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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
THE REPUBLIC OF THE PHILIPPINES

A STUDY ON THE IMPROVEMENT AND OPTIMIZATION OF TELECOMMUNICATIONS NETWORKS IN THE REPUBLIC OF THE PHILIPPINES

SUMMARY

March 1994

NTT INTERNATIONAL CORPORATION
TOKYO, JAPAN

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PREFACE

In response to a request from the Government of the Republic of the Philippines, the Government of Japan decided to conduct a master plan study on the Improvement and Optimization of Telecommunications Networks in the Republic of the Philippines and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Philippines a study team headed by Mr. Shiro Tamura, NTT International Corporation, three times between June 1993 and March 1994.

The team held discussions with the officials concerned of the Government of the Philippines, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of the Philippines for their close cooperation extended to the team.

March 1994

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

March 1994

Mr. Kensuke Yanagiya
President
Japan International Cooperation Agency

Letter of Transmittal

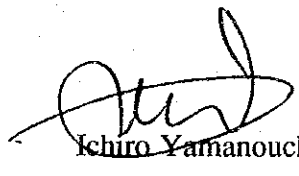
We are pleased to submit to you the study report on the Improvement and Optimization of Telecommunications Networks in the Republic of the Philippines.

This study was conducted by NTT International Corporation, under a contract to JICA, during the period of June 1993 to March 1994. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of the Philippines, and formulated the most appropriate master plan up to the year 2010, covered the whole territory of the Philippines, including guidelines, network and facilities plans, operation and maintenance plan, implementation plans, cost estimation and project evaluation, and recommendations.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, and other authorities concerned of the Government of Japan. We would also like to express our gratitude to the officials concerned of the DOTC, other related agencies of the Government of the Philippines, the JICA Philippines Office, and the Embassy of Japan in the Philippines for their cooperation and assistance throughout our study.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,



Ichiro Yamanouchi
President
NTT International Corporation

In this report, project cost is estimated at October 1993 price and at an exchange rate of 1US$ = 25 Peso.

Table List

Figure List

OUTLINE OF THE PLAN

This plan was prepared as a guideline to understand the perspective and targets of future telecommunications and to put forth a development principle for telecommunications toward the 21st century: thoroughly forecasting the size of a single network and the investment enough to meet the supply targets through the year 2010, and analyzing the expected financial situation.

1. Planning Period

As the planning period encompassed by the study is long; from 1993 to 2010, the periods of this plan are divided into three phases as follows.

(1) Phase A: (1993 - 1998)
(2) Phase B: (1999 - 2004)
(3) Phase C: (2005 - 2010)

2. Telephone Supply Target

(1) Telephone Density

Telephone main density is used to gauge the development of telephone networks. There were about 600,000 pending applicants for new telephone installation in Metro Manila. The 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 rural areas far from the center of municipalities should be met.

(2) Local Exchange Telephone Service Penetration

As of yearend 1992, only 329 out of 1597 cities and municipalities had local telephone service, a 20.6% coverage ratio. The implementation schedule has specific coverage ratio to 45% by 1998, 75% by 2004, and 100% by 2010.

(3) Digitization Plan of Network

All analog toll switching systems and analog toll transmission facilities are to be replaced to digital by 1998. For local network, SXS exchanges are to be replaced by the end of 1998, and analog SPC and XB-type exchanges are to be replaced by the

end of 2004. The digitization ratio will be 91.6% by the end of Phase A and 100% by the end of Phase B.

(4) Improvement in Telephone Service Quality

The NTC established national service performance standards for telecommunication services and operators are required to meet these standards. These service performance will be improved under a project in the telephone supply plan.

3. Non Telephone and New Services

Other services such as ISDN, intelligent network service will be introduced, and cellular mobile telephone service and radio paging service are planned to grow continuously meeting the demand through 2010. Packet switching network service and leased line are also planned based on the demand.

Next generation of mobile communication system after year 2000 was studied as a model case to introduce in Metro Manila.

4. Operation and Maintenance

Establishment of network management system to provide secure and reliable services in an interconnected networks, and centralization of maintenance work to reduce the load of the work are examined. Information hot line and supporting system between operators against troubles in the networks are recommended to keep good telephone service.

In this study, the number of additional personnel is computed on the basis of the facility plan up to 2010. The total number of 48 thousand staffs will be required. The training is also essential to promote smooth operation and maintenance work, suitable training measures are considered and examined.

5. Cost Estimation

The estimated cost based on the facility expansion plan including replacement plan to meet the supply targets is listed in Table 1.

Table 1 Total Investment Cost

(Unit: Million US $)

	Phase A	Phase B	Phase C	Total
Switching	1,662	1,954	3,135	6,751
Transmission	788	1,264	2,553	4,605
Outside Plant	1,430	1,790	2,714	5,934
Sub Total	3,880	5,008	8,402	17,290
New Services	1,132	1,504	3,525	6,161
Total	5,012	6,511	11,927	23,451

6. Financial and Economic Analysis

The FIRR (financial internal rate of return) for the master plan is calculated as 11.6% which shows high viability. To measure the economic benefits of the master plan, the idea of consumers' surplus is employed. The economic benefit is estimated as 189% of finical benefit. Using the economic benefit instead of financial benefit, the economic internal rate of return is calculated as 49%. This EIRR is higher than other infrastructure projects.

7. Implementation Plan

The project packages in this report would expand the network to the unserved rural areas as the implementation plan for each region for the phase A of this master plan, based on the condition that on-going and planned projects are implemented completely.

CHAPTER 1 INTRODUCTION

The master plan study on the Improvement and Optimization of Telecommunications Networks have been prepared in the form of the Final Report, which is composed of the following:

(1) Summary
(2) Main Report
(3) Appendix

The Study Team on "the Improvement and Optimization of Telecommunications Networks in the Republic of the Philippines" (hereinafter referred to "the Study Team"), dispatched by Japan International Cooperation Agency (JICA) has carried out the work during the period from June 1993 to January 1994. The study has been carried out in close cooperation with the counterparts of the Department of Transportation and Communications (DOTC).

The report presents the long term plan performed by the Study Team during the above period.

1.1 Background of the Study

In the Philippines, many telecommunications operators are providing the diversified telecommunications services with their own local networks in each franchised area. The problem/trouble on interconnections and time difference of facilities renovation among operators often result in the deterioration of qualities of the telecommunications network in the Philippines. The interconnection among operators is essential to provide good and economical telecommunications services throughout the country.
From the view point of the future development of telecommunications in the Philippines, many kinds of telecommunications system with new technologies such as the terrestrial digital microwave, optical fiber, satellite, mobile and submarine cable system, etc. should be introduced to establish the more economical, efficient and flexible network.
New telecommunications operators will get the franchise and are going to provide advanced telecommunications services. The service demand of ISDN is being appeared in the large cities Manila and Cebu.

Hence force, the need for study how to establish the integrated, efficient, economical and reliable nationwide telecommunications network which provides the new technologies and services in the Philippines is seen.

1.2 Objectives of the Study

The objective of the study is to formulate a Master Plan up to the year 2010, taking into consideration the interconnection of networks among operators for the establishment of an integrated, efficient and reliable network throughout the country and providing new technologies and services therefore. The Study shall cover the whole territory of the Republic of the Philippines. The result of the Study shall be used as a guidance for the implementation by the government and private sector, and as a tool for administrative guidance by the DOTC and NTC.

1.3 Scope of the Study

The Study supplements NTDP (National Telecommunications Development Plan) which was formulated in 1989 and reviewed by the DOTC in July 1993. NTDP provides a framework of government policies, objectives and strategies to development of the telecommunications sector up to 2010 such as privatization and competition.
In line with the NTDP's objectives, the Study focuses on network development planning including demand forecast, traffic forecasts and facilities plan.

CHAPTER 2 SOCIO-ECONOMIC CONDITIONS

2.1 Background

2.1.1 Geography

The Philippine archipelago is situated between 21°25' and 4°23' north latitude and between 116° and 127° east longitude. There are about 7,000 islands and they have a total land area of 300,000 square kilometers. There are two pronounced seasons, the rainy season from June to October and the dry season from November to May.

2.1.2 Demographics

The population of the Philippines is about 60.7 million, 55% of which occupies the largest island, Luzon. With an annual average growth rate of 2.3%, the Philippines has one of the fastest growing populations (about 1.3 million people added each year). As of 1990, the population density was 202 persons per square kilometer.

Filipino, based largely on Tagalog, is the national language. English and Filipino are the official language. English, the primary language of instruction in schools, is widely used.

Christian Filipinos constitute 93.3% of the population. Moslems make up the majority of the remaining 6.7%.

2.2 Economy

The share of service sector in GDP is growing, that in 1980 and in 1992 were 36% and 45% respectively. that of agriculture, fishery & forestry figures were 23% and 22%. That of industry were 41% and 33%. The economic growth is negative for the past two years. Major export commodity are coconut product, fruits, mineral product and chemicals textiles. Almost half of the employed persons are absorbed in the agriculture. Table 2.2-1 shows the GDP by area of the Philippines for the past five years (1988 - 1992)

Table 2.2-1 GDP by Area of the Philippines

(1988-1992)

		1988	1989	1990	1991	1992
GDP Total *1	peso million	799,182	925,444	1,073,098	1,244,741	1,338,421
-Agriculture	peso million	183,515	210,009	235,956	261,348	290,338
-Industry Sector	peso million	280,957	322,964	371,347	424,504	446,334
-Service Sector	peso million	334,710	392,471	465,795	558,889	601,749
-Real GDP Growth	%	6.75%	6.21%	2.66%	(0.80%)	(0.27%)

Note *1 : The number is as of July of each year.

Source : 1993 Philippine Statistical Yearbook (NSCB)

2.3 Official Development Assistance (ODA)

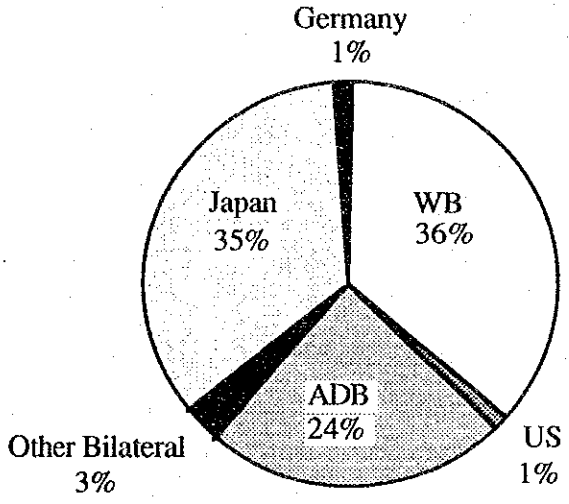
2.3.1 Private Sector

The government encourages the private sector to participate in and undertake developmental and priority projects of government. This policy recognizes the private sector's capability to manage resources efficiently; to innovate, adopt, and apply appropriate technology; and to bring in additional resources to augment public funds used for financing public investment programs. In recognition of the important role which the private sector plays as a partners of government process, the private sector will be allowed to use ODA and other official flow (OOF) for priority development projects of the public sector.

2.3.2 Results of ODA

Over the seven years 1986-1992, US$ 2 billion in ODA grant/technical assistance and US$ 11 billion in ODA loans were committed to the Philippines. Figure 2.3-1 shows ODA loans committed by source 1986-1992. The communications sector received about 3% of total loans.

Figure 2.3-1 ODA Loans Committed by Source (1986-1992)



Source: NEDA

2.4 National Development Plan

2.4.1 Medium-Term Philippine Development Plan (MTPDP)

The government-issued Medium-Term Philippine Development Plan for 1987-1992 recognized the importance of telecommunications in the economic development process and presented development targets for the telecommunication sector.

The Medium-Term Philippine Development Plan for 1993-1998 spells out the country's vision and goals for development, as well as the socio-economic development policies and programs that will be carried out during the Ramos administration. President Ramos clarified this vision of development when he launched "Philippine 2000". The objective of the government is to make the Philippines an industrialized country by the year 2000. To reach this goal, the telecommunication sector will need to pursue more vigorous development through intensified private sector participation.

2.4.2 Telecommunication Sector Targets

The Medium-Term Philippine Development Plan presented development targets for the telecommunication sector, including more extensive network coverage, higher telephone density, and the adoption of new telecommunication technologies. The main targets set by the plan are summarized as follows:

(1) Interconnect all local telephone exchanges into the main backbone to enable complete subscriber linking;
(2) Privatize all government telecommunication assets as soon as possible;
(3) Provide for more open entry of private firms to promote greater competition and efficiency in telecommunication services;
(4) Install about 1.32 million additional telephone lines to increase the telephone density from about 1.4 to about 4.0 lines per 100 people by the end of 1998; and
(5) Extend existing Public Calling Office (PCO) service to all municipalities.

2.4.3 National Telecommunications Development Plan

The first Philippine National Telecommunications Development Plan was issued in 1982 to guide the development of the country's telecommunications sector from 1982 to 1987. The NTDP for 1991-2010 was issued in October 1990.

The 1993 Update of the NTDP was issued in July 1993. Prepared at the initiative of the DOTC, the NTDP seeks to focus ongoing and future efforts in the sector to support both sector development goals and national development objectives. The NTDP therefore proceeds from and expands on the relevant sections of the MTPDP. The NTDP is intended to be the primary means of communicating the following information to interested parties:

(1) The desired development direction and minimum targets for the telecommunications sector during the plan period; and
(2) The general means proposed to deal with sector constraints and to achieve development targets.

The sector development targets incorporated in the NTDP are based on the broad development policy. NTDP gives more detail on the government's policy framework for telecommunications. The NTDP also contains the following;

(1) A review of the status of telecommunications in the Philippines at the start of the Plan period;
(2) Development targets and resource requirements;
(3) Implementation strategies; and
(4) Financial and economic assessments required to meet the development targets.

CHAPTER 3 TELECOMMUNICATIONS SECTOR OUTLOOK

3.1 Organizations

The entities involved in the Philippine telecommunications sector include relevant government agencies, private and public telecommunications network operators, equipment manufacturers and suppliers, users of telecommunications services, and local industry associations.

3.1.1 Government Agencies

The Philippine government's involvement is primarily through the following agencies:

(1) The Department of Transportation and Communications (DOTC) is the policy-making body for telecommunications.
(2) The National Telecommunications Commission (NTC) is the regulatory arm, with quasi-judicial powers.
(3) The Telecommunications Office (TELOF) is the operating arm, providing limited telephone and telegraph services in rural areas.
(4) The Municipal Telephone Project Office (MTPO) is the implementing arm for the Government's municipal telephone program.

The National Economic and Development Authority (NEDA) formulates the country's overall economic policies and development strategies. DOTC policies are prepared within this general framework. Both Congress and local (provincial or city) government agencies are empowered to enfranchise private carriers, while the NTC grants specific authority.

3.1.2 Private Sector

The private sector plays a major role in the communications industry: it has accounted for the bulk of investments to-date and handles most of the country's telecommunications traffic.

The Philippine Long Distance Telephone Company (PLDT) is the largest of 47 entities providing telephone services in the Philippines. It has a network of 127 exchanges serving Metro Manila and 133 other cities and municipalities. As of the end of 1992, it has 1,175,332 telephones in service, representing approximately 94% of all telephones in the country. It is the principal supplier of long distance (national and international) services in the Philippines.

3.2 Development Program

3.2.1 Government Sector

(1) National Telephone Program

The National Telephone Program will provide telephone lines primarily in unserved and inadequately served areas. This program is composed of many sub-programs, and on-going sub-programs are as follows.

(a) NTP Phase 1 - Tranche I-1 (Regions 3, 4, and 5)
This project is providing 66 new digital exchanges in 65 cities and municipalities and will install 59,150 subscriber lines in Regions 3, 4, and 5. It is also providing a backbone network connected with other NTP networks, creating a national interconnected network covering Region 3 to 12. This project was financed by Japanese ODA and is expected to be completed in 1994.

(b) NTP Phase 1 - Tranche I-2 (Regions 6, 7, and 8)
This project is providing subscriber lines in Regions 6, 7, and 8 and a backbone network for these regions. The complete package was financed under French protocol. The pilot project for Region 8 was initiated in October 1992. The rest of the Tranche I-2 project covers 20 cities/municipalities that have a total capacity of about 20,000 lines.

(c) NTP Phase 1 Tranche I-3
The Italian government, under memorandum of understanding entered into on April 22, 1988 between DOTC and ITALTEL, pledged to support the pilot project for the cities of Iligan and Marawi and detailed engineering services for the entire area under NTP Phase I, Tranche 1-3. The NTP 1-3 pilot project in Iligan and Marawi was initiated in January 1993. NTP I-3 will eventually provide 43,900 telephone lines to 32 cities and municipalities.

(2) RTDP-C (Regional Telecommunications Development Project Phase C)

Under the RTDP Phase-A project, 11,000 lines and 17 exchanges were completed in September. 1986. Under Phase-B, financed with Japanese ODA, 8,240 subscriber lines and 11 exchanges were completed in 1991. The proposed Phase C project will install three new local exchanges with 2,050 lines and expand 15 local exchanges with 5,750 subscriber lines. This project, which includes engineering services, began in 1993 and is financed by the Japanese Overseas Economic Cooperation Fund (OECF).

(3) Municipal Telephone Program (MTP)

This program was created by the Municipal Telephone Act of 1989 (Republic Act 6849) and calls for establishing PCOs in all municipalities without telephone service. Projects undertaken by the MTPO are funded with appropriations set forth in the Act and also with ODA funding from the French, Canadian, US, and German governments. As of September 1993, 560 PCOs have been established under the MTP.

3.2.2 Private Sector

PLDT expansion programs are as follows;

(1) X-5C (Complementary) Program

The X-5C program is composed of a fast-track program and a balanced program. The fast-track program is to install 142,000 additional lines in those Metro Manila areas that have many waiting applicants. It was expected to be completed by the end of 1993. The balanced program will install another 400,000 lines by 1995.

(2) X-6 Program

The X-6 program will run from 1994 to 1997 and provide 586,600 new digital lines in 124 exchanges nationwide. It is expected to eliminate the demand backlog for 600,000 telephones in the Metro Manila area and to satisfy new demands.

3.3 Financial Situation

3.3.1 Financial Performance

The carriers can be divided into three groups. There is a dominant carrier; PLDT, there are several big carriers, mainly record carriers (international and domestic), and there are many small carriers. Table 3.3-1 shows the financial performance of telecommunications carriers from 1989 to 1991.

Table 3.3-1 Financial Performance of Major Companies

Name of Companies	Investment (million peso)	Profit (million peso)	Growth
1) PLDT (Telephone)	64,649	8,227	29%
2) ETPI (International Record)	2,502	881	- 6%
3) PT&T (Domestic Record)	1,700	90	18%
4) Philcomsat (Other Service)	1,664	719	23%
5) PILTEL (Telephone)	1,521	148	443%
6) PHILCOM (Int'l Record)	1,032	697	18%
Total (60 Companies)	75,692	10,866	-
Average (60 Companies)	1,256	181	26%

Source: NTC, CCAD Report

3.3.2 Tariff Structure

(1) Tariff of Basic Telephone Service

The Philippines has a fixed tariff rate structure for local telephone service except for two companies. Rates range from as low as 50.00 pesos for a residential line using manual equipment, to as high as 570.36 pesos for business in Metro Manila as of June 29, 1993. Long distance service fees which are independent of the monthly subscription fees are based on duration and call distance.

(2) Return on Rate Base

The NTC established the area of operation for carriers and determines the rates for services. The rates are determined with a based on facility costs. The tariffs for companies with digital facilities are much higher than those with analog facilities. The rate structure is determined by return on rate base. The NTC has set the authorized maximum return at 12%.

CHAPTER 4 PRESENT STATUS OF TELECOMMUNICATION SERVICES

Telecommunications in the Philippines is a competitive industry; a number of carriers provide various services.

4.1 Telephone Services

There are about 887 thousand telephone subscribers in the Philippines as of the end of 1992. Telephone availability varies widely: from 10 telephones per 100 inhabitants in Metro Manila to less than 2 for other cities and 0.1 for the rest of the country.

4.1.1 Local Exchange Service

Local exchange service is provided by 42 private telephone operators and 5 government carriers (local governments and TELOF). Table 4.1-1 summarizes local exchange services. The largest private operator is PLDT which provides service to approximately 94% of the total telephone sets.

Table 4.1-1 Present Status of Local Exchange Service

(as of the end of 1992)

Total main lines	887,229 lines
Penetration	average 1.4
per 100 inhabitants	varies from 10 in Metro Manila to 0.1 for rest of the country
Service area	about 330 out of 1600 municipalities (20.6%)
PCO	560 as of September, 1993

Note: PLDT: Philippine Long Distance Telephone Company
PCO: Public Call Office witch is establishing public telephone functions in unserved municipalities

Local exchange services have several problems, including the following:

(1) Large applicant backlog (about 800,000 in nationwide and about 600,000 in Metro Manila)
(2) Poor quality service
(3) Isolated local exchanges

4.1.2 Long Distance Service

(1) Domestic

PLDT has an extensive nationwide backbone network. The government is providing an alternate backbone network, installed by RTDP and NTP projects. PT&T, RCPI, and DIGITEL also provide smaller scale national networks. Digital transmission equipment is primarily used; PLDT planed to introduce digital optical fiber routes in its X-5C and X-6 plans.

(2) International

The international carriers, PLDT, ETPI, and PHILCOM, have their own gateways facilities. Most of PLDT profits come from international telephone services.

4.2 Mobile Telecommunication Services

4.2.1 Cellular Mobile Telephone Service

There are two analog CMTS providers in the Philippines. One system is operated by PILTEL. The other system is operated by EXTELCOM. Both companies have been granted authority to provide CMTS service nationwide using the U.S. AMPS technology.

Smart Information Technologies, Inc (SMART), Globe Telecom and Isla Communication Co. (Islacom) were issued provisional authority to operate a nationwide cellular mobile telephone service by the NTC in 1993. SMART began operation in February 1994 and used the TACS standard.

At the end of 1992, there were 55,920 cellular subscribers in the Philippines.

4.2.2 Radio Paging Service

Six companies have been licensed to provide public radio paging service in the Philippines. Only three (POCKETBELL, EASYCALL, and DIGIPAGE), however, have services in operation. The remaining three are installing their networks. At the end of 1992, there were 71,758 subscribers.

4.2.3 Public Mobile Radio Communication Services

Public mobile radio communication services are provided through shared repeater/trunked networks. There are seven authorized shared repeater/trunked network providers. There were 1,938 subscribers at the end of 1991.

There are several private mobile radio (PMR) systems, many of which can be automatically or manually patched into the PSTN. At the end of 1992, there were 9,339 PMR base stations and 17,183 mobile units in operation.

4.2.4 Maritime Mobile Services

Maritime mobile service is provided through public coastal stations, both private and government. About 20 coastal radio stations handled about 2,000 vessels at the end of 1991. By the end of 1992, there were 15 public coastal station operators and 4,944 maritime stations.

4.2.5 Aeronautical Mobile Telephone Service

PLDT is the only provider of aeronautical telephone service with its Skyphone. This service allows users to place or receive direct-dial or operator-assisted calls between the ground and satellite-communication-equipped aircraft flying over selected regions.

4.3 Record Carrier Service

4.3.1 Domestic Record Service

The total volume for domestic telegraph in 1990 was 12.5 million messages. PT&T handled 53% of them. There were only 400 domestic telex subscribers in 1990. The traffic was 2 million minutes. PT&T handled 85%. There are other domestic record carriers which are RCPI and TELOF

4.3.2 International Record Services

The total volume for international telegraph in 1990 was about two million words. CAPWIRE handled about 50% of them. There were about 7,000 international telex subscribers in 1990. The traffic was six million minutes. PHILCOM, ETPI, and Globe Telecom, each handled 32~33%.

In line with world, trends telegraph and telex traffic is decreasing, as telephone and facsimile traffic increase.

4.4 Carrier's Carrier

Three carrier's carriers are operating in the Philippines: the Philippine Communications Satellite Corporation (Philcomsat), the Domestic Satellite Philippine Corporation (Domsat), and Oceanic Wireless Network, Inc. These companies lease circuits to other carriers.

4.4.1 International Satellite Service

International telephone service operates through both satellites and submarine cables. Philcomsat was established in 1968 to provide international satellite service, and leases circuits through earth stations located near Manila. At the end of 1991, 1202 circuits were in operation.

4.4.2 Domestic Satellite Service

Domsat began offering domestic satellite services in 1979. It has a earth control station near Manila (Antipolo) and 11 other stations nationwide. At the end of 1992, 156 channels were in service. Four operators are providing telecommunication services in rural areas by using very small aperture terminal (VSAT) technology.

4.5 Leased Line Service

Dedicated point to point circuits are used for private voice and data networks. 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.

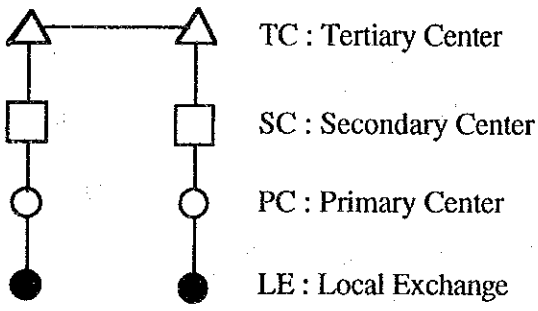
CHAPTER 5 PRESENT STATUS OF TELEPHONE NETWORK

5.1 Fundamental Network

5.1.1 Network Structure

The telephone network hierarchy consist of 4 levels as shown in Figure 5.1-1.

Figure 5.1-1 Network Hierarchy



5.1.2 Numbering Plan

"0" is used for National Trunk Prefix.
"00" is used for International Prefix.
The configuration of national significant number is:

Trunk code "0" + Area code + Subscriber Number
(National Significant Number)

An area code is composed of 1 or 2 digits, in which the first digit shows a region and the second code shows a province in principle.
A subscriber number consists of an exchange code and a local number shown as follows

Digit	Exchange code		Local Number
5 Digits	#	+	XXXX
5 Digits	##	+	XXX
6 Digits	##	+	XXXX
7 Digits	###	+	XXXX

1XY codes are used for special service

5.1.3 Signaling

Decadic Pulse Signaling, MFC-R2 and Common Channel Signaling No. 7 (CCS No. 7) are adopted. Decadic Pulse Signaling is adopted on trunk circuits interconnected with TELOF exchanges and private company exchanges. MFC Signaling is adopted on all trunk circuits between XB and SPC switching systems.
PLDT's CCS No. 7 network is connecting to 21 toll switching centers and 16 local exchanges.

5.1.4 Synchronization

PLDT synchronizes its nationwide network by using a three-level master slave hierarchy with the following characteristics.

(1) The national reference clock has an accuracy of 1×10^{-11} and uses a triplicate cesium clock located at the international gateway
(2) Security and high reliability are achieved by using redundant reference sources and synchronization links.
(3) Secondary reference clocks act as master 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 following service quality.

(1) Accuracy of transmitting information ----------Transmission standard
(2) Connection time and rate ----------Switching standard
(3) Stability of services ----------Stability standard

The MC No. 10-16-90 is composed of a main statement and annexes A to H which contain concrete technical standards, and also specifies the following terms.

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

5.2 Interconnection

Even though EO (Executive Order) No. 59 "Mandating Interconnection" and Memorandum Circular (MC) No. 9-7-93, "Implementing Guidelines on the Interconnection of Authorized Public Telecommunications Carriers" were promulgated, and the interconnection problems comes to another stage. There are still some interconnection problems remaining.

5.2.1 Current Situation

(1) Isolated exchanges

As of July 1993, 30 local telephone exchanges were still isolated from PSTN. 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

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 about network configuration, proposed point of interconnection, traffic forecast and implementation schedule, and so on.

In its Technical/Operational Requirements, MC No. 9-7-93 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).
It also requests that interconnection parties shall exchange traffic and facility forecasts on a semi-annual basis to facilitate allocation of facilities to meet future requirements after their interconnection.

5.2.2 Interconnection Problems

The study team sent questionnaires to the 43 local exchange carriers. Nine responses were received.
Reported interconnection problems included:

(1) insufficient number of interconnection circuits (almost all respondents),
(2) circuits are sometimes out of order and sometimes no circuits are available,
(3) noise in the interconnection circuit,

(4) difficulty in to completing dial connections, especially for incoming calls, due to using old PABX equipment as a local switching system, and

(5) 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. No. 10-16-90 and ITU standards.

5.3 Traffic

5.3.1 Calling Rate

The calling rate in originating, varies from 0.045 to 0.11 for local calls and from 0.0039 to 0.16 for toll calls, and in terminating, it varies from 0.036 to 0.086 in local calls and from 0.0031 to 0.01 in toll calls depending on the region. The NCR and Region VII, which have the major cities Metro Manila and Cebu respectively, are higher than other regions.

5.3.2 Traffic Distribution Conditions

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.

CHAPTER 6 PRESENT STATUS OF TELEPHONE FACILITIES

6.1 Switching

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

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

6.1.1 Toll Switching

PLDT has 32 toll switching centers, providing digital pure toll switching, digital local combined switching, and analog toll switching systems. The TELOF has five switching centers, providing digital local, toll combined switching systems.

6.1.2 Local Switching

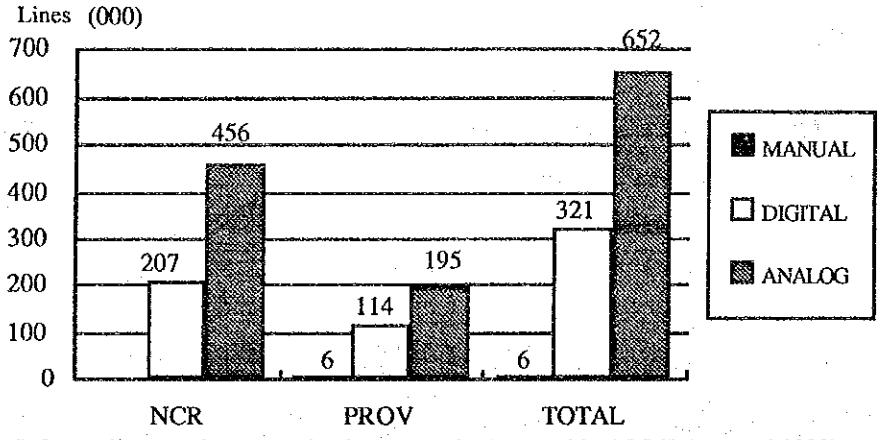
There are about 1600 municipalities in the Philippines, but only 329 have telephone service. There were a total of 323 local switching systems in the whole country, 54 in the NCR and 269 in the provincial areas as of December 1992. (Table 6.1-1).

Table 6.1-1 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% in the NCR and 36% in the provincial areas are digital local witching systems. Figure 6.1-1 shows switching capacity by type in the NCR and the provinces.

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)

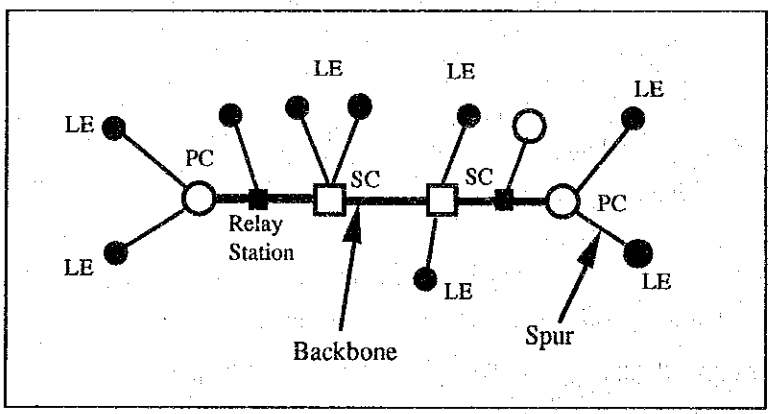
PLDT provides 858,437 (88%) of the switching capacity in the whole country, all of the switching capacity in the NCR.

6.2 Transmission

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

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

Figure 6.2-1 Long Distance Network Structure.



(1) PLDT Network

PLDT network is divided into three types of networks: a backbone network, local networks, and a NCR junction network. Main routes of backbone network are almost all composed of digital microwave radio transmission systems, local networks are 37% digital systems, and NCR junction network consists of 40% optical transmission systems and 60% PCM systems. Backbone network route map is shown in Figure 6.2-2.

(2) Government Network

The government network is divided into four areas by project: RTDP, NTP 1-1, NTP 1-2, and NTP 1-3. The government network will connect 23 toll exchanges around the country after completion of NTP 1-1, 1-2, 1-3. Only the RTDP network is operating by DIGITEL (private company). Facilities are mainly used digital microwave radio transmission systems. Government backbone network is shown in Figure 6.2-3.

Figure 6.2-2 PLDT Backbone Network Route Map

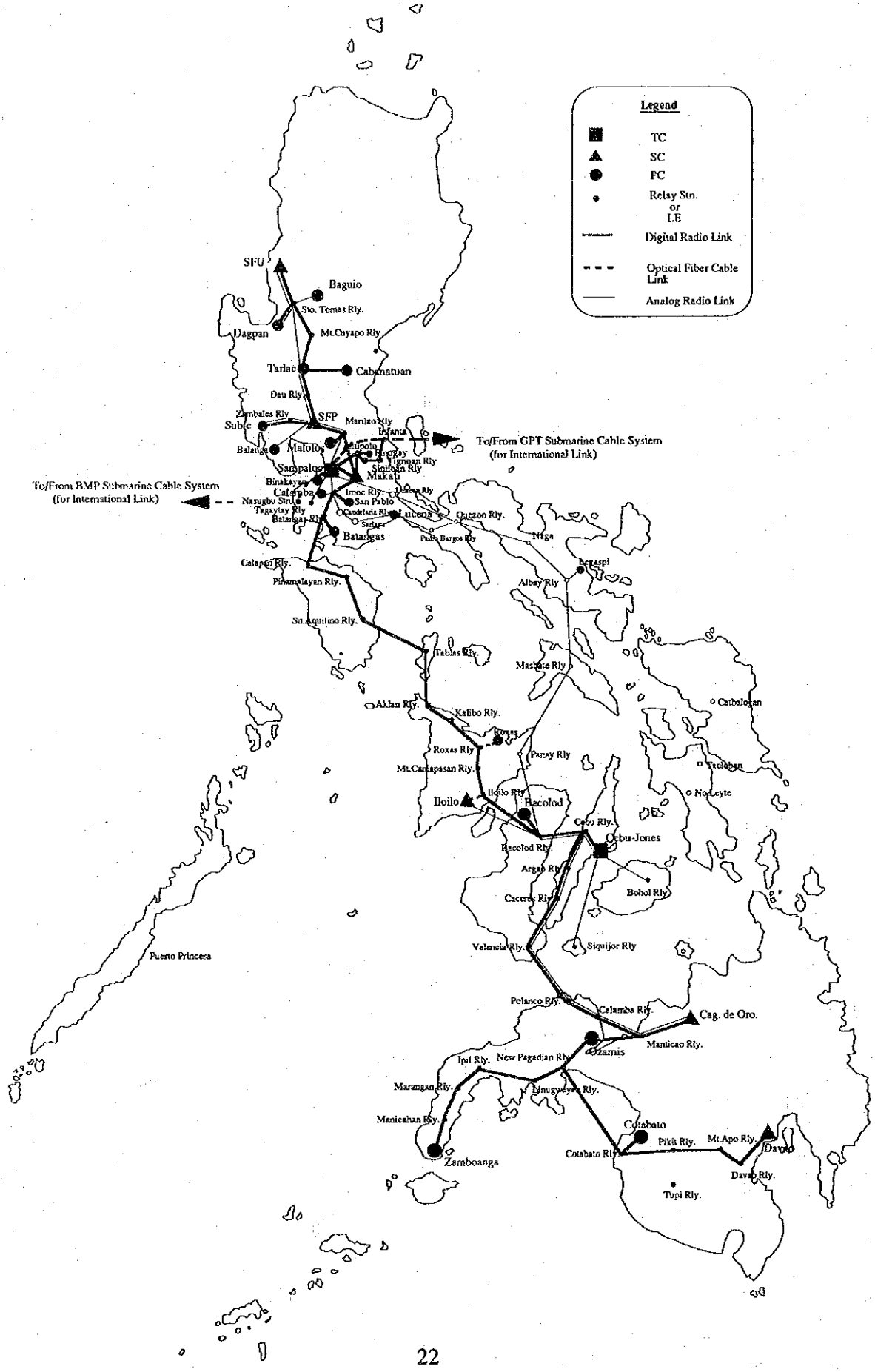
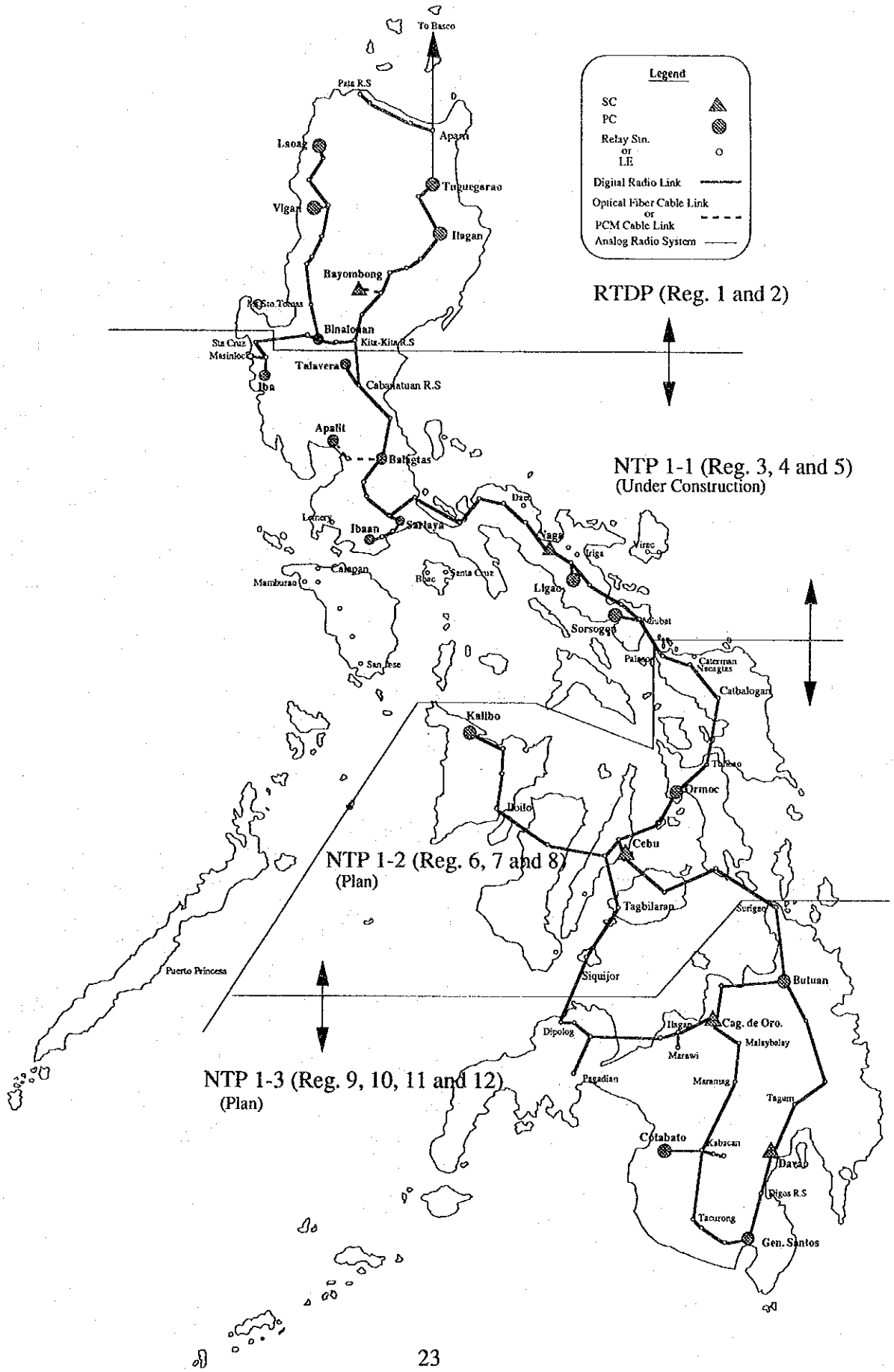


Figure 6.2-3 Government Backbone Network Route Map



6.3 Outside Plant

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 and a few project offices.

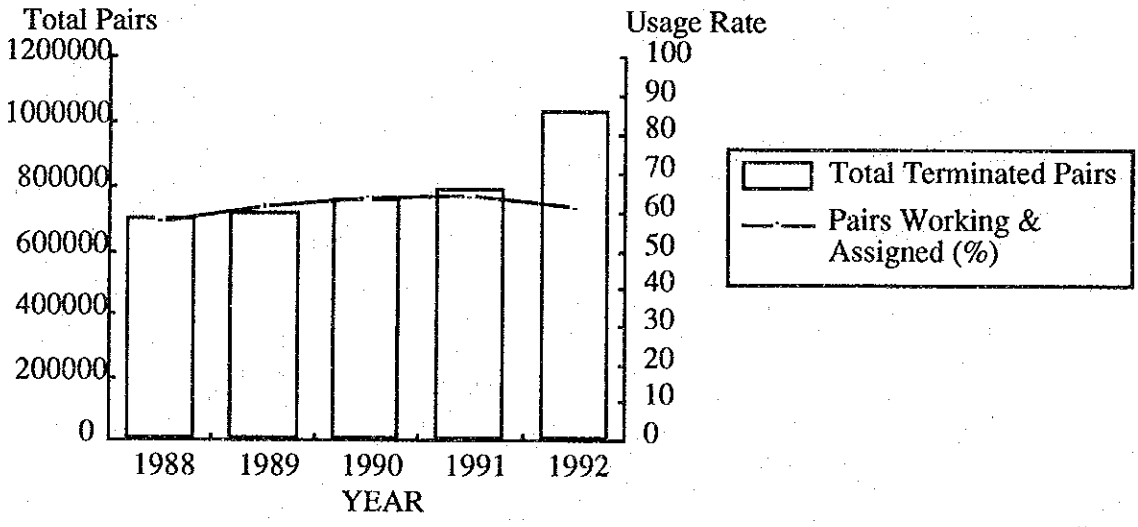
6.3.1 Facilities

According to the telecommunications technical standards for outside plant of the Philippines, 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.

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.

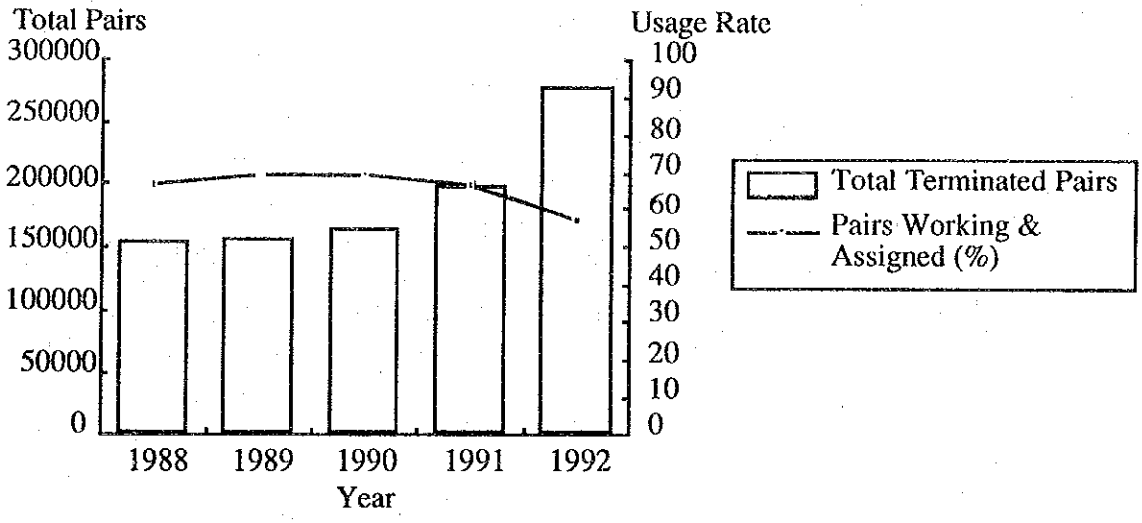
Figures 6.3-1 and 6.3-2 show the total terminated pairs of primary cable and the pair usage rate, including assigned pairs in the PLDT local network, in Metro Manila and the provinces, respectively.

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

6.3.2 Local Cable Networks

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

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.

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.

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 itself.

CHAPTER 7 PRESENT STATUS OF OPERATION AND MAINTENANCE

7.1 Operation and Maintenance Systems

Telecommunication networks are classified as follows:

(1) Backbone Networks

The backbone networks in the Philippines are primarily operated and maintained by the PLDT and TELOF. 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.

(2) Spur Links

Spur links are operated and maintained by both backbone network operators and local telephone operators.

7.2 Maintenance Activities

(1) TELOF operation and maintenance systems are centralized. These systems comprise mainly management and control (or support) centers, operation and maintenance centers, and sub-operation and maintenance centers.

(2) PLDT operation and maintenance systems support the PLDT switching and radio transmission networks; they check and correct failures and reduce service downtime. The systems consist of (a) operation and maintenance center, (b) service center, (c) network management and control systems, (d) transmission supervisory systems, and (e) junction network monitoring centers.

(3) 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

7.3.1 Training Facilities

TELOF has a telecommunication training institute (TTI) in the outskirts of Metro Manila, and the PLDT also has a technical training center (TTC) 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) The TTI conducted 79 training sessions in 1992, A total of 1375 trainees, including those from private companies were trained by 28 instructors.

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

7.4 Customer Service

7.4.1 Marketing Activities

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.

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

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. 24,000 subscribers in Metro Manila were disconnected and 23,000 were reconnected in March, 1993.

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.

CHAPTER 8 FORECASTED DEMAND

8.1 Telephone Service Subscription Demand

The Study Team reviewed existing telephone demand forecasted by the concerned sectors in the Philippines. Macroscopic demand at the national level was forecasted by using the ITU model. The logistic curve and the income elasticity model was used for forecasting demand for the NCR and other regions, respectively. Demand by municipality was estimated by dividing regional demand by the population of each municipality. This assumption was used since there was no available data on the economic parameters of the municipalities.

Table 8.1-1 summarized forecasted demand by region. The demand by municipality is shown in Appendix 8-3. A summary of the forecasted demand and the telephone demand density is shown in Table 8.1-2.

Table 8.1-1 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

Table 8.1-2 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	NCR	15.84	21.04	28.95	35.44
inhabitants)	Regional Area	2.47	3.14	4.80	7.42

8.2 Other Telecommunication Services

This section discusses following services:

1) basic telecommunication services except telephone network services (ISDN, Mobile telephone and Packet switching network services),
2) network supplementary services (Intelligent network services which are toll free, VPN, CLASS and so on), and
3) leased line service.

The basic methodologies of demand forecast for services are:

1) Extrapolation base on the historical data,
2) Making a growth curve referring to foreign countries' record.

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.

Table 8.2-1 summarizes forecasted demand for other telecommunication services

Table 8.2-1 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	Thousand	55.9	183.0	557.0	1,520.0
Radio Paging		71.8	362.1	650.9	1,097.6
ISDN (N-ISDN)		assumed start year 1998	0.08	155.5	1,572.5
ISDN (primary speed line)			0.006	13.2	133.7
Toll Free			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 show actual results
VPN: Virtual Private Network
CLASS: Custom Local Area Signaling Service

CHAPTER 9 GUIDELINE 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 period of this plan is divided into three phases.

The phases are :

(1) Phase A : (1993 - to 1998),
(2) Phase B : (1999 - to 2004), and
(3) Phase C : (2005 - to 2010).

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

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 is planned to be increased from 1.4 main stations per 100 inhabitants in 1992 to the following targets, listed in Table 9.1-1.

Table 9.1-1 Target of Telephone Density

Year	Density	Main Station (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

As of yearend 1992, only 329 out of 1,597 cities and municipalities had local exchange telephone service, a 20.6% coverage ratio. The implementation schedule has specific coverage ratio targets for each phase: as shown in Table 9.1-2.

Table 9.1-2 Coverage Ratio Targets

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

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

9.2 Interconnection Plan of Network

Executive Order 59, "Mandating interconnection" and Memorandum Circular No. 9-7-93 "Implementing guidelines on the interconnection of authorized public telecommunications carriers" were promulgated in 1993. There are still some problems remaining, which were identified by the study team from the returned by exchange operators. In the problems, insufficient circuits is the biggest which will be studied in this report.

9.3 Digitization Plan of Network

9.3.1 Toll Network

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

9.3.2 Local Network

Digitizing local switching systems has high priority in NCR areas and other major business centers. PLDT has plans to replace all SXS switching systems in NCR with digital switching systems in X-6 program. In this plan, SXS switching systems are to be replaced by the end of 1998 (Phase A), and Analog SPC and XB type switching systems 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

NTC established national service performance standards for telecommunications services. Public operators are required to meet the minimum levels that have been set for service quality (MC No. 19-17-90).

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 call)	4.6 - 85.4%	40%	60%

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

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 area where basic telephone networks already exist. As mentioned in section 8.2, demands 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 Introduction and Supply Plan of Services

(1) Cellular Mobile Telephone Service

Cellular telephone service technology is rapidly advancing. The facility plan presented here is based on today's conditions. Cellular telephone 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

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 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. 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.

(4) Intelligent Network (IN)

IN is the driving force for providing telecommunication service in the 21st century. 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).

The heart of an IN is NSSP (Network Service Support Point). This will be located in Metro Manila. The NSP (Network Service Control Point) will initially be located in Metro Manila and next one in Cebu in Phase B. Another one will be added in Metro Manila during 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 Line

Digital leased lines are becoming widely used for data communication. 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 telephone network circuits. The plan is assumed to meet demand.

(6) Packet Switching Network

This service is already popular in the Philippines. because this service has already been introduced. As businesses computerize, its use will grow quickly for data communications. This study assumes that ISDN service will begin in 1998 and that ISDN packet switching service will begin in NCR and MUC in 2004 and KDC by 2010. Therefore, some of the subscribers will shift to ISDN network after 2004.

9.6 Next Generation Mobile Communication Systems

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.

Telecommunication infrastructures are consolidated by application of PHP technology. The PHP system is being considered for Metro Manila area in the future, because of the 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

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. The most suitable surveillance and control system for telecommunication networks is considered and examined (chapter 13).

9.7.2 Centralization of Maintenance Work

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. For the purpose of the improvement of the maintenance work, a centralized maintenance center is considered and examined in this study.

9.7.3 Manpower Plan

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 operation and maintenance staffs by themselves. In this study, suitable training measures are considered and examined.

CHAPTER 10 TRAFFIC FORECAST

This chapter contains the traffic forecast of the target year 1998, 2004, and 2010, in each destination as an integrated network.

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 "community factor" based on distance.

10.2 Estimation of 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;
- 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 10.2-1.

10.3 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. Traffic matrices between PCs for 1998, 2004, and 2010 are shown in Appendix 10-1, 10-2, and 10-3.
In addition, 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 10.2-1 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.

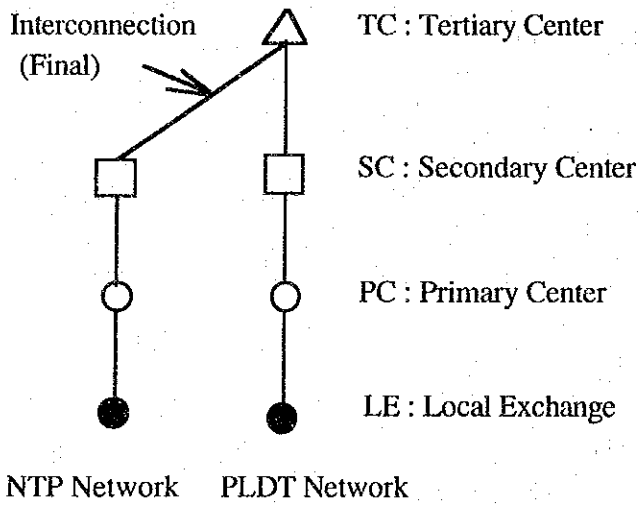
CHAPTER 11 TELECOMMUNICATION NETWORK PLAN

This master plan was prepared as a guideline to understand the perspective and targets of future telecommunications and to put forth a development principle for telecommunications toward the 21st century; thoroughly forecasting the size of a single network and investment enough to meet the supply target through the year 2010.

11.1 Network Structure

There are two nationwide toll networks, PLDT and NTP (on-going project) which will be interconnected as shown in Figure 11.1-1

Figure 11.1-1 Network Structure

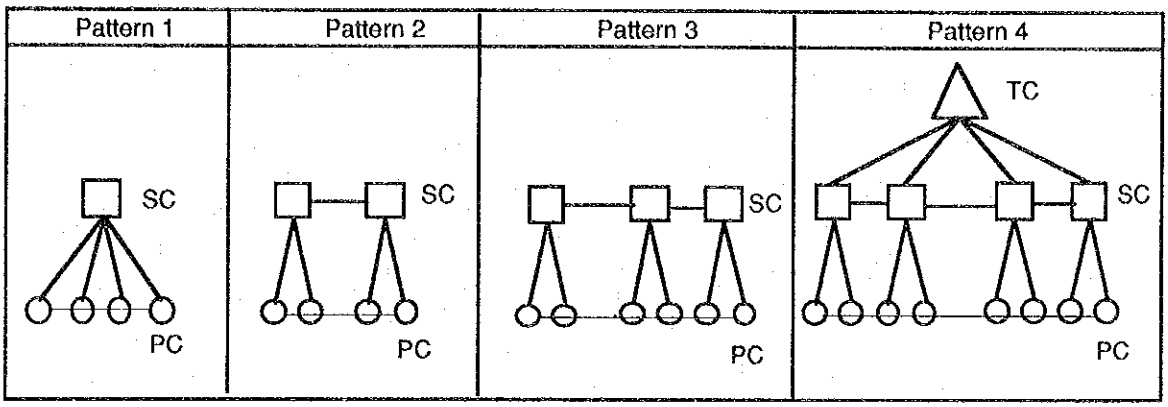


11.1.1 Optimization of Network Structure

Four (4) network patterns were selected for evaluation based on the forecasted traffic matrix in 2010 as shown in Figure 11.1-2.

Pattern 2 is the least cost network and adopted in this study. Transmission cost in long distance network has become cheaper and not affected by distance so much as before. In network optimization, the ease of network function development, the efficiency of operation and maintenance and network stability have become important factors.

Figure 11.1-2 Patterns of Network Structure



11.1.2 Defining Area of Telephone Network

Defining local exchange areas and primary center areas that correspond to the administrative areas as much as possible will improve efficiency. The followings area definitions are recommended.

(1) Local Exchange area	Municipalities	1600 exchanges including RSU/RLU
(2) Primary Center area	Province	72 primary centers
(3) Secondary Center area	M.M. and Cebu	2 centers (M.M. is Metro Manila)

11.2 Routing Plan

There are several possible routing methods as follows:

(1) Fixed routing (for step by step system),
(2) Alternative routing (for crossbar and SPC switching system), and
(3) Dynamic routing (Switching systems select the most suitable routs depending on the network conditions. It is the most flexible routing system, but it is now in a trial stage in the world).

Alternative routing and far to near rotation systems are adopted for toll network routing scheme.

11.3 Switching Plan

The requested switching capacity of telecommunication facility depends on the demand and traffic forecast, and the supply plan.

11.3.1 Toll Switching System

(1) Toll switching centers are primarily located in provincial capitals.
(2) The toll switching system is not located in a provinces with traffic demand below 4,000 Erlang. Instead, the toll traffic is routed to a toll switching system in an adjacent province.

11.3.2 Local Switching System

Each municipality has one local exchange. The type of the local switching system is defined as follows:

Table 11.3-1 Type of Switching System and Capacity

Type of Switching System	Capacity Range (Lines)
Local Switch (LS)	Over the 3,000
Remote Switching Unit (RSU)	301 to 2999
Remote Line Unit (RLU)	Less then 300

11.4 Numbering Plan

The types of numbers can be divided into the following categories.

0ABC:	mainly for connection to another subscriber, (including ABC type for local call),
1XY:	special service for all telephone users, and
*XY and #XY:	special service for push button telephone users with push button dialing signal.

The numbering plan should be logically and remain unchanged for the next 50 years or longer considering numbering capacity for the future telephone demand and new services. Table 11.4-1 summarizes the principle of number allocation scheme in the Philippines.

Table 11.4-1 Number Allocation Scheme

<table>
<tr><th>A \ B</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>0</th><th>*</th><th>#</th></tr>
<tr><td>1</td><td colspan="12">Special service codes and carrier access codes (1XY type)</td></tr>
<tr><td>2</td><td colspan="10" rowspan="8">Subscriber number for local calls
(xxx xxxx)</td><td colspan="2" rowspan="8">Special service for push bottun signaling terminal</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>0</td><td colspan="9">Trunk calls and Mobile telephone calls
(0+xx xxx xxxx)</td><td>00</td></tr>
<tr><td>*</td><td colspan="12" rowspan="2">Activate/deactivate special features of stored program control switching system</td></tr>
<tr><td>#</td></tr>
</table>

A: first digit to be dialed
B: second digit to be dialed
"00": International call prefix

11.5 Signaling Plan

Signaling of PSTN in the Philippines consists of three types, Loop Disconnected Decadic E&M, MFC-R2, and Common Channel Signaling No. 7 (CCS No. 7). Along with digitization, CCS No. 7 is diffusing. In CCS No. 7, there are associated mode of operation and non associated mode of operation. For a large scale of network for the future, non associated mode is suitable. PLDT has applied non associated mode already therefore.

11.6 Synchronization Plan

Network synchronization plays a key role in establishing a high-quality digital telecommunications network. PLDT has already implemented a synchronization network plan in that a primary clock is installed at Metro Manila. For the case of a disaster, it is recommended that another primary clock should be installed in Cebu against wide area disaster.

11.7 Interconnection Plan

Executive Order No. 59: "Mandating Interconnection" and Memorandum Circular (MC) No. 9-7-93: "Implementing Guidelines on the Interconnection of Authorized Public Telecommunications Carriers" specify the interconnection requirements. There are still

remaining problems to keep the above order and circular. Here is showing concrete measures.

(1) Adequate scale of network for each local operating company,
Each operator should have a franchise area with more than a few thousand subscribers capable of supporting an economical network.
(2) Adopting RSU or RLU for small service area,
(3) Eliminating PABX system as a local switching system,
(4) Maintaining high grade of service,
Each operator should have responsibility of maintaining his equipment up to the interconnection point. For trouble condition of interconnection lines, they should have hot lines to correspond each other which are independent lines, such as wireless communication system.
(5) Introduction of metering system between interconnection circuits.
To ensure the fair revenue sharing, it is desirable to measure the utilization of network of interconnection calls using metering system.

11.8 Technical Standard

MC No. 10-16-90 listed all digital telecommunications standards, which are based on ITU Recommendations. There are a few more things that need to be described for new technologies and services for ISDN which are under studying in ITU.

The study team recommends establishing telecommunications technology standards organization to study standards in telecommunication field in the Philippines, composed of telecommunication operators companies, manufacturers, representatives of users and government organizations.

11.9 Circuit Calculation

Required number of circuits were calculated from the result of the traffic forecast for each phase, based on the following design condition

(1) less than 20 erl. to an exchange, the traffic pass thorough transit exchange
(2) more than 100 erl. to an exchange, establishing direct circuits unconditionally in which traffic pass through
(3) for the traffic which is not in the above threshold range pattern, the routing was determined based on economical comparison by LTC (Last Trunk Capacity) method

(4) considering the grade of service described in MC No. 10-16-90: telecommunication standard in the Philippines.

The result of calculation of required circuits are shown in Appendix 12-2 .

11.10 Transmission Network Plan

It is studied as an integrated single network using existing transmission systems.

(1) Transmission Network Design

An integrated transmission network can be functionally divided into two networks.

(a) Long Distance Transmission Network

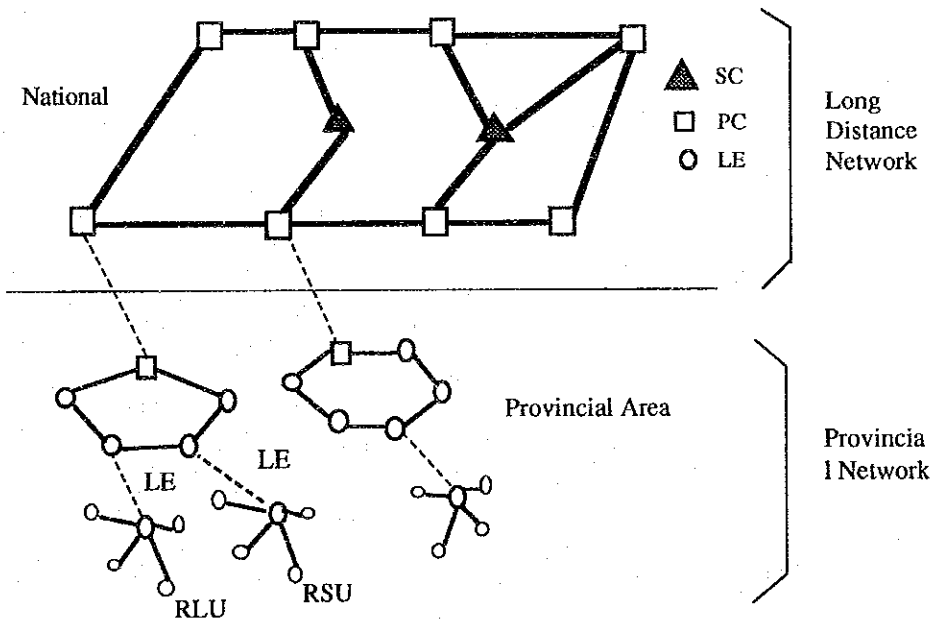
It forms the ladder and loop-type network for reliability using optical fiber system with SDH for high density routes.

(b) Provincial Transmission Network

PC-LE is formed loop type network in principle, LS-RSU-RLU is formed star type network.

Functional division of the transmission network is shown in Figure 11.10-1

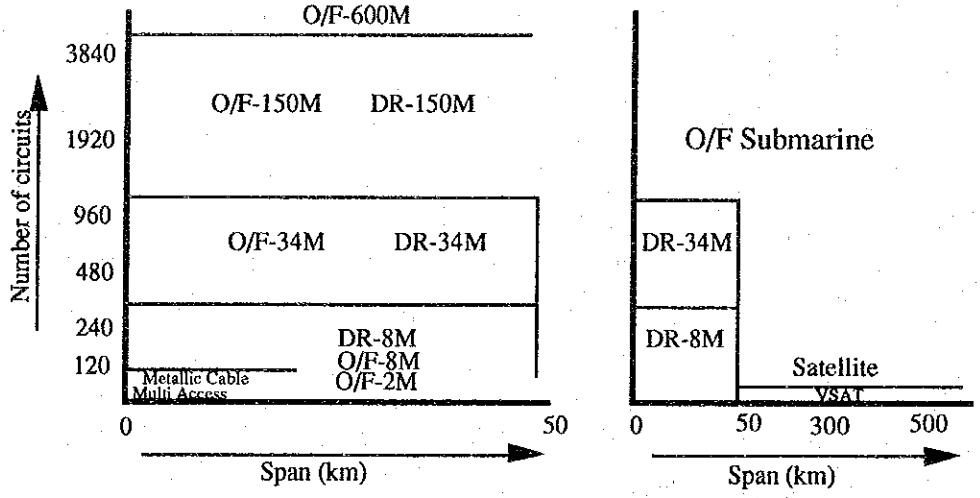
Figure 11.10-1 Division of Transmission Network



(2) Application Standards

From view point of environmental conditions, reliability, and cost, application standards which the Study Team developed for transmission systems to be used as a guideline by the operators when they are planning are shown in Figure 11.10-2.

Figure 11.10-2 Transmission Application Standards for PSTN



(a) Ground Links (b) Island Links

O/F: Optical Fiber System

DR: Digital Radio System

VSAT: Very Small Aperture Terminal System

CHAPTER 12 TELECOMMUNICATIONS FACILITIES PLAN

12.1 Switching Facilities

The number of additional municipalities served in Phase A is 450, in Phase B is 479, and in Phase C is 399.

12.1.1 Expansion Plan

(1) Local Switching Facilities

Local switching line capacity grows by 2,077,000 lines in Phase A, 2,550,100 lines in Phase B, and 4,116,000 lines in Phase C.

(2) Toll Switching Facilities

Toll switching trunk capacity grows by 26,986 trunks in Phase A, 33,016 trunks in Phase B, and 66,774 trunks in Phase C.

12.1.2 Replacement Plan

(1) Local Switching Systems

Manual and SXS facilities are replaced during Phase A and XB and SPC-analog facilities are replaced during Phase B. Analog switching line capacity is reduced by 403,235 lines in Phase A and 255,562 lines in Phase B. The total decrease is 658,797 lines.

The replacement of digital switching system is planed by 321,380 line capacities in local switching systems.

(2) Toll Switching Systems

Digital toll switching systems, with a capacity of 11,850 trunks will be replaced during Phase C.

12.1.3 Switching System Digitization

As analog switching systems are replaced by digital ones during Phase A and B, the percentage of digital system will rise from 32.8% to 91,6% at the end of Phase A and to 100% at the end of Phase B.

12.1.4 Cost Estimation

The estimated cost of expansion and replacement plan are shown in Table 12.1-1.

Table 12.1-1 Estimated Cost of Expansion and Replacement Plan

(Unit: US$ 1,000)

		Phase A		Phase B		Phase C	
		(lines)	Cost	(lines)	Cost	(lines)	Cost
Expansion Plan	Local	2,077,000	1,428,989	2,550,100	1,782,599	4,116,000	2,859,465
	Toll	26,986	52,276	33,016	55,996	66,774	123,204
Sub Total		-	1,481,265	-	1,838,595	-	2,982,669
Replacement Plan	Local	403,235	181,456	255,562	115,003	321,380	144,621
	Toll	-	730	-	0	11,850	7,564
Sub Total		-	182,186	-	115,003	-	152,185
Total		-	1,663,451	-	1,953,598	-	3,134,854

12.2 Transmission Facilities

12.2.1 Expansion Plan

In this study, required number of 2-Mb/s paths is estimated by using the result of the circuit accommodation plan, and also the cost is estimated based on 2M b/s paths.

(1) Long Distance Transmission Facilities

The estimated number of 2-Mb/s paths for the long distance transmission network is shown by phase in Table 12.2-2, Long distance transmission network plan (Integrated Network) of number of 2M b/s paths in each link by 2010 is shown in Figure 12.2-1.

(2) Provincial Transmission Facilities

Required number of 2-Mb/s paths for the provincial networks is shown by phase in Table 12.2-1.

Table 12.2-1 Provincial Transmission Network Facilities Plan

(number of 2-M b/s paths)

Region	Phase A	Phase B	Phase C	Total
CAR	31	47	108	186
1	134	174	311	619
2	68	107	130	305
3	269	462	735	1,466
4	299	544	1,007	1,850
5	60	153	186	399
6	142	272	391	805
7	62	216	324	602
8	36	131	233	400
9	21	84	131	236
10	80	161	273	514
11	110	229	477	816
12	43	63	102	208
ARMM	17	39	120	176
Total	1,372	2,682	4,528	8,582

12.2.2 Cost Estimation

Cost estimations of the transmission facilities were estimated for the long distance transmission network and provincial network which are included process of the expansion plan and replacement plan by phase.

Cost estimation for the transmission facilities are shown in Table 12.2-2.

Table 12.2-2 Estimated Cost for Transmission System

(in US $000)

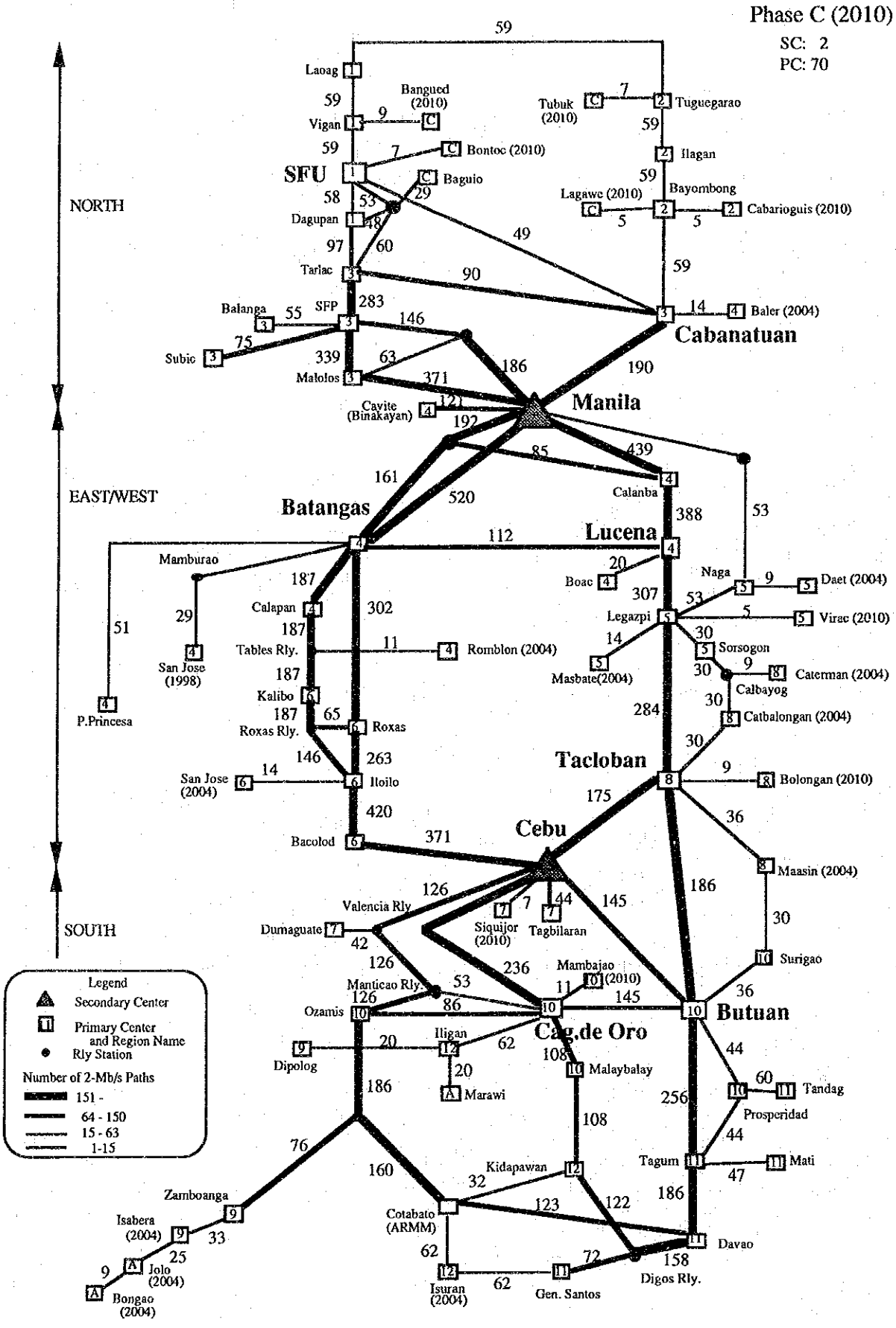
Long Distance	Phase A		Phase B		Phase C	
	Expand	Replace	Expand	Replace	Expand	Replace
No. of Paths	2,320	76	2,691	86	5,626	1,959
Cost	336,400	11,020	390,195	12,470	815,770	284,055
Phase Cost	347,420		402,665		1,099,825	
Total	1,849,910					

Province	Phase A		Phase B		Phase C	
	Expand	Replace	Expand	Replace	Expand	Replace
No. of Paths	1,372	-	2,682	-	4,528	-
Phase Cost	440,412	-	860,922	-	1,453,488	
Total Cost	2,754,822					

	Phase A	Phase B	Phase C
Phase Cost	787,832	1,263,587	2,553,313
Total	4,604,732		

2-Mb/s Path cost: Long distance - - - $ 145
: Provincial - - - $ 321

Figure 12.2-1 Long Distance Transmission Network Plan (Integrated Network)



12.3 Outside Plant

12.3.1 Expansion Plan

The number of primary cable pairs was estimated based on the targeted supply. The number of leased lines, test pair and other lines was estimated to be 3% of total connected lines. The cable pair slack margin rate was estimated to be 30% for all primary cable pairs.

We categorized cable pairs as those for large exchange areas and those for small exchange areas. Based on the switching facility plan, the supply target for the large exchange areas was estimated to be the target for subscribers connected to local switches, and the supply target for small exchange areas was estimated to be the target for subscribers connected to remote subscriber units or remote line units.

Table 12.3-1 shows the number of primary cable pairs to be installed in each area during each phase and Table 12.3-2 shows the installation cost for the expansion of outside plant by phase.

Table 12.3-1 Number of Primary Cable Pairs Installed in Each Area.

(Unit: Pairs)

	Phase A			Phase B			Phase C		
	Large Area	Small Area	Total	Large Area	Small Area	Total	Large Area	Small Area	Total
Total	2,231,392	440,792	2,672,184	2,819,403	616,367	3,435,770	4,731,304	756,035	5,487,339
NCR	1,742,370	0	1,742,370	1,809,656	0	1,809,656	1,571,623	0	1,571,623
Region Total	489,022	440,792	929,814	1,009,747	616,367	1,626,114	3,159,681	756,035	3,915,716
CAR	676	1,948	2,624	8,067	8,790	16,857	25,473	39,153	64,626
Region I	6,312	29,368	35,680	25,315	38,661	63,976	105,458	90,111	195,569
Region II	5,617	21,490	27,107	8,508	18,338	26,846	17,191	49,660	66,851
Region III	101,704	70,017	171,721	165,056	62,582	227,638	582,286	0	582,286
Region IV	142,422	131,328	273,750	346,878	75,682	422,560	1,013,989	66,351	1,080,340
Region V	9,667	14,898	24,565	12,909	31,827	44,736	24,805	47,190	71,995
Region VI	31,753	46,778	78,531	55,553	69,132	124,685	170,400	93,388	263,788
Region VII	27,957	23,696	51,653	115,754	83,044	198,798	392,432	89,775	482,207
Region VIII	5,292	4,641	9,933	9,117	25,711	34,828	22,282	51,604	73,886
Region IX	7,056	7,750	14,806	19,172	33,534	52,706	33,494	55,069	88,563
Region X	48,319	23,286	71,605	79,155	66,731	145,886	237,275	105,020	342,295
Region XI	84,770	43,978	128,748	155,288	67,396	222,684	509,221	0	509,221
Region XII	13,136	11,649	24,785	3,733	14,623	18,356	8,288	26,032	34,320
ARMM	4,342	9,966	14,308	5,242	20,317	25,559	17,088	42,681	59,769

Table 12.3-2 Cost for Expansion of Outside Plant

(Unit: 1,000 US$)

	Phase A			Phase B			Phase C		
	Large Area	Small Area	Total	Large Area	Small Area	Total	Large Area	Small Area	Total
Total	985,003	252,953	1,237,956	1,244,569	353,708	1,598,277	2,088,540	433,858	2,522,398
NCR	769,134	0	769,134	798,836	0	798,836	693,761	0	693,761
Region Total	215,869	252,953	468,822	445,733	353,708	799,441	1,394,778	433,858	1,828,636
CAR	298	1,118	1,416	3,561	5,044	8,605	11,245	22,468	33,713
Region I	2,786	16,853	19,639	11,175	22,186	33,361	46,552	51,711	98,263
Region II	2,479	12,332	14,811	3,756	10,523	14,279	7,589	28,498	36,087
Region III	44,895	40,180	85,075	72,861	35,913	108,774	257,038	0	257,038
Region IV	62,869	75,364	138,233	153,123	43,431	196,554	447,605	38,076	485,681
Region V	4,267	8,549	12,816	5,699	18,264	23,963	10,950	27,081	38,031
Region VI	14,017	26,844	40,861	24,523	39,672	64,195	75,220	53,592	128,812
Region VII	12,341	13,598	25,939	51,097	47,656	98,753	173,231	51,518	224,749
Region VIII	2,336	2,663	4,999	4,025	14,755	18,780	9,836	29,614	39,450
Region IX	3,115	4,447	7,562	8,463	19,244	27,707	14,785	31,602	46,387
Region X	21,330	13,363	34,693	34,942	38,294	73,236	104,740	60,267	165,007
Region XI	37,420	25,237	62,657	68,549	38,676	107,225	224,785	0	224,785
Region XII	5,798	6,685	12,483	1,648	8,391	10,039	3,658	14,939	18,597
ARMM	1,917	5,719	7,636	2,314	11,659	13,973	7,543	24,493	32,036

12.3.2 Replacement Plan

Outside plants equipment is affected by the elements, and thus deteriorates over time. It is therefore, necessary to replace old and deteriorated facilities in order to maintain service quality of and to prevent increases in maintenance costs.

All facilities in existence at the end of 1992 will be replaced sometime during the plan. The number of replaced facilities is level through out the Master Plan period. The existing facilities count is based on the number of main lines as obtained from NTC.

Table 12.3-3 shows the number of primary cable pairs to be replaced and the cost of replacing them by phase.

Table 12.3-3 Number of Primary Cable Pairs Replaced Cost

(Unit: Pairs and 1,000 US$)

	Phase A		Phase B		Phase C		Total	
	Cable Pairs	Cost	Cable Pairs	Cost	Cable Pairs	Cost	Cable Pairs	Cost
Total	435,165	192,095	435,165	192,095	435,165	192,095	1,305,494	576,284
NCR	294,593	130,042	294,593	130,042	294,593	130,042	883,778	390,126
Region Total	140,572	62,053	140,572	62,053	140,572	62,053	421,716	186,158

12.4 Non-Voice Services and New Services

On the basis of the introduction plan in section 9.5, the facility plans of non-voice services and new services are listed in Table 12.4-1

Table 12.4-1 Facility Plan of Non-Voice Services and New Services

Service	Unit	1998	2004	2010	Total
Cellular	1000 sub.s	164.7	336.6	922.6	1,423.9
Radio Paging	1000 sub.s	325.9	259.9	473.8	1,059.6
N-ISDN	1000 sub.s	0.05	120.5	1,020.3	1,140.8
P-ISDN	1000 sub.s	0.004	10.2	86.7	96.9
Intelligent	NSSP	1			1
Network	NSP	1	1	1	3
Leased Line	1000 lines	5.0	9.8	21.1	35.9
Packet Switch	1000 Sub.s	4.1	8.1	0	12.2

Note: - Including replacement in Cellular and Radio Paging column
- ISDN and Intelligent Network services are assumed started in the year 1998.
- N-ISDN: Narrow Band ISDN of basic speed: 64 Kb/s
- P-ISDN :Primary speed ISDN: 2.048 Mb/s
- NSSP: Network Service Support Point
- NSP : Network Service Control Point

12.5 Cost Estimation

The total investment cost is summarized in Table 12.5-1.

Table 12.5-1 Total Investment Cost

	Phase A	Phase B	Phase C	Total
Switching	1,662	1,954	3,135	6,751
Transmission	788	1,264	2,553	4,605
Outside Plant	1,430	1,790	2,714	5,934
Sub Total	3,880	5,008	8,402	17,290
New Services				
CMTS	430	878	2,406	3,714
Radio Paging	691	551	1,005	2,247
ISDN	4	67	113	184
Intelligent Network	4	1	1	6
Packet Switching	3	7		10
Sub-Total	1,132	1,504	3,525	6,161
Total	5,012	6,512	11,927	23,451

CHAPTER 13 OPERATION AND MAINTENANCE PLAN

To ensure the network reliability, the Study Team considered and examined the operational and maintenance plans of the public switched telecommunication networks (PSTNs).

13.1 Network Management Systems

In the Philippines, the PSTNs are operated and maintained by the respective carriers. Since they are interconnected with each other, an efficient network management system is needed. The Study Team therefore considered and examined establishing an efficient network management system.

(1) Backbone Network Control System

The existing backbone network for the PSTNs is mainly composed of two networks, each operated by a different company. They are interconnected with each other. Our examination of the backbone network control system identified the problems. The following actions would improve the control system.

(a) Establish Integrated Network Control Center.
(b) Establish Information Hot Line
(c) Establish Support System

It is necessary to strengthen the communications of operating information between operators in order to reduce network downtime. Therefore (b) and (c) are recommended.

(2) Local Network Control Systems

The local switches and spur links are individually controlled and maintained by the PLDT, governmental agencies, and local telephone companies. A large number of local switches are expected to be installed nationwide between now and 2010. These switches may create problems in the operation and maintenance of the local networks. The following actions would improve the control systems.

(a) Establish an Integrated Operation and Maintenance Center for each local network.
(b) Establish Information Hot Line.
(c) Unify franchised areas.

It is necessary to strengthen the communication of information between operators in order to reduce local network downtime. It is also, necessary to reduce the maintenance work volume of local telephone companies. Therefore (b) and (c) are recommended.

13.2 Subscriber Facilities Maintenance

The network expansion project will expand the telephone service area to all municipalities; the number of telephone subscribers will grow rapidly (to around 8,768 thousand). To meet this demand, a large number of subscriber facilities will need to be installed. Most local telephone companies will need to make significant investments in expanding their facilities. They will also need to significantly expand their maintenance staffs to construct and maintain these facilities. A properly located Centralized Maintenance Center for subscriber facilities could handle the maintenance and construction work for the telephone companies. Therefore, this concept should be implemented.

13.3 Staffing Plan

As the network expands, many switching facilities, transmission and radio facilities, and subscriber facilities will be installed. To smoothly operate and maintain this equipment, and to provide good quality service, an adequate number of personnel must be employed.

We calculated the number of additional support personnel based on the expected growth in the number of main lines with the correlation curve which shows the correlation between the number of main lines and the number of employees. A total of 48,003 additional support personnel will be required to operate and maintain the additional 7,880 thousand main lines expected to be installed through the year 2010.

Table 13.3-2 shows the number of additional personnel required through 2010.

Table 13.3-1 Required Additional Personnel through 2010.

	Phase A	Phase B	Phase C	Total
Main Lines (,000)	2,703	5,038	8,768	
Additional Personnel (,000)	11.7	15.1	21.5	48.3

13.4 Training Plan

The following measures are recommended for promoting smooth operation and maintenance.

(a) Promote on-the-job training.
(b) Expand the training capacities of the TTI and TTC.
(c) Enhance the project-associated training in the manufacturer's factories and in the Philippines.
(d) Also train local telephone company staff at the TTI and TTC.
(e) Promote regional training programs taught by instructors dispatched from the TTI and TTC.
(f) Conduct the four types of training (Leader training, engineer training, technician training, and new staff training).
(g) Establish a training center at each company.

CHAPTER 14 PROJECT EVALUATION

14.1 Purpose and Premise of Financial Analysis

The objective of project evaluation is to analyze the profitability of the project from the financial and economic viewpoint by estimating the cost to carry out the project and the revenues generated from the project. The result of evaluation can be used by the government in the process of policy making.

Basic assumption for the projection is as follows;

(1) Investment amount and number of telephone lines to be installed is subject to chapter 12.
(2) Construction period is 18 years from 1993 to 2010 and its operation will end in 2012.
(3) The foreign currency exchange rate employed in this analysis is 25 pesos per US dollar.
(4) Sunk cost, inflation and change of foreign currency exchange rate are not considered

14.2 Revenue Estimation

(1) Revenue estimation is based on the present tariff.
(2) The rate of telephone of residential use in the Philippines is supposed to increase and reach 70% in 2010.
(3) The local service tariff of Manila and Luzon for the study is used for the tariff of NCR and province respectively.
(4) The revenue for domestic toll call is estimated based on the sampling data of the present subscribers.
(5) Regarding to international toll call, the traffic volume per population is supposed to increase and reach the level of Malaysia. But the revenue per main line will decrease because the total number of main line will become ten times.
(6) The revenue for installation fee, transfer fee, advertisement in telephone directory and so on is estimated totally 1.4% of the total revenue.
(7) The provision for doubtful account is supposed to be 1.7% of total revenue.

14.3 Expenditure Estimation

(1) The total number of main lines in the 18 years construction period is 8.77 million and total investment amount is 17.3 billion US $ which includes facilities of exchange,

transmission, outside plant , power, building and so on. The detailed facility plan is described in chapter 12.

(2) The operating expense is set at 22,000 pesos per year which is based on the results of major operating company. The cost is set to decrease according to the efficiency improvement studied in chapter 13.

(3) Working capital is set to be 26% of revenue, that is the average of the past 10 years of the major operating company.

(4) The franchise tax is 3% according to the present law.

14.4 Financial Analysis

(1) The FIRR(financial internal rate of return) for the master plan is calculated as 11.67%. The FIRR for the master plan of NCR part and province part are 12.82% and 10.39% respectively. These FIRR exceeds the 6% of NEDA hurdle rate of projects and close to the upper limit of 12%.

(2) The cash flow of first seven years is minus and the required funds per year is 690 million US $ at the maximum year.

(3) The conditions and assumptions will change in the long term period. The sensitivity analysis sets assumptions on the fluctuation ranges of decrease of domestic toll call revenue, international toll call revenue and the increase of investment amount. The results of sensitivity analysis is shown in the Table 14.4-1.

Table 14.4-1 Results of the Sensitivity Analysis of the Project

IRR		Total	NCR	Province
Base Case	100%	11.67%	12.82%	10.39%
Dom. Toll Revenue	90%	10.97%	12.47%	9.31%
	80%	10.26%	12.12%	8.23%
Int'l Toll Revenue	90%	10.79%	11.86%	9.63%
	80%	9.88%	10.85%	8.84%
Investment	110%	9.90%	10.90%	8.81%
	120%	8.43%	9.31%	7.48%

14.5 Economic Analysis

The benefits of telecommunications vary large and range widely from the direct effect of the users such as substitution of traffic to the indirect effect such as enlargement of business scope and expansion of employment. To measure the economic benefits of the master plan, the idea of consumers' surplus is employed. In this evaluation, based on the data of the present tariff and traffic, the demand function derived from the multiple regression is used in order to calculate the consumers' surplus. The economic benefit is estimated as 189% of financial benefit.

Using the economic benefit instead of the financial benefit, the economic internal rate of return is calculated as 49%. The EIRR exceeds the 15% of NEDA hurdle rate for project and higher than other infrastructure projects.

CHAPTER 15 IMPLEMENTATION PLAN

The project packages proposed in this chapter are in line with the study on the improvement and optimization of telecommunications network and the NTDP, to increase telephone density to at least 3.8 nationwide by 1998 . This projects which cover the rural areas, have to be implemented by private sectors, but it needs the government leadership considering the governmental finance including ODA, on the basis of EO 109, because of low profitable areas.

The Personal Handy Phone system (PHP) is assumed to be installed in Makati district as a model case as one of the project package.

15.1 Relation to Master Plan

This proposed project packages primarily cover unserved provincial areas to supply telephone lines to meet the supply targets through 1998 (Phase A). According to the supply plan in Phase A, as shown in Table 15.1-1, 631,000 lines are planned to be supplied in provincial areas which are 45% of coverage ratio of the municipalities. Of those 631,000 lines, more than half are already planned in specific projects including X-5C, X-6, RTDP, NTP, and other Paptelco projects. Other unserved area's supply lines are mainly pick up by this project packages on Region by Region basis. The relationship between the Master Plan and this project packages is illustrated in Figure 15.1-1.

Table 15.1-1 Supply Plan in Phase A

(Unit: 1000 lines)

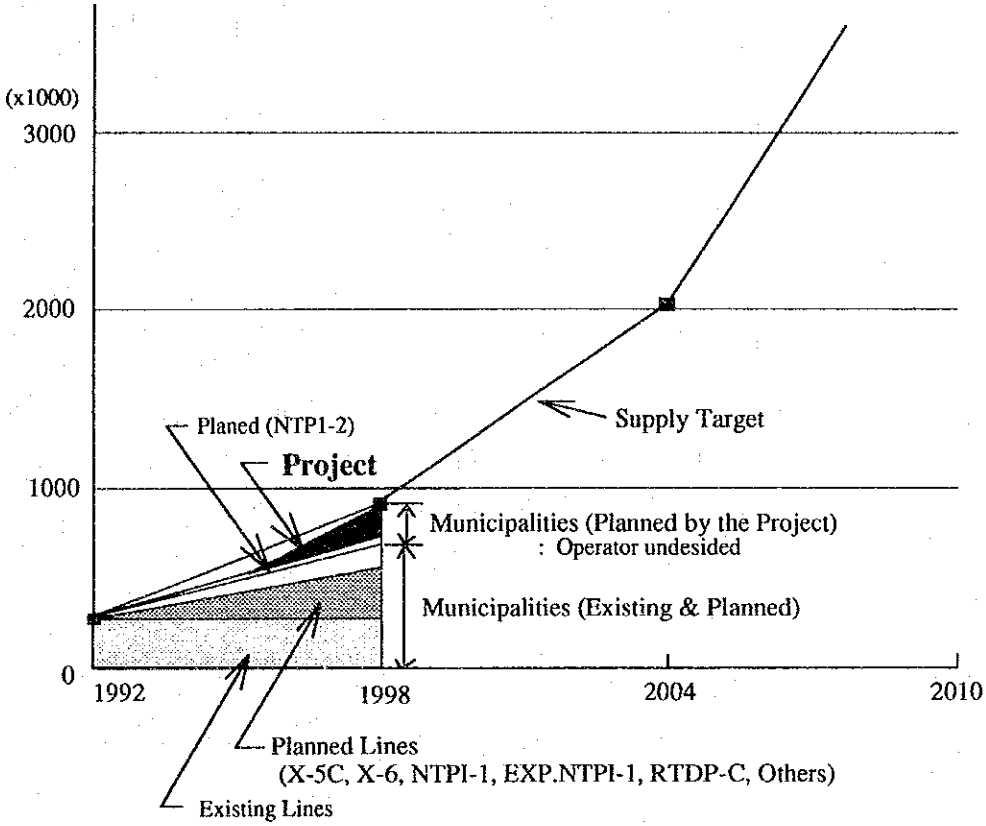
Area	Year end in Phase A	Supplied 1998	Year end
NCR	600	1,185	1,785
Province	287	631	918
Total	887	1,816	2,703

15.2 Selection of Project Sites

Projects are formed on a regional basis. Projects would provide telephone lines in primarily unserved or inadequately served areas.
Selection guidelines of project sites are as follows:

(1) Municipalities which are assigned to be served in Phase A and their adjacent are the main sites. Areas with on-going and planned projects would not be included in this project.

Figure 15.1-1 Relation between Master Plan and Project



(2) Municipalities including in NTP Tranche 1 and their adjacent areas (except in Region 3 to 5) would be included in this project.

Region 1 would not be included in this project, because all municipalities which are planned to be served in Phase A already have telephone service or a plan to be served, and the demand in unserved municipalities is small.

Expansion of PLDT, RTDP, and NTP 1-1 toll backbone network is not included in this packages.

15.3 Technical Feasibility

(1) Provisioning period

Telephone network must be augmented at regular intervals. In this project, switching and transmission plant are designed to meet the supply target by 2001 and outside plant to meet the supply target by 2003.

(2) Homing and routing plan

The homing and routing plan and interconnection plan to toll operating networks are illustrated in the report.

(3) Implementation Schedule

The project will be implemented in the form of engineering stages and construction stages. All projects are scheduled to be completed by the end of Phase A (1998).

15.4 Summary of Project Packages

The projects establish fully digital telephone systems, digital microwave/fiber optical cable links, outside plant, and interconnection toll facilities to provide 286,200 telephone switching lines to 224 cities and municipalities. Then umber of local exchange sites and the switching capacity, the estimated cost, and financial evaluation by project package are shown in Table 15.4-1, Table 15.4-2, and Table 15.4-3 respectively.

Table 15.4-1 Number of Sites and Switching Capacities

Project Name	Number of Sites	Switching Capacity (lines)
Region 2	18	7,000
Region 3	6	5,000
Region 4	25	37,300
Region 5	28	11,800
Region 6	26	31,600
Region 7	32	41,400
Region 8	19	9,300
Region 9	17	15,500
Region 10	13	41,100
Region 11	25	69,800
Region 12	15	16,400
Total	224	286,200

Table 15.4-2 Estimated Cost

(Unit: US$ Million)

Project Name	Total	Foreign	Local
Region 2	22.6	14.5	8.1
Region 3	13.9	8.9	5.0
Region 4	120.6	84.1	36.5
Region 5	39.1	25.2	13.9
Region 6	77.2	48.9	28.3
Region 7	97.9	62.0	35.9
Region 8	25.7	16.5	9.2
Region 9	45.7	29.4	16.3
Region 10	81.5	51.4	30.1
Region 11	143.1	90.6	52.5
Region 12	43.2	27.4	15.8
Total	710.5	458.9	251.6

Table 15.4-3 Financial Analysis

Project Name	IRR	Share of domestic toll revenue (%)	Cross subsidy per sub (peso)	Total cross subsidy (M.peso)
Region 2	1.01	30	9,000	1,051
Region 3	3.06	30	6,000	540
Region 4	5.27	50	5,000	3,416
Region 5	1.08	30	8,000	1,621
Region 6	8.34	50	2,000	1,152
Region 7	8.74	50	2,000	1,517
Region 8	5.86	50	5,000	773
Region 9	6.00	50	4,000	1,109
Region 10	10.64	50	500	376
Region 11	10.55	50	500	645
Region 12	7.78	50	3,000	911

Note: Cross subsidy required to maintain IRR between 11% and 12% per subscriber/ year which is the same IRR of Master Plan.

15.5 Other Project

PHP system with 10,000 terminals in Makati district is studied as a model case. System configuration is illustrated in Figure 15.5-1 and estimated cost is shown in Table 15.5-1 respectively. Cost per terminal shows about US$ 900.

Figure 15.5-1 System Configuration

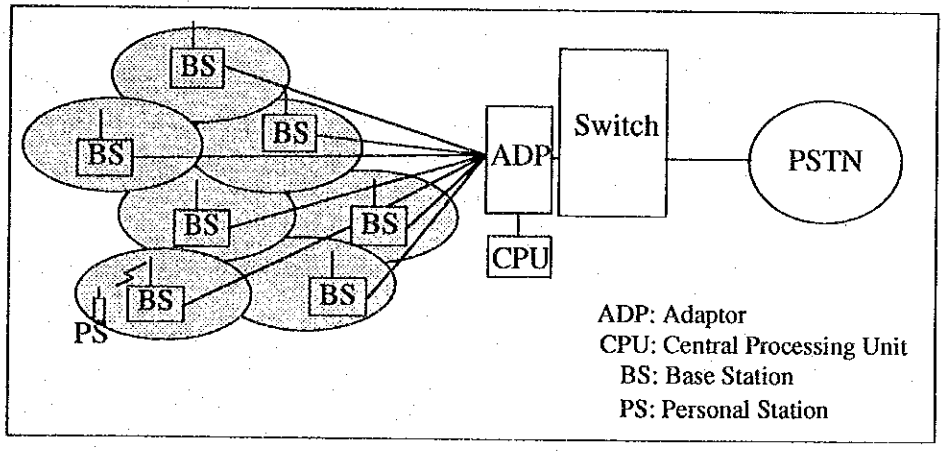


Table 15.5-1 Estimated Cost

	(Unit: US$ 1000)
Switching equipment(1,430 channel)	715
Adapter and CPU(including work station and software)	210
Base station (11 ch 130 station)	1,950
Installation(including entrance cable)	1,170
Terminals	5,000
Total	9,045

Note: Building cost is not included.

CHAPTER 16 RECOMMENDATIONS

This master plan was prepared as a guideline to understand the perspective and targets of future telecommunications and to put forth a development principle for telecommunications toward the 21st century: thoroughly forecasting the size of a single network and the investment enough to meet the supply targets through the year 2010, and analyzing the expected financial situation.

Based on the results of this study, the recommendations described in this chapter for implementing this master plan by the relevant organizations focus on the technical and economic aspects needed to improve and optimize the telecommunication network in the Philippines.

16.1 Higher Priority to Telecommunications

Telecommunications is no longer simply a means of communicating; it has also become a tool to control the various information processing systems that are essential to all socio-economic activities. The flow of information has become one of the determinants of the movement of people, goods, and money - the main elements of socio-economic activity. While people and goods physically move, monetary transactions are now simply settled between computers through telecommunication facilities. Daily socio-economic activities depend entirely on information and telecommunication systems to transmit and process vital information. These telecommunication and processing systems have reached the some level of importance in modern infrastructures as transport systems. Furthermore, economic activities no longer are restricted to domestic areas, but extend to the every corner of the world. Telecommunications is an indispensable tool for worldwide economic activities.

The EIRR (Economic Internal Rate of Return) for the master plan, calculated in chapter 14, is as high as 49%. This shows that the benefits of telecommunications to the national economy are significant. (Note: The FIRR (Financial Internal Rate of Return) for the master plan is calculated as 11.6%)

It is recommended that governmental organizations in the Philippines should recognize the importance of telecommunications to developing their country and give a higher priority to telecommunications than before in the development of the country.

16.2 Adequate Scale of Network for Each Local Operating Company

From the economic viewpoint, an adequate scale of network (at least several thousand subscribers) is needed for each operating company to attain network efficiency. Independent networks for small areas, such as a municipality are not economical. For a small municipality, it is better to use a RSU (Remote Switching Unit) or RLU (Remote Line Unit) connected to the host switching system in a nearby big city. Nevertheless, independent local switching systems serve small areas. (Some even use a PABX as a local switching system.) It is recommended that each local operator should have an adequate scale network, covering one or more provinces to create economical networks. These networks can be formed by rearranging franchises, such as through merger or joint operations.

While it may be possible to develop small and economical local switching systems, it is difficult to make a local switching system cheaper than an RSU or RLU because even small independent switching systems need a full range of functions if they are to function as a local switching system, including central processing, charging, alternate routing, and CCS No. 7, which are not needed in an RSU or RLU.

16.3 Interconnection

(1) Grade of Service (GOS)

Two carriers whose networks are interconnected with each other are responsible for maintaining their network up to the point of interconnection (POI) and keeping the quality in conformance with MC 10-16-90 issued by NTC. If a problem develops across the network systems, both carriers should work to restore normal operations. To do this quickly and efficiently, they must communicate with each other as soon as possible.

This intercarrier communication would be facilitated with a hot line system. Such a system must use a line independent from the regular communication network. A nationwide hot line system is best, because trouble in one part of the network may sometimes cause nationwide trouble. In such cases, a long distance carrier can limit the traffic going towards the affected area on the basis of the hot line information.

(2) Introduction of Metering System between Interconnection Circuits

To ensure fair sharing of income, it is recommended that meters be install on both sides of network interconnections to show how much interconnecting calls use the

networks. The meters would count the charging units, which would vary with the distance of each call, and record them.

It is also recommended that today's revenue sharing system should be changed to the this new metering system.

(3) Coordination of Interconnection Circuit Construction

Among cooperating organizations, especially two companies who intend to interconnect their networks, installation of interconnection circuits must be done in close cooperation. Otherwise, one side would have to wait until the other side completes its construction, so the system of the former remains idle until that of the latter is completed. The users of both networks as well as the operators will thus be inconvenienced. The operators should therefore coordinate their construction plans and implement them together. It is recommended that if trouble occurs during implementation, NTC coordinate the implementation schedule in according with MC No. 9-7-93.

16.4 New Mobile Telecommunication System

The introduction of a new digital cordless telecommunication system is expected to induce further expansion in the mobile communication system, as well as replace or compensate for wired telephone service, since the price of its terminals will be much lower than for cellular mobile telephones. These digital cordless telecommunication systems, such as PHP (Personal Handy Phone System) in Japan, DECT (Digital European Cordless Telecommunications system) and CT-2 (Cordless Telephone - 2 system) in Europe, have evolved from analog cordless telephone systems. In planning for the local telephone networks, it is recommended taking into consideration the new trends in technology and paying attention to the study of this field in ITU and APT.

16.5 Management of Telecommunications Information and Statistics

Having current and accurate data is indispensable to working out the best strategy. Correctly grasping the situation in telecommunications is essential to making strategies and plans. The following information should be recorded and updated at least annually in a standard format.

(a) Number of subscribers and waiting applicants
(b) Number of working subscriber lines (or main stations)
(c) Type and capacity of each switching system
(d) Type of transmission system, route, capacity, and location of repeater stations

(e) Financial statement
(f) Rate of applications for service that are satisfied within four weeks
(g) Monthly trouble complaints per 100 main stations
(h) Rate of trouble complaints that are cleared within two days
(i) Call completion rate

This data is not now always available in the Philippines. All operating companies should submit this data to NTC periodically. If necessary, NTC should direct the operating companies to report this information.

The statistics currently submitted by the operating companies are not consistent with respect to "data units". For example, for main stations, some companies report switching capacity, while some report working subscriber lines. For another example, for leased lines, some companies report the total transmission repeater spans of their leased lines, while others report the number of subscriber lines. The format and the units should be standardized in all operating company reports, including annual reports.

16.6 Technical Standards

(1) Establishment of Telecommunications Technology Standards Organization

ITU recommendations often obtain alternative standards, sometimes prescribed in an abstract way. As networks change to digital ones, offering new services and increasing interconnections, each country must determine their own standards either based on ITU recommendations or their own standards relevant to their special conditions.

It is recommended to establish a Telecommunications Technology Standards Organization composed of telecommunications operators, manufacturers, representatives of users, and governmental organizations (such as TELOF), to develop the Philippine standards in the telecommunication field. It would pursue the same activities as TTC (Telecommunication Technology Committee) in Japan, ETSI (European Telecommunications Standards Institute) in Europe, and T1 Committee in North America, standardizing such areas as network connection protocols and terminal equipment.

Its main activities would be as follow:
(a) study the establishment of standards for telecommunication network,

(b) study and research standards for connection within the national telecommunication network, and
(c) disseminate the standards.

In the Philippines, the Electronics and Telecommunications Standards Institute of the Philippines (ETSIP) was established for about the same purposes. It may therefore be a suitable organization for this role. Furthermore, it is recommended that the work should be carried out in close cooperation with APT (Asia Pacific Telecommunity), which has already started studying national technology standardization.

(2) Adoption of LR as Criteria of Speech Quality

On the basis of ITU Recommendations G.101 to 121 and P.76 to 79, it is recommended to adopt LR (Loudness Rating) as the criteria for prescribing accurate and practical units of speech quality, as mentioned in Section 11.8.

16.7 Fostering Local Manufacturing

As described in Chapter 12, the network expansion planned through 2010 will be far larger than previous projects. The network in 2010 will be about ten times as large as today's network. Fostering telecommunication equipment manufacturing in the Philippines, as mentioned in NTDP, is desirable in order to supply a considerable portion of the telecommunication equipment from domestic manufacture. This will contribute to growth in the Philippine economy through technology transfer, increase job opportunities, and reduce foreign currency expenditure.
It is recommended that the government should encourage manufacturing in this area by taking such actions as reducing taxes and providing financial support.

The telecommunications technology standards organization can also support manufacturing by establishing technical standards.

16.8 Financial Strategies

A huge amount of capital investment is needed to implement this master plan. Financial strategies are essential, as mentioned in Chapter V of NTDP. It includes:

(1) Access to Long-Term Financing
(a) Establishment of Philippine government-source sector development funds

(b) ADB/WB umbrella co-financing scheme
(c) Use of bilateral ODA

(2) Access to foreign capital markets

(3) Incentives during startup and formative period
(a) Reduced import taxes and duties for capital equipment
(b) Income tax holiday
(c) Carryover of net loss deduction from tax

(4) Obligation of financial reporting to NTC

Furthermore, tariff adjustments are desirable to attract investors and users. The government should:

(1) Study new tariffs, taking account of the network cost.
(2) Modify the present Foreign Currency Adjustment (FCA) mechanism.
(3) Revise the upper limit of the rate of return.
(4) Implement meter charging for local calls to make a more reasonable charging system based on the length of the call.

16.9 Strengthen Training

Training is essential to promoting smooth operations and maintenance work. It is recommended to implement the following measures.

(a) Promote on-the-job training.
(b) Expand the training capacity of the TTI and TTC.
(c) Enhance the project-associated training in manufacturers' factories and in the Philippines.
(d) Enhance training the staff of local telephone companies at the TTI and TTC.
(e) Promote training in each region by instructors dispatched from the TTI and TTC.
(f) Conduct efficient training programs (training of leaders, engineers, technicians, and new staff).
(g) Establish a training center in each company.

16.10 Project Package Implementation

The backlog of waiting telephone applicants must be eliminated and the network must be expanded to unserved areas. The majority of waiting applicants are concentrated in Metro Manila, where private operating companies will invest. It is desirable that telecommunication network expansion into the rural unserved areas will also be undertaken

by private sectors, but it should be implemented under strong government leadership considering the governmental finance including ODA , because these are low-profit areas.

Only 20.6% of cities and municipalities had local exchange telephone service as of the end of 1992. As mentioned in Chapter 9, the target coverage ratio for municipalities at the end of 2010 is 100%.

The project packages proposed in this report would expand the network to the unserved rural areas as the implementation plan for each region for the first phase (Phase-A: 1993 to 98) of the master plan, based on the conditions that PLDT's X-5C and X-6 projects, and the RTDP-C, NTP Tranche 1-1 and expansion of NTP Tranche 1-1 projects are implemented completely.

Therefore, it is recommended that these projects; PLDT's X-5C and X-6 projects, and the RTDP-C, NTP Tranche 1-1 and expansion of NTP Tranche 1-1 projects be implemented without exception and that the project packages proposed here be started as soon as possible as the first step toward the target.

JICA