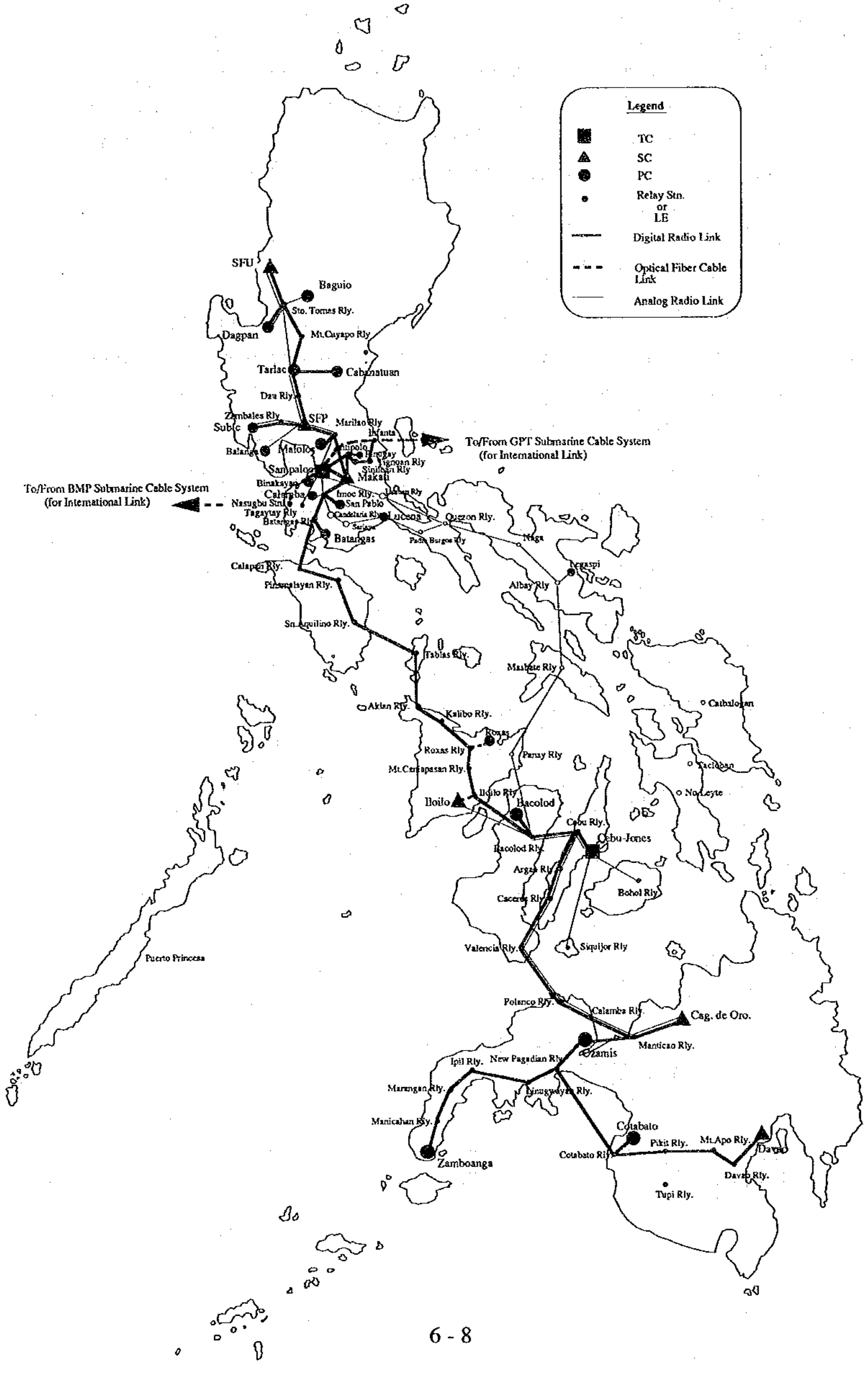
PLDT transmission backbone network links are summarized as shown in Table 6.2-1 and backbone transmission facilities by link are listed in Appendix 6-5.

Table 6.2-1 PLDT Transmission Backbone Network Links (as of 1992)

System	Route	D/A	System	Links
North	Sampaloc (Makati)-SFU	D	6/11G-140 Mb/s	11
		D	2G-34 Mb/s	2
		A	Analog Radio	12
East	International and Satellite	D	4/6G-140 Mb/s	8
		D	F/O-140.417.565 Mb/s	3
		A	Analog Radio	2
South-West	Sampaloc (Makati)-Cebu/Jones	D	6G-140 Mb/s	16
		D	2G- 34 Mb/s	1
		D	F/O-140. Mb/s	1
		D	F/O-34 Mb/s	1
		A	Analog Radio	10
South-East	Sampaloc-Cebu/Jones	A	Analog Radio	12
South	Cebu/Jones-Davao	D	4/6G-140 Mb/s	15
		D	2G- 34M b/s	5
		A	Analog Radio	8
Total		D/A		63/44

Source: PLDT

Figure 6.2-2 PLDT Backbone Network Route Map After X-5 Program. (as of 1992)



The backbone network is composed of radio transmission facilities, except for the international transmission system. There are 58 140-Mb/s or 34-Mb/s digital microwave transmission links, 44 analog transmission radio links and 5 optical-fiber links including the GPT (Guam-Philippines-Taiwan) and BMP (Burunei-Malaysia-Philippines) international links.

(2) Local Networks

There are 94 transmission links between local exchanges and RSUs as shown in Table 6.2-2.

Table 6.2-2 Local Network Facilities (as of 1992)

Facility	Links
Analog Copper Cable	16
Analog Radio System	44
Digital Radio System	10
Optical Fiber System	24
Total	94

Source: PLDT

(3) NCR Junction Network

(a) Transmission facilities

A combination of optical fiber systems and PCM systems are used in the Metro Manila network as shown in Table 6.2-3.

Table 6.2-3 NCR Transmission Facilities (as of 1992)

Facility	Links
PCM System	92
Optical Fiber System	62
Total	154

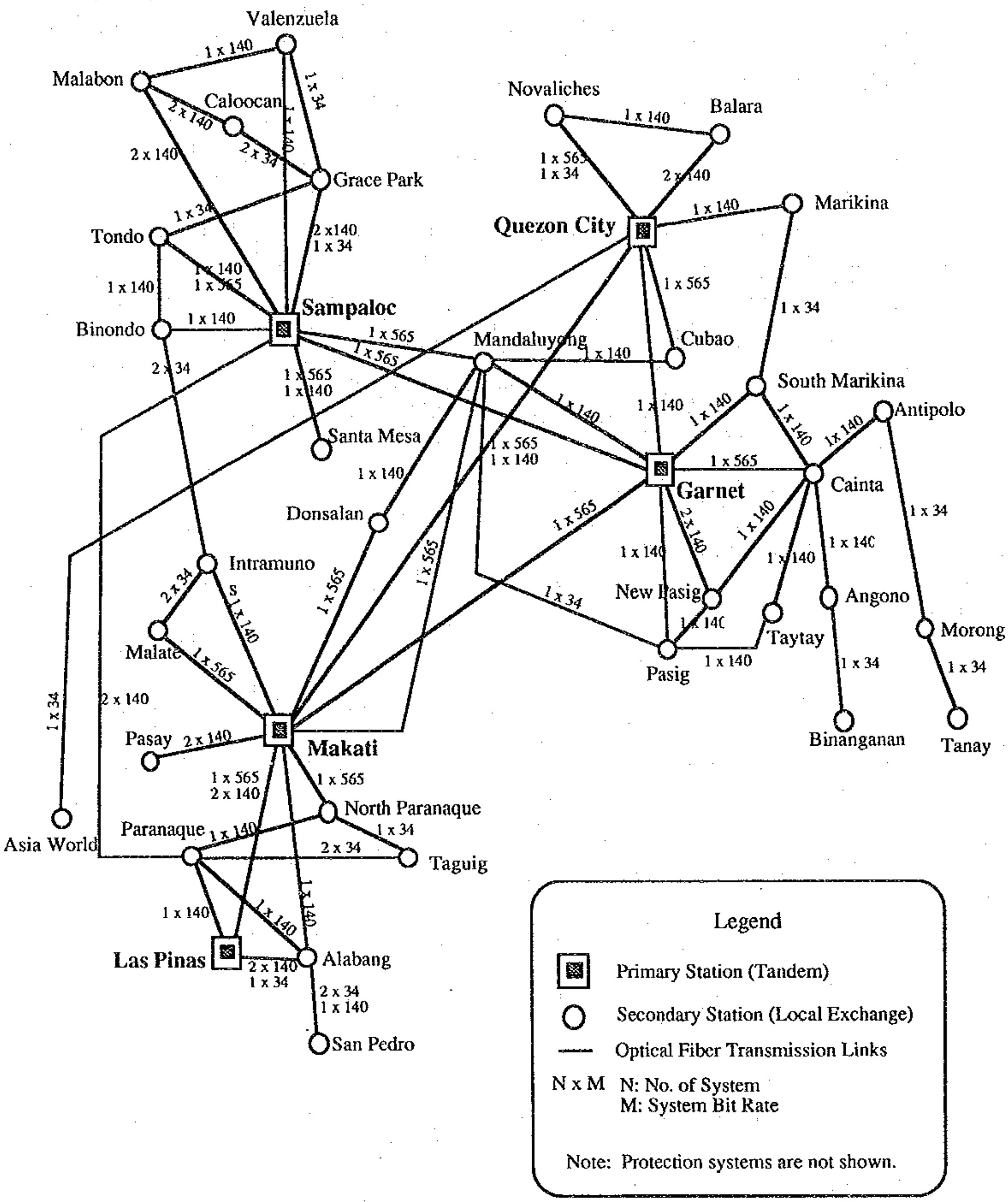
Source: PLDT

(b) Network configuration

i) Network between primary stations

5 primary stations (Tandem): Sampaloc, Makati, Quezon, Garnet and Las Pinas are connected to use 140-Mb/s looped optical fiber systems. There are two different routes to each station to ensure availability in case of system down.

Figure 6.2-3 Metro Manila Junction Network Transmission Systems (Optical Fiber Systems)



There are already 21 optical fiber systems between primary stations. The Metro Manila junction network is shown in Figure 6.2-3.

ii) Network between secondary stations

32 secondary stations (Local exchange) in Metro Manila are linked to their primary station by optical fiber and/or PCM systems.

(4) PLDT X-5C Expansion Program

The ongoing X-5C Program is upgrading secondary backbone networks mainly in Eastern Visayas and Eastern Mindanao, with 34-Mb/s digital microwave systems. A loop network will be established in the Mindanao area.
The backbone network route map after X-5C is completed is shown in Figure 6.2-4. The backbone network configuration is shown in Appendix 6-3 and the backbone network facilities are listed in Appendix 6- 5.

(5) PLDT X-6 Expansion Program

The X-6 Program will establish a loop network optical fiber system with a 2.5-Gb/s synchronous digital hierarchy.
The backbone network route map after X-6 is completed is shown in Figure 6.2-5. The backbone network configuration is shown in Appendix 6-4 and the backbone network facilities are listed in Appendix 6-5.

6.2.2 Government Network

The government network will connect 23 toll centers around the country after completion of NTP 1-1, 1-2 and 1-3. The expecting government backbone network is shown in Figure 6.2-6.

(1) RTDP Network

(a) Transmission route

The RTDP network was established and is owned by the government. Backbone routes are connected between six toll exchanges using the radio transmission systems. The RTDP transmission route map is shown in Appendix 6-6.

Figure 6.2-4 PLDT Backbone Network Route Map
(After X-5C Program is completed by the end of 1995)

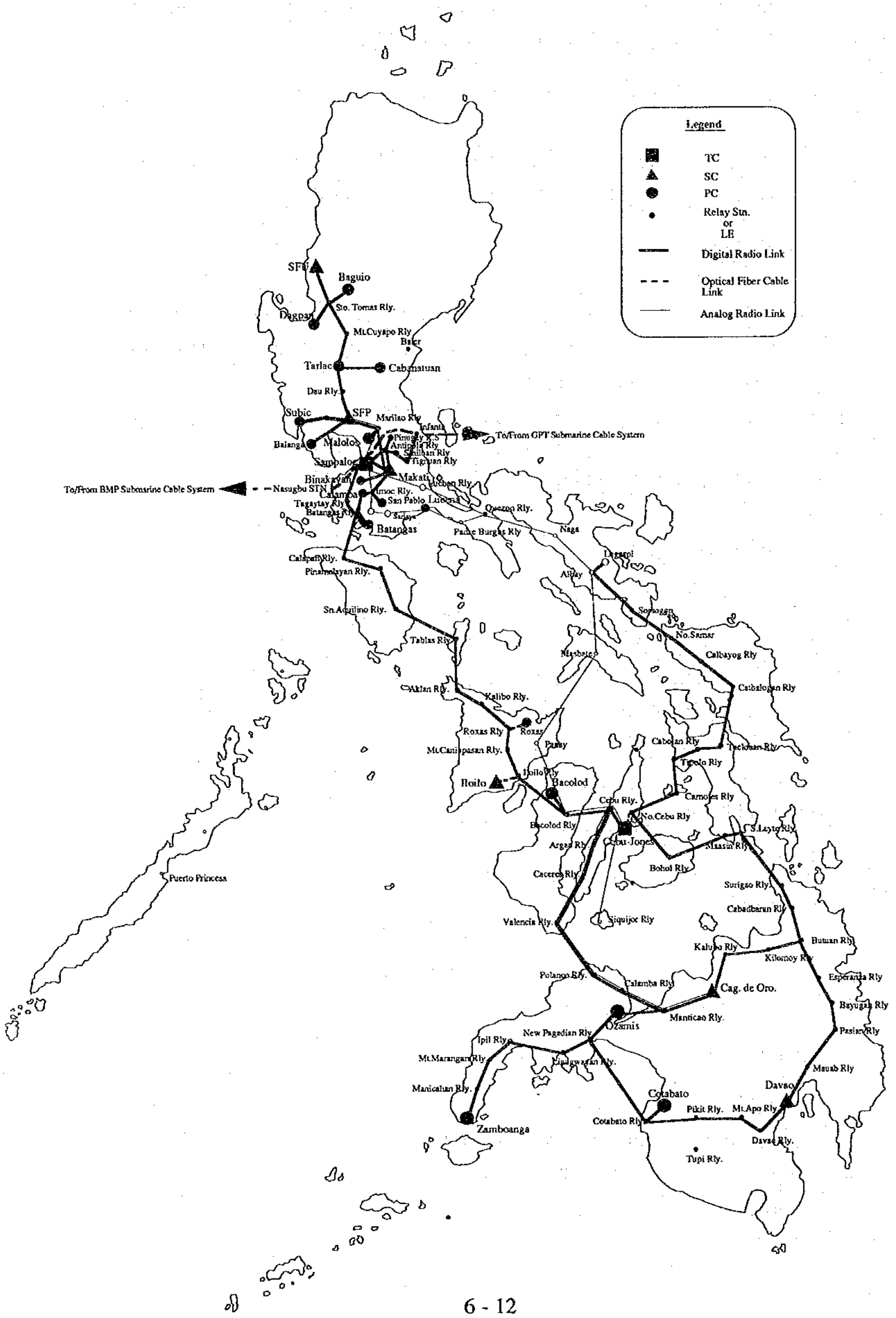
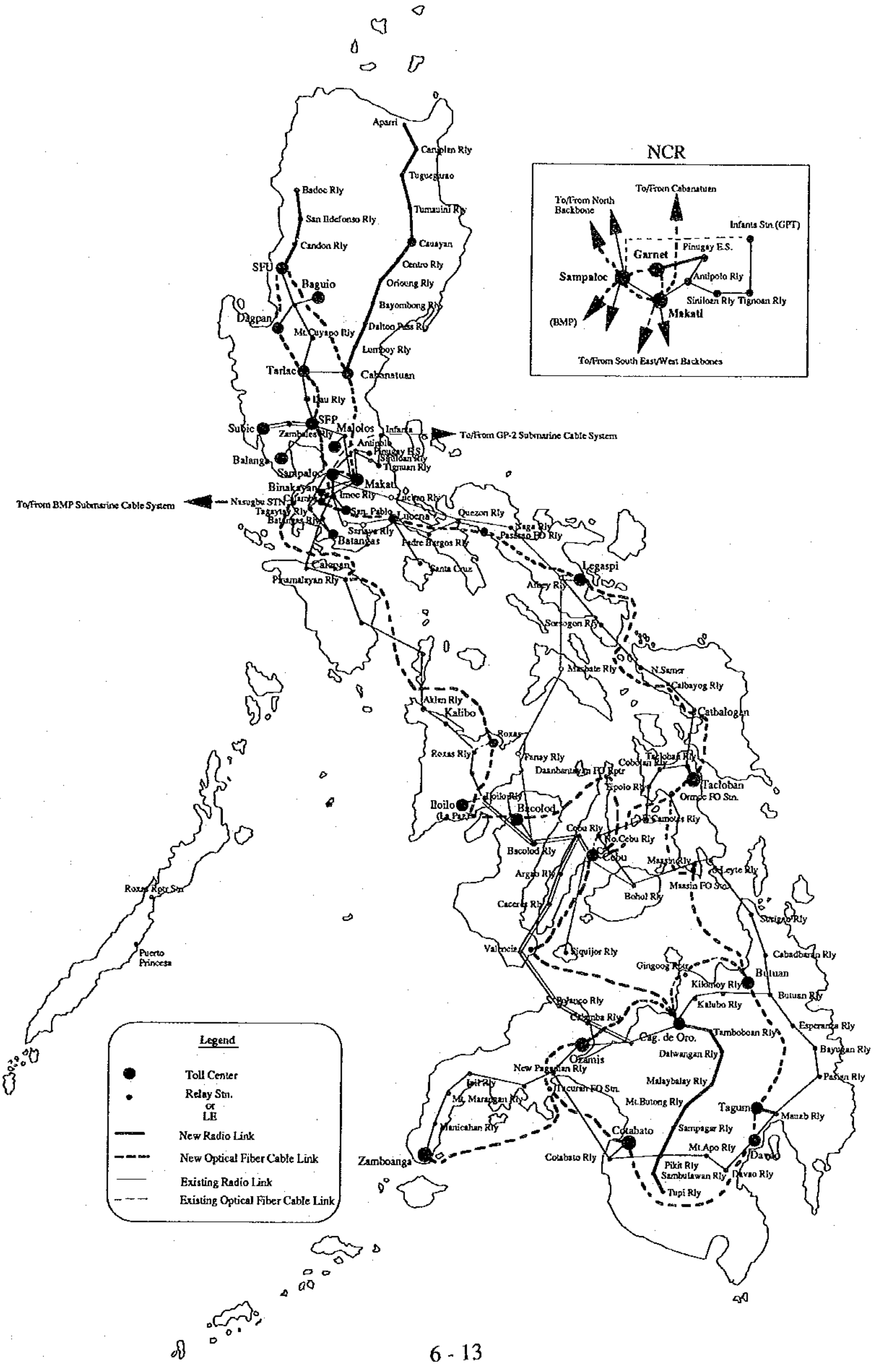


Figure 6.2-5 PLDT Backbone Network Route Map
(After X6 Program is completed by the end of 1996)



(b) Transmission facilities

(i) Current facilities

The backbone network has 24 68-Mb/s digital microwave transmission links, and a 2G-OH analog radio transmission system and a PCM cable System.

There are 79 digital radio transmission spur links (34 Mb/s, 17 Mb/s, 8 Mb/s, 4 Mb/s, 2 Mb/s), and an analog radio system with a 2G-OH and PCM cable systems and voice friquency cables.

The RTDP transmission links are listed in Table 6.2-4 and the transmission facilities are listed in Appendix 6-8.

Table 6.2-4 RTDP Transmission Links (as of 1992)

System	Back-bone	Interco-nnection	Laoag	Vigan	Binal-onan	Bayo-mbong	Ilagan	Tugu-egalao	Total
6G/8G-68M	22	0	0	0	0	0	0	0	22
6G/7G-34M	0	0	0	2	0	1	0	0	3
7G/8G-17M	0	0	0	0	6	0	1	1	8
1.5G-2G - 4M/8M	0	0	0	0	8	2	2	2	14
0.8G-2M/4M/8M	0	0	0	1	4	1	4	3	13
2G-OH	1	0	0	0	0	0	0	2	3
PCM/VF	1	5	10	8	11	4	2	4	45
Total	24	5	10	11	29	8	9	12	108

Source: RTDP Project

ii) Expansion plan (Phase C)

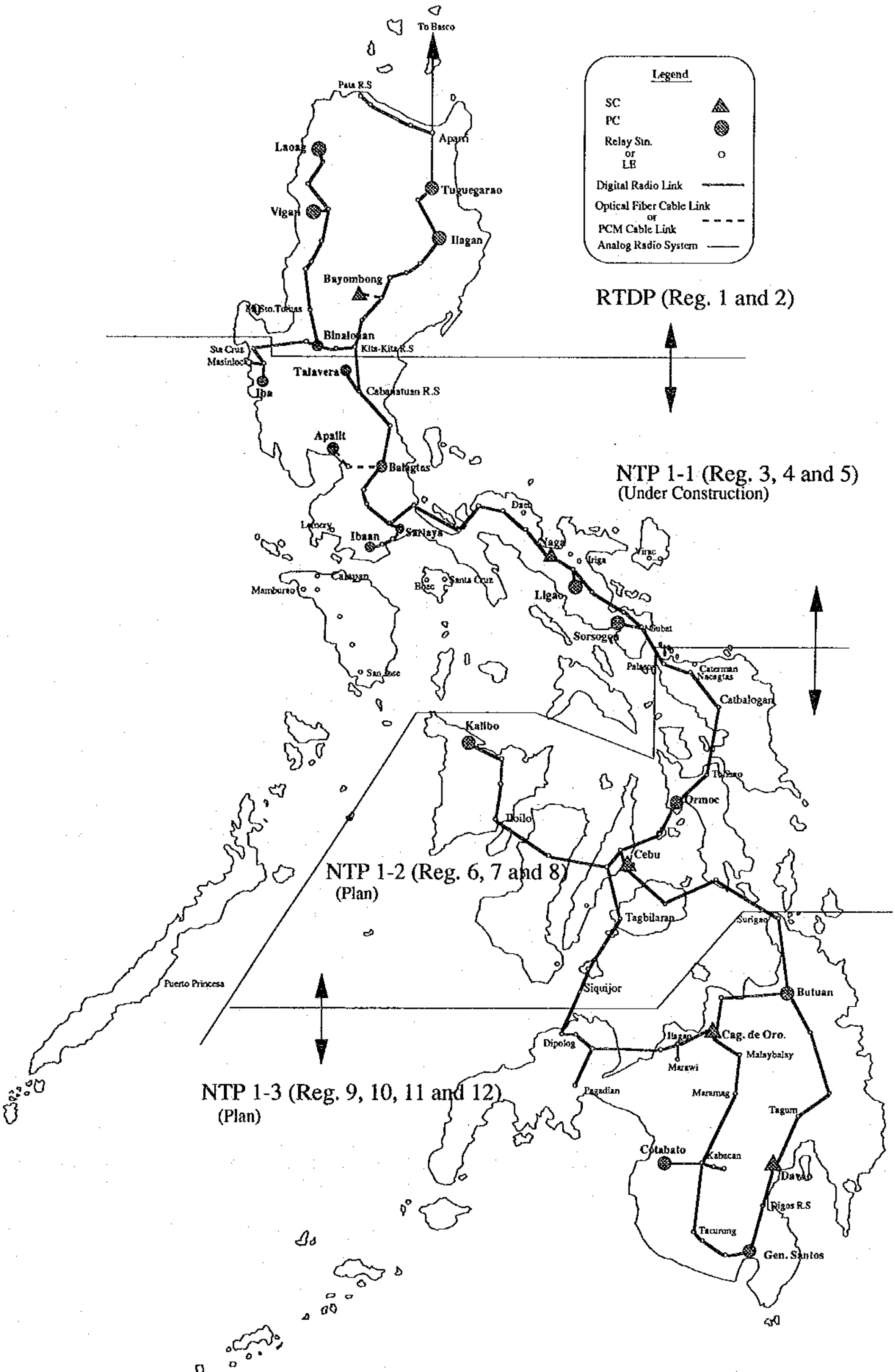
The main items of the RTDP expansion plan (Phase C) are listed in Table 6.2-5. The RTDP transmission route map (Phase C) is shown in Appendix 6-7 and the transmission facilities are listed in Appendix 6-8.

Table 6.2-5 RTDP Expansion Plan (Phase C)

	Items	Links
Sub-project A	Microwave Radio System (Spur)	7
	UHF Radio System	19
	Multi Access (DRMASS)	4 systems
	Trunk Cable	5
Sub-project B	Microwave Radio (Backbone)	5
	Replacement of 800 MHz to 2GHz Radio System	11
	Rehabilitation of Trunk Cable	13

Source: RTDP Project

Figure 6.2-6 Government Backbone Network
After NTP Program Phase 1 (as of 1992)



(2) NTP 1-1 Network

(a) Transmission route

The NTP 1-1 network will connect all digital transmission systems through nine toll centers. The NTP1-1 transmission route map is shown in Appendix 6-9.

(b) Transmission facilities

The backbone network will have 26 links connected with 140-Mb/s or 68-Mb/s digital microwave transmission systems, or 34-Mb/s or 140-Mb/s optical fiber systems.

The 61 planned spur links will use 34-Mb/s or 8-Mb/s digital microwave transmission systems, or 34-Mb/s or 8-Mb/s optical fiber systems or PCM cable. The transmission links are shown in Table 6.2-6 and the transmission facilities are listed in Appendix 6-10.

Table 6.2-6 NTP 1-1 Transmission Links

	B.-bone	Tala-vera	Iba	Apa-lit	Bala-gtas	Ibaan	Sari-aya	Naga	Ligao	Sors-ogon	Total
5/6G-140M	13	0	0	0	0	0	0	0	0	0	13
6G-68M	1	0	0	0	0	0	0	0	0	0	1
2G-34M	4	2	1	4	0	3	2	0	1	1	18
2G-8M	0	1	1	0	0	1	2	1	2	0	8
F/O-140M	2	0	0	0	0	0	0	0	0	0	2
F/O-34M	6	0	0	4	8	2	4	3	2	0	29
F/O- 8M	0	1	1	0	3	2	3	1	1	0	12
PCM Cable	0	0	0	3	0	0	0	0	0	0	3
Total	26	4	3	11	11	8	11	5	6	1	86

Source: NTP 1-1 Project

(3) NTP 1-2 Network

(a) Transmission route

The NTP 1-2 network will connect all digital systems through three toll centers. The NTP 1-2 transmission route map is shown in Appendix 6-11.

(b) Transmission facilities

The backbone network will have 24 links, 23 connected with 140-Mb/s or 34-Mb/s digital microwave transmission system and one connected with a 34-Mb/s optical fiber system.

There will be 35 spur links: 27 connected with digital microwave systems, 6 with optical fiber systems and 2 with PCM cable. The transmission links are shown in Table 6.2-7 and the transmission facilities are listed in Appendix 6-12.

Table 6.2-7 NTP 1-2 Transmission Links

	Backbone	Ormoc	Cebu	Kalibo	Total
7G-140M	11	0	0	0	11
2G-34M	12	8	0	0	20
2G/7G-8M	0	1	7	11	19
F/O-34M	1	0	1	0	2
F/O-8M	0	0	1	0	1
F/O-2M	0	0	3	1	4
PCM/Cable	0	2	0	0	2
Total	24	11	12	12	59

Source: NTP 1-2 Project

(4) NTP 1-3 Network

(a) Transmission route

The NTP 1-3 network will connect all digital transmission systems through five toll centers. The NTP 1-3 transmission route map is shown in Appendix 6-13.

(b) Transmission facilities

The backbone network will have 20 links connected with a 140-Mb/s or 34-Mb/s digital microwave transmission system.

There will be 19 spur links: 6 connected with a 34-Mb/s or 8-Mb/s digital microwave systems and 13 with a 34-Mb/s and 8-Mb/s optical fiber system. The transmission links are shown in Table 6.2-8 and the transmission facilities are listed in Appendix 6-14.

Table 6.2-8 NTP 1-3 Transmission Links

	Backbone	Cag. de Oro	Butuan	Davao	G.Santos	Cotabato	Total
7G-140M	7	0	0	0	0	0	7
7G-34M	13	0	0	0	0	1	14
2G-8M	0	2	3	0	0	0	5
F/O-34M	0	1	0	0	0	0	1
F/O-8M	0	4	1	4	1	2	12
Total	20	7	4	4	1	3	39

Source: NTP 1-3 Project

6.3 Outside Plant

This report on the present state of outside plant is based on a field survey of several telephone offices, data collected from a few private companies, and interviews with PLDT, NTP Tranche I-1 project office, and RTDP Phase B project office.

6.3.1 Facilities

(1) Ocular Inspection

According to PLDT standards, the length of a drop wire is limited to less than 200 meters. However, many dropwires in the old downtown area of Metro Manila are installed untidily from poles and the length of these dropwires seem to be more than 200 meters. On the other hand, aerial cables are not seen in newly developed commercial areas.

Also, in the older areas, many cables are installed on single poles; up to 6 or 7 cables are installed on one pole along the some cable route. There is some question about the strength of the poles.

At a civil work construction site for telecommunication cable in Metro Manila, polyvinyl chloride conduits with an inside diameter of 108 mm and a length of 4 meters were used. Conduits were installed in four rows and two layers inside concrete encasements. The conduits were about 0.6 meter below ground level. The conduits used at this site and the burying depth comply with the Telecommunications Technical Standard for Outside Plant (hereinafter referred to as "OSP Standard").

(2) Cables

According to the OSP Standard, all aerial and underground cables for new construction shall be filled-type, foam/skin insulated, paired cables unless otherwise required by existing field conditions. PLDT introduced jelly filled (JF) cable in 1984; JF cable now accounts for more than 50% of underground cable. Jelly filled cable was also adopted by NTP Tranche 1-1 project.

Table 6.3-1 shows the cable types and standards for cable pairs in the PLDT cable network.

Table 6.3-1 Cable Types in PLDT Local Networks

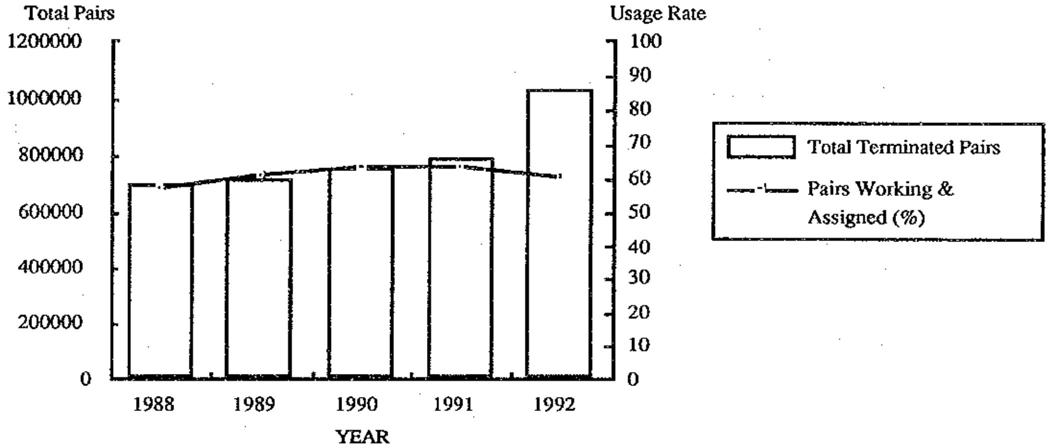
Cable Type	Structure	Standard Size (Pairs)
Aerial	Foam/Skin PE Insulated Jelly Filled	10, 20, 30, 50, 70, 100, 150, 200, 300, 400
Duct	Foam/Skin PE Insulated Jelly Filled	600 to 3000, increments of 100
Direct Buried of 100	Foam/Skin PE Insulated Jelly Filled with Armour Casing	600 to 3000, increments

While optical fiber cable is not used in the PLDT local cable network, there is a project to extend optical fiber cable to subscribers' premises.

(3) Usage Rate of Primary Cable Pairs

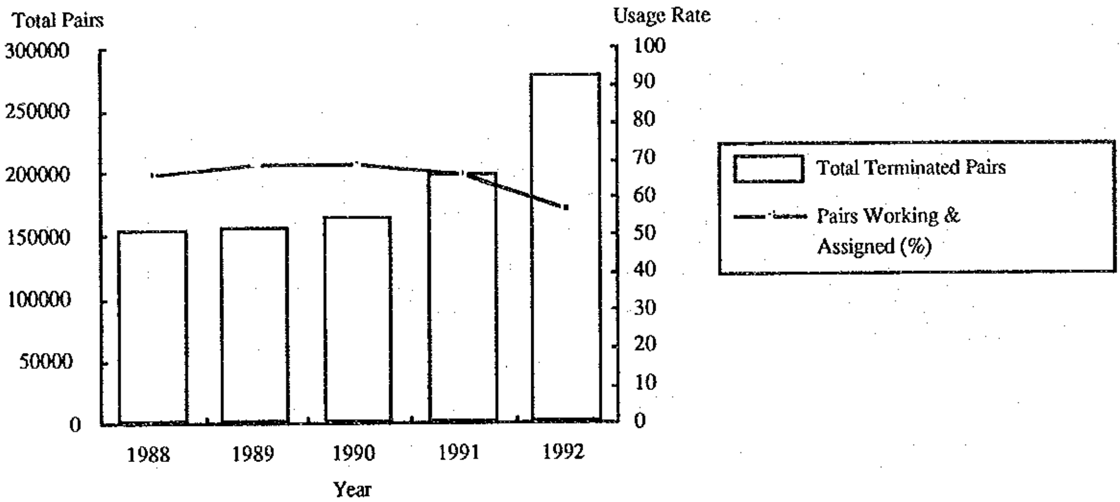
Figures 6.3-1 and 6.3-2 show the total terminated pairs of primary cable and the pair usage rate, including assigned pairs in the PLDT local network, in Metro Manila and the provinces, respectively.

Figure 6.3-1 Total Terminated Pairs (Primary Cable) and Usage Rate (Metro Manila)



Source: Information from PLDT

Figure 6.3-2 Total Terminated Pairs (Primary Cable) and Usage Rate (Provinces)



Source: Information from PLDT

Figures 6.3-3 and 6.3-4 show the status of the primary cable pairs in the PLDT local network as of 1992 in Metro Manila and the provinces, respectively.

Figure 6.3-3 Status of Primary Cable Pairs (Metro Manila)

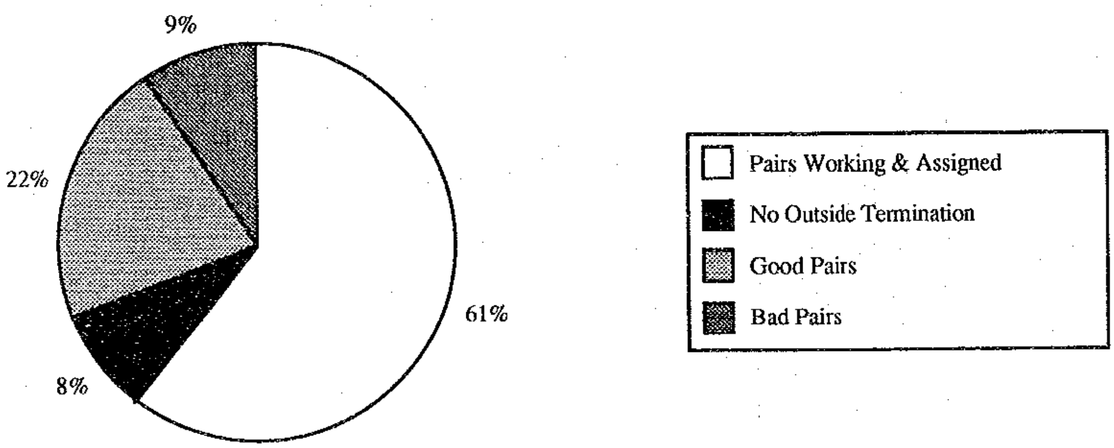
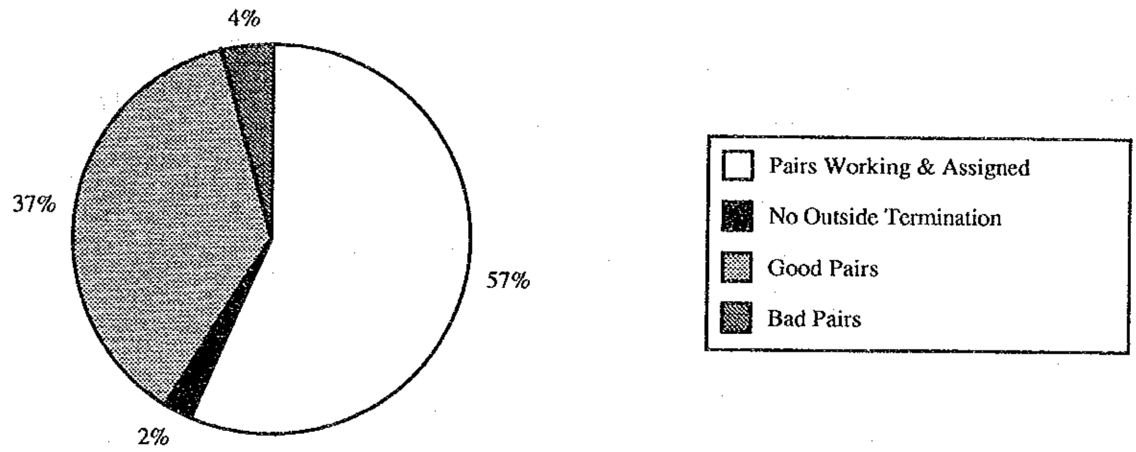


Figure 6.3-4 Status of Primary Cable Pairs
(Provinces)



(4) Cable Multiplying

Cable multiplying is not allowed in a flexible distribution network according to the OSP Standard. PLDT has adopted a rigid distribution system for their subscriber cable plant and the cable multiplying has been also adopted.

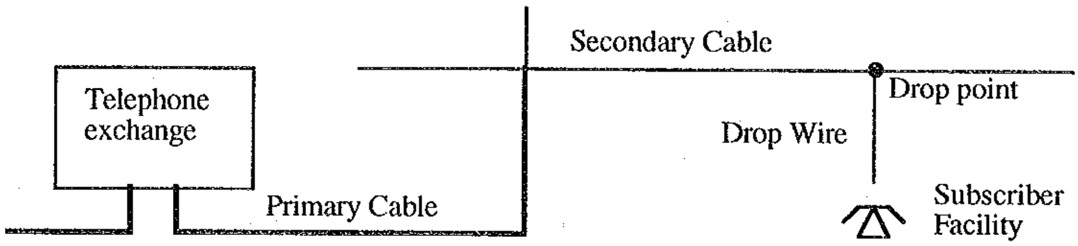
6.3.2 Local Cable Networks

(1) Network System

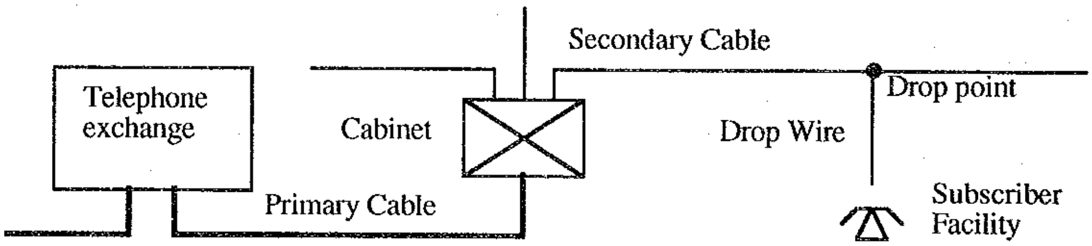
Two types of local cable network systems are used in the Philippines: flexible distribution and rigid distribution.

The flexible distribution system consists of primary cables, secondary cables, and cabinets. The cabinets are installed between the primary cables and the secondary cable: and the cable pairs are connected with jumper wire in the cabinet. This system can provide cable pairs effectively to meet fluctuating demand. In the rigid distribution system, on the other hand, the cable pairs are provided directly as they are required. The configurations of these two systems are shown in Figure 6.3-5.

Figure 6.3-5 Configuration of Local Cable Network System



Rigid Distribution System



Flexible Distribution System

The OSP Standard provides that a flexible distribution network system be used, except in areas where it is not economically justified. PLDT has recently (with the X-5 project in 1989) introduced a flexible distribution network system in their network for large cities.

The rigid distribution system is used by both the NTP Tranche 1-1 and RTDP Phase B projects because of its economy.

(2) Provision Period

The provision period provided by the OSP Standard for primary cable, secondary cable, and manhole and conduit systems is 3 to 5 years, up to 10 years, and 20 years, respectively. Interview results indicate that these guidelines are being met.

(3) Contract Construction

To meet the increasing demand for telephone installation, PLDT recently started to sublet the installation of in-house wiring to subcontractors, in addition to installing it by itself.

CHAPTER 7

PRESENT STATUS
OF
OPERATION AND MAINTENANCE

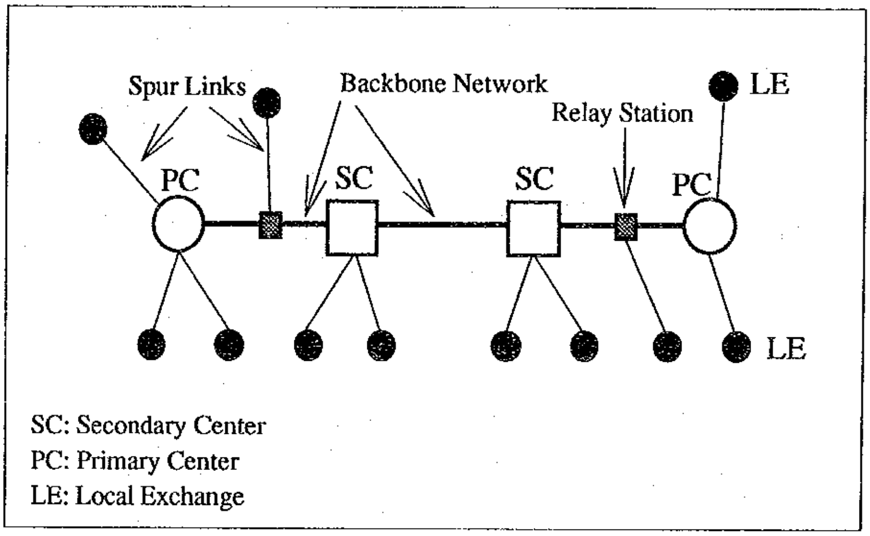
CHAPTER 7 PRESENT STATUS OF OPERATION AND MAINTENANCE

7.1 Operation and Maintenance Systems

7.1.1 Network Classification

A telephone network is divided into two parts: a backbone network and spur links, as shown in Figure 7.2-1.

Figure 7.2-1 Telephone Network Structure



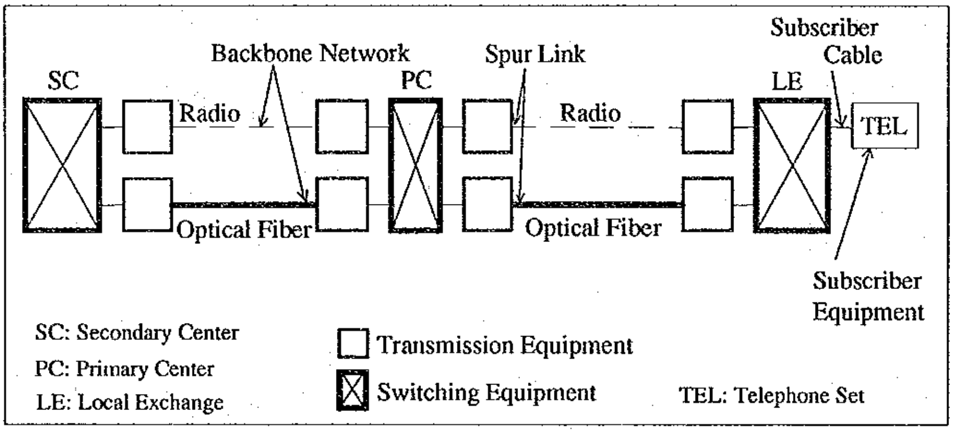
A telephone network has three types of components (Figure 7.2-2):

(a) subscriber cables and subscriber equipment,
(b) switching equipment, and
(c) transmission circuits and transmission equipment.

(1) Backbone Networks

The backbone networks in the Philippines are primarily operated and maintained by the PLDT and TELOF. The operation and maintenance of backbone networks can be divided into: network management and daily operation and maintenance activities. To carry out network management efficiently, operation and maintenance centers (OMCs) were introduced in Metro Manila and other major cities by the PLDT and TELOF individually. To carry out daily activities efficiently, the operation and maintenance staffs for the backbone networks are assigned to these OMCs.

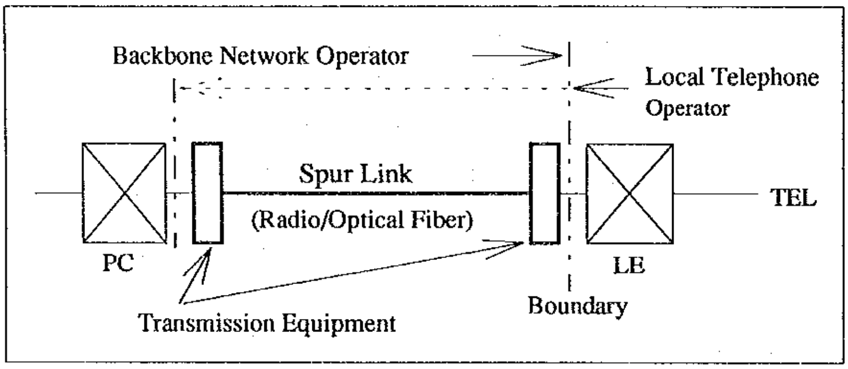
Figure 7.2-2 Telephone Network Components



(2) Spur Links

Spur links are operated and maintained by both backbone network operators and local telephone operators. Figure 7.2-3 shows the configuration of a spur link.

Figure 7.2-3 Configuration of Spur Link



7.2 Maintenance Activities

(1) TELOF Operation and Maintenance Systems

TELOF operation and maintenance systems are centralized. These systems comprise mainly management and control (or support) centers (MCCs or MSCs), operation and maintenance centers (OMCs), and sub-operation and maintenance centers (sub-OMCs). Appendix 7-1 to 7-3 shows these organizational structures.

(a) MCCs (MSCs) are located in Manila and Cebu and supervise, administer, and manage the toll network and the OMCs.
(b) OMCs are located at the toll centers in the main cities to operate and maintain the backbone network and spur links.
(c) Sub-OMCs operate and maintain local network facilities, which consist of subscriber equipment, subscriber cables, local switches, and junction circuits.

Local exchanges and transmission stations have alarm detection and transfer equipment; alarms and alarm data are transferred to the MCC and OMC through the data transmission links.

(2) PLDT Operation and Maintenance Systems

PLDT operation and maintenance systems support the PLDT switching and radio transmission networks; they check and correct failures and reduce service downtime.

(a) These operation and maintenance centers perform such functions as network control, traffic observation, and administration and maintenance of switches, subscriber cables, and terminals. A central OMC controls and monitors the performance of a group of SPC switches. Appendix 7-4 to 7-6 shows the organizational structures.

Operation and maintenance systems were installed in the following OMCs to supervise and monitor the performance of the local digital switching system.

Operation and Maintenance Center	Monitor and Control Area
Sampaloc (Metro Manila)	North Manila, Luzon
Makati (Metro Manila)	South Manila
Jones (Cebu)	Visayas, Mindanao

(b) Six service centers use line condition report (LCR) systems to provide computer-aided repair, test, and dispatch for the exchanges. They are located in Sampaloc, Makati, Del Monte, North Paranaque, Ortigas, and Garnet.

(c) Two network management and control points (NMCPs) function to prevent abnormal situations that cause network congestion and to ensure maximum utilization of facilities. NMCPs are located in Manila (for Luzon) and Jones-Cebu (for Visayas and Mindanao).

(d) Transmission supervisory systems were established under the X-5 program to automatically monitor and dynamically control the backbone network system from a central location. The toll backbone network is divided into two maintenance areas, each supervised by a control center.

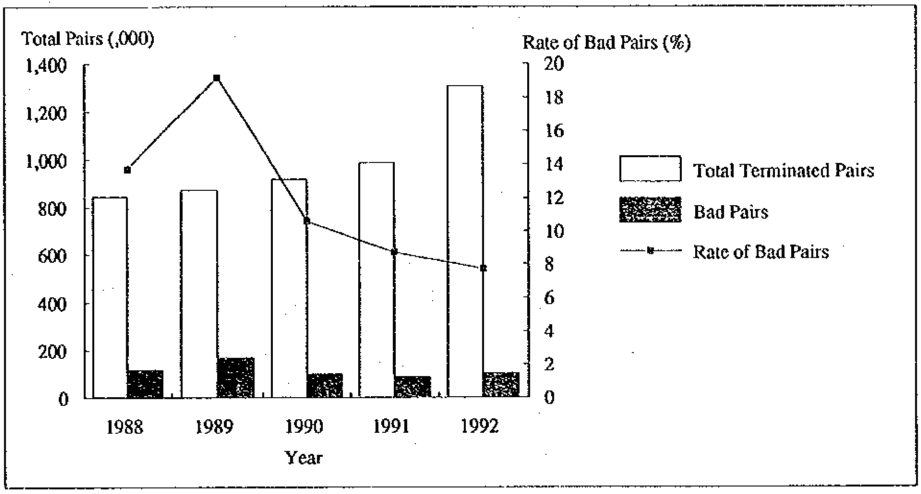
(e) The Junction network monitoring center (JNMC) is an integrated transmission maintenance system for the Metro Manila local network. It uses supervisory and line monitoring equipment to improve system reliability and availability. It can handle VF cable, PCM systems, digital multiplexers, and optical fiber transmission systems for total network management and control. It puts out such critical factors as bit error rate performance, voltages, alarms, and transmission line status. Fault location is also integrated into the system, making it possible to determine whether a problem is in a repeater or in the cable itself. The JNMC was installed in Reposo (Manila) under the X-5 program.

(3) PLDT Outside Plant Maintenance Activities

Historical data of total terminated pairs and bad pairs in the PLDT local cable network is shown in Figure 7.2-4.

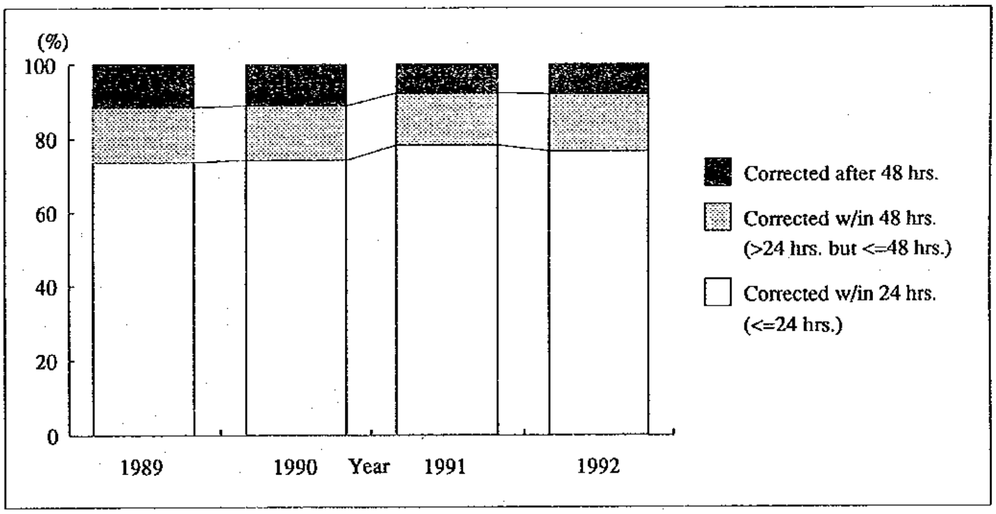
Figure 7.2-5 shows the time it takes to correct faults in the PLDT local cable network.

Figure 7.2-4 Trend in Bad Pairs (PLDT Local Cable Network)



Source: PLDT

Figure 7.2-5 Trend in Fault Correction Time (PLDT Local Cable Network)



Source: PLDT

(4) Telegraph Facilities

Telegraph systems are mainly operated and maintained by the TELOF, PT&T, and RCPI.

(5) Other Telecommunication Facilities

Cellular mobile telephone systems, telex, radio paging systems, maritime telephone systems, and shared repeater/trunked network are operated and maintained by the private operating companies.

7.3 Training

Operation and maintenance staff is trained by each company individually. The TELOF and PLDT training schools often train private companies' staffs.

7.3.1 Training Facilities

The TELOF has a telecommunication training institute (TTI) in the outskirts of Metro Manila, in which training is carried out by TTI instructors. The PLDT has a technical training center (TTC) located in Metro Manila. However, some private companies still do not have a training center. Thus, their training is normally carried out at hotels, company offices, and foreign manufacturer offices.

7.3.2 Training Conducted

(1) TTI

The TTI conducted 79 training sessions in 1992. A total of 1375 trainees, including those from private companies were trained by 28 instructors.

(2) PLDT (TTC)

The TTC has 26 training rooms and 21 instructors (11 engineers and 10 technicians). They conducted 268 classes in 1992. A total of 4042 trainees were trained.

7.4 Customer Service

7.4.1 Marketing Activities

(1) New Subscriber Connection Procedure

Subscribers information is managed by computer system. New applicants are given registration number. If the facility is available, the applicant can get telephone line immediately. There is no priority between business use and residential use regarding new installation. The principle is "first in first out". Governmental requests, however, get first priority.
Figure 7.4-1 shows the flow of the new subscriber connection procedure.

(2) Pending Requests

The number of pending requests for new installation is over 600,000 in Metro Manila and over 200,000 in the provinces, as of March 1993 (Table 7.4-1). The waiting period differs by area. In Quezon City, the oldest outstanding application was filed in 1962. In Garnet, there is enough capacity for telephone lines to be installed within two weeks from the day of application.

(3) Customer Service System

PLDT has already introduced a integrated computer system for customer service management. CSOP (Customer Service Order Processing System) is the big integrated system of PLDT for facility management, subscriber information, and billing information and so on. SIIS (Subscriber Integrated Information System) is also under the CSOP.

7.4.2 Billing Activities

(1) Standard Schedule of Billing and Collection

Telephone subscribers are billed monthly. Figure 7.4-2 shows the standard schedule of billing and collection. Followings are supplementary information on the schedule.

Figure 7.4-1 New Subscriber Connection Procedure

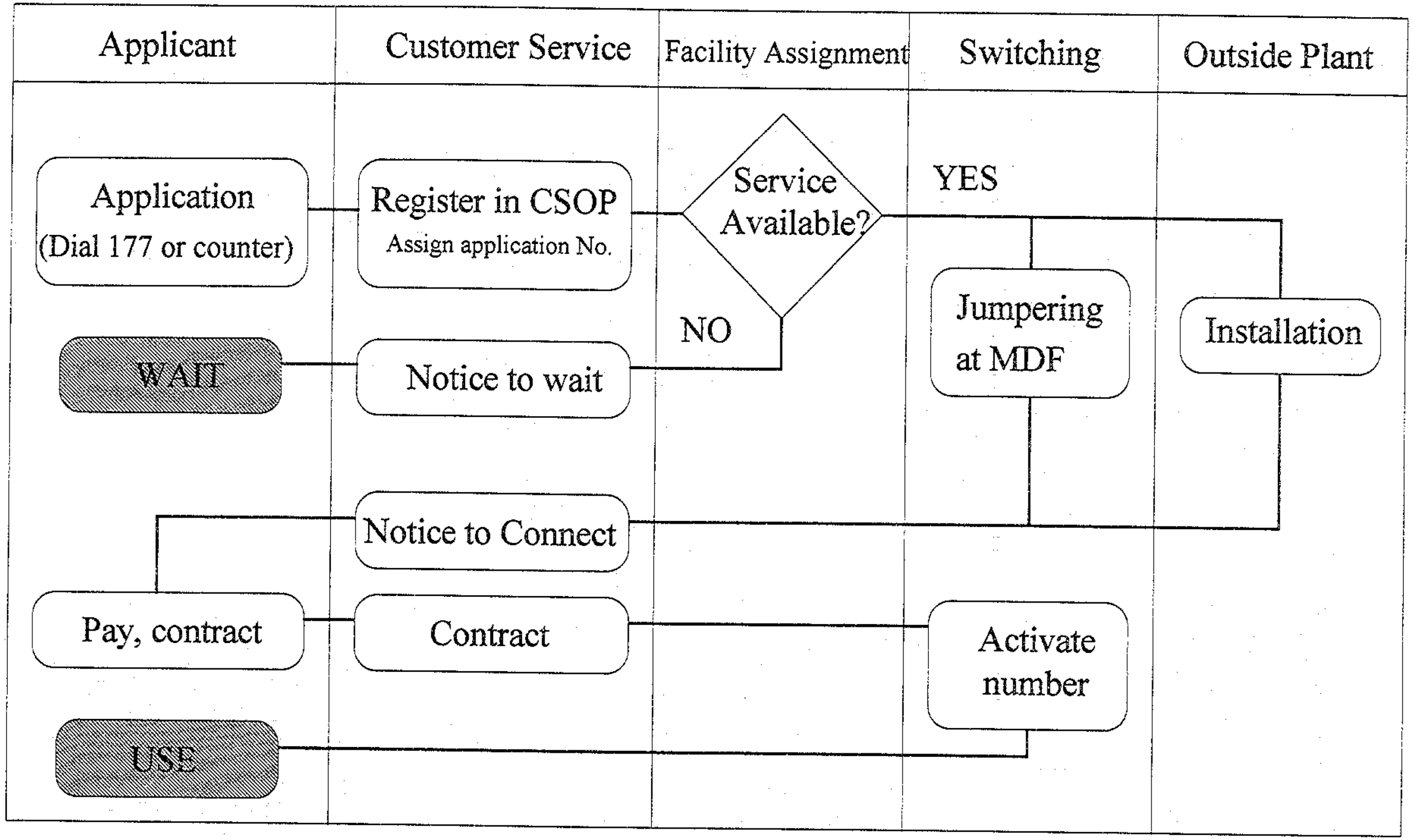


Table 7.4-1 Number of Pending Request for New Installation

as of March 1993

	METRO MANILA			PROVINCE			TOTAL		
	Residential	Business	Total	Residential	Business	Total	Residential	Business	Total
Balance forward	465,088	146,702	611,790	152,669	41,974	194,643	617,757	188,676	806,433
Received	10,139	5,429	15,588	4,505	1,886	6,391	14,644	7,315	21,959
Served	5,734	3,102	8,836	1,738	1,202	2,940	7,472	4,304	11,776
Cancelled	1,586	687	2,273	334	178	512	1,920	865	2,785
Infilled on Hand	467,907	148,342	616,269	155,102	42,480	197,582	623,009	190,822	813,831

Source: NTC Summary Report Pending request for New Installation as of march 1993

(a) Traffic period

One month, the end of the month is called cut-off day.

(b) Data processing period

13 days from cut-off day. The bill is mailed to the customer on the 13th day.

(c) Invoicing

17 days from due date or one month from cut-off date.

(d) Notice of disconnection

Notice of disconnection is sent 10 days after the due date.

(e) Temporary disconnection

The subscriber is temporary disconnected in case of non-payment 5 days from receipt of the notice (5 days from date of the Proof of Delivery)
(Assume: delivery is one week)

(f) Permanent disconnection

10 days after the subscriber is temporary disconnected.

(2) Disconnection

As is explained in (1), a notice of disconnection is sent when a subscriber fails to pay his or her bill within 30 days of the cut-off date or ten days after the last date for payment as shown in the upper right portion of the bill. A subscriber is given ten days from receipt of notice to settle an overdue account payment is made at any of the operator's business offices listed on the back of the notice.
24,000 subscribers in Metro Manila were disconnected and 23,000 were reconnected in March, 1993 according to the NTC summary report.

(3) Form of Payment

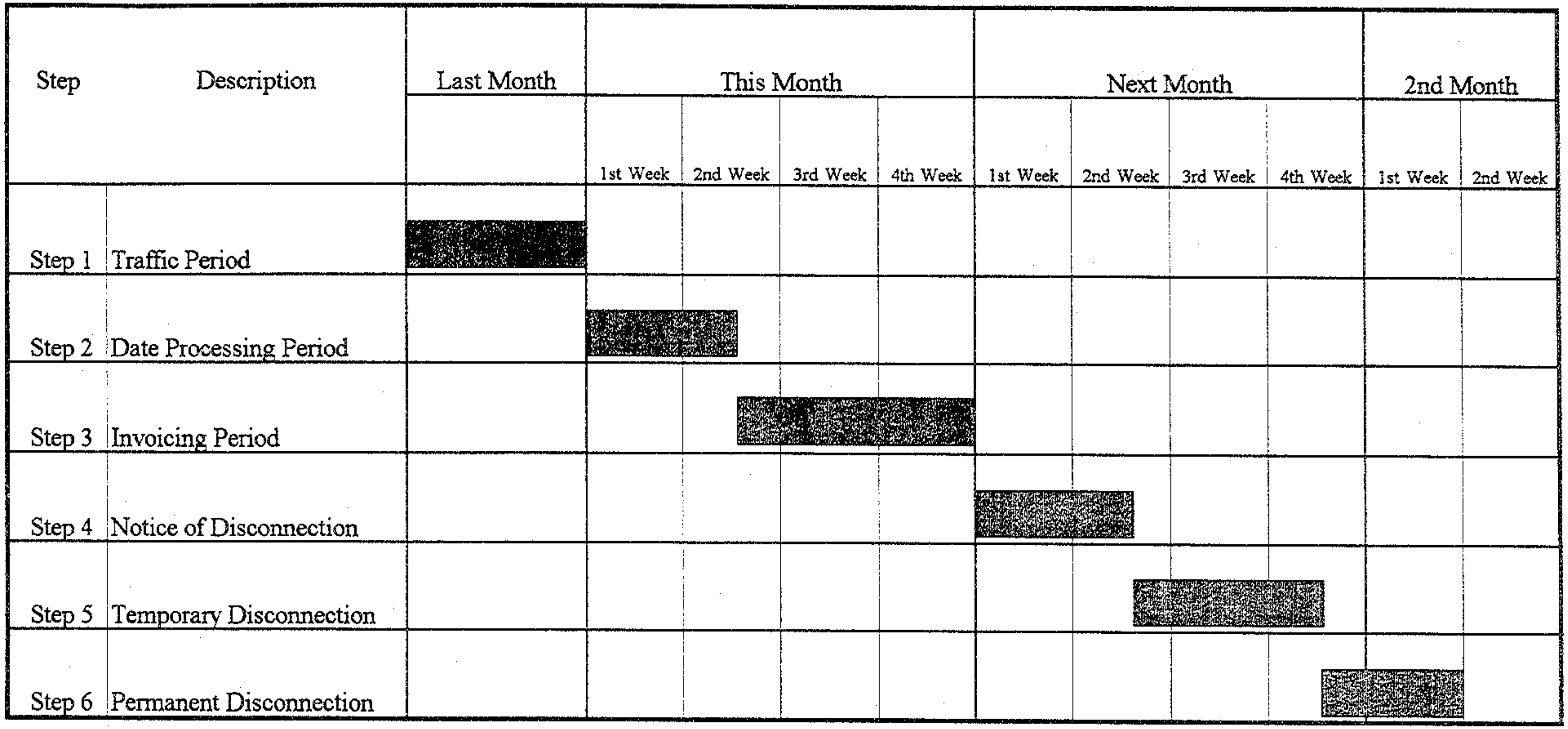
There are three ways to make payments for telephone bills. One is over the counter of telephone office by cash or check. Another is payment through mail. And the other is payment at head office or brunch of banks authorized to accept payment, the number of such head offices and brunches are more than one hundred in the Metro Manila area.

(4) Others

PLDT adopts Cyclic Billing to level out the peak. The subscribers are divided into some groups and each group has different due day so that the billing procedure for the subscribers is different accordingly.

There is a computer center in Makati. All bills for subscribers in Metro Manila are issued by the computer system. Remind letters are also automatically issued by the system.

Figure 7.4-2 Standard Schedule of Billing and Collection



Source: PLDT

CHAPTER 8

FORECASTED DEMAND

CHAPTER 8 FORECASTED DEMAND

8.1 Telephone Service Subscription Demand

The Study Team reviewed existing telephone demand forecasts and developed a macroscopic demand forecast for the national level based on the existing forecasts and various data collected through field surveys. Demand forecast for each municipality was done in cooperation with the DOTC after discussing the problems noted later in this report.

8.1.1 Review of Existing Demand Forecasts

We reviewed the macroscopic telephone demand forecasted by DOTC for the revised NTDP together with the demand forecasts for the last decade. Several subjects were discussed with DOTC based on the results of the review.

8.1.2 Forecasted Macroscopic Demand

(1) ITU Model

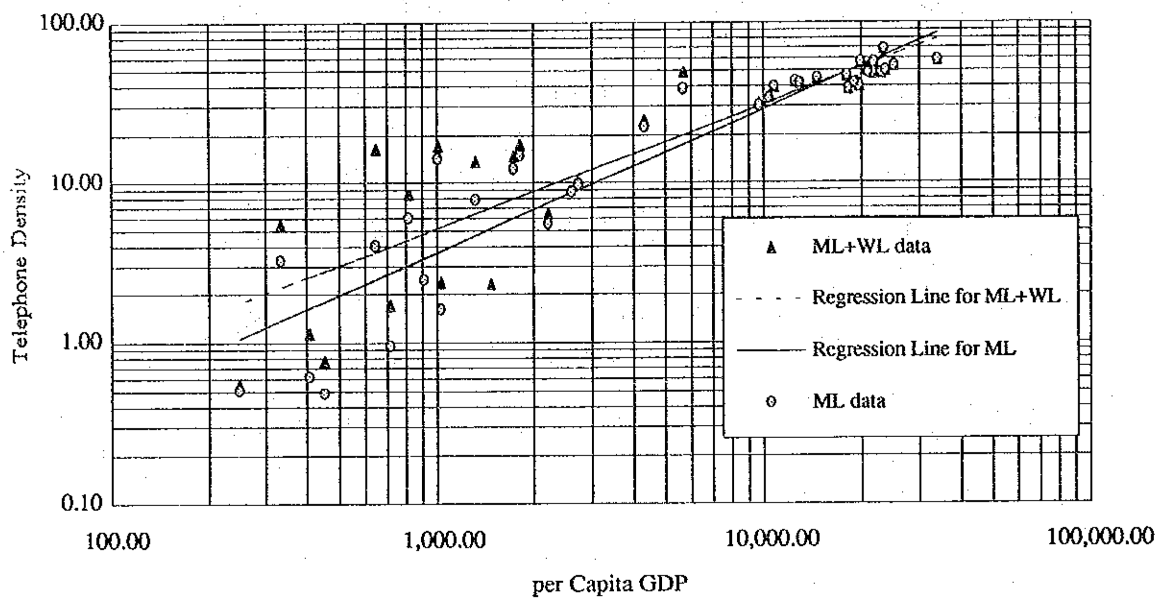
Macroscopic demand at the national level was forecasted by using the ITU model under the conditions described below.

(a) GDP was from the 1992 ITU Yearbook.
(b) Telephone density was from the 1992 ITU Yearbook.
(c) Countries were selected from the original NTDP list to calculate the regression line.
(d) Growth rate for per capita GDP was the same as in the revised NTDP until 1998, and was then based on the Medium-Term Philippine Development Plan.
(e) Two growth rates for per capita GDP were assumed: one approaches 4% gradually after 1998. The growth rate of 4% is same rate as in the original NTDP. The second continues to grow at the same rate as in 1998 and is the growth rate in the revised NTDP.

The Study Team met with the DOTC Counterpart Team to discuss the macroscopic demand forecast. The Team agreed to use the mean of the two growth rates to calculate demand in the study.

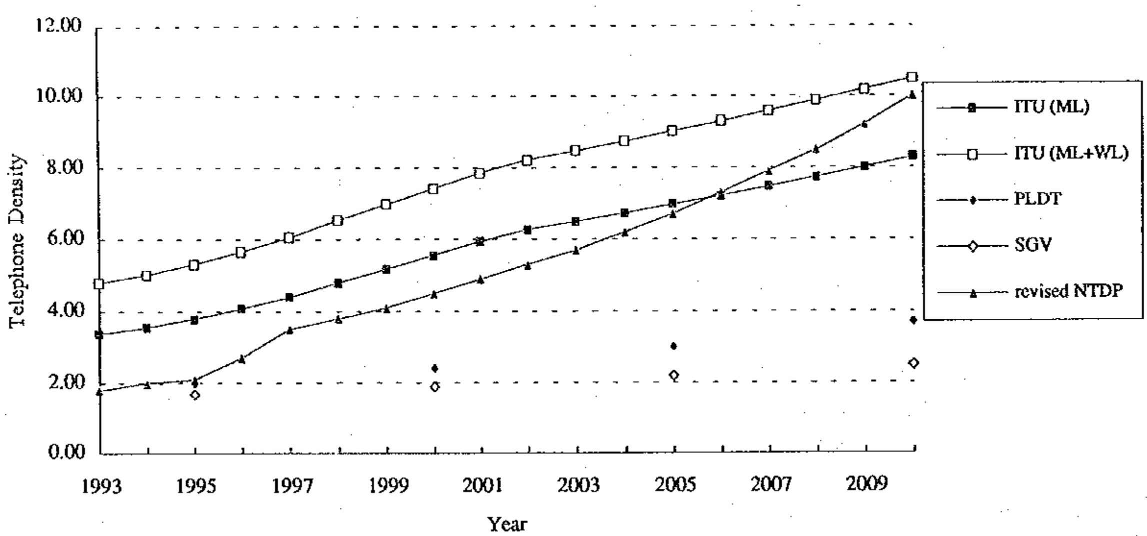
Figure 8.1-1 shows the calculated regression line for the main line and main line plus waiting list in the world. Figure 8.1-2 shows the forecasted telephone density and the forecasted demand density in the revised NTDP.

Figure 8.1-1 Per Capita GDP vs Telephone Density



ML: Main line
WL: Waiting line

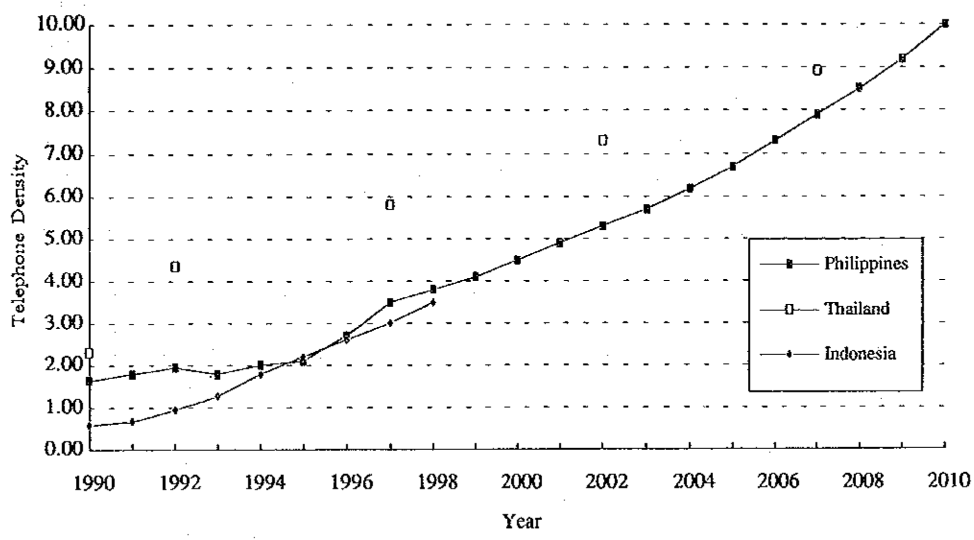
Figure 8.1-2 Telephone Density for Various Demand Forecasts



(2) Telephone Density Compared to Other Asian Countries

Figure 8.1-3 shows the forecasted demand density through the year 2010 for the Philippines, Thailand, and Indonesia, including the data for planned projects in each country. The trend in demand density in the revised NTDP is comparable to the trends in Thailand and Indonesia, both of which have aggressive projects planned.

Figure 8.1-3 Forecasted Telephone Density Compared to Other Asian Countries



8.1.3 Forecasted Microscopic Demand

(1) Population Projection by Region

The population projection of the Philippines is based on the medium assumption for population projection in the "Philippine Statistical Yearbook 1992". The population by region was projected by analyzing trends in prior census data.

The population of the national capital region (NCR) was projected as a percentage of the total population because of government emphasis on regional development and because the NCR is saturated in various fields.

The population projection by region is shown in Appendix 8-1.

(2) GDP Projection by Region

GDP by region through 1998 was projected by using the data in the Medium-Term Philippine Development Plan. From 1999 to 2010, the GDP growth rate used to forecast macroscopic demand was used to project regional GDP.

The GDP projection by region is shown in Appendix 8-2.

(3) Demand Forecast by Region

(a) Demand forecast by logistic curve

This model was suggested by ITU GAS 3 and was used for national and regional level forecasting. The model is as follows:

$$D_t/N_t = K/(1+me^{-at}),$$

where

D_t is the expressed demand in period t,

N_t is the population in period t,

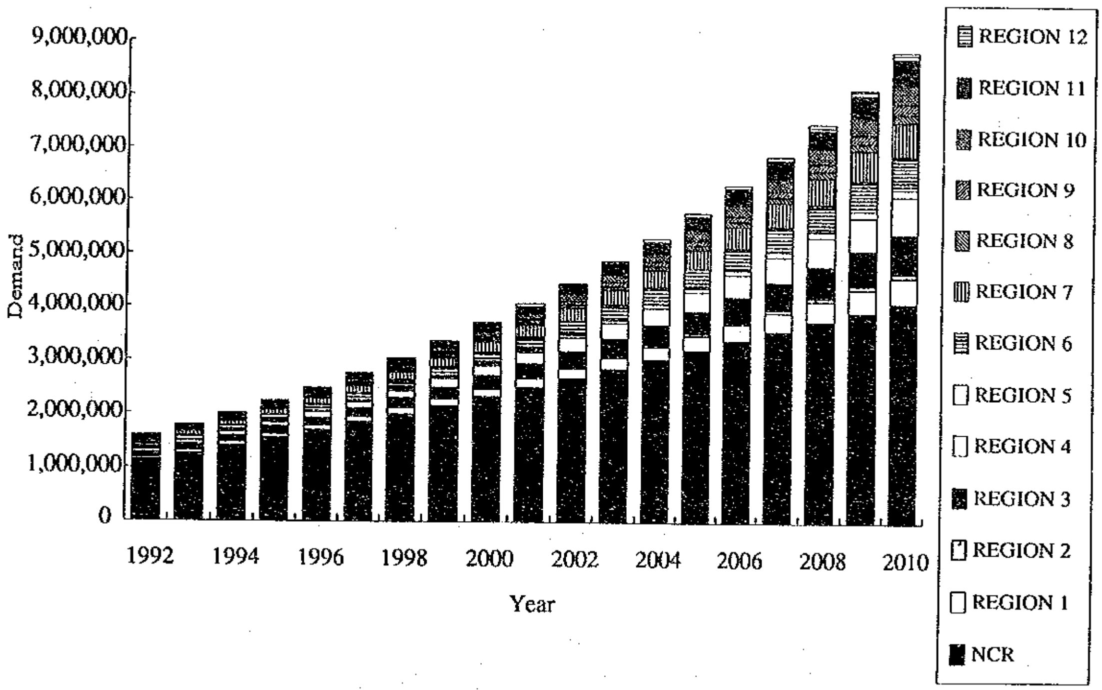
K is the saturation level,

m and a are coefficients.

Saturation level K and coefficient a were estimated because of insufficient data to calculate them: K=0.45 and a=0.12 were used to forecast demand for the NCR, and K=0.4 and a=0.12 were used for the regions. These values were estimated by referring to the data for other countries.

The forecasted demand by logistic curve is shown in Figure 8.1-4.

Figure 8.1-4 Forecasted Demand by Logistic Curve



(b) Demand forecast by income elasticity model

Although actual data are required to use this model, the actual data for main line and waiting list by region were not collected. A demand forecast by using this model was done however to better grasp the effect of population and GDP in each region on demand. The actual expressed demands were estimated by using the exchange capacity data by region from the NTC annual report.

This model is as follows:

$$D_{it}/N_{it} = a*(GDP_{it}/N_{it})^{\beta} *\exp(b*D),$$

where

D_{it} is the expressed demand of Region i in period t,

N_{it} is the population of Region i in period t,

GDP_{it} is the GDP of Region i in period t,

a, b, and β are coefficients, and

D is a dummy value for the NCR.

The model is rearranged in the following log-linear form for estimation:

The model is rearranged in the following log-linear form for estimation:

$\ln(D_{it}/N_{it}) = \ln(a)+ \beta *\ln(GDP_{it}/N_{it})+b*D.$

The calculated coefficients are shown in the following model:

$\ln(D_{it}/N_{it}) = -14.8700+1.1024*\ln(GDP_{it}/N_{it})+1.6555*D.$

The forecasted demand by using the income elasticity model is shown in Figure 8.1-5.

(c) Forecasted demand

Total forecasted demand for each model is shown in Figure 8.1-6, in addition to the target supply of the revised NTDP and the macroscopic demand of the Master Plan.

Forecasting demand by using logistic curves is best suited for areas where the demand will be filled in the near future. The results of forecasting demand for the NCR by logistic curve are used as the demand by region.

Figure 8.1-5 Forecasted Demand by Using Income Elasticity Model

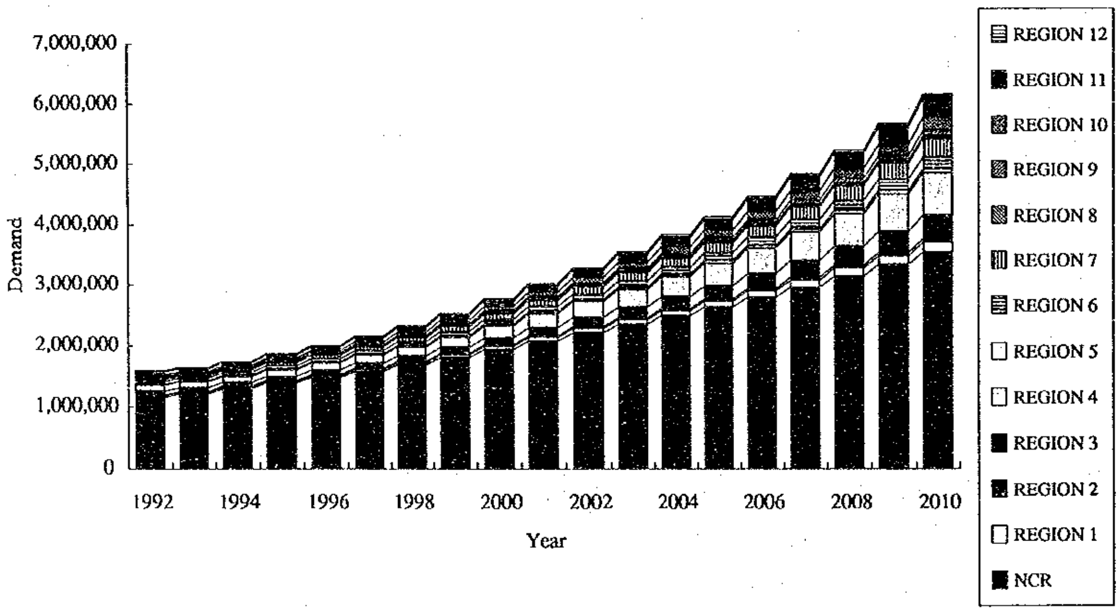
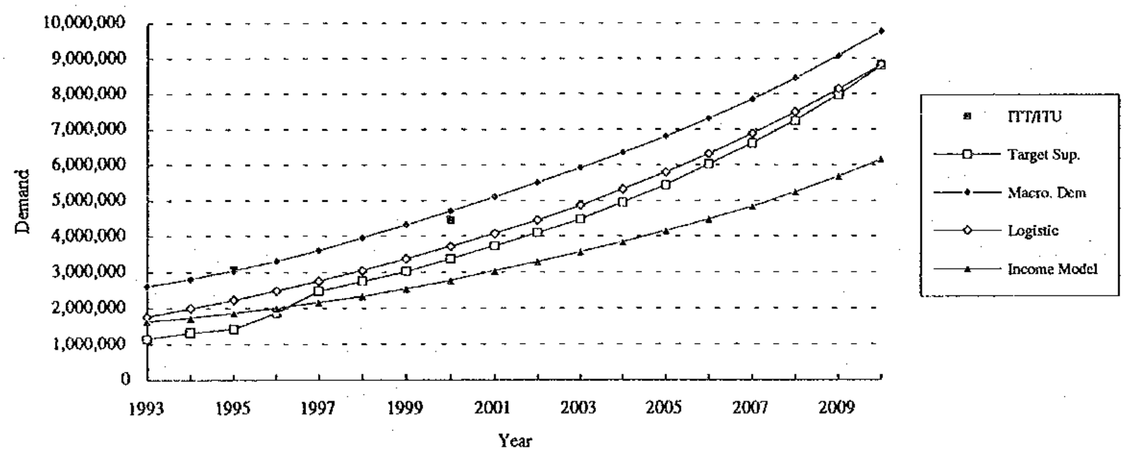


Figure 8.1-6 Forecasted Demand by Various Methods



The forecasted demand by using the income elasticity model is small compared to the other forecasted demands. This seems to be due to the rough estimation of the actual expressed demand. On the other hand, the results of this model reflect the trends in population and GDP for each region. Therefore, the macroscopic demand excluding the NCR demand is divided into each region in proportion to the demand of each region by using the income elasticity model. The forecasted demand by region is shown in Figures 8.1-7 and 8.1-8.

Figure 8.1-7 Forecasted Demand by Region

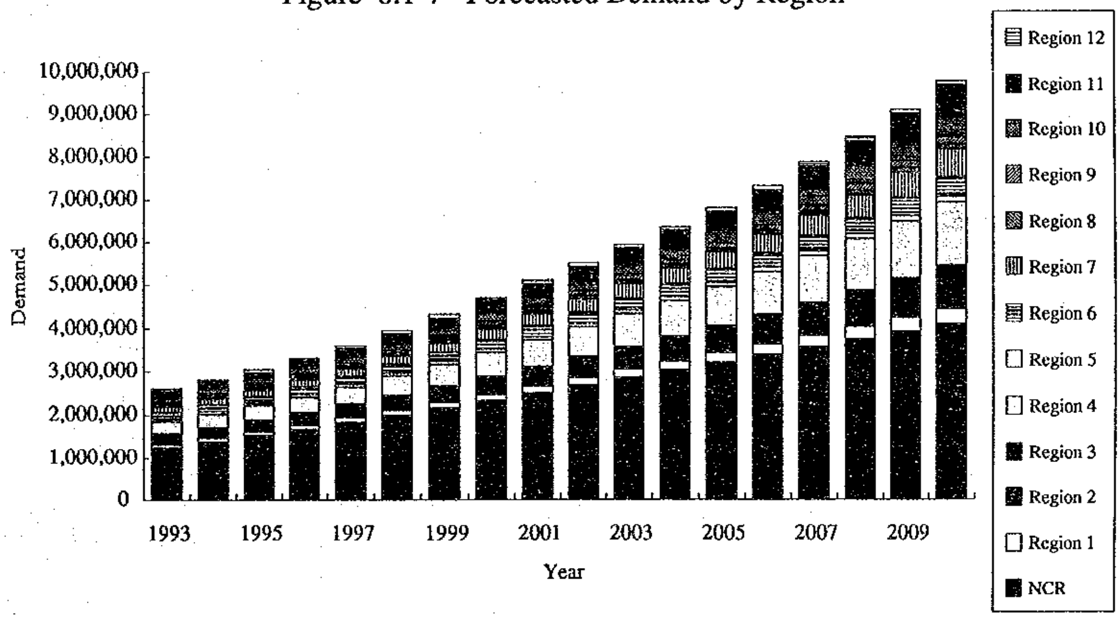
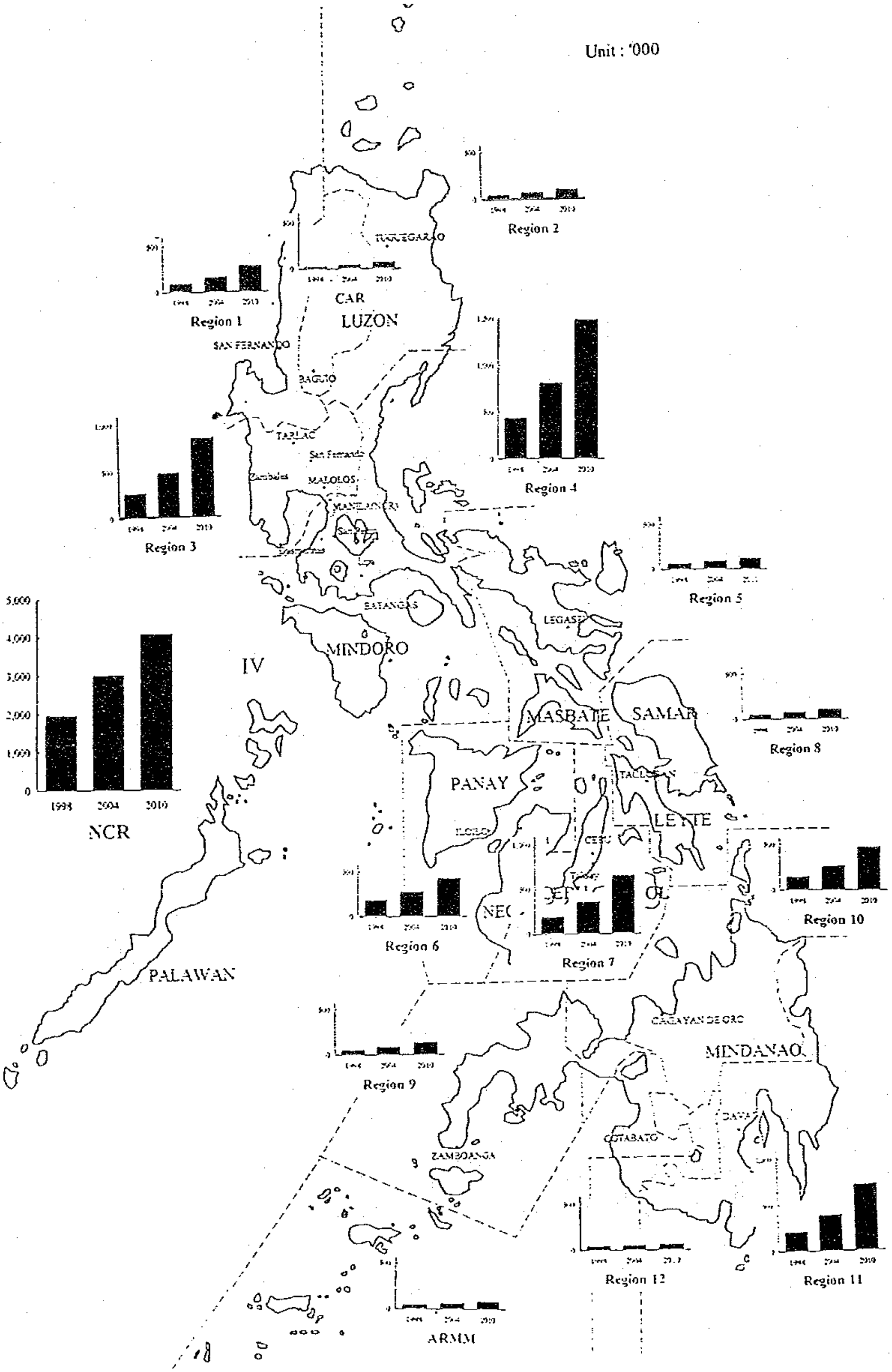


Figure 8.1-8 Forecasted Demand by Region



A summary of the forecasted demand and the demand density is shown in Table 8.1-1.

Table 8.1-1 Summary of Forecasted Demand and Demand Density

	Year	1994	1998	2004	2010
Demand	**Total**	**2,806,445**	**3,949,791**	**6,342,905**	**9,768,909**
	NCR	1,377,937	1,983,068	3,014,624	4,082,717
	Regional Area	1,428,508	1,966,723	3,328,281	5,686,193
Density	**Total**	**4.22**	**5.48**	**7.96**	**11.08**
(demand per 100 inhabitants)	NCR	15.84	21.04	28.95	35.44
	Regional Area	2.47	3.14	4.80	7.42

(4) Forecasted Demand by Municipality

The parameters needed to forecast demand by municipality are not available, except for population. Demand by municipality was therefore estimated by dividing regional demand by the population of each municipality. The population data was from the 1990 census.
Table 8.1-2 summarizes forecasted demand by region. The demand by municipality is shown in Appendix 8-3.

The demand by municipality was estimated by using the forecasted demand in each region based on their GDP growth rate. This assumption was used since there was no available data on the economic parameters of the municipalities. Thus, telephone density in each region was assumed to be evenly distributed in the provinces and municipalities.

A final evaluation of demand for the purpose of installing telephone lines should be determined by actual field surveys and other techniques and a feasibility study of the proponent.

Table 8.1-2 Summary of Forecasted Demand by Region

Year	1994	1998	2004	2010
Total	**2,806,445**	**3,949,791**	**6,342,905**	**9,768,909**
NCR	1,377,937	1,983,068	3,014,624	4,082,717
CAR	21,914	29,296	48,552	81,119
Region 1	70,472	96,748	167,646	290,060
Region 2	41,052	51,215	74,322	109,786
Region 3	197,496	275,464	487,329	858,470
Region 4	315,565	448,861	822,902	1,496,260
Region 5	57,374	71,750	96,248	132,665
Region 6	144,853	190,731	286,029	435,084
Region 7	137,926	199,557	364,665	661,335
Region 8	49,221	60,354	81,987	114,274
Region 9	46,257	60,493	91,642	140,623
Region 10	108,389	152,403	275,935	480,205
Region 11	154,014	220,028	399,934	721,558
Region 12	40,527	53,002	60,112	71,419
ARMM	43,448	56,821	70,979	93,335

8.2 Other Telecommunications Services

Telecommunication services are divided into four broad categories.

(1) Basic Telecommunication Services

(a) Connection and transmission (telephone, ISDN, telex, telegram, and packet switching, including mobile communication services)

(b) Leased lines

(2) Supplementary Services

(a) Switching supplementary services (call waiting, add on, alarm call, etc.)

(b) Network supplementary services (Intelligent network services)

(3) Subscriber End to End Service

(a) Information processing (e.g., data base)

(4) Terminal Equipment Service

(a) Telephone set, key telephone system, PABX, etc.

The first two are the network and carrier services that are analyzed in this study. From the point of view of facilities, (2)-(a) needs additional small software or a few additional facilities in the switching system. It is therefore excluded in this study. The last two are outside the function of a carrier network. This section discusses the following services.

(a) basic telecommunication services except telephone service (ISDN, Mobile communication service and Packet switching service),
(b) network supplementary services (Intelligent network services), and
(c) Leased line services.

Table 8.2-1 summarizes the service classifications and study areas.

Table 8.2-1 Telecommunication Service Classification

Class	Voice	Data	Visual
Basic service (connection and transmission)	○	○ packet ISDN, Mobile	
Switching Supplementary		----------	
Network supplementary	○	Intelligent Network	
Leased line	○		
Subscriber end to end (e.g., data base)		----------	
Terminal equipment		----------	

○ study area in this section
----- outside of study area

8.2.1 Forecasting Demand for Other Services

Historical records of telex, leased lines and telegram traffic are available for forecasting future trends. However, there is no historical data available for ISDN and intelligent networks (INs) in the Philippines. The study team, therefore, relied on data from other countries to forecast these two areas.

It is thought that except mobile telephone service, generally the demand for these services will arise from regular telephone subscribers. Therefore, the demand will be distributed in proportion to the number of telephone subscribers.

The two basic methodologies for forecasting demand were:

(1) extrapolation based on historical data, and

(2) estimating growth curve based on foreign country trends.

8.2.2 Outline of Forecasted Demand

Table 8.2-2 summarizes forecasted demand for other telecommunication services.

Table 8.2-2 Forecasted Demand for Other Telecommunication Services

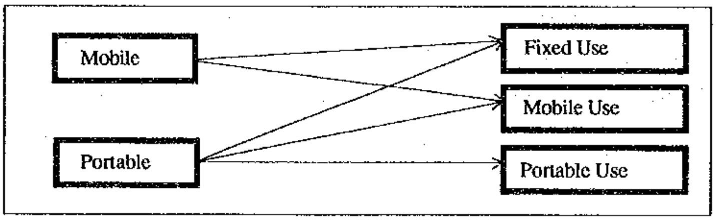
Service	Unit	1992	1998	2004	2010
Target telephone density	Per 100 inhabitants	1.4	3.8	6.3	10.0
Target telephone subscribers	Thousand	887	2,703	5,038	8,768
Cellular		55.9	183.0	557.0	1,520.0
Radio Paging		71.8	362.1	650.9	1,097.6
ISDN (N-ISDN)			0.08	155.5	1,572.5
ISDN (primary speed line)		assumed start year 1998	0.006	13.2	133.7
Toll Free	Thousand		2.0	26.1	84.2
VPN			2.6	33.7	108.7
CLASS			23.2	302.3	977.0
Leased Line			6.4	14.8	30.8
Packet Switch			5.5	14.6	14.6

Note: 1992 figures shows actual result
VPN: Virtual Private Network
CLASS: Customer Local Area Signaling Service

8.2.3 Cellular Mobile Telephone

(1) Forecasting method

There are two types of cellular mobile telephones, mobile and portable; they are used as shown below.



A large number of cellular mobile telephones are fixed. Portable cellular usage is expanding rapidly in the world. It is therefore suitable to forecast cellular mobile telephone demand on the basis of population.

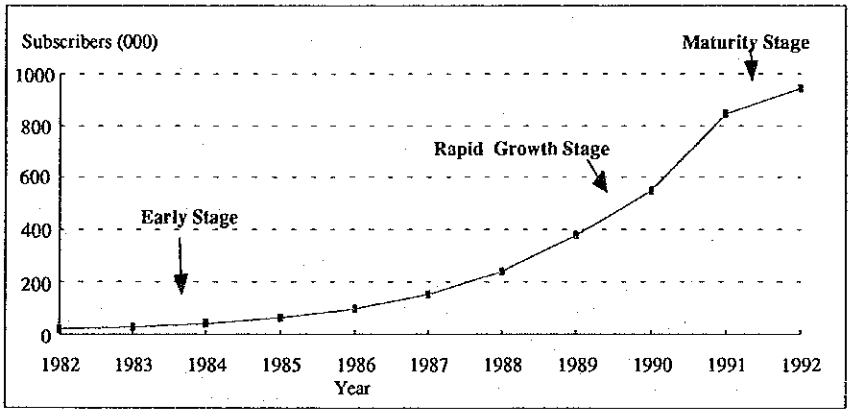
(2) Estimating number of subscribers

The future increase in subscribers is assumed to follow the logistic curve, as it did in Japan (Figure 8.2-1). In the Philippines, the number of cellular mobile telephone, is expected to increase rapidly because of the shortage of basic telephone services and a competitive mobile telephone market. The market will become saturated as the basic demand increase. The model is as follows:

$$Dt/Nt = K/(1+me^{-at}).$$

Mobile telephone usage is expected to reach 17 per 1,000 population in advanced countries by 2010. Table 8.2-3 shows the cellular mobile telephone penetration in various countries. Based on the values for the most advanced countries, we estimated the saturation level is to be K=0.07. The demand was calculated by adjusting the demand in 2010 to the target demand. The results are shown in Table 8.2-4 and Figure 8.2-2.

Figure 8.2-1 Growth in Cellular Telephone Usage (Japan)



Source: NTT (subscriber: NTT subscriber)

Table 8.2-3 Cellular Mobile Telephone Penetration

(As of December 1991)

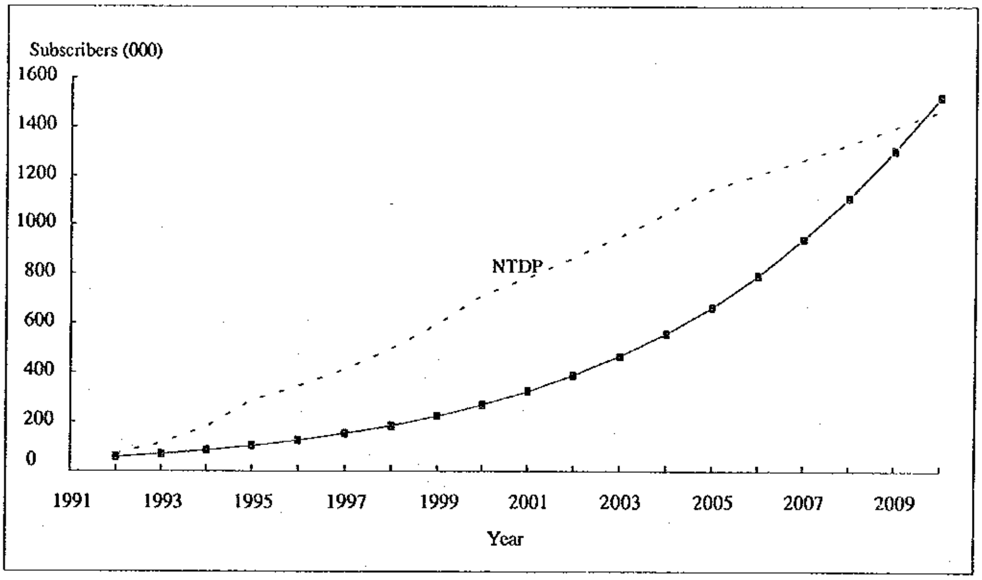
Country	No. of Subscribers	Subscribers Penetration	Country	No. of Subscribers	Subscribers Penetration
Sweden	564,060	6.70	Andora	380	0.62
Finland	276,110	5.80	United Germany	469,280	0.60
Norway	227,240	5.40	Malta	1,800	0.50
Iceland	12,240	5.10	France	276,110	0.48
Denmark	168,900	3.20	Belgium	46,950	0.47
Canada	812,903	3.05	Israel	21,350	0.45
Hong Kong	168,420	3.00	South Korea	143,800	0.33
Switzerland	164,080	2.90	Spain	91,890	0.23
USA	7,557,148	2.60	Thailand	124,600	0.22
Singapore	66,000	2.40	Oman	3,300	0.22
United Kingdom	1,205,000	2.10	Luxemburg	830	0.22
United Arab Emirates	26,070	1.58	Chile	21,500	0.16
Austria	103,620	1.35	Saudi Arabia	18,000	0.12
Brunei	3,500	1.30	Portugal	10,450	0.10
Bahrain	6,240	1.25	Turkey	43,310	0.07
Japan	1,089,160	0.88	Argentina	20,000	0.06
Italy	496,220	0.86	Philippines	33,000	0.05
Taiwan	168,000	0.84	Hungary	5,630	0.05
Macao	3,900	0.83	Venezuela	8,000	0.04
Ireland	29,080	0.81	Peru	4,700	0.02
Netherlands	109,450	0.73	Indonesia	22,100	0.01
Malaysia	129,060	0.71	Sri Lanka	1900	0.01
Qatar	3,300	0.70	Pakistan	4,770	0.004
Cyprus	4,470	0.63	China	37,100	0.003
			Average Penetration Rate:		1.24

Note; 1. Subscriber Penetration is the number of cellular subscribers per 100 population.
2. Data based on "Cellular Business/The World Report", May 1992 issue, obtained from PLDT

Table 8.2-4 Estimated Number of Subscribers

Year	1993	1994	1995	1996	1997	1998	1999-2004	2005-2010
Subscribers	69	84	103	125	151	183	557	1,520

Figure 8.2-2 Estimated Number of Subscribers



8.2.4 Radio Paging

Radio paging service began in 1975. It is now a popular service. Paging services now supply various features from simple tone messages to character messages. However, historical data on the number of subscribers is incomplete. Figure 8.2-3 shows the correlation between radio paging subscriber penetration and telephone subscriber penetration in Asian countries.

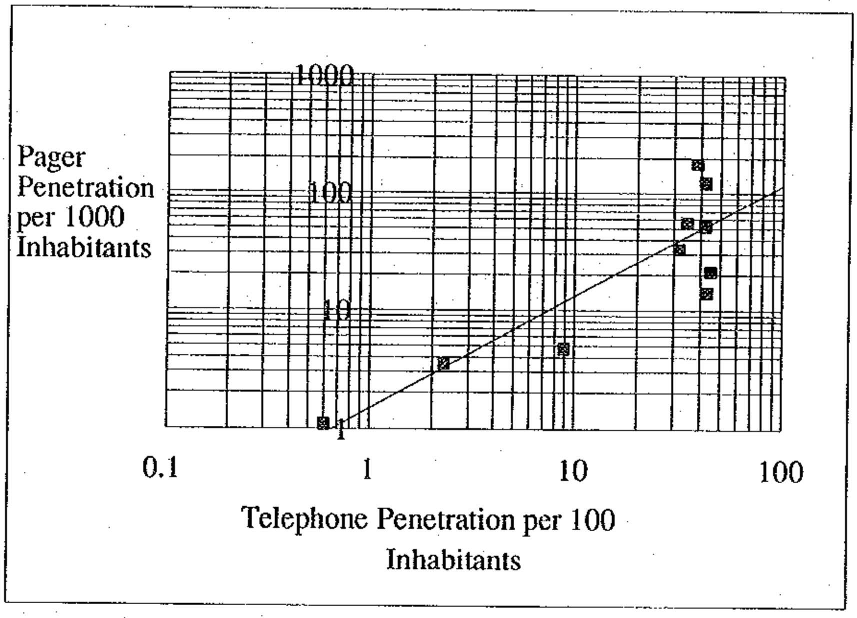
Correlation ratio:	0.861687
Slope:	0.930837
Interception point:	0.383589 in Log_e

The following regression formula was derived

Log D = 0.383589 +0.930837 Log P, where
D is pager penetration (per 1000 inhabitants), and
P is telephone penetration (per 100 inhabitants).

Forecasted demand for radio paging service in the Philippines based on this formula is shown in Table 8.2-5. As of December 31, 1992, the number of radio paging service subscribers in the Philippines was about 72,00, which is about 57 % of the demand derived from this regression formula.

Figure 8.2-3 Correlation between Radio Paging Subscriber Penetration and Telephone Subscriber Penetration in Asian Countries



Source: NTT data

Table 8.2-5 Forecasted Demand for Radio Paging Service in the Philippines

year	1992	1998	2004	2010
Target telephone density (per 100 inhabitants)	1.4	3.8	6.3	10.0
Radio paging penetration (Per 1000 inhabitants)	2.0	5.0	8.2	12.5
Demand (thousand)	126.4	362.1	650.9	1,097.6

8.2.5 ISDN (Integrated Services Digital Network)

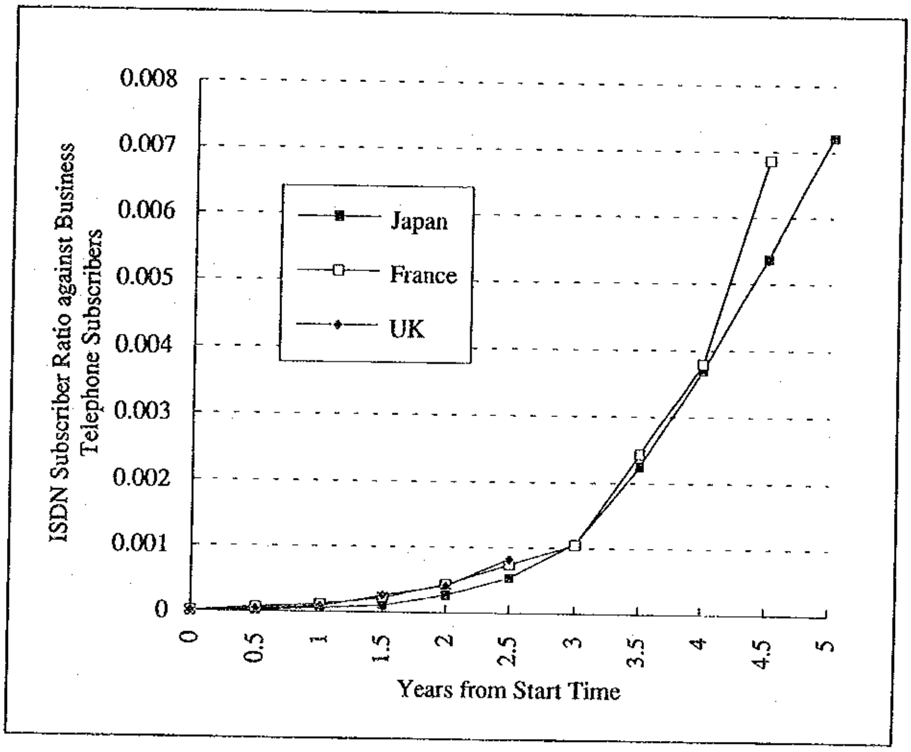
ISDN is now used mainly for data communications (approximately 80%) in Japan. Users are shifting to ISDN service from packet switching networks, leased lines (approximately 20% of ISDN users) and telephone networks (approximately 30%). It is expected that ISDN service will be available to at least 60% of business customers in the future.

ISDN has the ability of handling data communication services (including packet switching and leased lines for data communication), and visual communication services (video conference, picture phone, facsimile transmission, and so on). There will be no separation of record carriers and telephone carriers who have ISDN in future networks. In the future telecommunications society, exclusive packet switching networks may disappear.

Ratio of N-ISDN (Narrow band ISDN) lines to business telephone subscribers in Japan, France and the UK are lotted in Figure 8.2-4.

In the Philippines, N-ISDN service is assumed to become available in 1998 in this study. Demand is assumed to grow at the average growth curves in Figure 8.2-4. The maximum demand for N-ISDN is projected to reach_60% of business telephone subscribers. A suitable method for forecasting future N-ISDN demand is to use the logistic formula, because it has a saturation parameter.

Figure 8.2-4 N-ISDN Line Ratio against Business Telephone Subscribers in Japan, France, and the UK



The formula is:

$D = K/(1+me^{-at})$ (Standard Logistic Formula), where

D is demand ratio against business telephone subscribers, < 1 or =1, K is 0.6: (Maximum ratio against business telephone subscribers),

m is a constant,

a is a constant > 0, and

t is the time since implementation

The constants derived by regression analysis based on the average growth curves of Japan, France, and the UK are as follows:

m is 21540.18492, and

a is 1.20032054.

The correlation ratio is 0.9916488.

The study team calculated N-ISDN demand against business telephone subscribers using the logistic formula. The ratio of business telephone subscribers against total telephone subscribers ranges from 20% to 40%. (ITU data: Japan 30%, USA 30%, the UK 23%, Singapore 33%, Thailand 34%, Malaysia 28%). Study team used 30% as the average ratio of business telephone demand. The maximum ratio of N-ISDN demand against total telephone demand is therefore 18% (30% x 60%). The projected demand for N-ISDN in the Philippines is shown in Figure 8.2-5. The tariff for N-ISDN is assumed to be about the same as Japan; where the basic monthly charge is about twice that of an analog telephone line, because an ISDN line supplies 2 speech channels, and the calling charge is about the same as for a normal telephone call.

Figure 8.2-5 N-ISDN Demand Against Total Telephone Subscribers

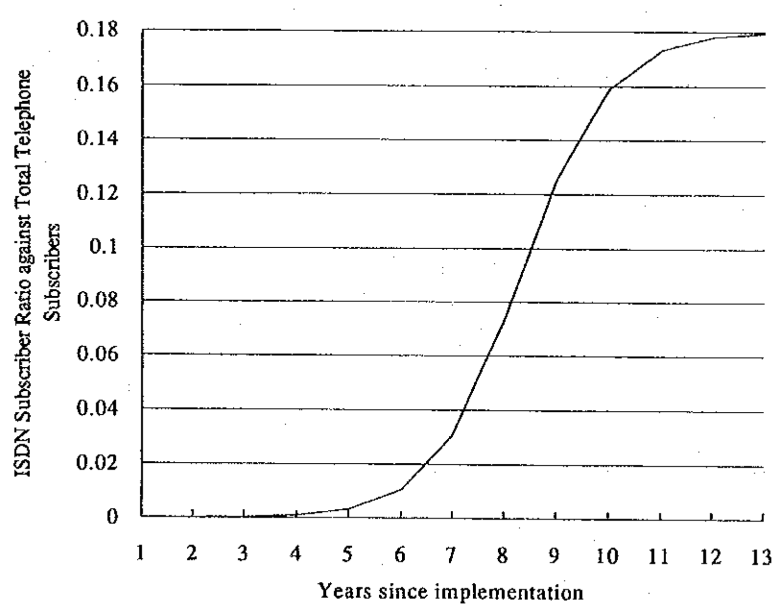
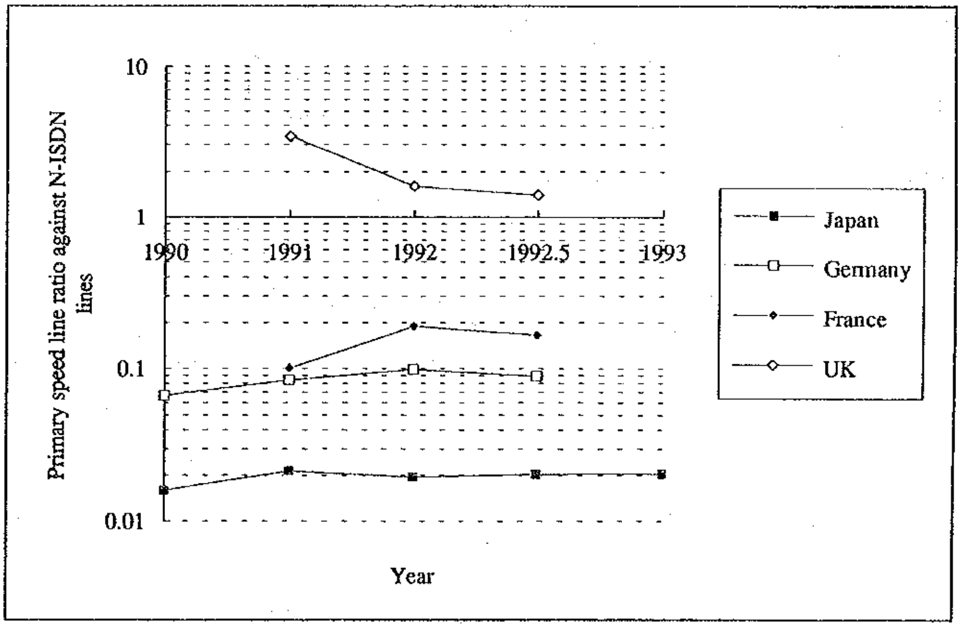


Figure 8.2-6 shows the ratio of ISDN primary speed lines against basic speed (N-ISDN) lines for four countries. It shows that the ratio varies between countries and that the ratio is nearly fixed in each country except the UK, where the primary speed line service is faster than that of N-ISDN. (The average ratio of primary speed lines to N-ISDN lines is 2% in Japan, 8% in Germany, and 15% in France.) For the primary speed line demand forecast in the Philippines, the study team used the average ratio (8.5%) for Japan, France and Germany.

Figure 8.2-6 Ratio of Primary Speed Lines against Basic Speed Lines (N-ISDN)



The forecasted demand for ISDN in the Philippines is shown in Table 8.2-6, assuming in the condition that the service begins in 1998.

Table 8.2-6 Forecasted Demand for ISDN Service in the Philippines

(Assumed to start in 1998)

Year	1998	2004	2010
Target telephone subscribers ('000)	2,703	5,038	8,768
Ratio of N-ISDN demand to total telephone subscribers	0.0000277	0.0309	0.179
N-ISDN demand ('000)	0.075	155.5	1,572.5
Primary speed Line demand ('000) (0.085 x N-ISDN)	0.006	13.2	133.7

8.2.6 Intelligent Network

Intelligent network services are provided through centralized management computer systems (NSSP: Network Service Support Point) and network control computer systems (NSP: Network Service Control Point) instead of adding functions to each switching system. Intelligent networks are expected to provide various services in the future; the final target is providing to customers the ability to customize their own service package by registering each desired program into the centralized management computer center. The advantages of an intelligent network are:

(a) faster implementation (software is added at the central management center, rather than at each switching system);
(b) lower costs (same reason as (a));
(c) more sophisticated charging, connection, and other services (by controlling the network instead of modifying each switching system; including toll free service, virtual private network (VPN), CLASS, automatic alternative billing(AAB)); and
(d) easier to operation and maintenance (through centralized service facility).

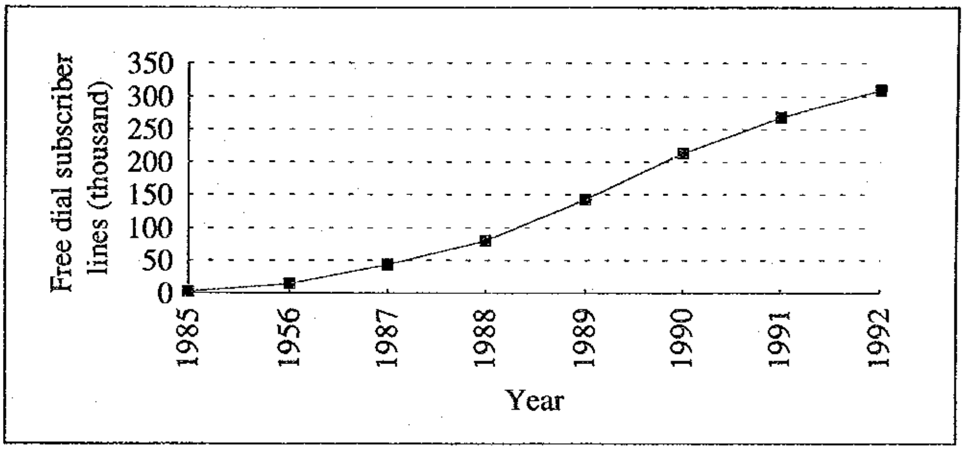
America, Europe, and Japan are introducing these kind of facilities in their network with CCS No. 7. Typical services include:

- toll free ("800" service in America, "free dial" service in Japan),
- VPN (Virtual Private Network),
- CLASS (Custom Local Area Signaling Service),
- special charge service ("900" in America, "dial Q^2" in Japan).

(1) Toll Free (free dial)

The growth of NTT's free dial service in Japan is shown in Figure 8.2-7. The historical curve is close to a straight line. Since the use of toll free service is in proportion to the number of telephone subscribers, The study team used the growth rate in Japan: 0.0007387, which was derived from regression analysis. The formula we used to forecast demand is as follows:

Figure 8.2-7 Free Dial Service Lines in Japan



Source: NTT data

$D = 0.0007387 \times T$, where

D is demand ratio against telephone subscribers,

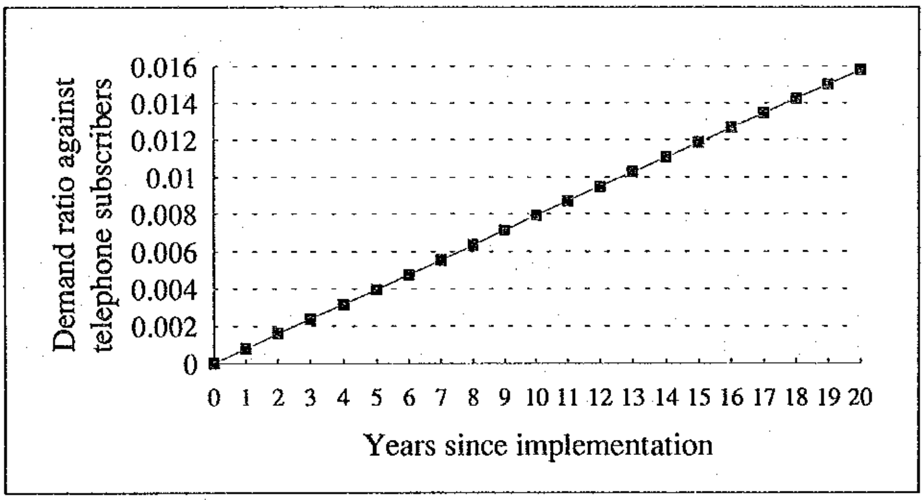
T is time from the year of implementation,

Growth rate is 0.0007387.

The correlation ratio is 0.980041847

Figure 8.2-8 shows the result of applying this formula to the Philippines.

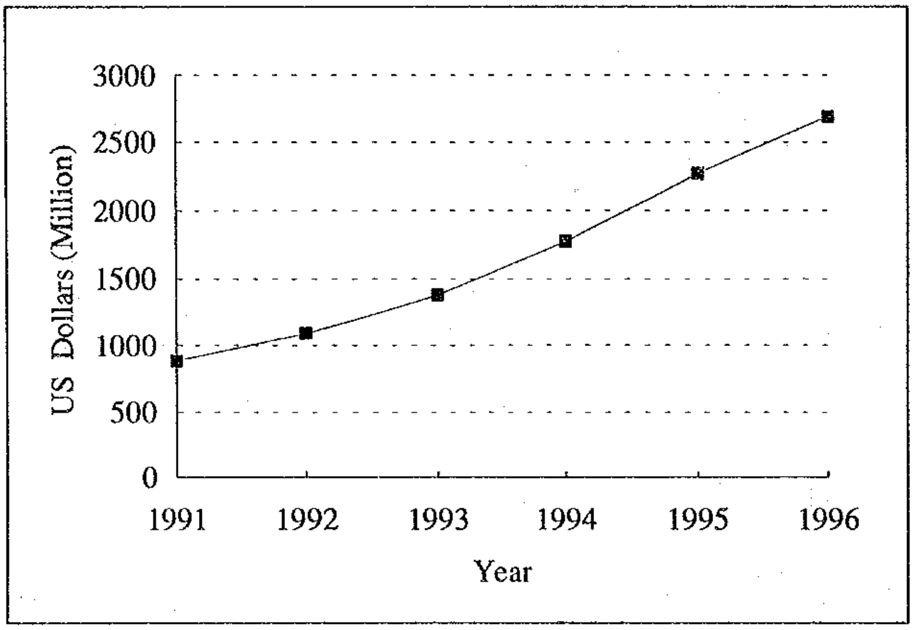
Figure 8.2-8 Forecasted Demand for Toll Free Dial Lines Against Telephone Subscribers in the Philippines



(2) Virtual Private Network

Figure 8.2-9 shows virtual private network revenue in the US

Figure 8.2-9 Virtual Private Network Revenue in US



The revenue and volume are both about 1% of the total revenue and volume of telecommunications in the US The growth rate is about 0.0009535 as derived by regression analysis.

The demand for VPN can be approximated with the following formula:

$D = 0.0009535 \times T$, where

D is demand ratio against telephone subscribers,

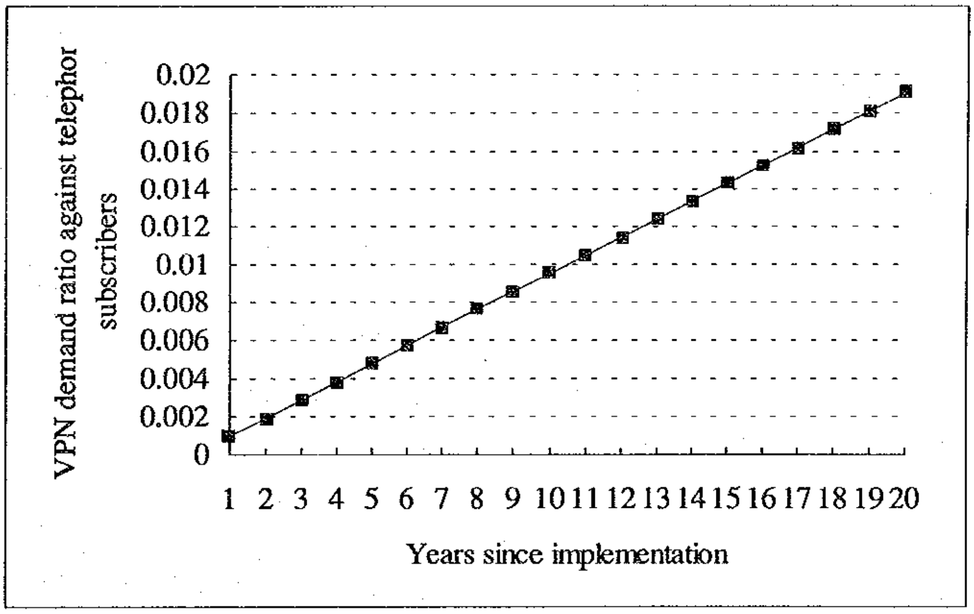
T is time from year of implementation,

Growth rate is 0.0009535.

The correlation ratio is 0.98487.

Figure 8.2-10 shows result of applying this formula to the Philippines.

Figure 8.2-10 Forecasted Demand for Virtual Private Networks against Telephone Subscribers in the Philippines



(3) CLASS (Custom Local Area Signaling Service)

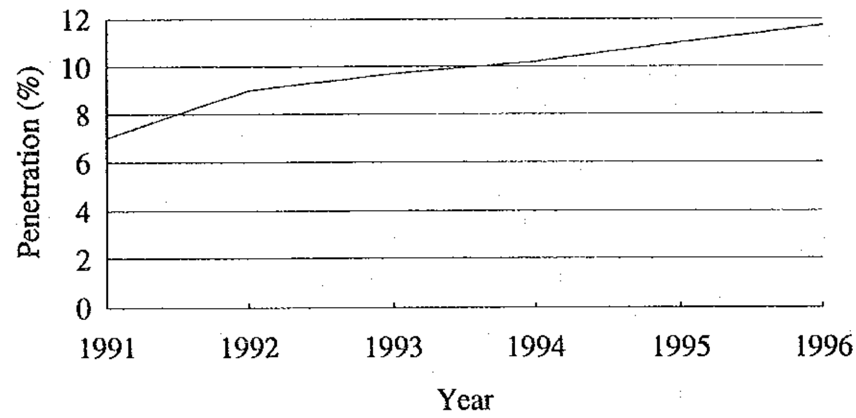
CLASS uses the transmission of the calling party identification using CCS NO. 7 as the same function as one used in ISDN. The services include:

(a) calling number delivery,
(b) calling number blocking,
(c) continuous redial/repeat dial/automatic recall,
(d) distinctive ringing/priority call,

(e) call return/automatic callback,
(f) call trace/customer oriented trace,
(g) select call/call screening,
(h) selective call rejection, and
others.

Figure 8.2-11 shows forecasted penetration of CLASS in the US.

Figure 8.2-11 CLASS Subscriber Penetration in the US



The US growth curve approximates a straight line and the growth rate is 0.857 % from the regression analysis. The formula is :

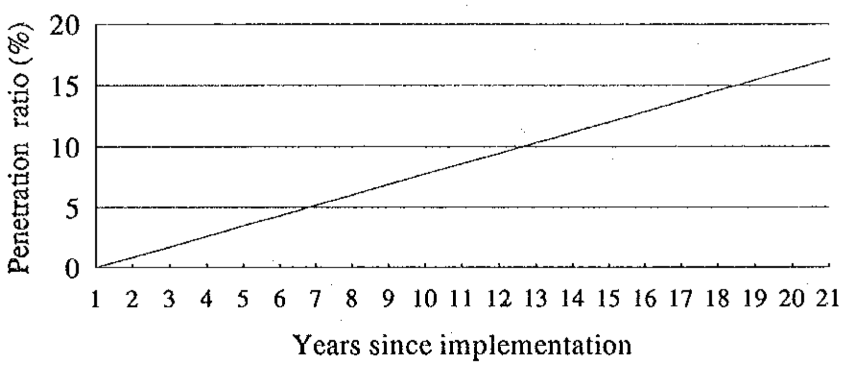
D = 0.0085714 x T, where

D is CLASS penetration ratio against telephone subscribers, and
T is Time from the year of implementation.
Growth rate is 0.0085714.

The correlation ratio is 0.968986

Figure 8.2-12 shows the results of applying this formula to the Philippines.

Figure 8.2.12 CLASS Subscriber Penetration Forecast in the Philippines



(4) Summary of Intelligent Network

The forecasted demand for intelligent network services, assuming that they are implemented in 1998, is summarized in Table 8.2-7. The largest demand is for CLASS.

Table 8.2-7 Forecasted Demand for Intelligent Network Services

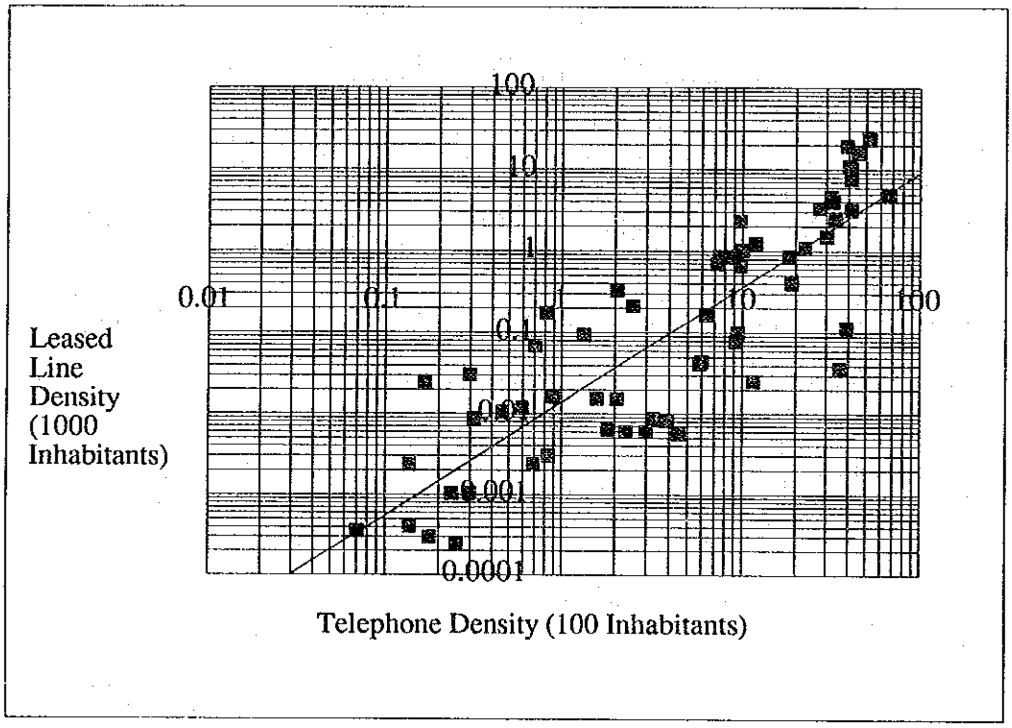
Year	1998	2004	2010
Target telephone subscribers ('000)	2,703	5,038	8,768
Toll free demand against telephone subscribers	0.0007387	0.0051711	0.0096034
Toll free forecasted demand	1,997	26,053	84,192
VPN demand against telephone subscribers	0.0009535	0.006674	0.0123955
VPN forecast demand	2,578	33,628	108,678
CLASS demand against telephone subscribers	0.008571	0.06	0.111429
CLASS forecasted demand	23,170	302,296	976,957
Total demand for IN services	27,745	361,977	1,169,827
Intelligent Network line ratio against telephone subscribers	0.01026	0.07185	0.13343

There are other services in intelligent network services. Especially, information providing service with special charge ("900 service" in America, "Dial Q^{2}" in Japan) is famous, but it is tightly controlled, so it is difficult to forecast demand accurately. Others are not so popular in the world now.

8.2.7 Leased Line

The historical data on leased lines provided by NTC is insufficient for projecting trends, so it is difficult to forecast demand based on it.
Figure 8.2-13 shows the correlation between leased line density (per 1000 inhabitants) and telephone density (per 100 inhabitants) in the world.

Figure 8.2-13 Correlation between Leased Line Density and Telephone Subscriber Density (Worldwide)



(Source: ITU data)

Correlation ratio: 0.854715
Slope: 1.4014914
Interception point: -4.269447 in Log_e

The Team decided the following regression model from this figure:

$Log_e D = - 4.269447 + 1.4014914 \times Log_e P$, where
D is the leased line density per 1000 inhabitants and
P is the telephone subscriber density (per 100 inhabitants).

The result of applying this formula to the Philippines are shown in the Table 8.2-8.

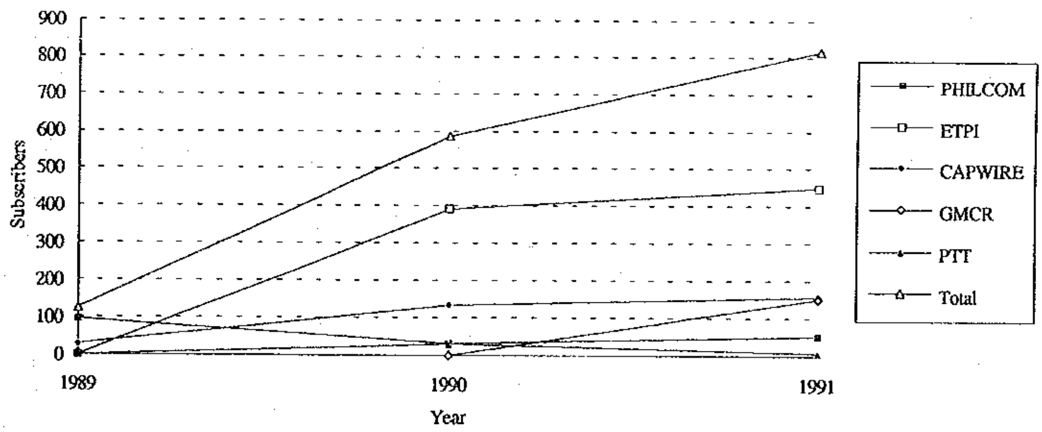
Table 8.2-8 Projected Leased Line Demand in the Philippines

Year	1992	1998	2004	2010
Telephone target density (Per 100 inhabitants)	1.4	3.8	6.3	10.0
Leased line density (Per 1000 inhabitants)	0.0224	0.0891	0.185	0.350
Demand for leased lines	1,411	6,428	14,779	30,844

8.2.8 Packet Switching Service

Figure 8.2-14 shows the number of packet switching network subscribers in the Philippines.

Figure 8.2-14 Number of Packet Switching Network Subscribers in the Philippines



Source: NTC

These are insufficient historical data to forecast future demand, because the time frame is too short to determine the trend.

Demand for packet switching service is increasing both in ISDN and in exclusive packet switching networks. Figure 8.2-15 shows the growth in the number of subscribers connected directly to exclusive NTT packet switching networks in Japan. The decreasing after 1990 means that some subscribers shifted to ISDN (The total number of subscribers to packet switching networks including connection through the telephone network, is *about ten times more: 363,661 in total as of September, 1992.).*

Figure 8.2-15 Number of Subscribers Directly Connected to Packet Switching Networks in Japan (NTT)

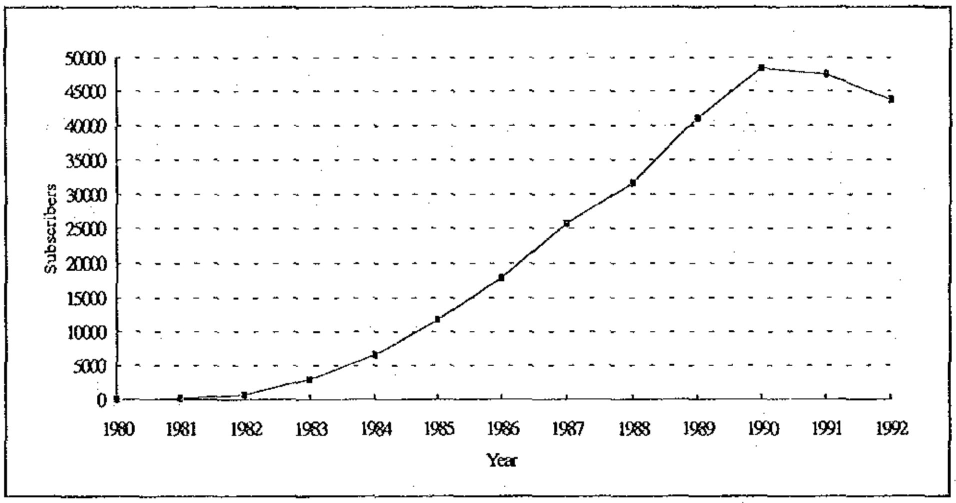
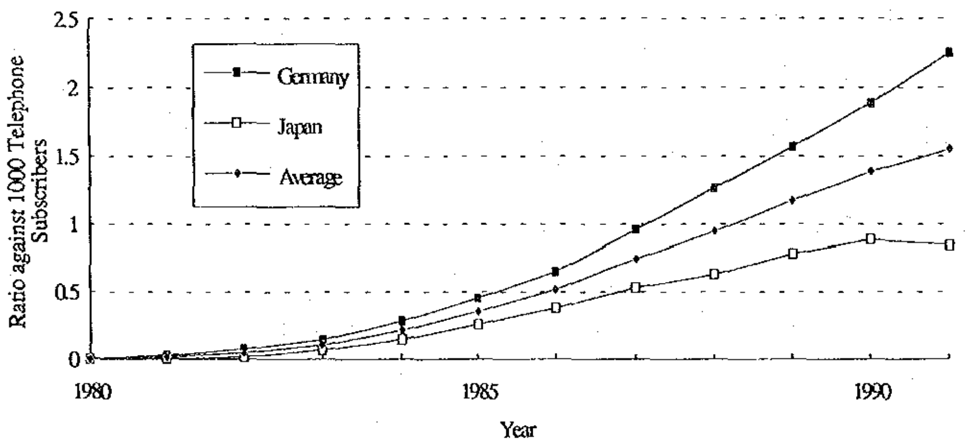


Figure 8.2-16 shows the growth curve for the packet switching network subscribers against telephone subscribers in Japan and Germany.

Figure 8.2-16 Packet Switching Network Lines against Telephone Subscribers in Japan and Germany



Source: NTT

The average growth curve becomes almost straight after a few years of operation. The growth rate is 0.0001439 as derived from regression analysis.

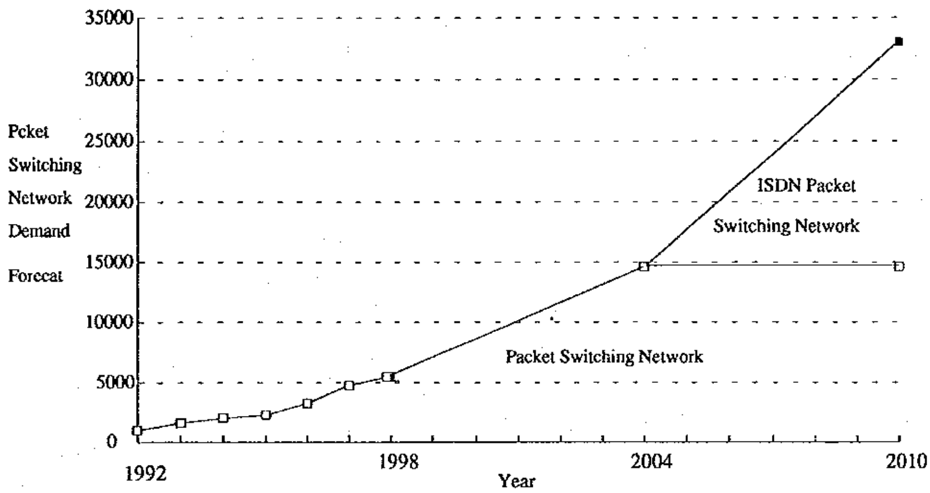
The following regression model was derived based on the packet switching subscribers ratio against main telephone lines in the Philippines:

D = 0.00103178+0.0001439458 x T, where
- D is the packet switching network demand ratio against telephone subscribers, and
- T is the number of years since 1992.
- The packet switching subscribers ratio against telephone subscribers in 1992 is 0.00103178.
- Growth rate of the packet switching network subscribers ratio against telephone subscribers is 0.0001439458.

The correlation ratio is 0.965489.

The forecasted demand for packet switching networks in the Philippines is shown in Figure 8.2-17.

Figure 8.2-17 Forecasted Demand for Packet Switching Network in the Philippines



After 2004, demand will shift to ISDN, because it is assumed that ISDN service starts in 1998 and that ISDN packet switching network service starts in 2004. After 2004, demand for exclusive packet switching network will level off. Table 8.2-9 shows the demand for packet switching networks in the Philippines.

Table 8.2-9 Forecasted Demand for Packet Switching Networks in the Philippines

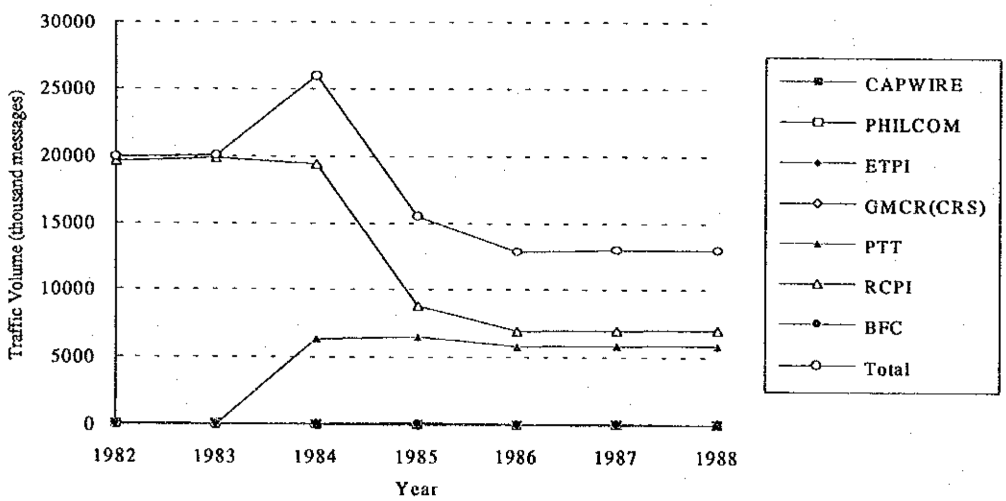
Year	1992	1998	2004	2010
Telephone target density (Per 100 inhabitants)	1.4	3.8	6.3	10.0
Packet switching network demand ratio against 1000 telephone subscribers	1.176	2.039	2.903	3.767
Total demand	928	5,513	14,624	33,025
Exclusive packet switching network demand		5,513	14,624	14,624
ISDN packet switching network demand			0	18,401

8.2.9 Other Services

(1) Telegram

The historical data of telegram traffic in the Philippines is plotted in Figure 8.2-18.

Figure 8.2-18 Telegram Traffic in the Philippines (messages)



Source: NTC

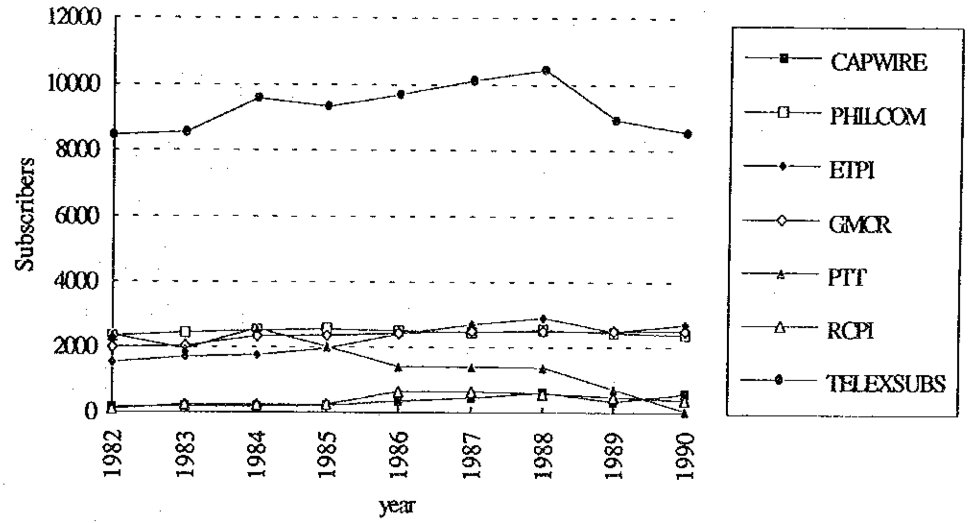
Since telegram traffic is decreasing as telephone and other various services are increasing, telegram service is excluded from this report.

(2) Telex

Since telex service is being replaced by new services such as facsimile and data communication. Forecasting demand is no longer necessary for facility planning purposes. Telex services are therefore included in the packet switching network forecast.

Figure 8.2-19 shows the number of telex service subscribers in the Philippines.

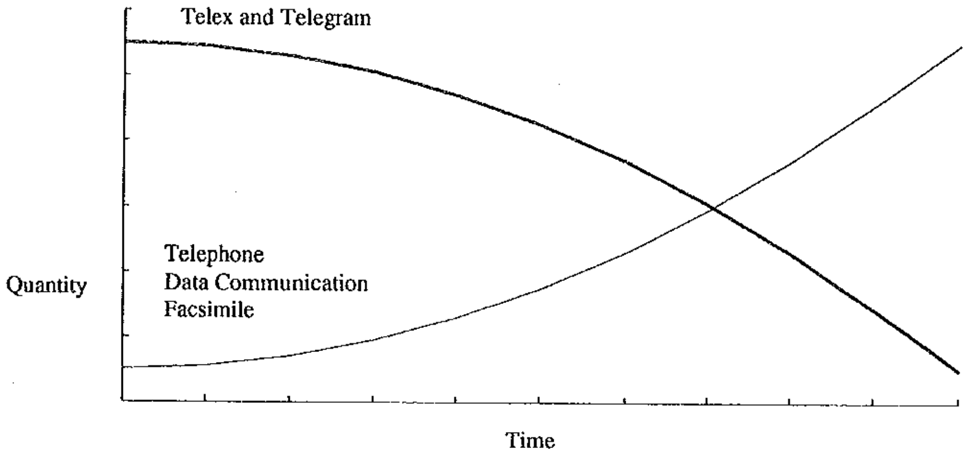
Figure 8.2-19 Telex Subscribers in the Philippines



Source: NTC

The decrease in these services in relation to the increase in facsimile and data communication services is shown in Figure 8.2-20.

Figure 8.2-20 Projected Trend in Telex and Telegram Service Volume



(3) Others

Facsimile users in the Philippines primarily use telephone networks. After ISDN is introduced, it will be a more attractive network for facsimile, as it is in Japan. Therefore, facsimile network demand is excluded from this study.

CHAPTER 9

GUIDELINES OF THE PLAN

CHAPTER 9 GUIDELINES OF THE PLAN

This chapter describes the development objectives for the telecommunications sector. The planning period encompassed by the study is from 1993 to 2010. The periods of this plan are divided into three phases.

The phases are:

(1) Phase A: (1993 - 1998),

(2) Phase B: (1999 - 2004), and

(3) Phase C: (2005 - 2010).

Targets have been set for the following objectives for each project phase:

(1) telephone supply target to meet demand and provision of local telephone exchange service to all municipalities,

(2) interconnection plan of the networks,

(3) digitization plan of networks,

(4) improvement in telephone service quality,

(5) introduction of non-voice and new services, and

(6) operation and maintenance plan.

The following guidelines were used in selecting the targets and in determining the desired attainment dates:

(1) support the Medium-Term National Development Plan,

(2) support national policy and balance the need widely to distribute services against the need to provide adequate services to business,

(3) be economically feasible,

(4) be financially viable, given that government policy requires the telecommunication sector to be financially self-reliant and dependent on private-sector initiative as the main source of growth,

(5) be consistent with government priorities, and

(6) be measurable, given the need to monitor progress against the implementation target dates.

9.1 Telephone Supply Target

Public switched telephone networks (PSTNs) are the mainstay of modern telecommunications. The targets for higher telephone density and more extensive network coverage were set based on the present status of telecommunication facilities and demand forecasts.

9.1.1 Telephone Main Station Density

Telephone main station density, defined as the numbers of telephone main stations (lines) per 100 inhabitants, is used to gauge the development of telephone networks. There were about 600,000 pending applications for new telephone installations in Metro Manila and 200,000 in the provinces as of March 1993.

To meet this demand, main telephone density is planned to be increased from 1.4 per 100 inhabitants in 1992 to 3.8 by 1998, 6.3 by 2004, and 10.0 by 2010. By the end of 2010, all demand except that in unserved areas far from the center of municipalities should be met. The targets of telephone density are listed in Table 9.1-1.

Table 9.1-1 Targets of Telephone Density

Year	Density	Main Stations (000)	Demand (000)
1992	1.4	887	
1998	3.8	2,703	3,950
2004	6.3	5,038	6,343
2010	10.0	8,768	9,769

9.1.2 Local Exchange Telephone Service Penetration

The development of the local telephone network is the next step in the expansion of telephone service from the Pubic Call Office (PCO) level. As of yearend 1992, only 329 out of 1,597 cities and municipalities had local exchange telephone service, a 20.6% coverage ratio. Expansion plans by the government, PLDT, and other private companies through 1996 will provide an additional 287 municipalities with local exchange service, increasing the coverage ratio to 38.5%.

The implementation schedule has specific coverage ratio targets for each phase:

Year	Coverage Ratio	Served Municipalities
1998	45%	719
2004	75%	1,198
2010	100%	1,597

The order in which areas will be developed is determined as follows:

- existing and planned municipalities,
- NCR,
- MUC and KDC, and
- other municipalities.

Priority within "other municipalities" is determined by population size. The list of all municipalities with supply over demand ratio is shown by area in Table 9.1-2.

Table 9.1-2 Supply Over Demand Ratio

Year	NCR	MUC	KDC	Others
1998	90%	75%	65%	55%
2004	100%	80%	70%	55%
2010	100%	95%	85%	75%

These supply and service plans for each municipality are listed in Appendix 9-1.

9.2 Interconnection Plan of Network

Executive Order No. 59, "Mandating interconnection" and Memorandum Circular No. 9-7-93 "Implementing guidelines on the interconnection of authorized public telecommunications carriers" were promulgated in 1993.

As of July 1993, 30 local exchanges were still isolated from the PSTN; they are supposed to be interconnected by the NTP Tranche 1-1, 1-2, and 1-3 projects. Several remaining problems were identified by the study team from the questionnaires returned by exchange operators. They are:

(1) insufficient number of interconnection circuits,
(2) poor interconnection circuit quality, and
(3) obsolete exchange equipment.

Of these problems, insufficient circuits is the biggest. Determining the required number of interconnection circuits will be studied in this report (Chapter 11). The other two problems affect not only interconnection, but also the whole network; they are not addressed in this report.

9.3 Digitization Plan of Network

9.3.1 Toll Network

Digitizing the networks, including transmission facilities and toll exchanges, is a high priority. All analog toll switching systems and analog toll transmission facilities are to be replaced to digital by 1998 (Phase - A).

(1) Toll switching equipment
PLDT had 27 toll switching centers nationwide as of December 1992, 25 of which were digital. The two remaining analog switching systems were to be replaced in 1993. RTDP and NTP networks are composed of all digital.

(2) Transmission equipment
PLDT backbone network is a combination of analog and digital radio systems, 72% of which is already digital. An optical fiber cable system will be installed nationwide in X-6 program as a backbone network, upgrading the existing analog and digital networks. RTDP and NTP networks are composed of digital .

9.3.2 Local Networks

Digitizing of local switching systems has high priority in NCR areas and other major business centers. PLDT has plans to replace all SXS exchanges in NCR with digital exchanges in X-6 program. In this plan, SXS exchanges are to be replaced by the end of 1998 (Phase A), and analog SPC and XB-type exchanges are to be replaced by the end of 2004 (Phase B). The digitization ratio will be 91.6% by the end of Phase A and 100% by the end of Phase B.

9.4 Improvement in Telephone Service Quality

Using its authority to establish and prescribe rules, regulations, standards, and specifications, the NTC established national service performance standards for telecommunication services, particularly telephone, telegraph, and telex. Public operators are required to meet the minimum levels that have been set for service quality (Memorandum Circular No. 10-17-90 NTC).

The telephone service quality parameters include the following:

(1) Service Application Response: percentage of applications for service which were filled within four weeks
(2) Monthly Trouble Rate: number of subscriber trouble complaints per 100 main stations in service per month
(3) Effective Trouble Response: percentage of subscriber trouble complaints cleared within two days
(4) Monthly Billing Complaint Rate: number of subscriber billing complaints per 100 main stations
(5) Toll Transmission Quality of Service: percentage of toll transmission measurements not exceeding loss and noise limits
(6) Call Completion Rate: percentage of calls completed as measured during a busy hour.

Table 9.4-1 summarizes the targets for these performance parameters.

Table 9.4-1 Telephone Quality of Service Targets

Performance Parameter	1992	1998 Target	2004 Target
Applications for service satisfied within four weeks	47%	90%	98%
Monthly trouble complaints per 100 main stations	13	10	5
Trouble complaints cleared within two days	92%	94%	98%
Call completion rate (Toll Calls)	4.6 - 85.4%	40%	60%

Note: There are no targets for the billing complaint rate and toll transmission quality as their present status is unknown. Targets for these will be set by NTC in the future.
The toll completion rate is based on international incoming traffic to PLDT exchanges nationwide. (September 1992 data)

The service application response will be improved under a project in the telephone supply plan. The monthly trouble complaint rate will be improved through the supply plan, the digitization plan, and the replacement programs, which are discussed in Chapter 12. Trouble response is essentially a management issue. There are costs associated with securing adequate staff, equipment, and training; however, these costs are relatively small and may be considered negligible compared with other investments.

9.5 Introduction and Supply Plan of Non-telephone and Other New Services

In addition to basic telecommunications, future society will demand enhanced services based on advanced technology. This section describes the introduction of non-telephone and other new services in the Philippines through 2010.

9.5.1 Introduction Strategy

Non-telephone and other new services will generally be introduced in the areas where basic telephone networks already exist. As mentioned in section 8.2, demand for these services, except for mobile telephone service, will arise from regular telephone subscribers. Demand will therefore be distributed in proportion to the number of telephone subscribers.

9.5.2 Service Introduction and Supply Plan

(1) Cellular Mobile Telephone Service

Cellular telephone service technology is rapidly advancing. Usage is also growing rapidly; in some countries, cellular systems have been introduced in large numbers to supplement inadequate telephones systems or replace public telephones in large urban areas. Cellular telephones are expensive, so they have not yet become the mainstay telecommunications infrastructure in any country. As technological advances reduce costs and user demand increases, it may be possible to develop cellular telecommunication facilities at a cost comparable to that of conventional wired systems.

The facility plan presented here is based on today's conditions. Cellular telephones supply target are assumed to provide 90% of the yearly demand in the

Philippines by 2010. The coverage areas are assumed to be all of MUCs, 70% of KDCs, and major highways connecting MUCs and KDCs by the end of 2010.

(2) Radio Paging

Since radio paging is connected to telephone networks, a telephone network must exist before radio paging can be introduced. Demand is distributed in proportion to the number of telephone subscribers. The supply target is to provide 90% of the yearly demand by 2010. The introduction plan covers all MUCs and 70% of KDCs by the end of 2010.

(3) ISDN

PLDT plans to put pilot test ISDN service in Metro Manila and Cebu in 1994 and 1995 respectively. The introduction plan will be based on these pilot tests.

In this study, we assume that commercial ISDN service will begin in 1998. Since digital switching systems, digital transmission systems, and CCS No. 7 are essential for ISDN, the introduction is limited to those areas with digital switching systems. It is assumed that the demand will be distributed in proportion to the number of telephone subscribers. Initial implementation is assumed to occur in the NCR and in Cebu in 1998, followed by MUC by 2004 and KDC by 2010 with meeting all demand in the areas at the time. While smaller areas can be served with remote terminal equipment through digital transmission lines from a host digital switching center, we assume that introduction areas are at least at the level of the MUC and KDC by 2010. The remote terminal equipment is therefore not considered here.

The basic monthly charge will be about twice of a normal because of 2B + D in N-ISDN. The charge for speech service is generally equal to or a little more than 64 Kb/s telephone service, which is a world trend, because it is still a basic service like the telephone. The charge for primary speed service is expected to be less than 30 times than for telephone service on the basis of the cost.

(4) Intelligent Network

In an intelligent network (IN), the network routing logic is separated from the service intelligence. IN is the driving force for providing telecommunication service in the 21st century. It enables services to be created rapidly. Its deployment is open-ended: there is no limit to the kinds of services it can support or to sophistication of the services. With INs, the regular telecommunication services can be combined into tailor made packages that meet individual needs and that can be made available as and when required.

There are several IN services, including: toll-free dialing, premium rate service, virtual private network (VPN), automatic alternative billing, and custom local area signaling services (CLASS). An IN system can supply any combination of these services. The equipment required by an IN system depends on the traffic volume; system capacity depends on the type of equipment used.

The heart of an IN is NSSP (Network Service Support Point). This will be located in Metro Manila. NSP (Network Service Control Point) will initially be located in Metro Manila in Phase A and Cebu in Phase B. Another site will be added to the one in Metro Manila in Phase C.

The assumed implementation schedule is NCR and Cebu in 1998, MUC by 2004 and KDC by 2010 with meeting demand in the areas at the time.

(5) Leased Lines

Digital leased lines are becoming widely used for data communication. Since the transmission lines are accommodated in telephone circuits by dividing the channels into time slots, introducing leased lines into the areas without a telephone network is difficult. As noted in section 8.2, the penetration of leased lines is highly correlated to the number of telephone subscribers. The distribution of leased lines is generally proportional to the distribution of telephone subscribers. The facility plan in this study is based on the number of targeted telephone network circuits. The plan is assumed to meet demand.

(6) Packet Switching Network

This service is already popular in the Philippines. As businesses computerize, its use will grow quickly for data communications. ISDN is also attractive to packet switching users because of its high quality and speed; it is clear that some subscribers will shift to ISDN.

This study assumes that ISDN service will begin in 1998 and that ISDN packet switching service will begin in 2004 in NCR, MUC, and KDC. Therefore, some of the subscribers will shift to ISDN network after 2004. It is assumed that ISDN packet networks are introduced in NCR, MUC, and KDC by 1998, 46% of the other cities and municipalities by 2004, and 52 % by 2010, and will meet all demand.

9.6 Next-Generation Mobile Communication Systems

9.6.1 General

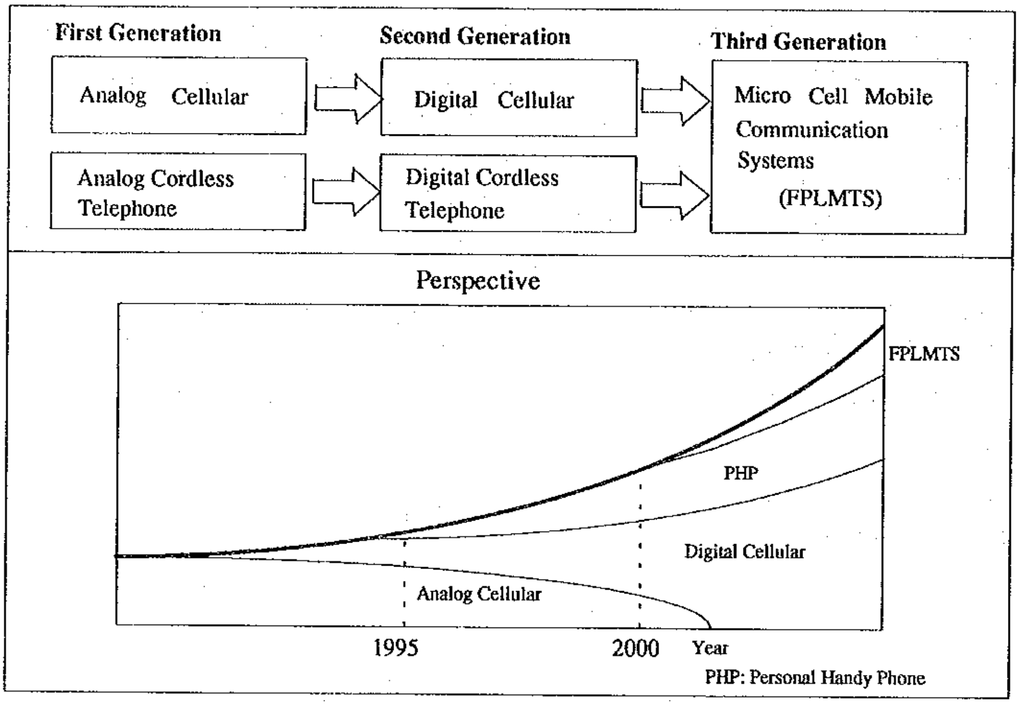
Second-generation mobile communication systems are now being developed. These digital cellular/cordless telecommunications systems use time division multiple access (TDMA) technology. They are expected to meet the rapidly growing demand for mobile communication services through the year 2000 and provide a bridge to future personal communication services (PCS).

The third-generation mobile communication systems, coming after the year 2000 are expected to use the FPLMTS (Future Public Land Mobile Telecommunication Systems) international standard. These third-generation systems are expected to meet the demand after 2000. Figure 9.6-1 shows this system evolution.

9.6.2 Demand for Mobile Communication Services

The demand for mobile communication services is growing rapidly. The growth rate of cellular subscribers in Japan is around 24% (1.71 million users in March 1993, up from 1.38 million in March 1992) and between 20% and 30% in the U.S.. This growth rate is expected to continue or increase since the cost of services and terminal equipment is likely to drop due to increased competition and the introduction of customer-owned and maintained equipment.

Figure 9.6-1 Mobile Communication System Evolution



The expected introduction of new digital systems will further increase the demand for mobile communication systems since the price of these services and terminals will be much lower than for cellular mobile telephone systems. Example of this digital cordless telecommunication system are PHP (Personal Handy Phone System) and PHS (Personal Handy-Communication System).

It is expected that mobile communication services will further continue developing until most of subscribers have radio access capability. To achieve this, research and development of third-generation mobile communication systems is necessary. The ITU is currently developing the standard FPLMTS. The target date is 1997 and service is expected to begin by 2000.

9.6.3 Second-Generation Systems

(1) Digital Cellular Mobile Telephone Systems (CMTSs)

Digital CMTSs are being introduced worldwide to meet the future demand for CMTS services. In the Philippines, PILTEL is planning to introduce TDMA technology. ISLA Communications is now applying to NTC to operate CMTSs in

Cebu and Metro Manila using the GSM standard. CMTSs are not enough to handle the demand for cheaper mobile communications. In response to this demand, PHP can offer high quality service for pedestrian users. It is also useful because it bypasses local loops.

(2) Mobile Satellite Communication Systems

Satellites are an effective way to expand the service areas of mobile communications. A dual mode terminal, one that handles both terrestrial CMTS and satellite will access CMTS services when terrestrial services are available and will access satellite services otherwise.

While mobile satellite communication systems do not have as large a capacity as terrestrial systems, they can provide nationwide service. An efficient mobile communication service can be offered by combining of terrestrial systems with satellite systems.

(3) Cordless Telecommunication Systems

The digital cordless telephone is the second-generation cordless telecommunication system. There are many digital cordless telephone systems, such as the Digital European Cordless Telecommunication System (DECT) and Cordless Telephone-2 (CT-2), which were both developed in Europe, and PHP in Japan. Characteristics of the PHP are as follows:

- the same compact, portable terminal can be used at home, in the office, and outdoors,
- it is easy to use and costs less than CMTSs,
- spectrum resources are used efficiently,
- the spectrum is sufficient to meet increased demand,
- security is enhanced,
- it is compatible with ISDN,
- it can use radio relay links, and
- it uses the 1.9 GHz band.

Access at home, in the office, or outdoors is achieved with a common air interface and the use of micro-cell service areas. The service coverage area of an outdoor base station has a radius of 100 to 200 meters. The micro cell allows the use of a low-power terminal (maximum 10 mw) and a low-power base station (indoor maximum 10 mw, outdoor maximum 500 mw).

Figure 9.6-2 PHP System

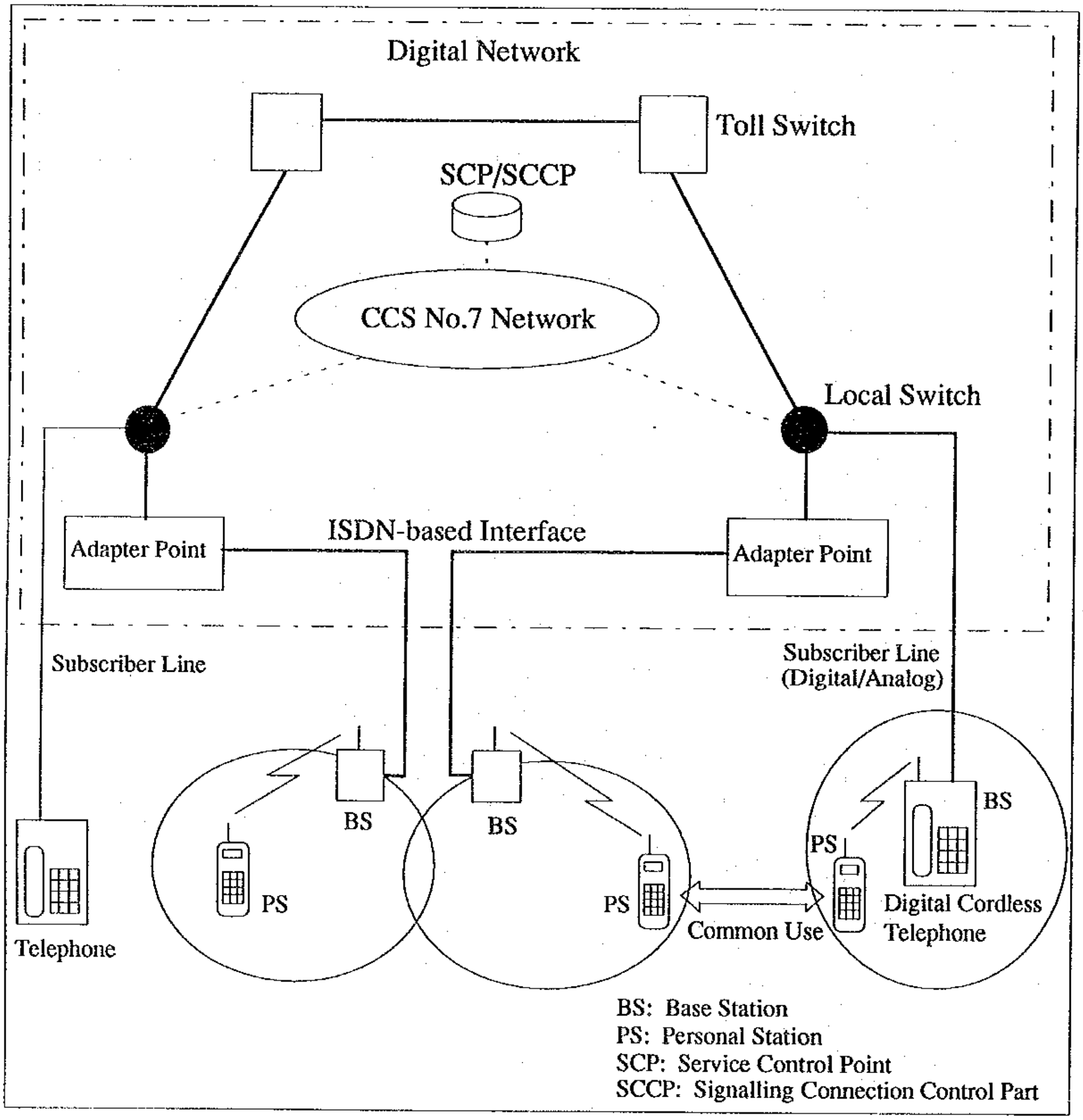


Figure 9.6-3 Concept of PHP Network

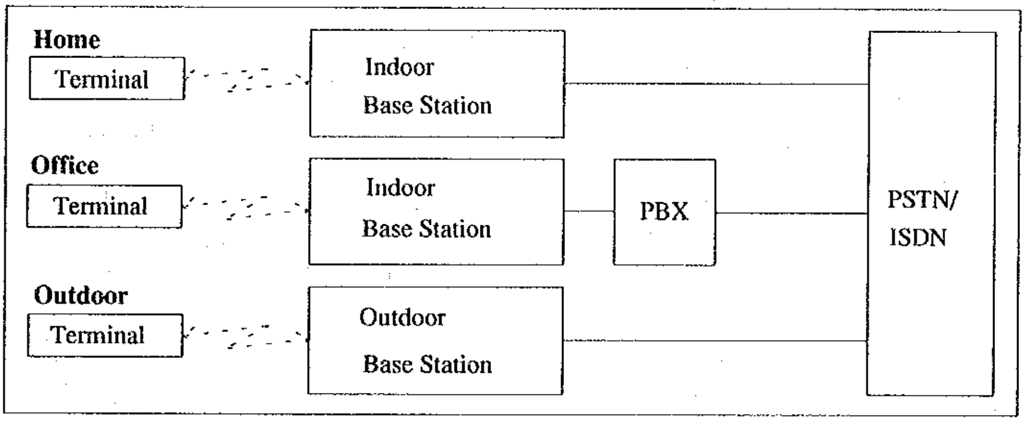


Table 9.6-1 Main Parameters and Features of PHP, DECT, and CT-2 and DECT

	PHP	DECT	CT-2
Frequency Band	1.9 GHz	1.9 GHz	800 MHz
Access Scheme	TDMA/TDD	TDMA/TDD	FDMA/TDD
Ch/Carrier	4	12	1
Carrier Spacing	300 kHz	1728 kHz	100 kHz
Transmission Speed	384 kbps	1152 kbps	72 kbps
Speech Codec	ADPCM (32 kbps)	ADPCM (32 kbps)	ADPCM (32 kbps)
Control Channel	dedicated common control channel	shared use of information transmission channel	shared use of information transmission channel
Incoming Calls	Yes	Yes	No
Hand over Function	Yes	Yes	No
Connecting Networks	Digital/Analog	Digital	Analog

Lower power requirements and digital technology enable smaller and cheaper terminals and base stations. It is expected that a terminal 150 g in weight and 100 cc in size will soon be manufactured. Its price will be $300 to $500. Additionally, the capacity and cost of the outdoor base station are remarkable; its size will be around 10 l (ten liters) with an antenna that is 15 to 100 cm high, and the cost will be $5,000 to $7,000. Figure 9.6-2 shows the PHP system, Figure 9.6-3 shows the concept of PHP network and Table 9.6-1 compares the main parameters and features of PHP with DECT and CT-2.

Digital transmission technology improves the quality of cordless telecommunications: the spectrum is used more efficiently and it is easier and cheaper to secure privacy of communications. Base stations (indoor/outdoor) can be connected directly to an ISDN with a dedicated control channel and also can be connected to a public switched telephone network (PSTN).
The PHP can handle outgoing and incoming calls to and from PSTNs and ISDNs since the location is registered in a database in the network. A hand over function is available for pedestrian users. Autonomous channel assignment and re-assignment of base stations and portable terminals is done within a slot-by-slot interference detection function.

Two different types of radio links are used for PHP services. They are utilized to carry the collected traffic to and from several base stations in a building or outdoors. PHP thus offers a transmission path for the last 100 meters and can be a strong competitor for copper cable systems. The capacity of each relay link is 150 to 200 voice channels.

9.6.4 Third-Generation Systems

FPLMTS are studied by ITU-R Section. One of the basic characteristics of FPLMTS is its use of micro-cell technology. Frequency bands of 1885-2025 MHz and 2110-2200 MHz are being considered. In Japan, the FPLMTS Study Committee was established in April 1993 to promote international standardization activities through ITU.

A key issue in FPLMTS development is common air interface technology. Also, important is the development of network technology, especially development of the intelligent network technology. To achieve multi-vendor compatibility, interface standardization is crucial.

Then ultimate personal communication system (PCS) would enable communication with anyone at anytime, anywhere, at reasonable cost. The key factors in achieving PCS is a personal number, intelligent network functions, and mobility. The integration of wireless communication services, which bring mobility to intelligent network services, is an indispensable element of PCS.

9.6.5 Introduction Plan

Telecommunication infrastructures can be consolidated by applying PHP technology. PHP systems provide several advantages over conventional wired telecommunication systems. Telecommunications facilities can be quickly introduced, the initial amount of capital required for facility installation is relatively small, facility maintenance and operation are relatively easy, there is reduced risk of excessive capital investment due to erroneous demand forecasts, and facilities can be modified to respond flexibly to changes in demand.

The PHP system is being considered for the Metro Manila area in the future, because of advantage mentioned above and its large system capacity, which is indispensable for Metro Manila whose population density is strikingly high.

9.7 Operation and Maintenance

The guidelines to improve and optimize the operation and maintenance work are described below.

9.7.1 Network Management System

In the Philippines, the telecommunication networks are operated and maintained by the respective carriers. While users must be provided efficient, secure, and reliable service, this is not easy in an interconnected, complicated network. It is important to ensure network reliability against failures and natural disasters, to take adequate countermeasures against abnormal traffic, and to keep information secure. The most suitable surveillance and control system for telecommunication networks is considered and examined (chapter 13).

9.7.2 Centralization of Maintenance Work

(1) Improved Maintenance

As telephone facilities rapidly expand nationwide, maintenance work at subscriber facilities will increase. The local telephone companies will have to employ additional maintenance staff in spite of their financial difficulties to maintain service quality. It is therefore necessary to reduce the load of maintenance work of the local telephone companies. For the purpose of the improvement of the maintenance work, a centralized maintenance center is considered and examined in this study.

(2) Spare Parts

In the Philippines, an almost all telecommunications equipment is imported. And there is a mix of old and new models in service. Maintenance work, especially repair, depends on spare parts availability, the measuring equipment, and the staff's abilities. It is necessary to purchase and retain several years worth of spare part. The facility plan developed here contains a sufficient level of spare parts.

9.7.3 Manpower Plan

To promote efficient operation and maintenance of the enhanced networks and facilities, an adequate number of personnel is needed in the newly constructed exchange offices, stations, maintenance centers, public call offices (PCOs), and so on.

A large number of additional staff personnel will need to be recruited yearly up to 2010. While it is not easy to recruit a large staff, especially engineers, technicians, and graduates of university/technical colleges, it is necessary. In this study, the number of additional personnel is computed on the basis of the facility plan up to 2010.

9.7.4 Training Plan

Almost all the local telephone operators in the Philippines handle their own staff training. However, they will have trouble training their expanded, operation and maintenance staffs by themselves. In this study, suitable training measures are considered and examined.

CHAPTER 10

TRAFFIC FORECAST

CHAPTER 10 TRAFFIC FORECAST

This Master Plan forecasts a large increase in the number of telephones installed through 2010. This chapter discusses the effect on traffic volume.

10.1 Methodology

Due to the difficulty of collecting historical traffic data which is confidential, the gravity model was used to forecast traffic volume. This model calculates the traffic volume between two exchanges by using a "community factor" based on distance. The community factor is calculated as follows:

$$C(i,j) = \frac{1}{d(i,j)^a},$$

where
$C(i,j)$ is the community factor between exchange i and exchange j,
$d(i,j)$ is the distance between exchange i and exchange j, and
α is reference value (in this study, the most common value 1.0 was used).

Traffic volume between exchange i to j can be calculated using the following formula:

$$F(i,j) = \frac{C(i,j) \times Di \times Dj}{\sum_j C(i,j) \times Dj} \text{ [erl]},$$

where
$F(i,j)$ is the traffic volume from exchange i to j,
$C(i,j)$ is the community factor between exchange i and j,
Di is the outgoing traffic volume of exchange i, and
Dj is the outgoing traffic volume of exchange j.

After calculating the future traffic matrix with the gravity model, Kruithof's algorithm is used to match incoming and outgoing traffic.

10.2 Toll Traffic Distribution

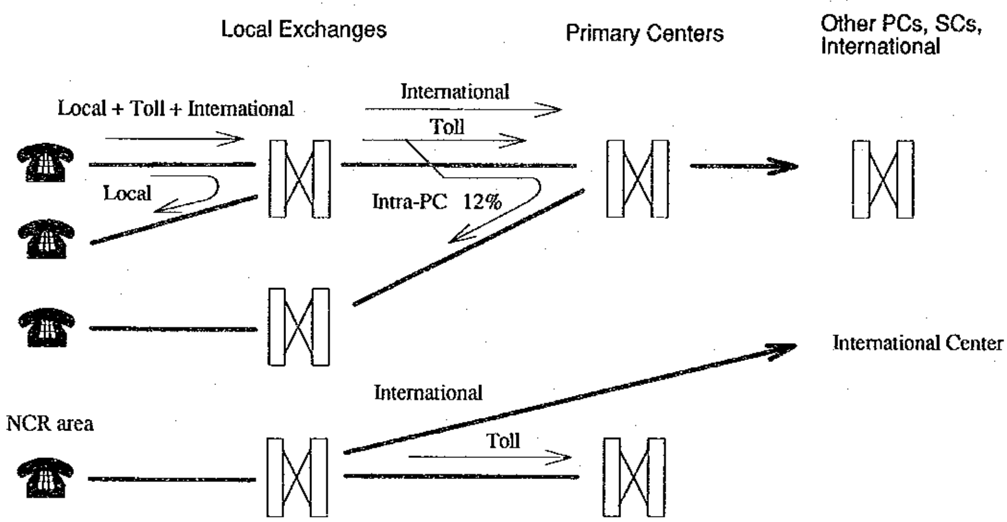
The toll traffic distribution of each region was estimated based on collected data using the following assumptions:

- Toll traffic includes international traffic, except for the NCR because it has direct circuits from local exchanges to international exchange.

- Intra-PC traffic is 12% of toll traffic excluding international traffic.

Figure 10.2-1 shows the toll traffic distribution used in this study.

Figure 10.2-1 Toll Traffic Distribution



10.3 Estimation of Calling Rate

The calling rate is determined by telephone density and social and geographical conditions. Generally as the number of telephones increases, the calling rate decreases due to the increasing number of residential telephones, which have a lower calling rate.

In this study, future calling rate was estimated based on the following assumptions and considerations:

- the PLDT calling rate for both local and toll calls was used as the base year value;
- the base data for Regions V, VIII, and XII was based on neighboring regions data (Region IV, VII, and XI, respectively), because no data were available for these regions;
- the ratio of international calls to toll calls was estimated based on PLDT data;
- the estimated ratio of intra-PC calls to toll calls is 12%; and
- future calling rates by region were estimated based on the growth in the number of subscribers.

The estimated calling rates used for the traffic forecast in this study are shown in Table 10.3-1.

10.4 Traffic Matrix of Target Year

Traffic between PCs was estimated for each phase based on the number of estimated subscribers and the calling rate for toll calls. Tables 10.4-1, 10.4-2, and 10.4-3 show the forecasted traffic between regions for 1998, 2004, and 2010. The traffic matrices between PCs for the same years are shown in Appendix 10-1, 10-2, and 10-3.

10.5 Traffic from Local Exchanges

Both toll and local traffic from local exchanges (including RSU/RLU) were estimated using the estimated calling rates and number of subscribers. The results are shown in Appendix 12-2.

Table 10.3-1 Estimated Calling Rate (Originating)

unit [erl]

Region	Phase A (1998)			Phase B (2004)			Phase C (2010)		
	Local	Toll	International	Local	Toll	International	Local	Toll	International
NCR	0.0662	0.0015	0.0000	0.0609	0.0014	0.0000	0.0573	0.0013	0.0000
I	0.0501	0.0075	0.0027	0.0418	0.0068	0.0024	0.0313	0.0061	0.0022
II	0.0503	0.0053	0.0019	0.0445	0.0049	0.0018	0.0364	0.0045	0.0016
III	0.0481	0.0105	0.0030	0.0398	0.0094	0.0026	0.0294	0.0084	0.0024
IV	0.0419	0.0070	0.0029	0.0343	0.0062	0.0026	0.0249	0.0055	0.0023
V	0.0432	0.0072	0.0030	0.0387	0.0068	0.0028	0.0326	0.0064	0.0026
VI	0.0840	0.0076	0.0026	0.0729	0.0070	0.0024	0.0581	0.0064	0.0022
VII	0.0997	0.0041	0.0019	0.0812	0.0036	0.0017	0.0588	0.0032	0.0015
VIII	0.1035	0.0042	0.0020	0.0928	0.0040	0.0019	0.0779	0.0037	0.0017
IX	0.0744	0.0053	0.0028	0.0644	0.0049	0.0026	0.0512	0.0045	0.0024
X	0.0522	0.0061	0.0018	0.0429	0.0054	0.0016	0.0316	0.0048	0.0015
XI	0.0891	0.0099	0.0015	0.0730	0.0088	0.0014	0.0531	0.0078	0.0012
XII	0.0908	0.0101	0.0016	0.0834	0.0098	0.0015	0.0739	0.0095	0.0015

Notes:

1 Estimated based on the PLDT data.

2 Data for Regions V, VIII, and XII based on data for neighboring regions (IV, VII, and XI respectively).

3 Toll calling rate does not include intra-PC traffic.

4 International calling rate for NCR is zero, because NCR has direct curcuits from local exchanges to international center.

Table 10.4-1 Forecasted traffic matrix between Regions in 1998

unit [erl]

	NCR	CAR	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	ARMM	TOTAL
NCR	0.000	44.892	316.478	112.569	1,300.924	1,258.072	165.338	483.019	280.021	59.216	109.363	259.322	355.851	36.207	85.794	4,867.066
CAR	44.662	0.000	9.130	1.634	12.325	4.017	0.618	1.489	0.566	0.129	0.163	0.713	1.497	0.222	0.295	77.459
I	306.423	9.360	26.462	11.013	91.933	29.572	4.576	11.421	4.370	0.989	1.278	5.568	11.783	1.741	2.315	518.803
II	104.668	1.900	11.858	7.347	23.403	11.066	2.168	4.929	1.934	0.458	0.546	2.532	5.249	0.769	1.016	179.842
III	1,391.848	10.371	75.650	16.684	414.966	132.922	13.448	31.885	11.596	2.584	3.242	13.890	28.925	4.361	5.793	2,158.164
IV	1,323.575	3.453	24.239	8.116	135.116	223.115	15.187	37.977	12.659	2.664	3.498	13.855	28.651	4.461	5.954	1,842.519
V	158.434	0.756	5.255	2.239	19.800	21.142	10.930	15.279	5.577	1.561	1.115	5.883	10.806	1.670	2.153	262.599
VI	470.353	1.929	13.870	5.388	49.722	54.273	16.076	172.582	53.676	6.465	7.361	30.605	55.972	10.074	12.901	961.248
VII	260.645	0.809	5.841	2.331	19.948	19.962	6.470	58.962	13.018	4.474	4.644	22.508	36.241	7.248	8.709	471.810
VIII	53.687	0.191	1.371	0.573	4.614	4.419	1.877	7.394	4.651	0.000	0.609	4.596	7.002	1.102	1.350	93.434
IX	94.684	0.277	2.034	0.785	6.640	6.382	1.540	9.555	5.394	0.692	0.811	7.349	17.415	3.367	5.174	162.097
X	233.237	1.065	7.758	3.194	24.955	22.813	7.152	34.972	23.266	4.631	6.463	38.549	94.061	21.875	22.032	546.024
XI	339.734	2.150	15.766	6.356	49.953	45.094	12.618	61.938	36.381	6.769	14.722	91.240	442.980	67.333	61.479	1,254.513
XII	55.292	0.313	2.285	0.912	7.381	6.862	1.911	10.908	7.113	1.044	2.821	20.985	66.398	3.139	15.771	203.135
ARMM	63.803	0.419	3.066	1.216	9.895	9.213	2.487	14.112	8.639	1.291	4.340	21.319	60.781	15.882	5.331	221.797
Total	4,901.045	77.883	521.063	180.358	2,171.574	1,848.924	262.396	956.423	468.860	92.967	160.977	538.913	1,223.610	179.450	236.065	13,820.510

Table 10.4-2 Forecasted Traffic Matrix between Regions in 2004

unit [erl]

	NCR	CAR	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	ARMM	TOTAL
NCR	0.000	70.744	460.206	168.855	1,872.733	2,281.616	292.801	743.785	602.108	131.056	251.954	490.835	666.575	86.328	123.429	8,243.025
CAR	70.396	0.000	18.596	3.364	26.532	10.499	1.444	2.967	1.498	0.374	0.474	1.725	3.419	0.450	0.430	142.168
I	444.452	18.982	50.162	20.225	183.056	70.882	9.845	20.937	10.651	2.641	3.425	12.392	24.738	3.249	3.110	878.747
II	155.531	3.821	21.640	12.877	46.058	26.325	4.552	8.804	4.596	1.199	1.429	5.505	10.761	1.398	1.314	305.808
III	2,049.296	22.869	154.936	34.435	903.845	344.161	32.101	65.120	31.329	7.692	9.645	34.298	67.480	9.007	8.614	3,774.828
IV	2,419.287	9.460	61.425	20.743	354.643	628.957	44.734	101.808	44.496	10.138	14.062	44.345	87.668	12.103	12.007	3,865.875
V	280.246	1.717	11.117	4.675	44.806	57.654	30.439	34.049	16.226	5.571	3.519	15.438	26.768	3.602	3.195	539.021
VI	724.727	3.716	24.868	9.521	95.776	132.492	35.429	298.697	116.962	15.519	18.686	63.042	110.916	16.961	15.069	1,682.384
VII	564.639	2.042	13.737	5.407	50.134	62.880	18.377	126.747	60.377	13.930	16.697	64.041	99.348	16.673	13.393	1,128.423
VIII	119.810	0.518	3.459	1.433	12.508	14.845	6.377	17.160	14.206	3.560	2.148	13.321	19.440	2.583	2.099	233.469
IX	220.984	0.742	5.069	1.930	17.713	21.990	4.578	23.103	18.750	2.404	12.724	21.776	48.552	8.535	9.888	418.740
X	443.077	2.445	16.570	6.736	56.993	65.098	18.225	70.765	65.958	13.586	19.769	99.853	231.806	39.957	27.017	1,177.855
XI	637.396	4.723	32.224	12.819	109.307	124.417	30.806	122.040	100.562	19.318	42.931	227.424	995.107	137.891	69.160	2,666.127
XII	86.065	0.614	4.180	1.644	14.399	16.869	4.089	18.388	16.611	2.533	7.489	38.855	136.521	11.178	16.493	375.928
ARMM	107.810	0.644	4.402	1.695	15.132	18.150	3.937	17.658	14.200	2.202	9.499	27.366	71.073	16.897	6.025	316.690
TOTAL	8,323.717	143.037	882.591	306.360	3,803.635	3,876.834	537.733	1,672.028	1,118.531	231.724	414.453	1,160.219	2,600.171	366.813	311.242	25,749.088

Table 10.4-3 Forecasted Traffic Matrix between Regions in 2010

unit [erl]

	NCR	CAR	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	ARMM	TOTAL
NCR	0.000	220.676	826.192	241.285	2,948.240	4,211.452	438.131	1,182.477	1,193.049	235.245	431.449	937.634	1,131.031	124.861	226.273	14,347.994
CAR	210.679	11.101	75.367	18.536	93.233	51.848	5.707	11.755	7.433	1.800	2.080	7.964	15.363	1.577	2.022	516.464
I	786.610	75.464	128.299	42.549	422.832	205.987	21.160	45.181	28.365	6.750	8.031	30.162	58.577	6.032	7.775	1,873.775
II	218.990	19.372	44.714	22.779	90.160	62.370	8.001	15.472	9.969	2.503	2.729	10.913	20.756	2.114	2.676	533.518
III	3,279.861	78.472	363.100	70.757	2,241.469	1,034.311	67.744	137.962	81.558	19.221	22.062	81.549	155.794	16.321	21.025	7,671.207
IV	4,483.020	46.036	184.532	52.153	1,071.816	1,621.333	110.747	255.284	136.831	29.896	38.009	125.028	239.898	25.995	34.717	8,455.295
V	411.374	6.365	23.764	8.379	91.532	136.440	54.173	61.126	35.942	12.061	6.941	31.779	53.417	5.628	6.770	945.693
VI	1,136.771	13.799	53.371	17.052	196.506	319.079	63.688	545.473	256.598	32.368	37.056	129.554	220.810	26.611	32.223	3,080.958
VII	1,115.432	9.343	35.838	11.769	124.463	183.189	40.132	273.851	191.353	35.049	41.423	164.763	245.189	32.802	36.329	2,540.924
VIII	213.351	2.275	8.575	2.972	29.502	40.970	13.476	34.881	35.374	11.884	4.869	32.144	44.764	4.635	5.163	484.834
IX	376.995	2.921	11.328	3.598	37.599	55.191	8.658	43.944	45.426	5.361	25.795	46.933	100.955	14.172	21.671	800.545
X	846.372	10.361	39.385	13.344	128.785	173.562	36.816	142.911	169.517	32.974	43.707	235.506	514.973	69.172	68.237	2,525.620
XI	1,070.884	19.723	75.477	25.037	242.941	326.520	61.113	241.392	250.471	45.332	92.587	509.987	2,126.619	226.935	152.095	5,467.114
XII	122.792	2.008	7.712	2.528	25.235	34.924	6.383	28.796	33.131	4.654	12.945	68.065	225.775	14.659	32.905	622.512
ARMM	196.184	2.751	10.630	3.416	34.730	49.312	8.123	36.778	38.219	5.424	21.096	68.864	154.900	33.373	17.306	681.104
TOTAL	14,469.314	520.666	1,888.284	536.154	7,779.042	8,506.488	944.052	3,057.283	2,513.237	480.523	790.778	2,480.844	5,308.818	604.888	667.187	50,547.557

CHAPTER 11

TELECOMMUNICATIONS NETWORK PLAN