I. INTRODUCTION

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1. Purpose of Study

This study has been made to determine the feasibility of the Rural Telecommunications Project in Regions III and IV, which had been planned by the MOTC and the BUTEL, at the request of the Government of the Philippines.

2. Study Methods

The study team listened to those concerned in the Philippines regarding the project and related items, conducted field survey and study by using data and information, and studied the feasibility of the project from both technical and economic standpoints.

3. Scope of Study

3-1 General Study Items

The following items were surveyed/studied.

(1) Present status of telecommunication services and facilities in the Philippines

(2) Telecommunications development program

(3) Organization and management of BUTEL

3-2 Study Items Concerning This Particular Project

(1) Engineering standars for telecommunications facilities

(2) Demand forecast

(3) Traffic forecast

(4) Circuit estimation

(5) System design and amount of works

(6) Estimated costs

(7) Implementation plan

(8) Operation and maintenance

(9) Charging system

(10) Economic and overall evaluations

4. Organization of Primary Survey Team and Feasibility Study Team

4-1 Preliminary Study Team

Member	In Charge of	Affiliated to
Koichi Onoe	General Leader	International Cooperation Division, Minister's Secretariat, Ministry of Posts and Telecommunications (MPT)
Masayuki Kashiwano	Radio	International Affairs Bureau, Nippon Telegraph & Telephone Public Corporation (NTT)
Akira Matsuki	Outside Plant	International Affairs Bureau, NTT
Shigemaro Aoki	Exchange	International Affairs Bureau, NTT

(Continued)

Member	In Charge of	Affiliated to
Akio Ito	Coordinator	Social Development Cooperation Dept., Japan International Cooperation Agency (JICA)

4-2 Feasibility Study Team

Member	In Charge of	Affiliated to
Ryoji Sasaki	General Leader	Special Advisor for International Cooperation Div. Minister's Secretariat Ministry of Posts and Telecommunications
Masayuki Kashiwano	Radio (A)	International Affairs Bureau, Nippon Telegraph and Telephone Public Corporation (NTT)
Kuninori Tanaka	Telegraph (C)	International Affairs Bureau, NTT
Shozaburo Shimamura	Radio (B)	International Affairs Bureau, NTT
Shigemi Hayashi	Radio (B)	International Affairs Bureau, NTT
Shiro Tamura	Exchange (B)	International Affairs Bureau, NTT
Keizo Eguchi	Transmission (C)	International Affairs Bureau, NTT
Yoshio Ito	Exchange (A)	International Affairs Bureau, NTT

Member	In Charge of	Affiliated to
Hisato Yokomizo	Outside Plant(A)	Maintenance Bureau, NTT
Eitaro Yagi	Outside Plant(B)	International Operation Div., The Nippon Telecommunications Consulting Co., Ltd. (NTC)
Katsuhiko Sato	Radio (A)	International Operation Div., NTC
Tadanori Wada	Economist	Telecommunication Policy Bureau, Ministry of Posts and Telecommunications
Norimoto Ohtake	Coordinator	Social Development Cooperation Dept., Japan International Cooperation Agency (JICA)

Alphabets in ( ) in the "In Charge" column represent the following individual groups: Group "A" engaged in study mainly in the western part of Luzon Is., the eastern part of Mindoro Is., Lubang Is., Palawan Is., and Panai Is. (Kalibo), Group "B" engaged in study in the eastern part of Luzon Is., the western part of Mindoro Is., Tablas Is., and Romblon Is., and Group "C" accompanied Group "A" or Group "B" as required.

5. Itinerary

5-1 Preliminary Study Team

The itinerary of the preliminary study team was as follows.

Date	Place	Contents of Survey
March 19	Left Narita (9:00, JL741) Arrive Manila (12:35)	Salutation to Japanese Embassy. Visit to JICA Manila Office.
March 20	BUTEL	Meeting with BUTEL personnel regarding the project, submission of inquiries to BUTEL, and adjustment of study itinerary.
March 21	National Telecommunications Comission (NTC) BUTEL	Study on organization and activities, etc. Meeting on field survey plan.
March 22	Bulacan and Nueva Ecija	Field survey in major cities/ municipalities in Region III
March 23	Manila	Data filing/analysis
March 24	Pampanga and Tarlac	Field survey in major cities/ municipalities in Region III
March 25	Cavite	Field survey in major cities/ municipalities in Region IV
March 26	Oriental Mindoro	Same as above.
March 27	Batangas	Same as above.

(Continued)

Date	Place	Contents of Study
March 28	Japanese Embasy, JICA Office, Overseas Economic Cooperation Fund (OECF) BUTEL	Study on site conditions Discussion on the scope of work
March 29	Manila	Data filing/analysis
March 30	Manila	Date filing/analysis
March 31	MOTC National Economic and Development Authority (NEDA)	Salutation to MOTC Meeting on telecommunications development progrums
April 1	BUTEL Telecommunication Training Institute (TTI)	Agreement on the scope of work Inspection in TTI
April 2	BUTEL	Meeting with Japansese Export attached to BUTEL
April 3	Left Manila (13:30, JL746) Arrived Narita (20:20)	

5-2 Feasibility Study

The itinerary of the feasibility study team was as shown in Table I-5-2-1.

Table I-5-2-1 (1/5) Itinerary of Feasibility Study Team for the Rural Telecommunications Project in Regions III and IV

Date	Leader	Group A	Group B	Group C	Economist	Coordinator
Oct. 6	Left Tokyo (14:00, PR431) Arrived Manila (17:00)	Same as Leader.	Same as Leader.	Same as Leader.		Same as Leader.
Oct. 7	Meetings at JICA Manila Office, Japanese Embassy and BUTEL	Same as Leader.	Same as Leader.	Same as Leader.		Same as Leader.
Oct. 8	Meeting at BUTEL	Same as Leader.	Same as Leader.	Same as Leader.		Same as Leader.
Oct. 9	Meeting at BUTEL	Same as Leader.	Same as Leader.	Field Survey in Pampanga area		Same as Leader.
Oct. 10	Field survey in Cavite area	Meeting at BUTEL	Same as Group A.	Same as Leader.		Same as Group A.
Oct. 11	Data collection	Same as Leader.	Same as Leader.	Same as Leader.		Same as Leader.
Oct. 12	Data collection	Same as Leader.	Same as Leader.	Same as Leader.		Same as Leader.
Oct. 13	Meeting at BUTEL and OECF	Same as Leader.	Same as Leader.	Same as Leader.		Same as Leader.
Oct. 14	Meeting at BUTEL and MOTC (Min. DANS)	Same as Leader.	Same as Leader.	Same as Leader.		Same as Leader.
Oct. 15	Meeting at BUTEL and NEDA (Mr. SUNGA)	Same as Leader.	Same as Leader.	Same as Leader.		Same as Leader.
Oct. 16	Agreement on I/A at BUTEL	Same as Leader.	Same as Leader.	Same as Leader.		Same as Leader.
Oct. 17	Meeting at BUTEL	Same as Leader.	Same as Leader.	Same as Leader.		Same as Leader.
Oct. 18	Tagaytay	Same as Leader.	Same as Leader.	Same as Leader.		Same as Leader.
Oct. 19	Tagaytay	Same as Leader.	Same as Leader.	Same as Leader.		Same as Leader.
Oct. 20	Pagsanjan, San Pablo Batangas	Same as Leader.	Batangas, Candelaria, Lucena	Same as Group B.		Same as Leader.
Oct. 21	Batangas	Caraca, Agoncillo, Mt. Panay	Atimonan, Plaridel, Gumaca	Same as Group B.		Same as Leader.

Table I-5-2-1 (2/5) Itinerary of Feasibility Study Team for the Rural Telecommunications Project in Region III and IV

Date	Leader	Group A	Group B	Group C	Economist	Coordinator
Oct. 22	Nasugbu	Inspection in Balayan	Unisan, Guinayangan	Same as Group B.		Same as Leader.
Oct. 23	Calatagan	Ibaan Tel. Office, Batangas Tel. Office, Mt. Banoy	Catanauan, Mulanay, San Francisco	Same as Group B.		Same as Leader.
Oct. 24	Report to Japanese Embassy, JICA Manila Office and BUTEL	Mt. Gonzares	Lucena	Same as Group B.		Same as Leader.
Oct. 25	Left Manila (08:00, PR432) Arrived Tokyo (12:45)	Data collection	Data collection	Same as Group B.		Same as Leader.
Oct. 26		Data collection	Data collection	Same as Group B.		
Oct. 27		Padre Garcia Municipal Office	Dasmarinas	Same as Group B.		
Oct. 28		San Pablo, Mayabobo Municipal Office	Mt. Gonzares, Tagaytay	Same as Group B.		
Oct. 29		Taysan	Ibaan, Batangas	Same as Group B.		
Oct. 30		San Fernando Region III, Arayat, Candaba, Mexico	San Fernando, Tarlac	Same as Group A.		
Oct. 31		Magalang Agricultural University, Porac and Sexmoan Magalang Municipal Offices	Angeles, Bustos, San Rafael, Angat	Same as Group A.		
Nov. 1		Data collection	Data collection	Same as Group A.		
Nov. 2		Data collection	Data collection	Same as Group A.		
Nov. 3		Tarlac Tel. Office (PLDT, BUTEL) Radio Repeater Station	San Ildefonso	Same as Group A.		

Table I-5-2-1 (3/5) Itinerary of Feasibility Study Team for the Rural Telecommunications Project in Regions III and IV

Date	Leader	Group A	Group B	Group C	Economist	Coordinator
Nov. 4		Alaminos proposed radio repeater station site (C4, C5)	Cabanatuan	Same as Group A.		
Nov. 5		Iba Tel. Office, Radio repeater station, Botolan Tel. Office, Municipal Office	Pantabangan, San Jose, Rizal	Same as Group A.		
Nov. 6		Dinalupihan Tel. Office, proposed radio repeater station site (C1)	Santa Rosa, Quezon, Licab	Same as Group A.		
Nov. 7		Bagac, Abucay, and Samal Municipal Offices, outside plant	Zaragosa	Same as Group A.		
Nov. 8		Data collection	Jaen, San Antonio, Cabiao, San Isidro	Same as Group A.		
Nov. 9		Batangas → Calapan	Data collection	Same as Group A.		
Nov. 10		Naujan, Victoria, Calapan Municipal Offices	San Jose, Central	Same as Group A.		
Nov. 11		Socorro Municipal Office	Sablayan	Same as Group A.		
Nov. 12		Gloria Municipal Office, radio repeater station site (B4)	Manila	Same as Group A.		
Nov. 13		Bongabong and Roxas Municipal Offices	Data collection	Same as Group A.		
Nov. 14		Calapan Tel. Office	Mamburao	Same as Group A.		
Nov. 15		Data collection	Mamburao radio repeater station site	Same as Group A.		
Nov. 16		Data collection	Mamburao	Same as Group A.		

Table I-5-2-1 (4/5) Itinerary of Feasibility Study Team for the Rural Telecommunications Project in Regions III and IV

Date	Leader	Group A	Group B	Group C	Economist	Coordinator
Nov. 17		Lubang Municipal Office and proposed radio repeater station site	Data collection	Same as Group A.		
Nov. 18		Gerona, Lapaz, Magalang, Porac and Sexmoan Municipal Offices	Looc	Same as Group A.		
Nov. 19		Hagonoy, Malolos, Bulacan, Pandi and Angat Tel. Offices and Kalibo radio repeater station site	Romblon	Same as Group A.		
Nov. 20		San Ildefonso, San Miguel Tel. Offices and inspection of Kalibo City	San Agustin, Odiongan	Same as Group A.		
Nov. 21		San Jose, Guimba, Quezon, Aliaga and Cabanatuan Tel. Offices	Tablas	Same as Group A.		
Nov. 22		Data collection	Data collection	Same as Group A.		
Nov. 23		Data collection	Data collection	Same as Group A.		
Nov. 24		Batangas Tel. Office	Aliaga	Same as Group A.		
Nov. 25	Left Tokyo (14:00, PR431) Arrived Manila (17:00)	Lemery and Calamba Tel. Offices	Aliaga	Same as Group A.	Same as Leader.	Same as Leader.
Nov. 26	JICA Manila Office, Japanese Embassy, BUTEL, Puerto Princesa	San Pablo Tel. Office, Puerto Princesa Municipal Office	Cabanatuan	San Pablo	Same as Group C.	Same as Leader.
Nov. 27	Puerto Princesa	Santa Cruz and Narra Tel. Offices	Gabaldon	Santa Cruz	Same as Group C.	Same as Leader.
Nov. 28	Manila	Taytay	Manila	Taytay	Same as Group C.	Same as Leader.

Table I-5-2-1 (5/5) Itinerary of Feasibility Study Team for the Rural Telecommunications Project in Regions III and IV

Date	Leader	Group A	Group B	Group C	Economist	Coordinator
Nov. 29	Data collection	Data collection	Data collection	Data collection	Data collection	Same as Leader.
Nov. 30	Data collection	Data collection	Data collection	Data collection	Data collection	Same as Leader.
Dec. 1	BUTEL	BUTEL	BUTEL	BUTEL	BUTEL	Same as Leader.
Dec. 2	BUTEL	BUTEL	BUTEL	BUTEL	BUTEL	Same as Leader.
Dec. 3	Pandi, Santa Rosa, Cabanatuan	BUTEL	BUTEL	BUTEL	Same as Leader.	Same as Leader.
Dec. 4	Tarlac, San Fernando	BUTEL	BUTEL	BUTEL	Same as Leader.	Same as Leader.
Dec. 5	BUTEL	BUTEL	BUTEL	BUTEL	Same as Leader.	Same as Leader.
Dec. 6	Data collection	Data collection	Data collection	Data collection	Same as Leader.	Same as Leader.
Dec. 7	Data collection	Data collection	Data collection	Data collection	Same as Leader.	Same as Leader.
Dec. 8	BUTEL, TTI	Data collection	BUTEL	BUTEL	Same as Leader.	Same as Leader.
Dec. 9	PLDT, BUTEL	PLDT, BUTEL	PLDT, BUTEL	PLDT, BUTEL	PLDT, BUTEL	Same as Leader.
Dec. 10	Agreement on I/R, NEDA, OECF	BUTEL	BUTEL	BUTEL	BUTEL, NEDA	Same as Leader.
Dec. 11	MOTC, BUTEL, Party	BUTEL	BUTEL	BUTEL	BUTEL, NEDA	Same as Leader.
Dec. 12	Report to JICA Manila Office, Japanese Embassy and BUTEL	Same as Leader.	Same as Leader.	Same as Leader.	Same as Leader.	Same as Leader.
Dec. 13	Preparation for return to Japan	Same as Leader.	Same as Leader.	Same as Leader.	Same as Leader.	Same as Leader.
Dec. 14	Left Manila (8:00, PR432) Arrived Tokyo (12:45)	Same as Leader.	Same as Leader.	Same as Leader.	Same as Leader.	Same as Leader.

II. STANDARDS

II. STANDARDS

1. Traffic Engineering Standards

Traffic engineering standards are to be in conformity with CCITT Recommendations and standards employed in the Northern Luzon Project and are to be as follows.

1-1 Loss Probability Standard

(1) Loss probability standard in toll connection

The loss probability of each basic trunk is to be 0.01 per link.

(2) Loss probability standard in local connection

The loss probability of each intra-office trunk is to be 0.02.

1-2 Waiting probability standard

(1) The waiting probability in semi-automatic connection is to be 0.05.

(2) The waiting probability in offering connection is to be 0.01.

2. Transmission Standards

2-1 Transmission Engineering Standard

Reference equivalent (RE) is to be employed as the standard for transmission performance in the Philippines in conformity with the relevant CCITT Recommendations.

The CCITT Recommendations set out are as follows.

(1) The maximum reference equivalent for 97% of calls in a country of the average size between a subscriber and internaitonal exchange be as follows.

Sending system: 21 dB

Receiving system: 12 dB

(2) Reference equivalent objectives of national system

Short-term objectives

Sending reference equivalent: 10 ~ 16 dB

Receiving reference equivalent: 2.5 ~ 6.5 dB

Long-term objectives

Sending reference equivalent: 10 ~ 13 dB

Receiving reference equivalent: 2.5 ~ 4.5 dB

In the Philippines, neither BUTEL nor private operating companies have yet determined reference equivalent values specifically but a typical private operating companies, PLDT, is expected to introduce the following reference equivalent values.

Tertiary Center (TC) ~ Secondary Center (SC): 0 dB

Secondary Center ~ Primary Center (PC): 0 dB

Primary Center ~ Local Exchange (LE): 9 dB*

Local Exchange ~ Subscriber

Sending reference equivalent: 12 dB**

Receiving reference equivalent: 3 dB**

* Not includes the office loss of the LE.

** Includes the office loss of the LE.

on the other hand, the following reference equivalent values are recommended in the Northern Luzon Project.

TC ~ SC: 0 dB

SC ~ PC: 3.5 dB

PC ~ LE: 6 dB

Sending reference equivalent: 11.5 dB

Receiving reference equivalent: 1.5 dB

These reference equivalent values have been set out on the premise that a 2-wire switching system is to be employed at PC.

In this project, it is necessary to consider the following factors in addition to the above-mentioned ones.

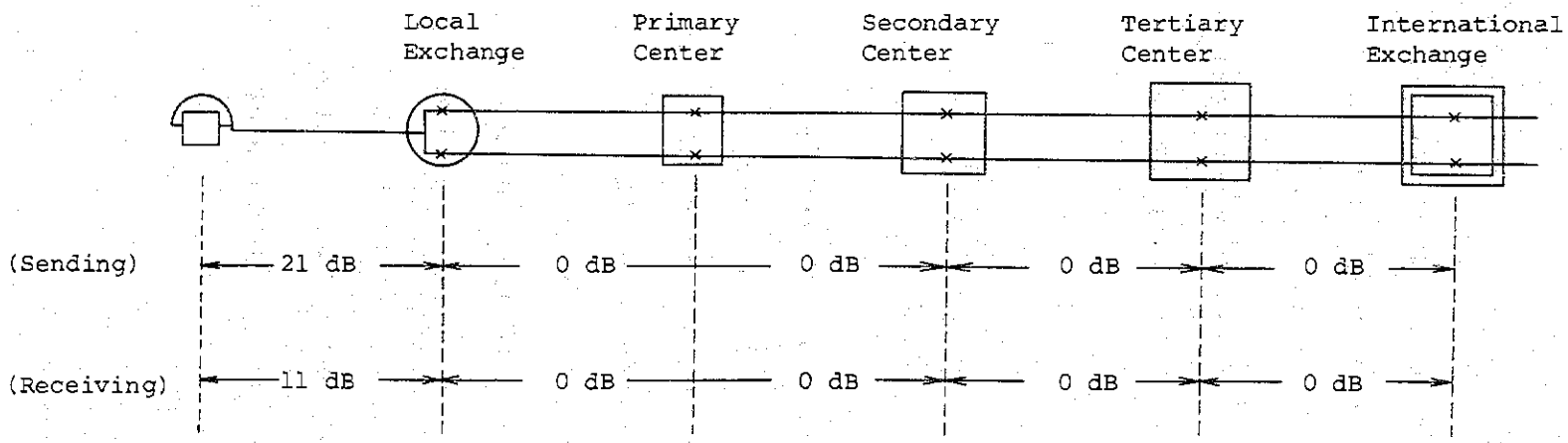
1) It is not desirable that the transmission performance of the network operated by BUTEL and that of telephone networks operated by private operating companies will be different from each other. Moreover, in consideration of interface between the BUTEL telephone network and the telephone networks of private operating companies, it is important to have a consistent transmission performance as much as possible.
2) It is desirable to determine the reference equivalent values of BUTEL in consideration of

those to be introduced by private operating companies, since it may be expected that private operating companies will also introduce digital switching at PC and LE.

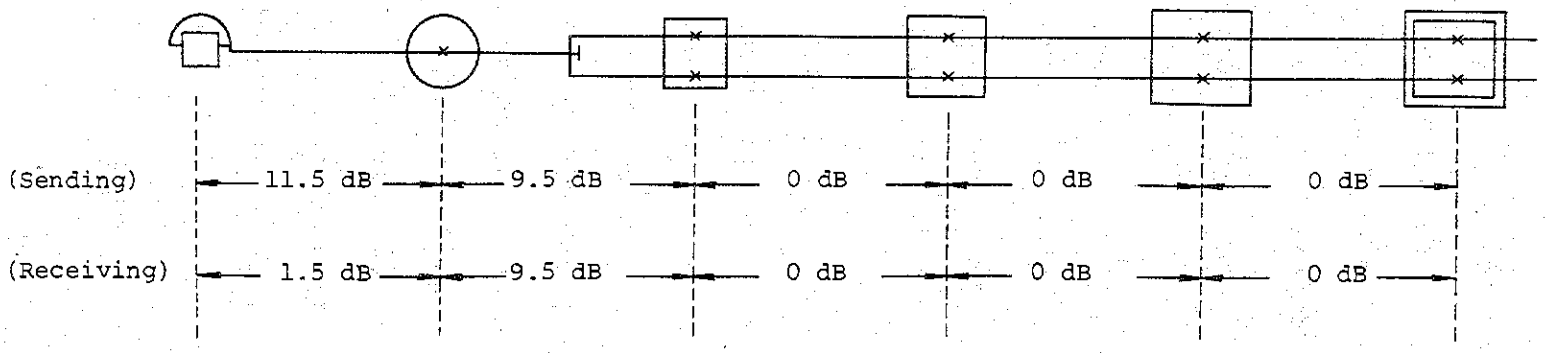
3) A digital switching system is to be introduced at all PCs and either a digital switching or 2-wire switching system is to be employed at LEs depending on the scale of the LE, in Regions III and IV to be covered in this project.

4) Reference equivalent allocation upon introducing a digital switching system at an LE is being studied in CCITT and considerable time will be necessary for reaching a conclusion.

5) Reference equivalent values used in the Northern Luzon Project can be applied to LEs at which 2-wire switching equipment is to be installed. On the other hand, for LEs to be furnished with digital switching system, the reference equivalence value of the subscriber system is set up by adding the reference equivalent component to be reduced between the LE and PC to the reference equivalent value of the subscriber system. In consideration of these points, such reference equivalent values as shown in Fig. II-2-1-1 are to be introduced in this project.



When LE is furnished with digital switching system



When LE is furnished with 2-wire switching system

Fig. II-2-1-1 Allocation of Reference Equivalents

2-2 Noise

For noise, the following noise objectives are to be employed in conformity with the Northern Luzon Project.

TC ~ SC: Noise objectives for 2500km hypothetical reference circuits set out in CCITT Recommendation G222.

SC ~ PC: 2000pW

PC ~ LE: 2000pW

Noise in the exchange office: 200pW

For noise in PCM systems, all that is required is to consider quantizing noise caused in the busy condition and other noises are to be negligible. The above-mentioned circuit noise can be applied to the PCM system, since the estimated amount of quantizing noise of the PCM circuit to the speech quality is approximately 250pW at the zero relative level point, as compared with that of the multiplex terminal noise of the FDM circuit which is estimated to be approximately 400pW ~ 500pW at the same point.

2-3 Minimum Transmission Loss

The minimum transmission loss of a 4-wire/2-wire circuit between an LE (IPTS) to be furnished with 2-wire exchange and a PC to be furnished with 4-wire exchange to be constructed by this project has been calculated under the following conditions. The method of calculation is detailed in the Northern Luzon Project and thus is omitted here.

(1) It is assumed that the telephone networks of private operating companies to be connected with the BUTEL network will all be composed of FDM systems in the worst condition in calculating the minimum transmission loss.

(2) Five sections of 4-wire circuit are to be inserted between subscribers.

(3) Variations of transmission loss

FDM circuit

Loss variation:	1.5 dB/section
Attenuation distortion:	0.5 dB/section

PCM circuit

Loss variation:	0.3 dB/section
Attenuation distortion:	0 dB/section
Nonlinear	0.3 dB/section
Nonlinear distortion:	0.3 dB/section

(4) Other factors

Terminal singing return loss:	3 dB
Deviation of structural singing point:	1 dB
Singing margin:	7 dB

The results of minimum transmission loss calculation for a 4-wire/2-wire circuit under these conditions are shown in Figs. II-2-3-1 and II-2-3-2.
Points a, b, c, and d shown in these figures give maximum entrance cable loss which meets the reference equivalent of 9.5 dB between LE and PC specified in paragraph II-2-1.

3. Network Plan

3-1 Telephone Network Plan

3-1-1 Basic Items

In order to construct an economical telephone network in consideration of future, the following telephone network has been planned. For the toll telephone network, a combined star and mesh network configuration incorporating direct circuits in sections with much traffic is to be composed on the basis of star networks by giving office ranks of PC, SC and TC as in the Northern Luzon Project. This network has been studied synthetically in the relation with the numbering plan and rate system and given consideration not to provide any redundant system with private operating companies so as to secure coexistence.

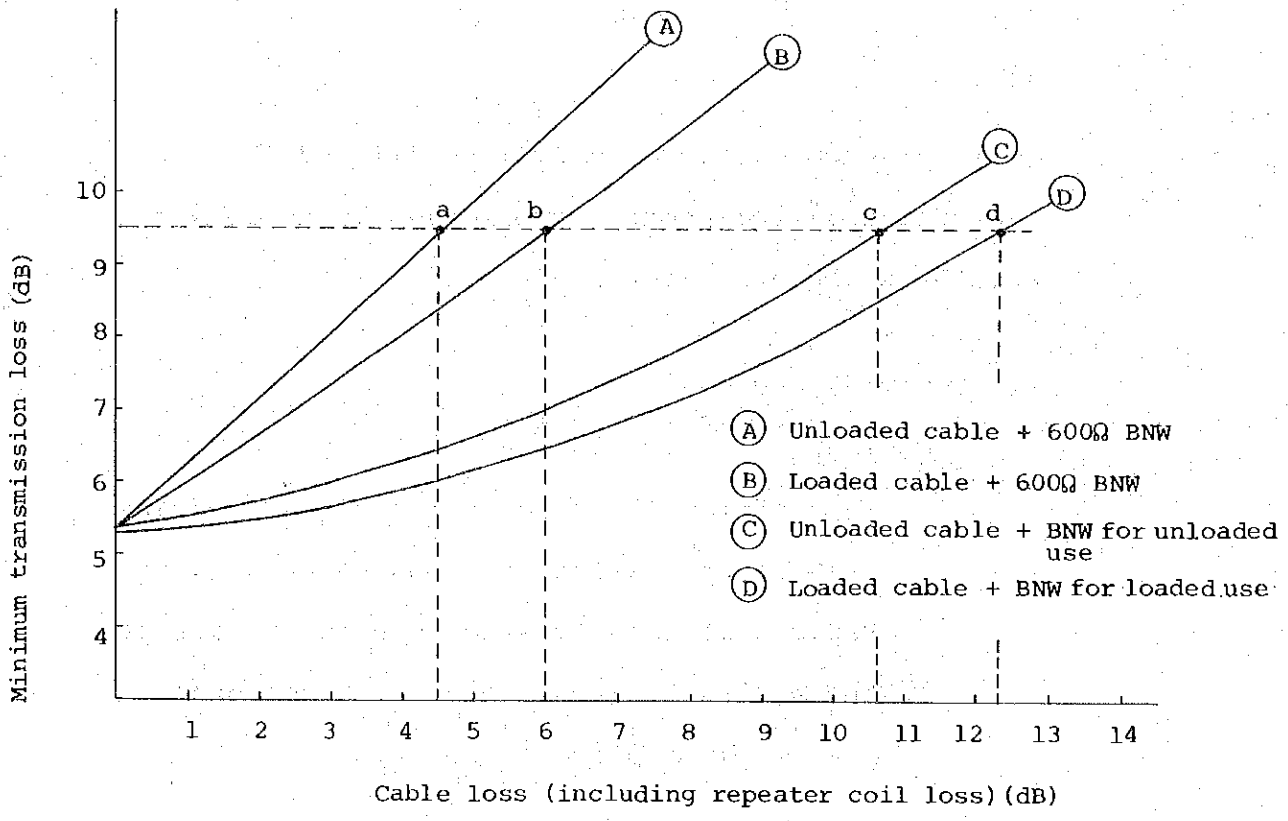


Fig. II-2-3-1 Minimum Transmission Loss of 4-Wire/2-Wire PCM System

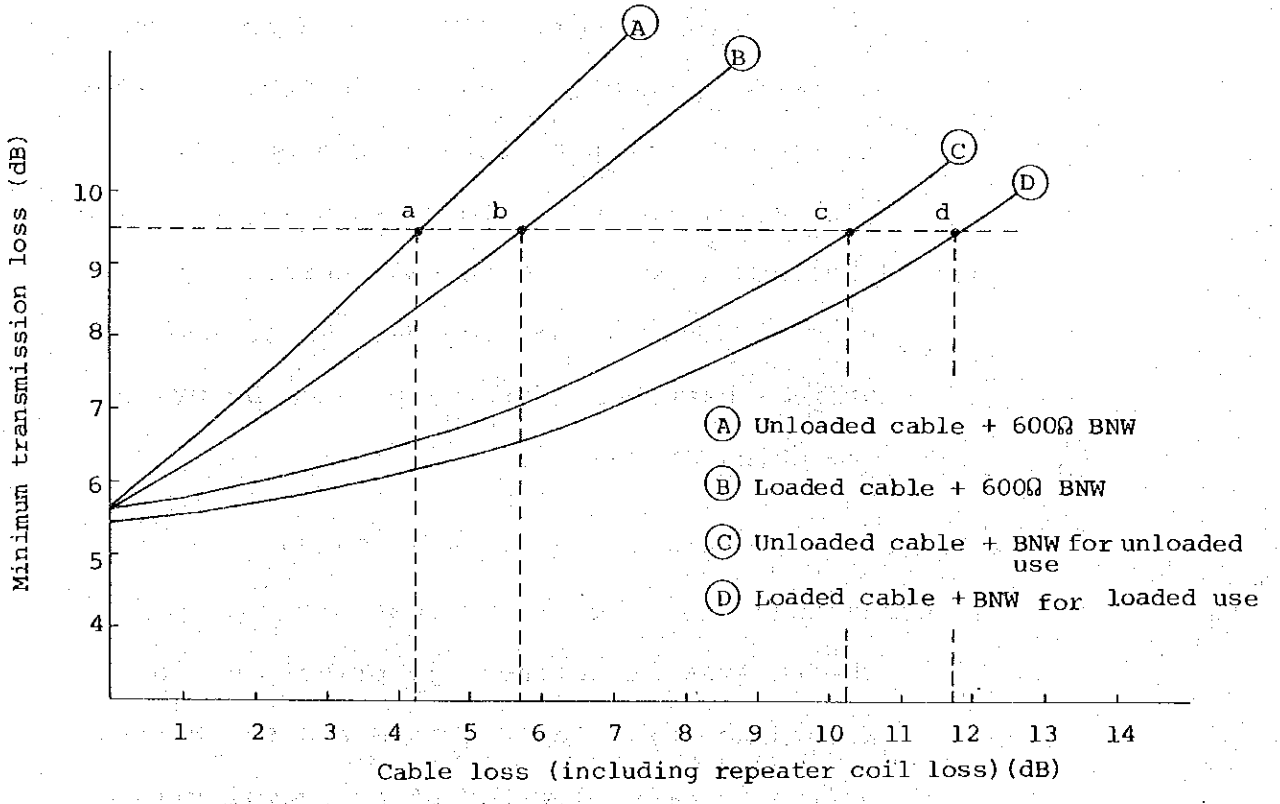


Fig. II-2-3-2 Minimum Transmission Loss of 4-Wire/2-Wire FDM System

3-1-2 Toll Telephone Network in Regions III and IV

The toll telephone network plan in Regions III and IV is shown in Fig. II-3-1-1.

(1) TC (Tertiary Center)

Manila

This office is to be at the highest office rank in the national telephone network and Regions III and IV area composes a part of the Manila TC area. Manila TC has been planned by a private operating company.

(2) SC (Secondary Center)

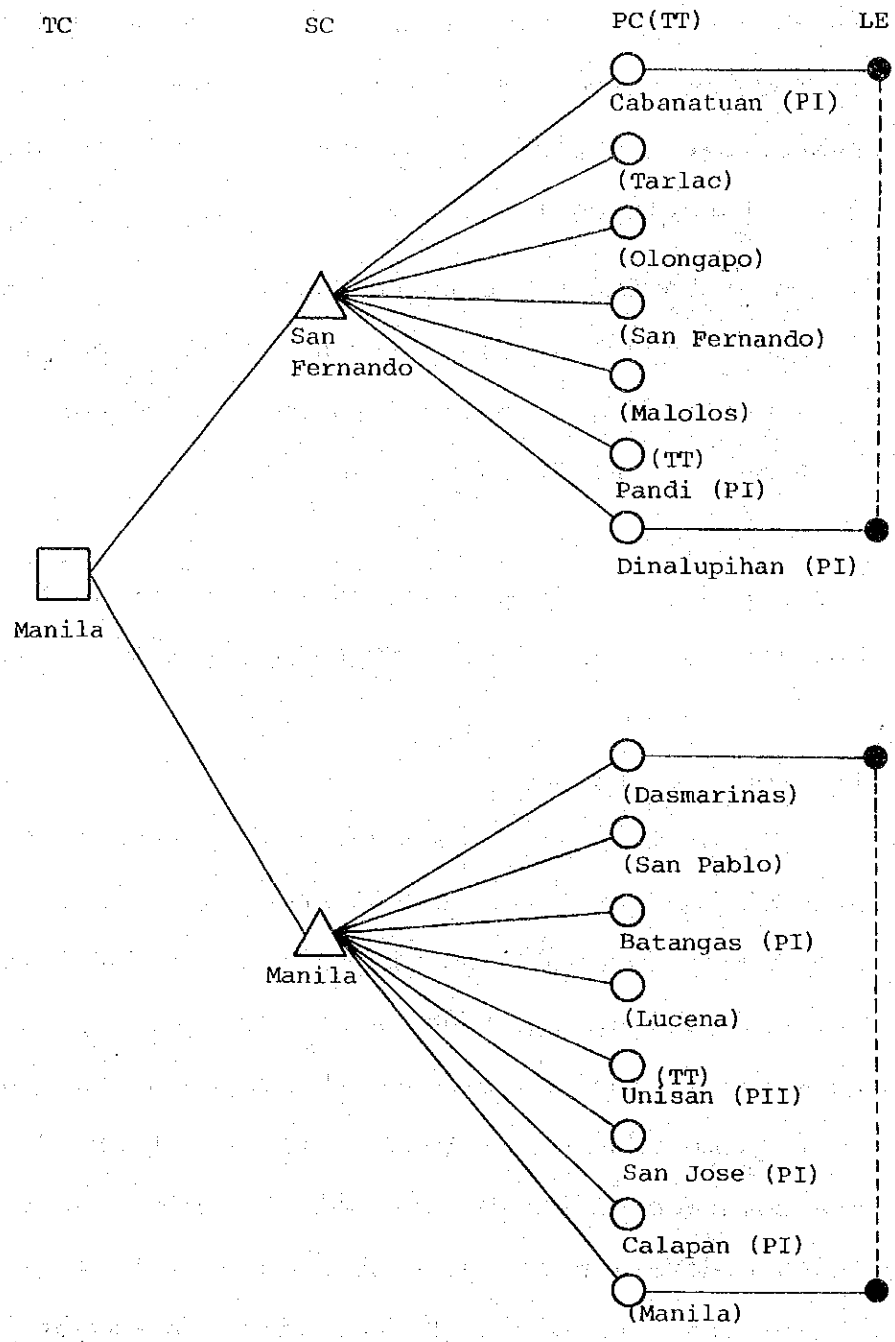
Manila and San Fernando

The SC area is defined in accordance with each administrative region and SC is located at the pivotal city in each region. For Region IV, the SC is to be located in Manila together with the TC in consideration of traffic flow in this region. These two offices have been already planned by private operating companies.

(3) PC (Primary Center) and TT (Toll Tandem)

Cabanatuan and other 14 offices

The PC area is defined, in principle, in accordance with the Province and the PC office is to be located at a pivotal city.



Legend

PI: Phase I

PII: Phase II

( ): To be installed by private operating companies

Fig. II-3-1-1 Telephone Network Plan

In this projet, the following measures are to be introduced in consideration of the number of subscribers, traffic flow, and the conditions of the transmission line.

1) Some provinces are to be made belong to adjacent PC offices (such as Palawan, Romblon and Marinduque).
2) TT offices are expected to cover some part of the Province (Pandi and Unisan).

Other PC offices than planned in this project have been or are planned by private operating companies.

(4) LE (Local Exchange)

LE offices is the lowest office rank in the network configuration and LE area is defined in accordance with each administrative city/municipality which is taken as a local area. Toll telephone networks in Regions III and IV are shown in Fig. II-3-1-2 where some LEs belong temporarily to other PCs and the coverage of PCs do not coincide with their provinces in consideration of the convenience of transmission. The office rank of an IPTS of which the major service is the handling of toll calls is to be the same as that of an LE.

3-1-3 Principles of Network Planning

(1) The objects to be covered in the telephone network plan of this project are to include all existing and planned

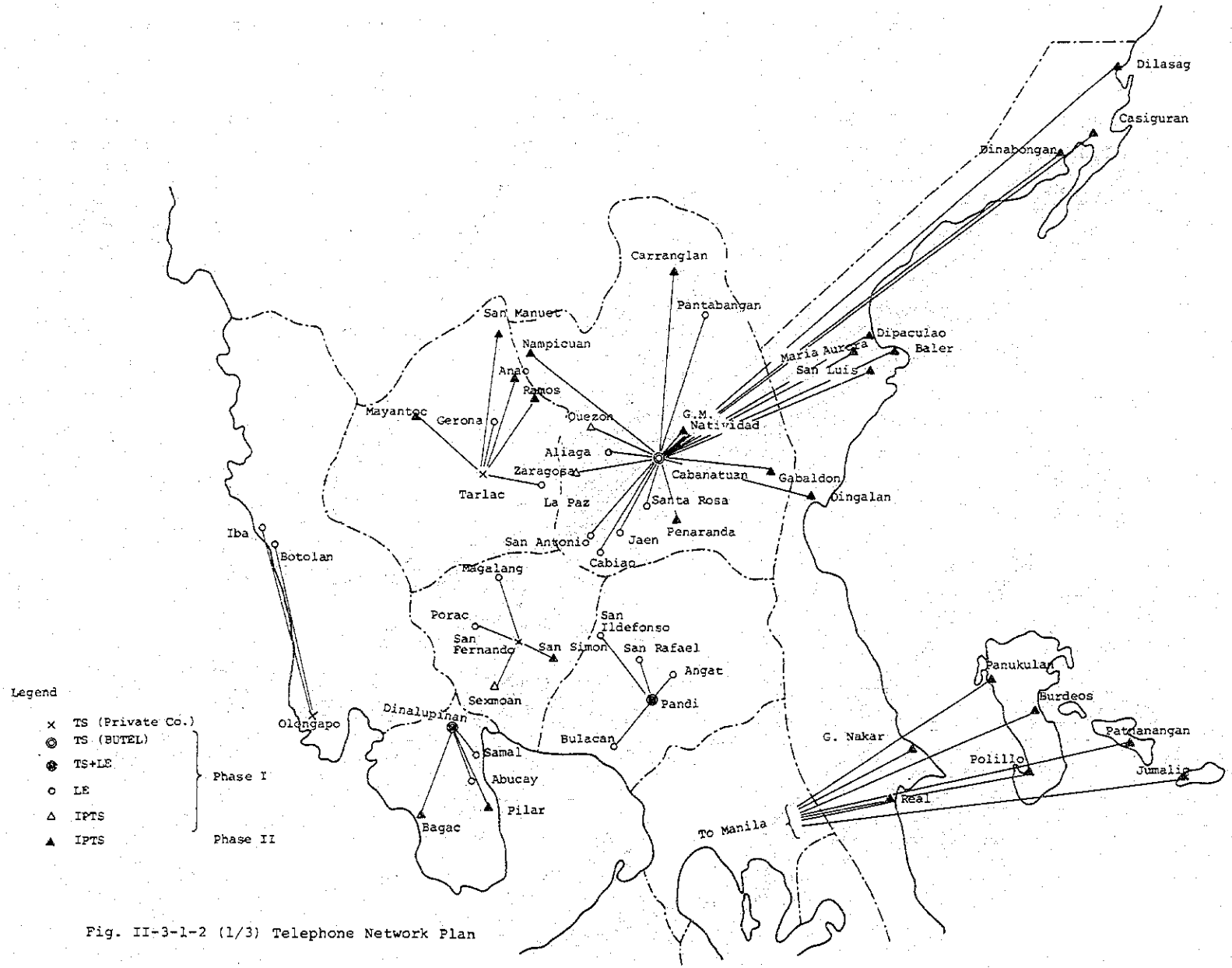


Fig. II-3-1-2 (1/3) Telephone Network Plan

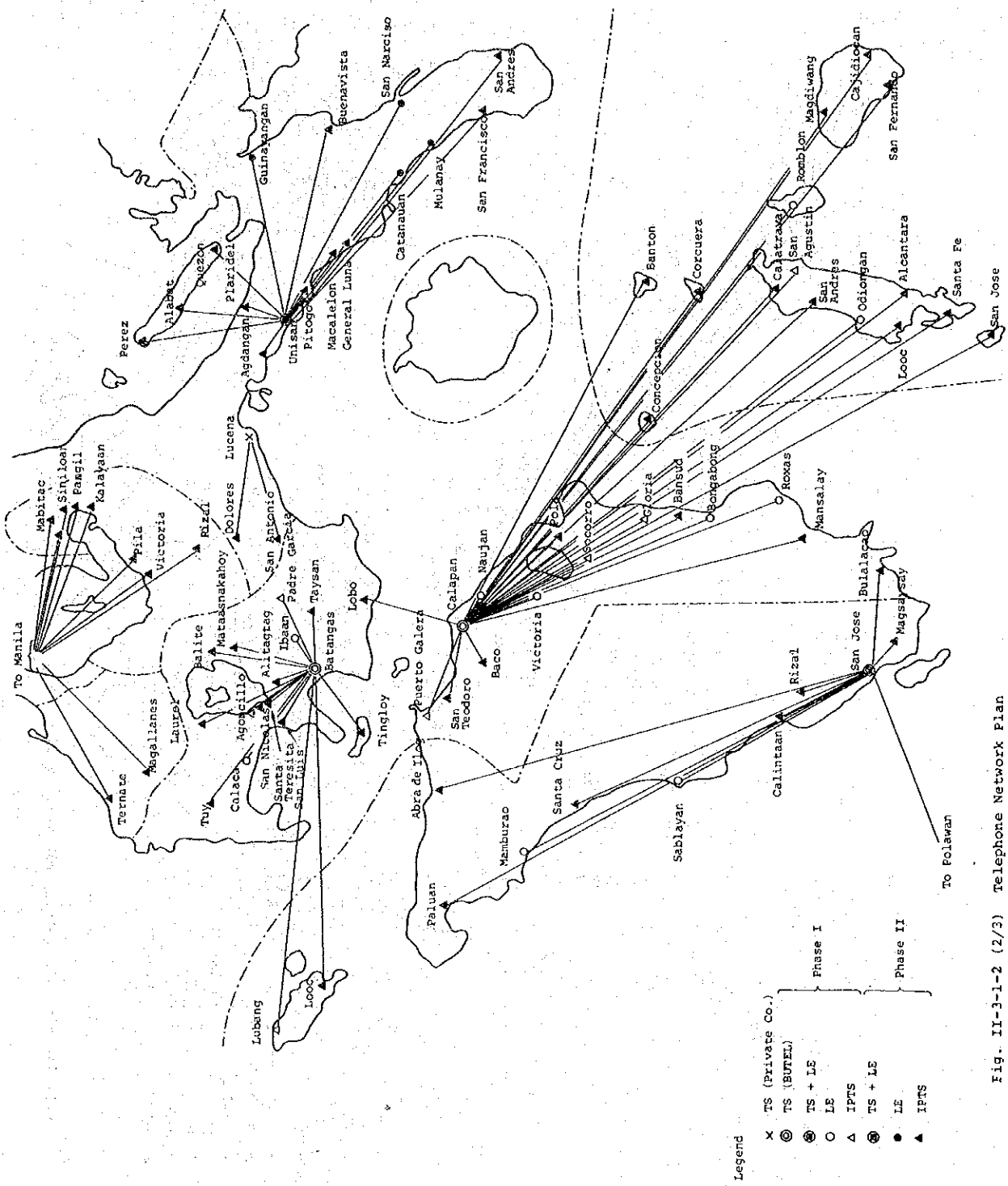


Fig. II-3-1-2 (2/3) Telephone Network Plan

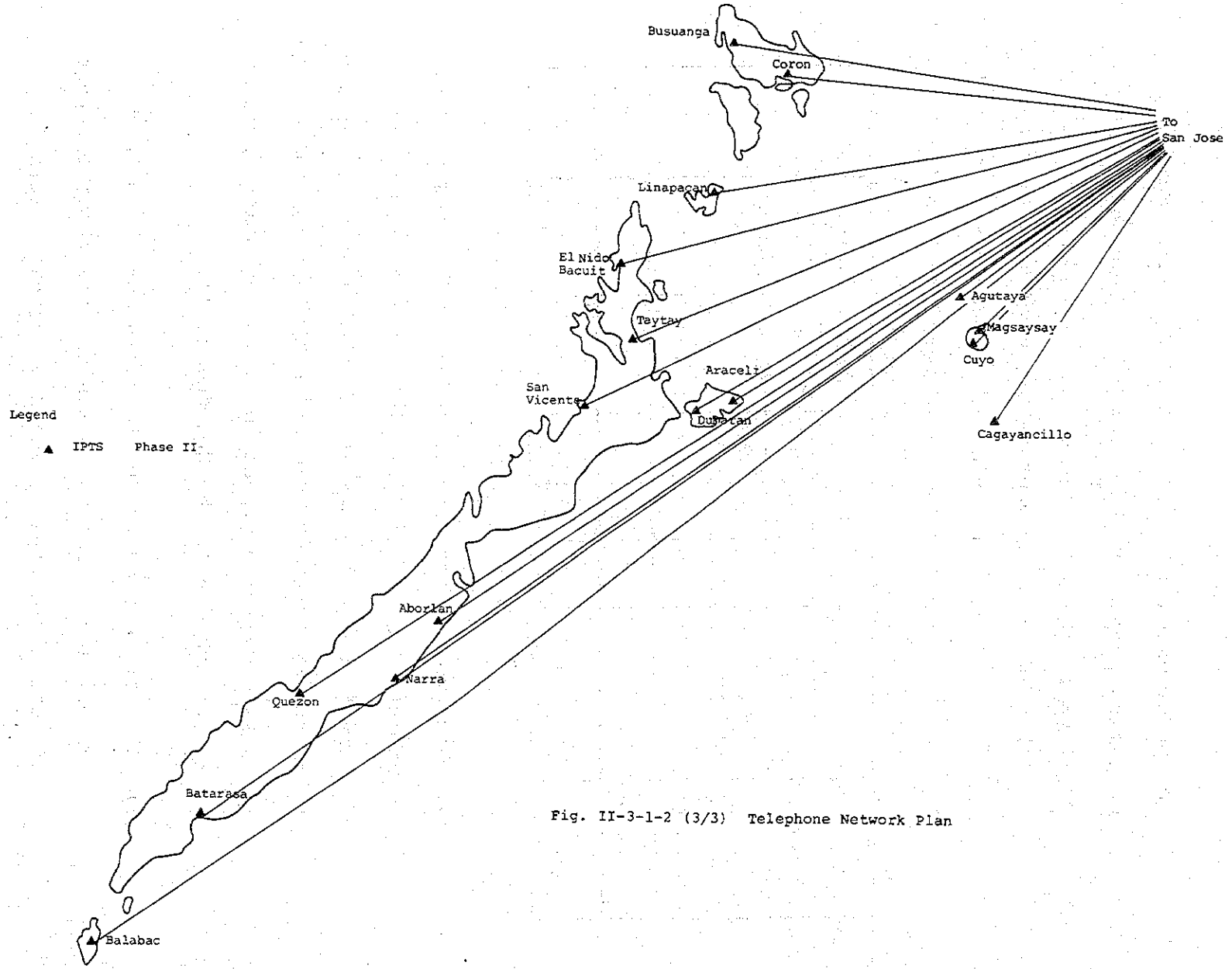


Fig. II-3-1-2 (3/3) Telephone Network Plan

telephone exchange offices of BUTEL and private operating companies and cover all cities and municipalities in Regions III and IV.

Table II-3-1-1 Number of Cities/Municipalities in which Telephone Service is to be Provided in Regions III and IV

Region	BUTEL					Private Operating Company		Total
	Phase I			Phase II		Existing	Planned	
	To Be Replaced	LE	IPTS	LE	IPTS			
Region III	6	14	3	0	12	38	47	120
Region IV	3	8	7	5	91	43	58	215
Total	9	22	10	5	103	81	105	335

(2) This project has been designed on the premise that DDD service is to be provided by both BUTEL and private operating companies (semi-automatic service in the case of IPTS) in principle but semi-automatic service may be employed until the existing equipment is furnished with the DDD functions.

(3) In order to prevent duplicate investment by BUTEL and private operating companies, telephone exchange offices having been planned by private operating companies are not included in this project.

(4) Handling of operator assisted calls, directory inquiry, etc., are to be concentrated at PC or TT.

3-2 Telegraph Network Plan

In planning the telegraph network in Regions III and IV, consideration has been given to the following points.

(1) The telegraph network is to consist of telex centers, telex concentrator stations, telex subscriber stations to be furnished with telex subscriber equipment, and telegraph offices (gentex stations), as in the Northern Luzon Project.
Fig. II-3-2-1 shows the telex network configuration to be employed.

(2) Regional telex centers are to be set up at San Fernando and Batangas, or the pivotal cities of the regions, where telegraph traffic will be concentrated. Regional Telex Centers are to be engaged in telex communication with an international telex center and other Regional telex centers via the National Telex Center located in Manila.

(3) Each telex concentrator station is to be set up, in principle, at the existing message center located in the pivotal city of the Province.

(4) Accommodation of gentex stations and telex subscribers to a telex center or telex concentrator

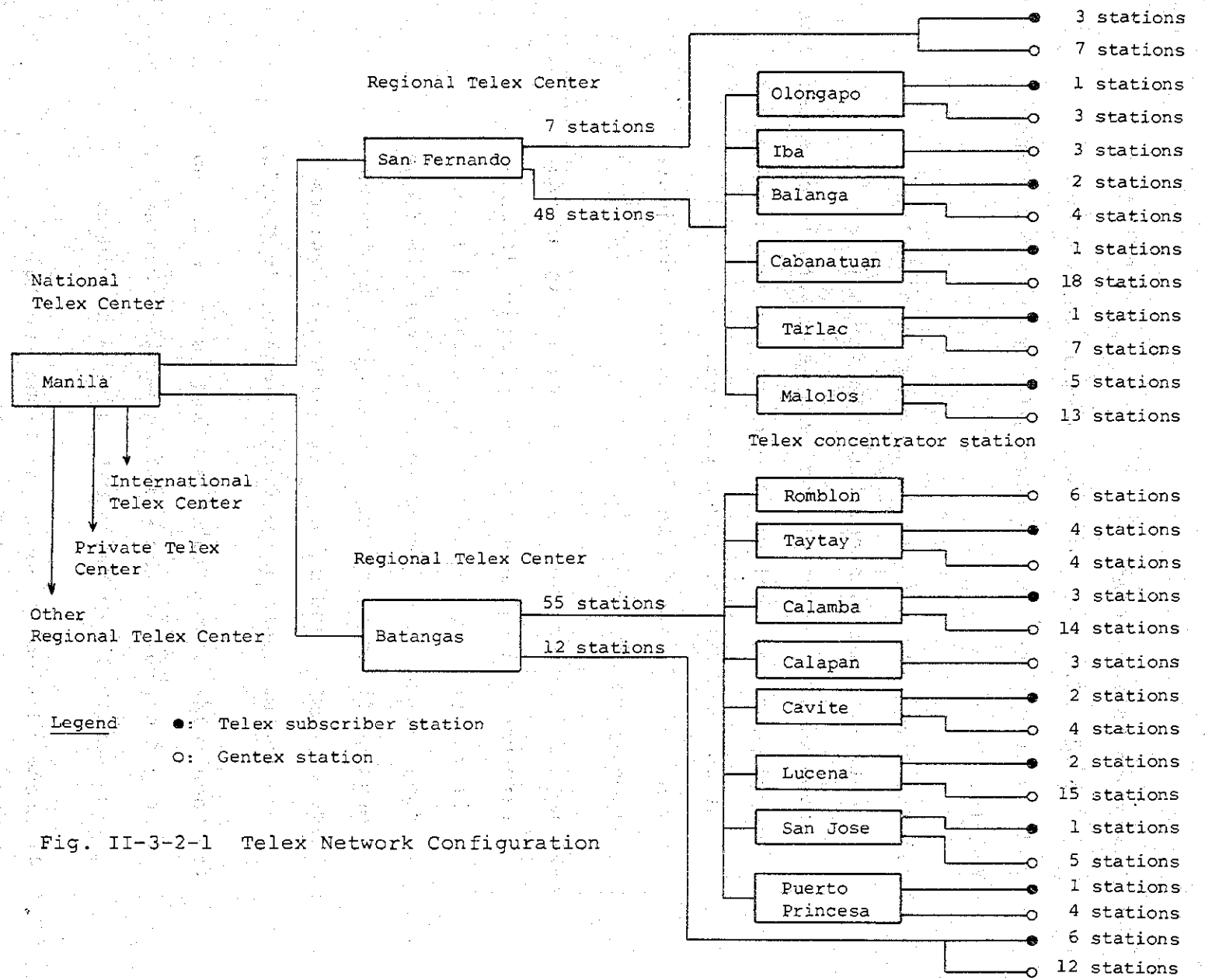


Fig. II-3-2-1 Telex Network Configuration

station is to be made not to cover other control areas such as regions and districts in principle.

(5) Telex lines are to be arranged as much in conformity with the transmission network plan of this project as possible. When no transmission line is proposed in this project but a leased circuit operated by a private operator is available, the leased circuit is to be used in principle.

(6) Gentex stations are to be provided places where much telegraph traffic is to be handled by the telegraph office. Telegraph offices with less telegraph traffic are to accept telegrams by telephone. The telex network to be constructed in Phases I and II in consideration of the above-mentioned points is shown in Fig. II-3-2-2.

4. Charging System

The charging system to be employed in this project are to be the same as in the Northern Luzon Project and as follows.

4-1 Local Calls

Local calls are to be charged by a given rate per call.

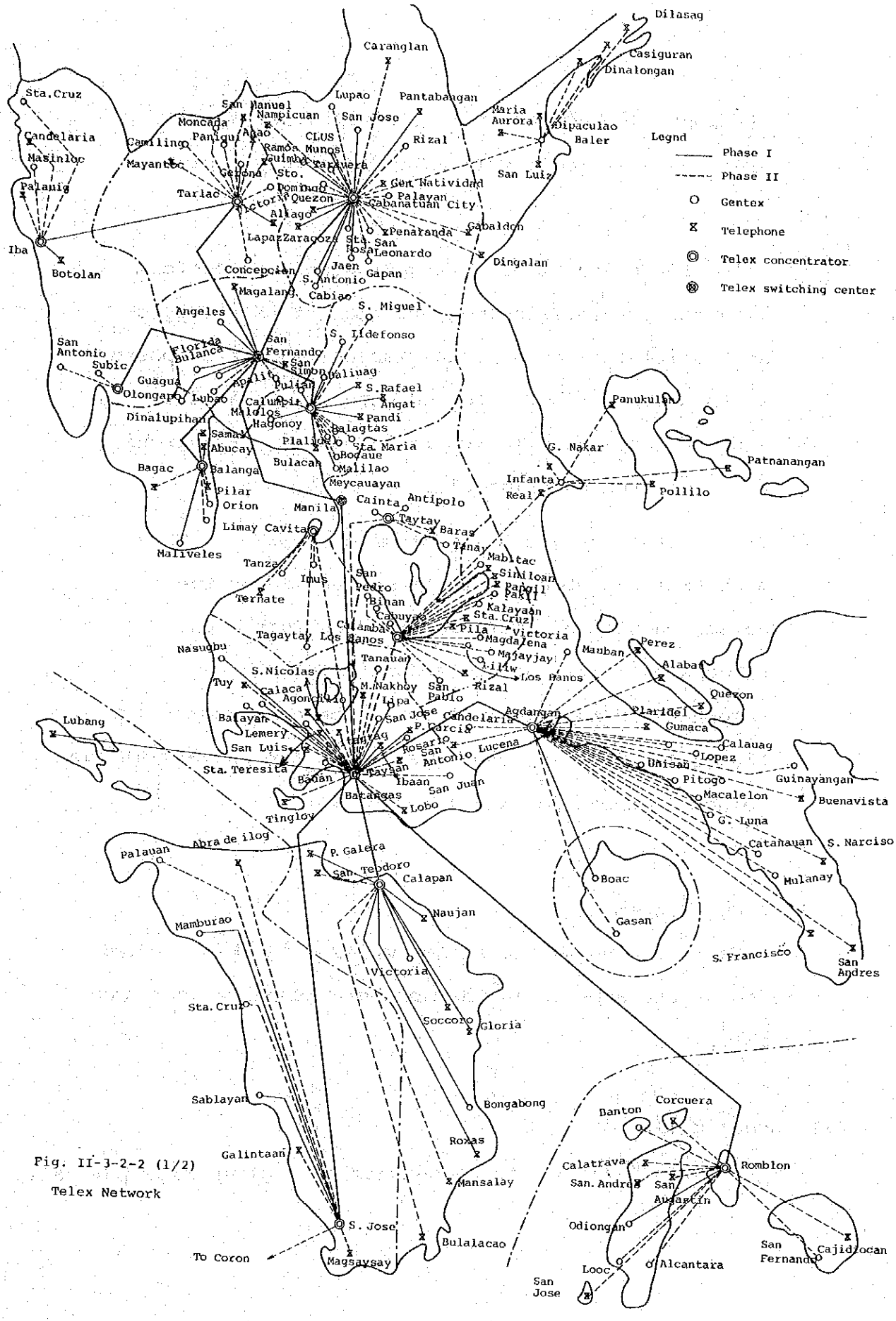


Fig. II-3-2-2 (1/2)

Telex Network

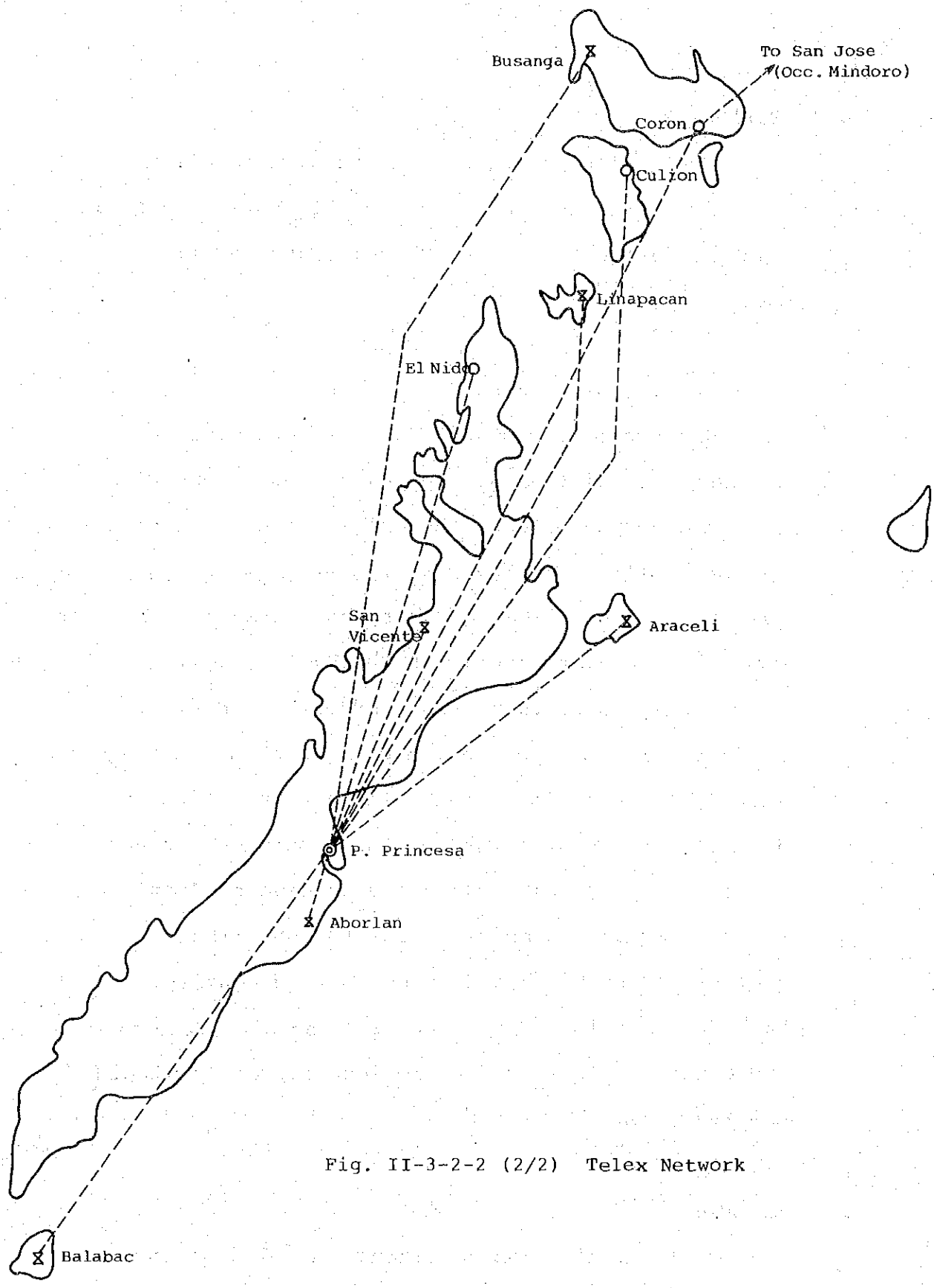


Fig. II-3-2-2 (2/2) Telex Network

4-2 Toll Calls

Toll calls are to be charged by a detailed billing system by recording the originating subscriber number, destination, kind of call, and duration of call at the PC.

4-3 Setting of Message Area

The charge for a toll call is determined by the duration of the call and distance. However, if the distance between the originating and terminating exchange offices is taken as the charging distance, there will be a great number of charging distances, which only complicate the processing of the billing system. Accordingly, a certain number of exchanges are to be incorporated into one group in which one message area is to be employed and calls are to be charged in steps depending on the distance between message areas. That is, all toll calls originated from subscribers in one message area to subscribers in another message area are to be charged equally. Each Province is to be temporarily as a message area and a given rate is to be provided for calls within the Province.

5. Numbering Plan

5-1 Numbering

Although the national numbering plan of the Philippines has not yet been determined, universal

numbering system using a maximum of 8 digits for national numbers and closed numbering system within the local area is to be adopted in this project. The national number configuration is to be as given in Table II-5-1-1 and prefix "0" is to be employed for DDD calls to outside the closed numbering area.

Table II-5-1-1 National Number Configuration

Trunk Code	Subscriber's Number
N	NXXXXXX or NXXXXX
NX	NXXXXX or NXXXX
NXX	NXXXX, NXXX or NXX
NXXX	NXXX or NXX

N = 2 ~ 9

X = 0 ~ 9

5-2 National Number

National number allotment is being examined in the Philippines and the "A" Code Allotment (proposed) is shown in Fig. II-5-2-1. A national numbering plan prepared by partially changing the above-mentioned "A" Code Allotment in consideration of the network plan, numbering capacity, etc., to be applied in the telephone network to be constructed in this project is proposed.

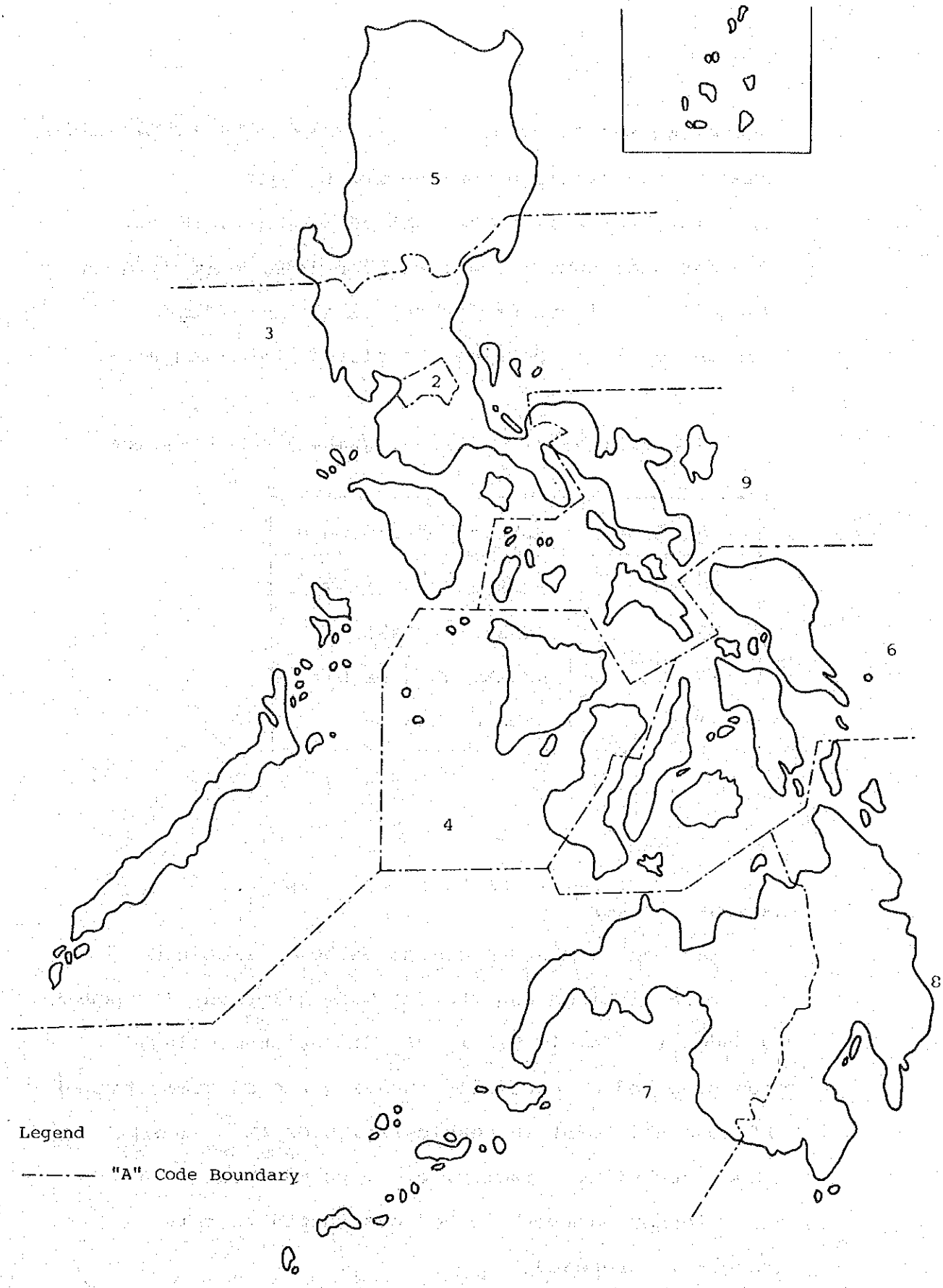


Fig. II-5-2-1 National Numbering Plan (Being Studied)

This plan is shown in Fig. II-5-2-2. "AB" Code Allotment in Regions III and IV is shown in Fig. II-5-2-3 and the national numbering plan for individual exchanges in this project is shown in Table II-5-2-1.

A 4-digit trunk code is to be given to each IPTS.

5-3 Special Service Code

Each special service code consists of 3 digits of 1XY. Special service codes can be classified into subscriber's special service codes and operator's special service codes, as follows.

(1) Subscriber's special service codes

104: Directory inquiry board

105: Toll information board

106: Billing information board

108: International board

109: Booking for delayed service

100: Dial service assistant board

112: Complaint board

113: Ambulance

117: Fire

119: Police

(2) Maintenance codes

111: Maintenance

180: Subscriber's circuit tester (Test robot)

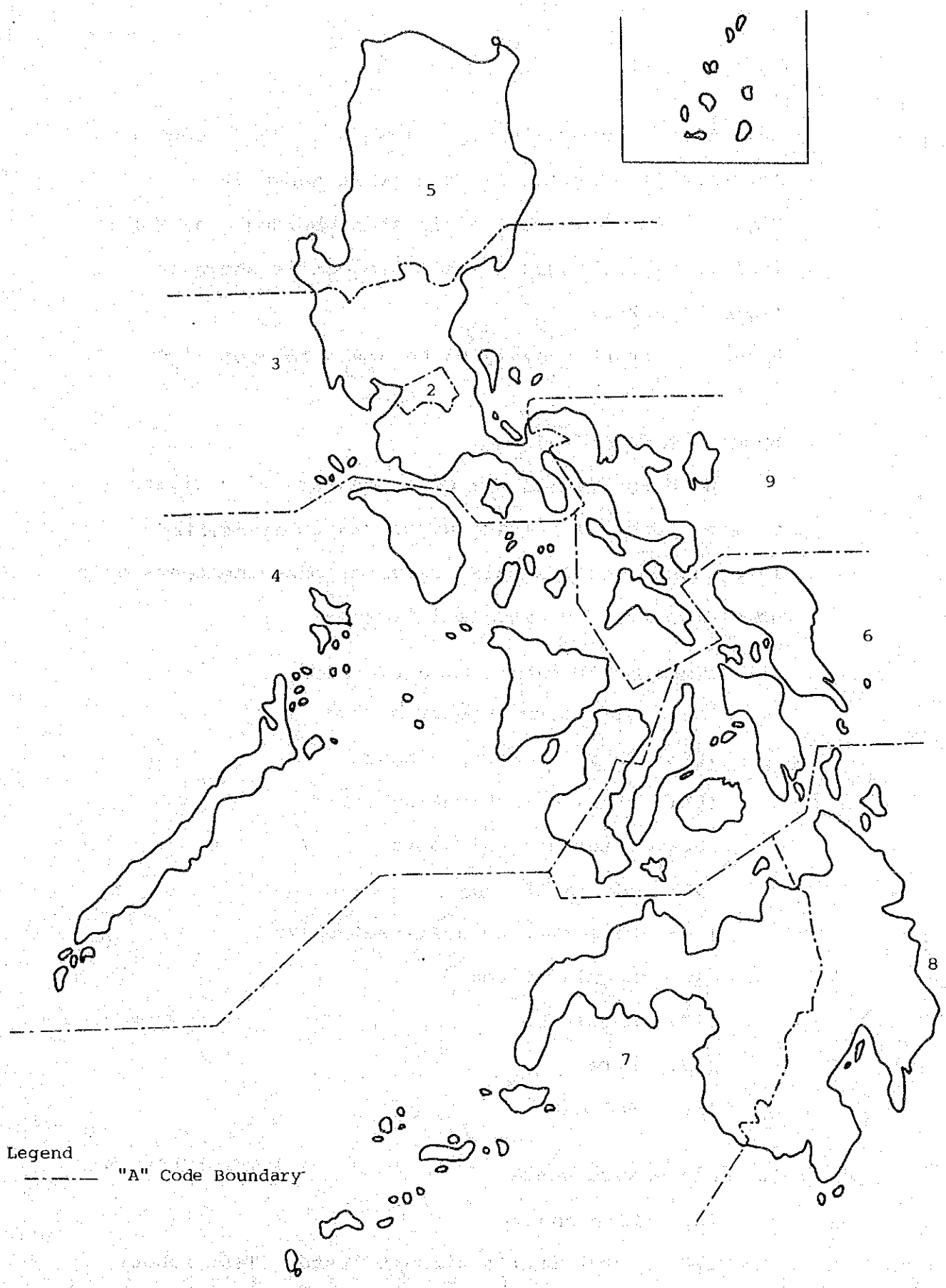
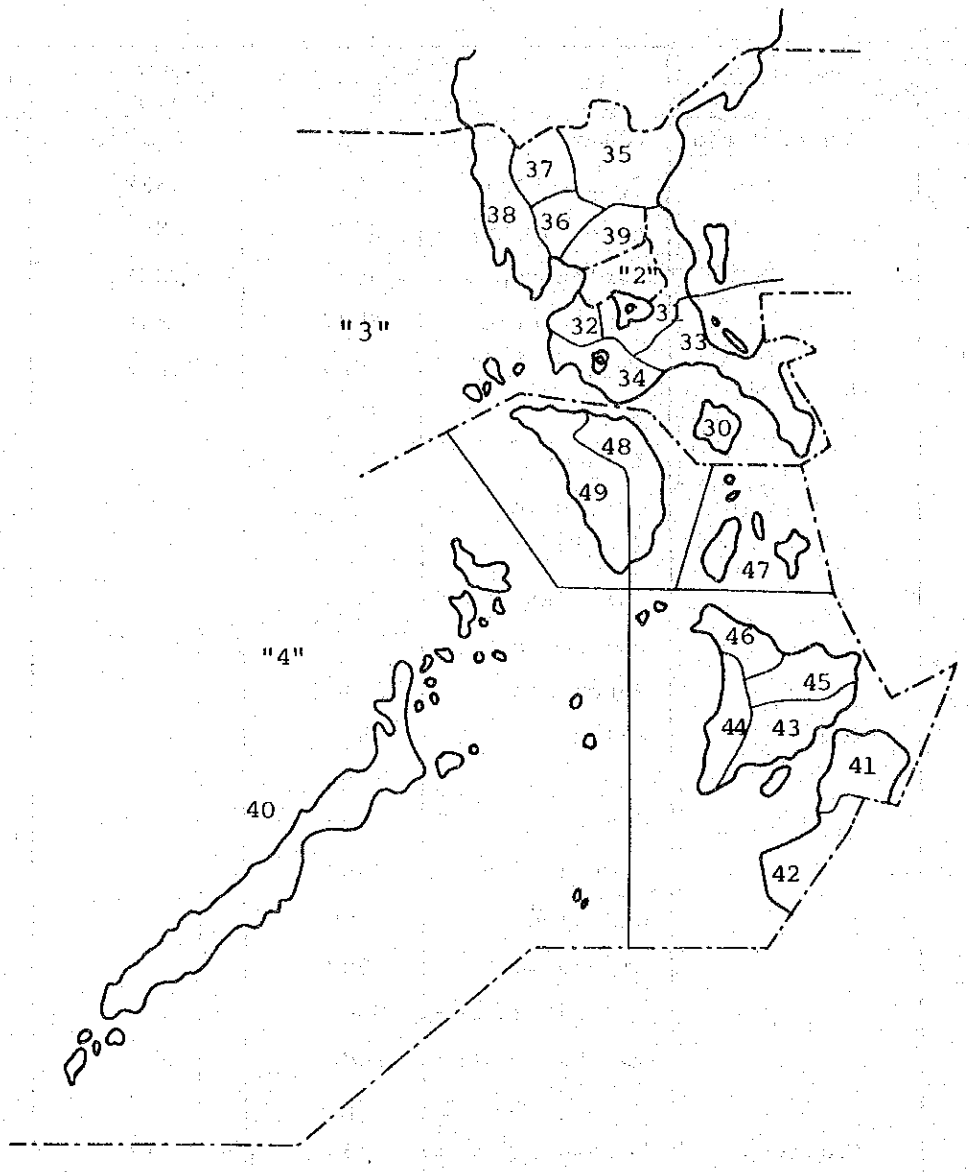


Fig. II-5-2-2 National Numbering Plan (Proposed)



Legend

———— "A" Code Boundary

———— "AB" Code Boundary

Fig. II-5-2-3 "AB" Code Allotment in "A" Code Areas "3" and "4"

Table II-5-2-1 (1/5) National Numbering for BUTEL Exchanges

TS	Province	LE	Trunk Code	Subscriber's Number	Phase
Cabanatuan	Nueva Ecija	Aliaga	3526	2XXX	I
		Cabiao	3538	2XXX	I
		Jaen	3535	2XXX	I
		Pantabangan	3576	2XXX	I
		San Antonio	3537	2XXX	I
		Sta. Rosa	3525	2XXX	I
		Quezon	3527		I
		Zaragosa	3529		I
		Carranglan	3575		II
		Gabaldon	3546		II
		G.M. Natividad	3545		II
		Nampicuan	3565		II
		Penaranda	3547		II
	Quezon	Baler	3582		II
		Casiguran	3588		II
		Dilasag	3589		II
		Dinalongan	3587		II
		Dingalan	3586		II
		Dipaculao	3583		II
		Maria Aurora	3584		II
		San Luis	3585		II
Tarlac	Tarlac	Gerona	3743	2XXX	I
		La Paz	3726	2XXX	I
	Tarlac	Anao	3758		II
		Mayantoc	3745		II
		Ramos	3757		II
		San Manuel	3759		II
Olongapo	Zambales	Botolan	3834	2XXX	I
		Iba	3832	2XXX	I

Table II-5-2-1 (2/5) National Numbering for BUTEL Exchanges

TS	Province	LE	Trunk Code	Subscriber's Number	Phase
San Fernando	Pampanga	Magalang	3677	2XXX	I
		Porac	3636	2XXX	I
		Sexmoan	3646		I
		San Simon	3664		II
Pandi	Bulacan	Angat	3973	2XXX	I
		Bulacan	3935	2XXX	I
		Pandi	3972	2XXX	I
		San Ildefonso	3975	2XXX	I
		San Rafael	3974	2XXX	I
Dinalupihan	Bataan	Abucay	3874	2XXX	I
		Dinalupihan	3862	2XXX	I
		Samal	3865	2XXX	I
		Bagac	3878		II
		Pilar	3875		II
Batangas	Batangas	Calaca	3475	2XXX	I
		Ibaan	3437	2XXX	I
		Agoncillo	3468		I
		Padre Garcia	3436		I
	OCC. Mindoro	Lubang	3482		I
	Batangas	Alitagtag	3428		II
		Balite	3458		II
		Laurel	3457		II
		Mataasnakahoy	3459		II
		San Luis	3465		II
		San Nicolas	3467		II
		Santa Teresita	3466		II
		Taysan	3438		II
		Tingloy	3429		II
		Tuy	3476		II
	OCC. Mindoro	Looc	3483		II

Table II-5-2-1 (3/5) National Numbering for BUTEL Exchanges

TS	Province	LS	Trunk Code	Subscriber's Number	Phase
Lucena	Quezon	Dolores	3336		II
		San Antonio	3334		II
Unisan	Quezon	Unisan	3362	2XXX	II
		Catanauan	3366	2XXX	II
		Guinayangan	3373	2XXX	II
		Mulanay	3367	2XXX	II
		San Narciso	3375	2XXX	II
		Agdangan	3343		II
		Alabat	3386		II
		Buenavista	3374		II
		General Luna	3365		II
		Macalelon	3364		II
		San Francisco	3368		II
		Perez	3387		II
		Pitogo	3363		II
		Plaridel	3345		II
		Quezon	3385		II
		San Andres	3376		II
San Jose	OCC. Mindoro	Mamburao	4942	2XXX	I
		Sablayan	4932	2XXX	I
		San Jose	4922	2XXX	I
		Calintaan	4926		II
		Magsaysay	4924		II
		Paluan	4945		II
		Rizal	4925		II
		Santa Cruz	4943		II
	OR. Mindoro	Bulalacao	4855		II
	Palawan	Aborlan	4033		II
		Agutaya	4054		II
		Araceli	4045		II
		Balabac	4037		II
		Batarasa	4036		II
		Busuanga	4047		II

Table II-5-2-1 (4/5) National Numbering for

BUTEL Exchanges

TS	Province	LE	Trunk Code	Subscriber's Number	Phase
San Jose	Palawan	Cagayancillo	4056		II
		Coron	4048		II
		Cuyo	4052		II
		Dumaran	4044		II
		El Nido Bacuit	4043		II
		Linapacan	4046		II
		Magsaysay	4053		II
		Narra Aborlan	4033		II
		Quezon	4034		II
		San Vicente	4026		II
		Taytay	4042		II
	OCC. Mindoro	Abra de Ilog	4944		II
Calapan	OR. Mindoro	Bongabong	4852	2XXX	I
		Naujan	4848	2XXX	I
		Roxas	4853	2XXX	I
		Victoria	4847	2XXX	I
	Romblon	Odiongan	4732	2XXX	I
		Romblon	4722	2XXX	I
	OR. Mindoro	Gloria	4843		I
		Puerto Galera	4832		I
		Socorro	4846		I
	Romblon	San Agustin	4723		I
	OR. Mindoro	Baco	4834		II
		Bansud	4844		II
		Mansalay	4854		II
		Pola	4845		II
		San Teodoro	4833		II
	Romblon	Alcantara	4733		II
		Banton	4752		II
		Cajidiocan	4743		II
		Calatrava	4724		II
		Concepcion	4754		II
		Corcuera	4753		II
		Looc	4734		II

Table II-5-2-1 (5/5) National Numbering for BUTEL Exchanges

TS	Province	LE	Trunk Code	Subscriber's Number	Phase
Calapan	Romblon	Magdiwang	4742		II
		San Andres	4725		II
		San Fernando	4744		II
		San Jose	4736		II
		Santa Fe	4735		II
	Batangas	Lobo	3439		II
Manila	Quezon	Burdeos	3196		II
		G. Nakar	3194		II
		Jumalig	3199		II
		Panukulan	3195		II
		Patnanangan	3198		II
		Polillo	3197		II
		Real	3193		II
	Laguna	Kalayaan	3183		II
		Mabitac	3187		II
		Pakil	3184		II
		Pangil	3185		II
		Pila	3157		II
		Rizal	3167		II
		Siniloan	3186		II
		Victoria	3156		II
	Cavite	Magallanes	3243		II
		Ternate	3258		II

(3) Operator's special service codes

These codes are to be dialed following the "trunk code."

108: International board

109: Toll board

5-4 Numbering Plan for Calls within IPTS

(1) Local call: 2 digits (subscriber's number)

(2) Calling of IPTS operator: "0"

6. Signaling System

Electronic switching system is to be introduced in this project. Accordingly, it is recommendable to introduce CCITT Signaling System R-2 (MFC) between exchange offices for the following reasons.

(1) This system is expected to be used at BUTEL exchange offices in Regions I and II.

(2) This system provides higher speed and higher stability.

(3) This system is an economical system applicable to electronic switching system.

(4) This system is applicable to international subscriber dialing.

(5) A great amount of information is available, allowing application to various new services expected to be introduced in future.

7. Principles in Facility Planning

7-1 Switching Equipment

The principles introduced in planning switching equipment are as follows.

(1) Conditions on service

1) Local switching equipment is to be such that can cope with all demands to be made.

2) Toll calls are to be connected by subscriber's dialing as much as possible.

3) All existing switching equipment are to be replaced.

4) IPTSs are to be patterned to cover 40 subscribers and furnished with six trunk lines. The switching equipment at each IPTS is to be used for ten years as it is and then will be replaced one after another with local switching equipment in areas where a great number of demands are expected.

5) For connection with facilities operated by private operating companies, subscriber's dialling connection is to be introduced as much positively as practicable.

(2) Electronic switching system is to be introduced for both toll and local switching equipment.

(3) The standard design period of switching equipment is to be as follows.

Design period of switching equipment which determine the ultimate capacity ..... 15 years

Design period of switching equipment which determines the expansion capacity ..... 5 years

7-2 Radio

For radio transmission, PCM systems are to be employed in principle. However, the FDM system is to be employed in such radio sections that may not allow the adoption of the PCM system because of, for example, long-distance propagation on sea.

The types and applications of radio systems to be employed in this project have been determined in consideration of the ultimate demands to be made by the year 2001 between telephone offices and are given in Table II-7-2-1.

Table II-7-2-1 Types and Applications of Radio Systems

Type	Frequency Band		Protection System	Applicable Sections
960-channel System	SHF	6GHz	Radio channel protection system	Sections with ultimate capacities of more than 500 telephone channels, sections between PCs and CTV transmission sections

(Continued)

Type	Frequency Band		Protection System	Applicable Sections
240-channel System	UHF	2GHz	Radio channel protection system	Sections between PCs and between PC and LE and sections to use reflector
60-channel System	UHF	800MHz	Set stand-by system	Sections between PC and LE
24/30-channel System	UHF	800/ 400MHz	Set stand-by system	Sections between PC and LE and between PC and IPTS
6-channel System	UHF/ VHF	400/ 250MHz	Set stand-by system	Sections between PC and IPTS and between LE and IPTS
OH System	UHF	800MHz	Set stand-by system	Sections in which this system will be particularly required in propagation.
MDM System*	UHF	400MHz	Set stand-by system	Areas where IPTSs are concentrated.

* MDM System: Multi-Direction Multiplex Radio System

Color television signal transmission is to be performed by using the protection radio channel at the initial stage and when it is necessary to transmit color TV signal frequently in future, another radio channel is to be set

up newly. The radio frequencies to be required for these radio systems range widely from the SHF to VHF band. Since frequency allocation to these radio systems to be employed in this project is indispensable for the successfull completion of the project, the related Philippine government authority is requested to give due consideration to the frequency allocation for this project.

7-3 Multiplex Equipment

The basic multiplex equipments are designed for the ultimate demand which can meet the number of toll circuits to be demanded in 15 years after the completion of the project and terminal equipments for expansion are designed for demands to be made in 5 years thereafeter. That is, in Phase I as many circuits as will be required by 1991 are to be installed and in Phase II as many circuits as will be required by 1994 are to be installed. In the telephone network plan in this project, however, digital switching equipment is to be introduced for use at TS and LE and digital transmission is to be employed for toll transmission line in principle, so that circuits to be connected to TS and LE are not to be connected through PCM multiplex equipment but the transmission and switching equipment are to be connected by the primary block of PCM (30 channels).

When FDM system is employed for toll transmission lines, FDM to PCM conversion is to be performed on the way in the transmission line and connection to the switching equipment of TS and LE offices is to be made by the primary block of PCM.

7-4 Telegraph

The major telegraph facilities to be installed in this project are telex switching equipment, telex concentrators, and telex subscriber or gentex station equipment. Telegraph facilities are to be as follows.

(1) Sufficient quantities of facilities necessary to meet telegraph traffic to be involved in 2001 are to be provided.

(2) The engineering standard of telegraph facilities are to meet the relevant CCITT Recommendations.

(3) For telex switching equipment, such an automatic digital switching system that allows the addition of other new services in future, that has high flexibility for change, and that provides a high reliability is to be employed.

(4) For telex concentrators, such a time division multiplex (TDM) system that allows economic transmission of 46 telegraph channels of 50 bauds on one telephone channel is to be employed.

(5) For telex subscriber and gentex station equipment, such equipment that is furnished with a keyboard

printer using 50-baud, 5-unit, alphabet No.2 characters and symbols usable for international telex communication and that is provided with an answer-back mechanism, a paper tape punching mechanism, and a paper tape sending and receiving functions is to be employed. For telex subscriber equipment, identical equipment as used for gentex is to be used for convenience of maintenance and operation.

7-5 Outside Plants

7-5-1 Outside Plants for Local Cables

(1) Service area

Service areas in which telephone service is to be made in cities and municipalities in this project have been determined in consideration of the public interest of telephone, economy, and technical problems and are to be, in principle, as follows.

1) In cities/municipalities where LE is to be installed, major urban districts are to be covered in the service areas.
2) In cities/municipalities where IPTS is to be installed, major urban districts or, to be more concrete, areas in which telephone service is to be provided to approx. 40 subscribers (to be determined by BUTEL) are to be served.

(2) Design period

The design period of outside plant for local cable is to be determined through economical analysis in consideration of the costs for completing the foundation necessary for the installation of the facilities, the cost of cable per line, the rate of interest, annual increase in the number of demand, etc. The design period of outside plant for local cable to be installed in this project is to be 10 years to meet demands to be made by the applicable year.

(3) Distribution method

There are many subscriber cable distribution methods and in determining the distribution method to be employed, consideration should be given to the demand density, the degree of hardness in procuring materials, maintenability, etc. In the cities/ municipalities in Regions III and IV to be covered in this project, urban districts are considered as the service area and it is recommendable to employ a fixed distribution method which is usually employed in areas with high demand densities. Whether duplicated or non-duplicated fixed distribution method is to be employed should be determined in consideration of demand distribution and other conditions in each service area upon designing the system.

(4) Structure of cable network and major materials

1) For the structure of cable network, aerial cables are to be employed in principle. When the cable entrance to the exchange comprises more than 400 pairs, conduit cable is to be employed to the exchange manhole.

2) For aerial cable supporters, creosote impregnated poles are to be employed and guy wires to be provided wherever required. When power poles are employed on aerial cable routes, these poles are to be used jointly in principle.

(5) Techniques for long service line

When the subscriber line is in long distance and the required transmission performance is not achievable by ordinary outside plant design, the use of a telephone set intended for long service lines, a negative impedance converter for long service lines, and a loading coil for long service lines should be considered for improving the transmission performance.

(6) Class of service

The class of telephone service to be introduced by this project is individual line telephone service.

7-5-2 Outside Plants for Trunk Cable

(1) Structure of cable network

In this project, aerial cables are to be

employed in principle. When power poles are employed on aerial cable routes, these poles are to be used jointly in principle.

(2) Design period

The design period of outside plants for trunk cables to be employed in this project is to be 15 years.

(3) Number of cable pairs

First, the number of circuits to be required in 15 years after the commencement of service (i.e., by the year 2001) be obtained on the basis of traffic forecast for each destination. Then, obtain the number of cable pairs to be required in 15 years after the commencement of service by the following equations for different types in individual sections.

1) Voice circuits using physical circuits only

(Required No. of circuits) x 1 + (No. of spare pairs)

2) Voice circuits using phantom circuits

(Required No. of circuits) x $\frac{2}{3}$ + (No. of spare pairs)

3) PCM circuits

(No. of circuits) x $\frac{1}{30}$ x 2 + (No. of spare pairs)

(Cable pairs for PCM spare circuits, alarm, monitoring, orderwire, and other purposes)

The number of cable pairs to be employed should

be determined from the number of pairs to be required in 15 years after the commencement of service which has been obtained as above in consideration of economy and the hardness of construction work. For PCM circuits, consideration should be given also to the PCM pair assignment depending on the type of cable to be employed.

7-6 Power Plant

The principles in the design of power facilities are to be as follows.

(1) When telephone exchange, telex exchange, and radio and carrier equipment are installed in a station building, common power facilities are to be used.

(2) The power facilities to be installed are to have a capacity to cover all demands to be made by the year 2001.

(3) For offices/stations where commercial power may not be available by the commencement of construction work in this project, two engine generators are to be installed. For other offices/stations, one engine generator is to be installed. Start and stop of the engine generators at offices/stations excluding IPTSs are to be performed automatically.

(4) The battery capacity of at ordinary offices is to be 4 hours and that of at stations to be set up on a mountain/hill is to be 8 hours. Each IPTS is to be furnished with a simple engine generator of manual start and stop and its battery capacity is to be 8 hours. At each IPTS furnished with transmission equipment to which circuits from other offices are to be connected is to be, in principle, furnished with an engine generator of automatic start and stop.

7-7 Office Buildings and Towers

7-7-1 Office Buildings

Building construction paln of this project is to be similar to that of the Northern Luzon Project and as follows.

(1) Office buildings are to be made of reinforced iron concrete.

(2) Buildings are to be less subject to earthquake, high tide, typhoon, and other disasters. Buildings in areas subject to water flood when struck by a typhoon or the like are to have sufficiently high floor levels not to be submerged under water or be furnished with plates or walls against submersion.

(3) The switching equipment room is to be airconditioned.

(4) Windows and doors are to be of airtight type for preventing dust.

(5) For countermeasures against fire, fireproof doors and shutters and incombustible gas fire extinguishers are to be provided in the building.

It is desirable to consider, in addition to these points, the introduction of standardized buildings with due consideration given to the scale of facilities to be installed from the standpoints of labor saving and economy upon designing buildings since the number of telephone offices, etc., and that of radio repeater stations to be constructed in this project are to amount 147 and 30 respectively..

7-7-2 Tower

Usually, two types of antenna towers are used: selfsupporting and guyed towers. A selfsupporting tower is generally expensive when compared with a guyed tower but requires less space for its site area and thus is advantageous when the procurement of site is difficult as in urban areas or atop a mountain/hill. It is desirable to employ a selfsupporting tower from the standpoint of strength in structural design when a number of antennas are mounted on the tower because of the nessecity of propagation to many directions or when an antenna with a sharp directivity is mounted on the tower.

For IPTSs expected to introduce the 6-channel radio system, a steel pole with a height of 20 meters from the ground level is to be employed instead of a steel tower in consideration of economy. These types of towers are to be employed as follows.

1) Selfsupporting steel tower: For stations/offices to adopt radio stations with channel capacities of not less than 240 channels, stations/offices to have not less than three directions of propagation and radio repeater stations.

2) Guyed steel tower: Stations/offices other than those to employ items 1) and 3).

3) 20m steel pole: For IPTSs to apply the 6-channel radio system to.

8. Interface with Private Operating Companies' Facilities

Although the areas to be served by BUTEL will greatly be increased by the implementation of this project, the major areas of urban districts such as Manila where more than 70% of all subscribers in the country gather are served by private operating companies so that it is extremely important for this project to smoothly accomplish interface with private operating companies' facilities.

8-1 Principles in Interface Design

The principles to be introduced in the interface with private operating companies' facilities in this project are as follows.

(1) Duplicate investment by BUTEL and any private operating company should be avoided and the project should be planned to allow smooth operation of individual services.

(2) DDD connection should be enhanced positively between BUTEL's and private operating companies' subscribers.

(3) Future incorporation of BUTEL's and private operating companies' telephone networks into one telephone network should be considered.

8-2 Points of Interface with Private Operating Companies' Facilities

(1) Connection with private operating company's facilities is to be made at TS stages.

(2) Each transmission line between TS and LE offices is to be constructed by the operating company franchising the LE office.

8-3 Interconnection Service Method

DDD service is to be provided for all subscribers except IPTS subscribers. Where DDD service has not yet been available with private operating company's facilities, originating calls from private operating

company's subscribers may be made entatively by the delayed service.

8-4 Installation of Charging Equipment for Interconnection

When interconnection with private operating company's facilities is made, charge calculation for interconnected calls should be made. For this purpose, charging equipment is to be installed at the point of connection with private operating company's facilities.

8-5 Transmission Network Plan

One of the major purposes of this project is to plan necessary transmission networks for providing telecommunication services to BUTEL subscribers in Regions III and IV. Since there are TSs and transmission routes operated by private operating companies and those being planned by private operating companies, it is important to avoid the duplicate construction of facilities by BUTEL and these private operating companies. Accordingly, it is necessary to plan transmission lines for sections having not been covered by private operating companies and when connection to a private operating companies' TS is necessary, the entrance route should be planned so that circuits from the BUTEL's LE office in the area can be connected to the TS.

III. DEMAND FORECAST

III. Demand Forecasting

1. Telephone Subscription Demand Forecasting

1-1 Purpose

The main pupose of telephone demand forecasting in this project is to examine the growth in telephone subscription demand in Regions III and IV and to provide the basis for the economic and technical study of telecommunications network development.

1-2 Method of Forecasting

The forecasting was conducted for all municipalities in Regions III and IV, using each municipality as a unit and in terms of 5-year intervals for 20 years from the year of start of the service under this project (1986).

The method used for the forecast was to estimate the basic demand as of 1981 and multiply this estimate by the magnifying power up to the time of forecasting.

As the basic demand, we used the demand expected for 1981 if it is assumed that service corresponding to the service conditions likely to be available at the time of start of the service under this project are already provided in all municipalities. In consideration of the state of service at present, i.e., insufficient telephone supply, a narrow base rate area and poor toll call connection, we used a level approximately double the number of existing telephones for the basic demand.

The basic demand in areas still without telephone service and some areas already with telephone service was estimated using a regression model and the number of workers in establishments in the study area.

The demand growth power from the basic time to the fore-as casting time was estimated by multiplying the magnifying power of the telephone demand rate determined from the elasticity model (elasticity value 1.4) for the per-capita GNP increase by the population increase rate for each municipality.

The economic growth rate used was an annual average of about 7% while the population increase rate was estimated by referring to NEDA data and correcting these data according to recent actual statistics.

The results of forecasting of the telephone subscription demand in each municipality from the above are shown in Table III-1-2-1.

For details of this demand forecasting, see the explanation in the Appendix.

Table III-1-2-1 (1/20)

Telephone Demand Forecast

Region III	Province (BATAAN)					
City/ Municipality	Number of Telephone Demands					Remarks
	1986	1991	1996	2001	2006	
Abucay	270	410	620	950	1,470	X-5 (IPTS) ◉
Bagac	130	200	310	490	770	X-5 (IPTS) ◉ ◉
Balanga	1,180	1,840	2,870	4,490	7,080	RETELCO (1,000)
Dinalupihan	530	800	1,230	1,890	2,920	BUTEL (300) ◉
Hermosa	150	230	360	570	900	X-4
Limay	990	1,580	2,500	3,970	6,360	RETELCO (200)
Mariveles	2,340	3,850	6,300	10,410	16,990	RETELCO (50)
Morong	180	280	440	690	1,090	Proposed by RETELCO
Orani	620	960	1,470	2,280	3,540	Delfin A. Papa (200)
Orion	560	880	1,370	2,130	3,370	Proposed by RETELCO X-5 (IPTS)
Pilar	260	510	790	1,230	1,950	◉ ◉
Samal	260	400	630	970	1,530	◉
Total	7,470	11,940	18,890	30,070	47,970	(12)

Table III-1-2-1 (2/20)

Telephone Demand Forecast

Region III	Province (BULACAN)					
City/ Municipality	Number of Telephone Demands					Remarks
	1986	1991	1996	2001	2006	
Angat	250	400	540	800	1,200	BUTEL (300) ◉
Balagtas	550	860	1,340	2,100	3,330	Del Asis (200)
Baliuag	860	1,280	1,910	2,850	4,310	RETELCO (400)
Bocaue	790	1,230	1,940	3,030	4,790	Radio City Tel. Sys. (340)
Bulacan	190	300	470	730	1,160	◉
Bustos	170	260	390	590	910	X-5
Calumpit	360	530	780	1,170	1,750	X-4
Guiguinto	530	820	1,290	2,020	3,200	From Malolos
Hagonoy	280	410	610	910	1,350	RETELCO (400)
Malolos	1,490	2,280	3,490	5,350	8,260	RETELCO (600)
Marilao	3,000	4,780	7,610	12,030	19,220	Radio City Tel. Sys. (320)
Meycauayan	1,940	3,030	4,720	7,320	11,470	Meycauayan Tel. Sys. (360)
Norsagaray	530	830	1,310	2,050	3,240	X-5
Obando	460	730	1,140	1,780	2,820	RETELCO (720)
Pandi	250	390	610	940	1,460	BUTEL (300) ◉ X-5 (IPTS)
Paom bong	130	190	280	420	630	From Hagonoy X-5 (IPTS)
Plaridel	460	690	1,060	1,610	2,480	From Malolos
Pulilan	190	280	420	640	970	X-4
San Ildefonso	300	470	740	1,160	1,840	X-5 (IPTS) ◉
San Jose Del Monte	200	340	570	930	1,550	Rural Tel. (200)
San Miguel	310	460	690	1,020	1,530	PLDT (100)
San Rafael	280	440	680	1,070	1,700	◉
Santa Maria	1,040	1,630	2,550	4,000	6,320	Radio City Tel. Sys. (100)
Dona Remedios Trinidad	80	120	190	290	450	
Total	14,640	22,750	35,330	54,810	85,940	(24)

Table III-1-2-1 (3/20)

Telephone Demand Forecast

Region III	Province (NUEVA ECIJA)					
City/ Municipality	Number of Telephone Demands					Remarks
	1986	1991	1996	2001	2006	
Aliaga	90	130	210	320	500	◉
Bongabon	320	490	760	1,170	1,820	X-5
Cabanatuan	3,010	4,670	7,330	11,470	18,130	RETELCO (1000)
Cabiao	160	250	390	600	940	X-5 (IPTS) ◉
Carranglan	100	170	270	430	700	◉ ◉
Cuyapo	460	650	960	1,440	2,080	X-4 (IPTS) X-5
Gabaldon	120	180	290	440	700	X-5 (IPTS) ◉ ◉
Gapan	780	1,200	1,860	2,890	4,520	PLDT (400)
Gen. M. Natividad	300	470	730	1,150	1,820	◉ ◉
General Tinio	120	180	280	440	670	X-5
Guimba	530	800	1,220	1,860	2,860	X-4
Jaen	310	490	770	1,220	1,930	◉
Laur	250	380	600	940	1,490	X-5
Licab	45	65	100	160	250	X-5 (IPTS)
Llanera	140	220	350	550	860	X-5
Lupao	240	350	540	820	1,250	X-4
Munoz	710	1,070	1,640	2,510	3,900	X-4
Nampicuan	35	50	75	110	160	◉ ◉
Palayan City	95	160	230	470	800	Proposed by PLDT
Pantabangan	180	290	460	750	1,220	X-5 (IPTS) ◉
Penaranda	170	250	390	590	920	◉ ◉
Quezon	95	150	230	360	570	◉
Rizal	330	500	760	1,170	1,810	X-4 (IPTS) X-5
San Antonio	330	510	800	1,240	1,940	X-5 (IPTS) ◉
San Isidro	200	310	470	730	1,130	From Gapan X-5 (IPTS)
San Jose	420	640	990	1,540	2,420	Municipality of San Jose (100) X-4
San Leonardo	390	590	920	1,430	2,240	X-4
Santa Rosa	500	780	1,210	1,890	2,970	BUTEL (500) ◉ X-4 (IPTS)

continue to next page

Table III-1-2-1 (4/20)

Telephone Demand Forecast (Continued)

Region III	Province (NUEVA ECIJA)					
City/ Municipality	Number of Telephone Demands					Remarks
	1986	1991	1996	2001	2006	
Santo Domingo	150	240	370	570	890	X-4
Talavera	560	860	1,340	2,080	3,250	X-4
Talugtog	70	100	160	250	400	X-5 (IPTS)
Zaragosa	240	350	530	810	1,240	X-4 (IPTS) ◉
	11,450	17,545	27,285	42,400	66,380	(32)
Total						(32)

Legend: Figures in ( ) in" "Total" column denote No. of cities/municipalities.

◉ Phase I (1986)

◉ ◉ Phase II (1989)

X-4 PLDT Project (1984)

X-5 PLDT Project (1989)

Table III-1-2-1 (5/20)

Telephone Demand Forecast

Region III	Province (PAMPANGA)					
City/ Municipality	Number of Telephone Demands					Remarks
	1986	1991	1996	2001	2006	
Angeles City	10,510	17,350	28,570	46,890	77,610	Evang Elista Tel. Co. (4,100)
Apalit	560	870	1,370	2,150	3,410	Valencia Tel. Co. (200)
Arayat	340	520	790	1,210	1,880	X-4
Bacolor	220	340	510	770	1,180	Filipinas Tel. Co. (500)
Candaba	350	550	860	1,350	2,140	X-4
Florida blanca	490	740	1,120	1,710	2,640	X-4
Guagua	970	1,490	2,300	3,570	5,570	Filipinas Tel Co. (500)
Lubao	480	730	1,120	1,740	2,140	X-4
Mabalacat	1,440	2,240	3,520	5,530	8,770	Mabalacat Tel. Sys. (400)
Macabebe	610	950	1,490	2,350	3,730	Pampanga Tel. Co. (200)
Magalang	460	700	1,080	1,660	2,570	◉
Masantol	410	610	930	1,410	2,160	Pampanga Tel. Co. (200) X-4 (IPTS)
Mexico	680	1,060	1,650	2,600	4,120	X-4
Minalin	190	300	470	740	1,170	X-4 (IPTS) X-5
Porac	470	730	1,160	1,820	2,900	◉
San Fernando	4,260	6,600	10,270	16,000	25,170	PLDT (2,300)
San Luis	130	200	310	490	780	X-5 (IPTS)
San Simon	100	150	230	360	560	◉ ◉
Santa Ana	120	190	290	430	670	X-4
Santa Rita	10	160	230	340	510	X-5 (IPTS)
Santo Tomas	500	0	1,100	1,660	2,510	From Sanfernando
Sexmoan	120	180	270	410	620	◉
Total	23,520	37,400	59,640	95,190	153,410	(22)

Table III-1-2-1 (6/20)

Telephone Demand Forecast

Region III	Province (TARLAC)					
City/ Municipality	Number of Telephone Demands					Remarks
	1986	1991	1996	2001	2006	
Anao	90	140	210	320	500	◉ ◉
Bamban	150	230	350	540	850	From Capas
Camiling	420	620	930	1,400	2,120	PLDT (208)
Capas	330	500	780	1,200	1,870	PLDT (50)
Concepcion	480	740	1,160	1,800	2,830	PLDT (700)
Gerona	310	460	710	1,080	1,670	◉
La Paz	280	420	640	970	1,490	X-5 (IPTS) ◉
Mayantoc	140	210	320	490	760	◉ ◉
Moncada	320	480	740	1,120	1,720	X-4
Paniqui	350	520	810	1,240	1,930	X-4
Pura	110	170	250	390	590	X-5 (IPTS)
Ramos	70	100	160	240	370	◉ ◉
San Clemente	90	130	190	280	420	X-5 (IPTS)
San Manuel	100	140	210	320	480	◉ ◉
Santa Ignacia	160	250	380	580	900	X-4 (IPTS)
Tarlac	3,960	6,090	9,510	14,800	23,270	PLDT (1,721)
Victoria	250	370	560	840	1,290	X-4 (IPTS)
Total	7,610	11,570	17,910	27,610	43,060	(17)

Table III-1-2-1 (7/20)

Telephone Demand Forecast

Region III	Province (ZAMBALES)					
City/ Municipality	Number of Telephone Demands					Remarks
	1986	1991	1996	2001	2006	
Botolan	510	810	1,280	2,010	3,190	BUTEL (50) ◉ X-5 (IPTS)
Cabangan	610	260	420	660	1,060	X-5 (IPTS)
Candelaria	130	200	310	480	750	
Castillejos	240	380	590	930	1,480	Proposed by PILTEL X-5 (IPTS)
Iba	380	580	900	1,400	2,180	BUTEL (500) ◉
Masinloc	840	1,340	2,120	3,370	5,390	X-5
Olongapo City	8,350	13,320	21,130	33,490	53,610	PILTEL (3,600)
Palauig	290	460	730	1,160	1,850	
San Antonio	440	710	1,140	1,820	2,930	X-4
San Felipe	190	300	480	760	1,210	X-4
San Marcelino	410	650	1,040	1,640	2,630	X-4
San Narciso	330	530	840	1,320	2,120	X-4
Santa Cruz	1,010	1,570	2,450	3,820	6,010	X-4
Subic	360	600	990	1,630	2,700	PILTEL (300)
Total	13,640	21,710	34,420	54,490	87,110	(14)

Table III-1-2-1 (8/20)

Telephone Demand Forecast

Region IV	Province (BATANGAS)					
City/ Municipality	Number of Telephone Demands					Remarks
	1986	1991	1996	2001	2006	
Agoncillo	35	120	170	250	370	◉
Alitagtag	85	120	180	260	380	◉ ◉
Balayan	1,400	2,060	3,080	4,590	6,880	Western Tel. (340)
Batangas City	3,300	4,830	7,190	10,650	15,890	RETELCO (1,200)
Balite	30	40	60	85	130	◉ ◉
Bauan	430	640	940	1,400	2,080	From Batangas
Calaca	260	390	590	890	1,360	X-5 (IPTS) ◉
Calatagan	160	240	370	550	850	X-5 (IPTS) Proposed by RETELCO
Cuenca	95	130	200	290	430	X-5 (IPTS) Proposed by RETELCO
Ibaan	300	440	660	980	1,480	BUTEL (200) ◉
Laurel	15	25	35	55	85	◉ ◉
Lemery	660	970	1,440	2,150	3,230	From Taar
Lian	230	340	510	760	1,140	X-4 (Toll connection) Proposed by RETELCO
Lipa City	1,270	1,890	2,820	4,350	6,770	RETELCO (600)
Lobo	170	250	370	540	800	◉ ◉
Mabini	160	230	340	490	730	X-4 (Toll connection)
Malvar	110	160	230	350	520	X-5 (IPTS)
Mataasnakahoy	130	190	290	420	630	◉ ◉
Nasugbu	1,130	1,660	2,480	3,680	5,510	Western Tel. (220) X-5 (Toll connection)
Padre Garcia	150	230	350	520	800	X-5 (IPTS) ◉
Rosario	360	520	770	1,120	1,660	X-4 (IPTS) Proposed by RETELCO
San Jose	120	170	250	370	550	X-5 (IPTS) Proposed by RETELCO
San Juan	570	830	1,230	1,810	2,680	X-4 (IPTS) Proposed by RETELCO
San Luis	85	120	180	270	410	◉ ◉
San Nicolas	60	85	120	170	260	◉ ◉
San Pascual	210	310	470	700	1,040	From Batangas
Santa Teresita	40	55	80	120	170	◉ ◉
Santo Tomas	200	290	440	650	980	Proposed by RETELCO

continue to next page

Table III-1-2-1 (9/20)

Telephone Demand Forecast (Continued)

Region IV	Province (BATANGAS)					
City/ Municipality	Number of Telephone Demands					Remarks
	1986	1991	1996	2001	2006	
Taal	420	610	890	1,300	1,920	Western Tel. (340) X-5 (IPTS)
Talisay	100	150	220	320	480	Proposed by RETELCO
Tanauan	1,160	1,720	2,580	3,850	5,790	RETELCO (500)
Taysan	180	260	380	550	810	◉ ◉
Tingloy	70	100	150	230	350	◉ ◉
Tuy	70	100	160	240	360	◉ ◉
Total	13,815	20,275	30,225	44,960	67,525	(34)

Table III-1-2-1 (10/20)

Telephone Demand Forecast

Region IV	Province (CAVITE)					
City/ Municipality	Number of Telephone Demands					Remarks
	1986	1991	1996	2001	2006	
Alfonso	180	260	360	510	730	X-5
Amadeo	95	130	190	280	410	X-5
Bacoor	590	870	1,310	1,970	2,960	Filipinas Tel. Co. (500)
Carmona	220	360	580	930	1,510	X-5
Cavite City	2,880	4,270	6,410	9,620	14,510	Filipinas Tel. Co. (1,000)
Dasmarinas	310	460	690	1,040	1,590	Filipinas Tel. Co. (200)
Gen. Emilio Againaldo	35	50	75	110	170	X-5
General Trias	270	390	580	860	1,290	CEDA (100)
Imus	820	1,210	1,800	2,680	4,020	Filipinas Tel. Co. (500)
Indang	280	400	570	810	1,170	X-4
Kawit	410	600	900	1,340	2,010	From Bacoor
Magallanes	40	55	80	110	170	◉ ◉
Maragondon	120	180	260	370	550	X-5
Mendez Nunez	150	210	300	430	630	X-5
Naic	520	730	1,040	1,480	2,120	CEDA (50) Proposed by PLDT
Noveleta	95	140	210	310	460	From Rosario
Rosario	670	980	1,460	2,170	3,260	Filipinas Tel. Co. (600)
Silang	500	740	1,100	1,640	2,470	X-4
Tagaytay City	250	370	550	830	1,240	X-4
Tanza	380	560	830	1,230	1,830	From General Trias
Ternate	70	100	150	220	230	◉ ◉
Trece Martires City	120	170	270	400	610	CEDA (150)
Total	9,005	13,235	19,715	28,970	44,040	(22)

Table III-1-2-1 (11/20)

Telephone Demand Forecast

Region IV	Province (LAGUNA)					
City/ Municipality	Number of Telephone Demands					Remarks
	1986	1991	1996	2001	2006	
Alaminos	160	230	330	490	720	X-4 (IPTS)
Bay	270	400	610	920	1,400	X-5 (IPTS)
Binan	1,560	2,420	3,760	5,840	9,140	Independent Tel. Co. (250)
Cabuyao	380	570	860	1,300	1,980	From Calamba
Calamba	2,990	4,490	6,770	10,230	15,570	RETELCO (1,000)
Calauan	260	390	590	890	1,310	X-4 (IPTS)
Cavinti	130	180	260	380	550	X-5 (IPTS)
Famy	45	70	100	150	230	X-5 (IPTS)
Kalayaan	110	160	240	350	520	◉ ◉
Liliw	180	260	380	550	810	X-5 (IPTS) Proposed by RETELCO
Los Banos	3,140	4,690	7,050	10,610	16,090	RETELCO (1,000)
Luisiana	220	310	450	650	950	X-5 (IPTS)
Lumban	240	350	500	740	1,090	From Santa Cruz
Mabitac	110	170	250	370	560	◉ ◉
Magdalena	310	460	700	1,050	1,600	X-5 (IPTS)
Majayjay	250	350	510	730	1,060	X-5 (IPTS)
Nagcarlan	150	220	320	470	700	X-4 (IPTS)
Paete	260	390	590	890	1,360	X-4 (IPTS) Proposed by RETELCO
Pagsanjan	270	390	560	830	1,230	From Santa Cruz
Pakil	40	60	90	140	210	◉ ◉
Pangil	110	170	260	390	590	◉ ◉
Pila	280	400	590	870	1,300	◉ ◉
Rizal	95	130	190	270	400	◉ ◉
San Pablo City	5,510	8,450	13,000	19,990	30,970	PLDT (2,126)
San Pedro	1,750	2,830	4,560	7,300	11,790	Proposed by RETELCO
Santa Cruz	1,390	2,050	3,060	4,560	6,860	RETELCO (1,000)
Santa Maria	100	150	220	330	510	X-4 (Toll Connection)
Santa Rosa	560	860	1,300	1,980	3,030	From Calamba

continue to next page