

REPORT OF THE DIRECTOR
OF THE BUREAU OF RESEARCH
ON THE DEVELOPMENT OF
A NETWORK PROJECT
IN THE NORTHWEST PART OF TEXAS

DECEMBER, 1978

TEXAS INTERNATIONAL COOPERATION BOARD

REPUBLIC OF THE PHILIPPINES

FEASIBILITY REPORT ON THE TELECOMMUNICATIONS
NETWORK PROJECT
IN THE NORTHERN PART OF LUZON

[VOLUME I]

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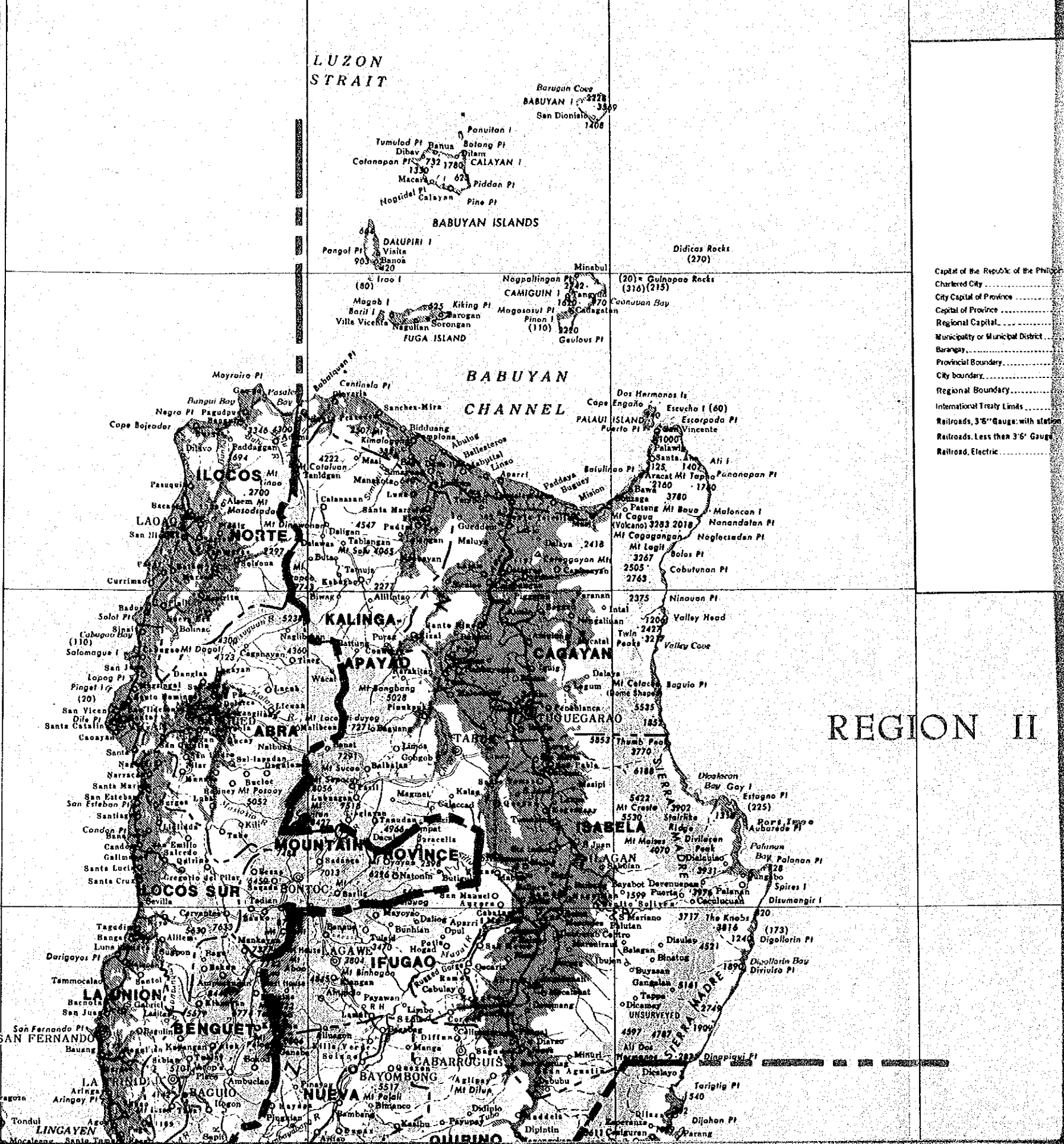
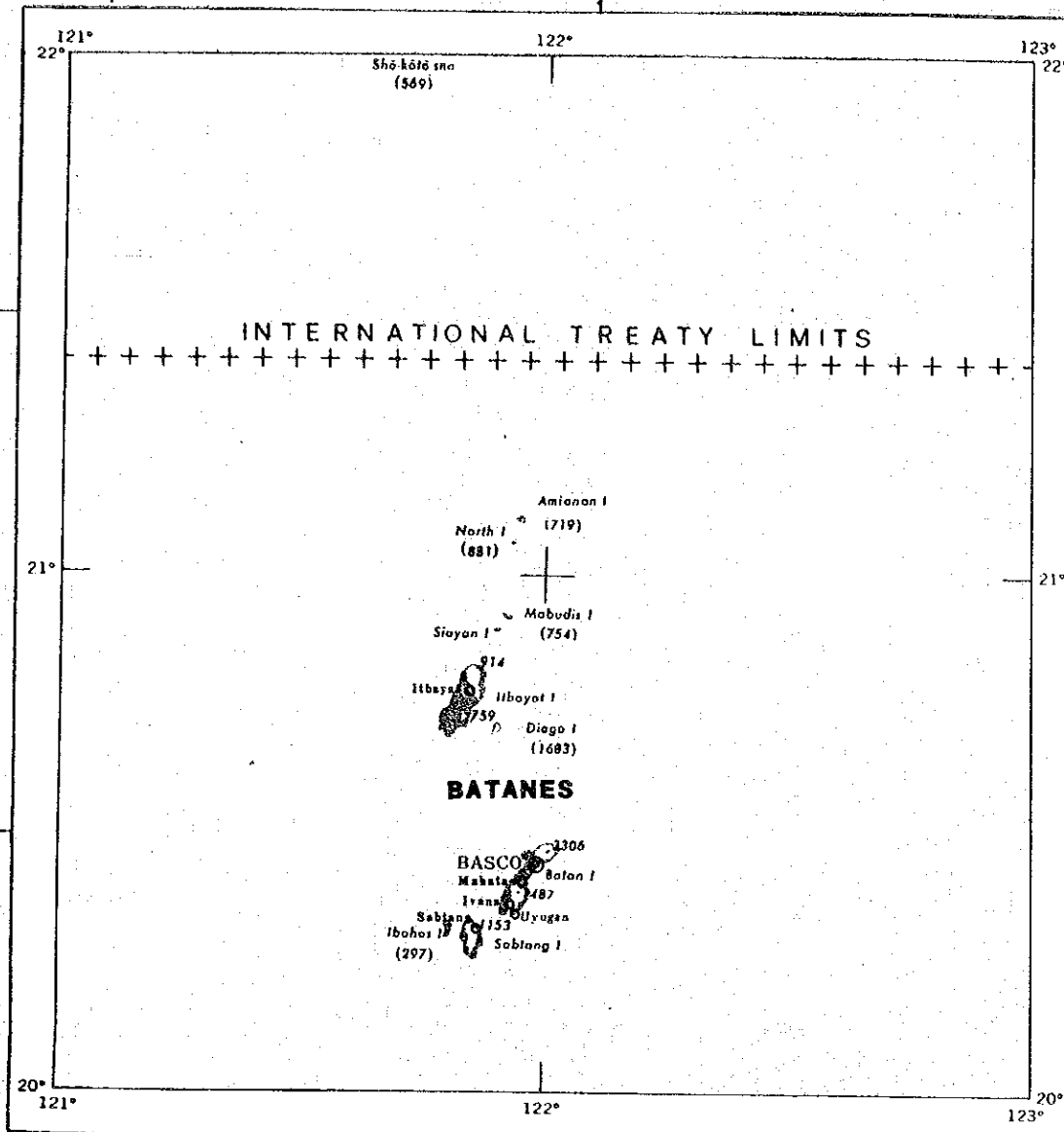
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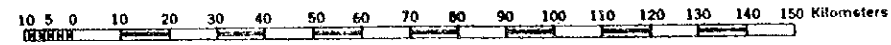
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Capital of the Republic of the Philippines
Chartered City
City Capital of Province
Capital of Province
Regional Capital
Municipality or Municipal District
Barangay
Provincial Boundary
City boundary
Regional Boundary
International Treaty Limits
Railroads, 3'6" Gauge; with station
Railroads, Less than 3'6" Gauge
Railroad Electric

NORTHERN PART OF LUZON THE PHILIPPINES

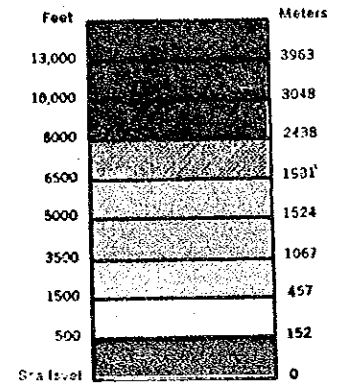
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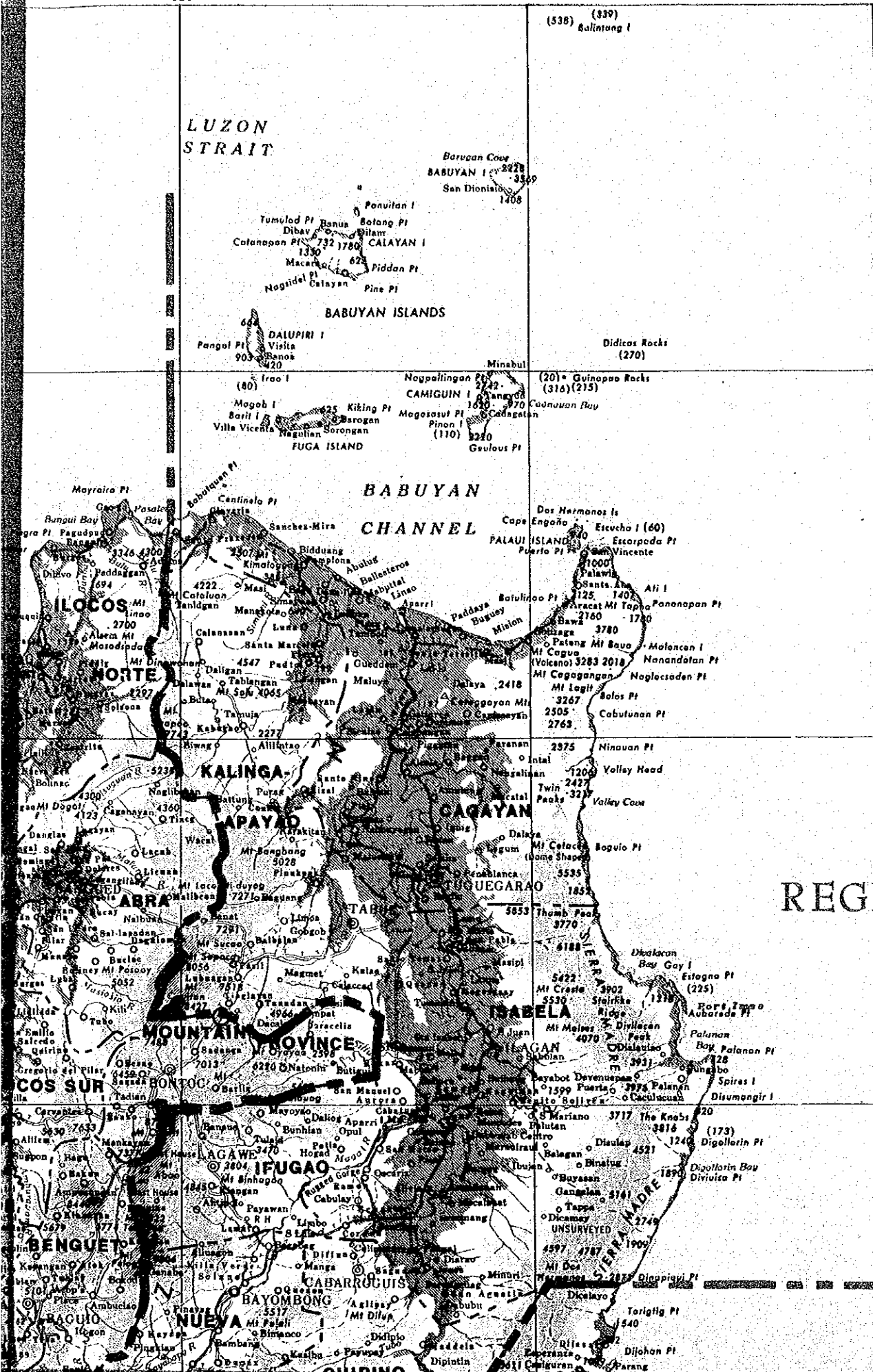
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| Capital of the Republic of the Philippines | ⊙ | Main Road | — |
| Chartered City | ● | Secondary Road | - - - - - |
| City Capital of Province | ⊙ | Track or Trail | ⋯⋯⋯ |
| Regional Capital | ⊙ | Road under Construction, 1941 | - · - · - · - |
| Municipality or Municipal District | ○ | Ferry | ⚓ |
| Barangay | ○ | Telephone and Telegraph Line | ⋯⋯⋯ |
| Provincial Boundary | — | Power Transmission Line | ⋯⋯⋯ |
| City boundary | — | Marsh | ⋯⋯⋯ |
| Regional Boundary | — | Mud or Tidal Flat | ⋯⋯⋯ |
| International Treaty Limits | +++++ | Height (in feet) | 743 |
| Railroads, 3'6" Gauge with station | ⋯+⋯+⋯+⋯ | Mine | ⋯+⋯ |
| Railroads, Less than 3'6" Gauge | ⋯+⋯ | Rock Awash | ⋯+⋯ |
| Railroad, Electric | ⋯+⋯ | Limiting Danger Line | ⋯+⋯ |
| | | Principal Navigation Light | ★ |

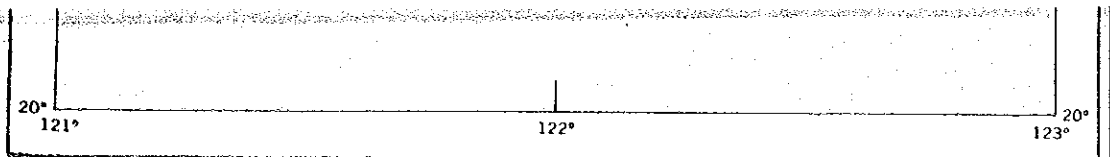
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HEIGHTS IN FEET

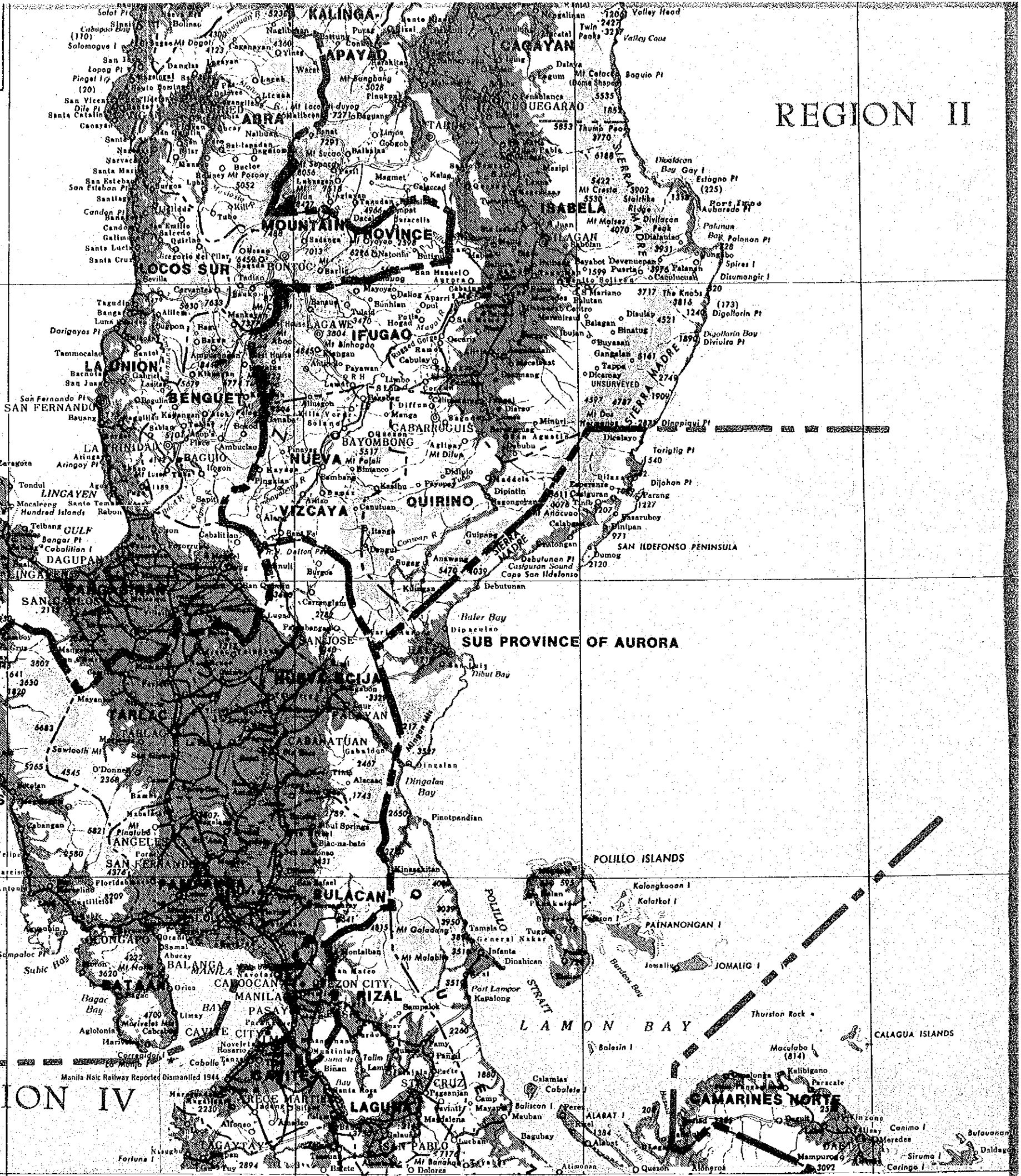
REGION II





REGION I

REGION II



REGION III

REGION IV

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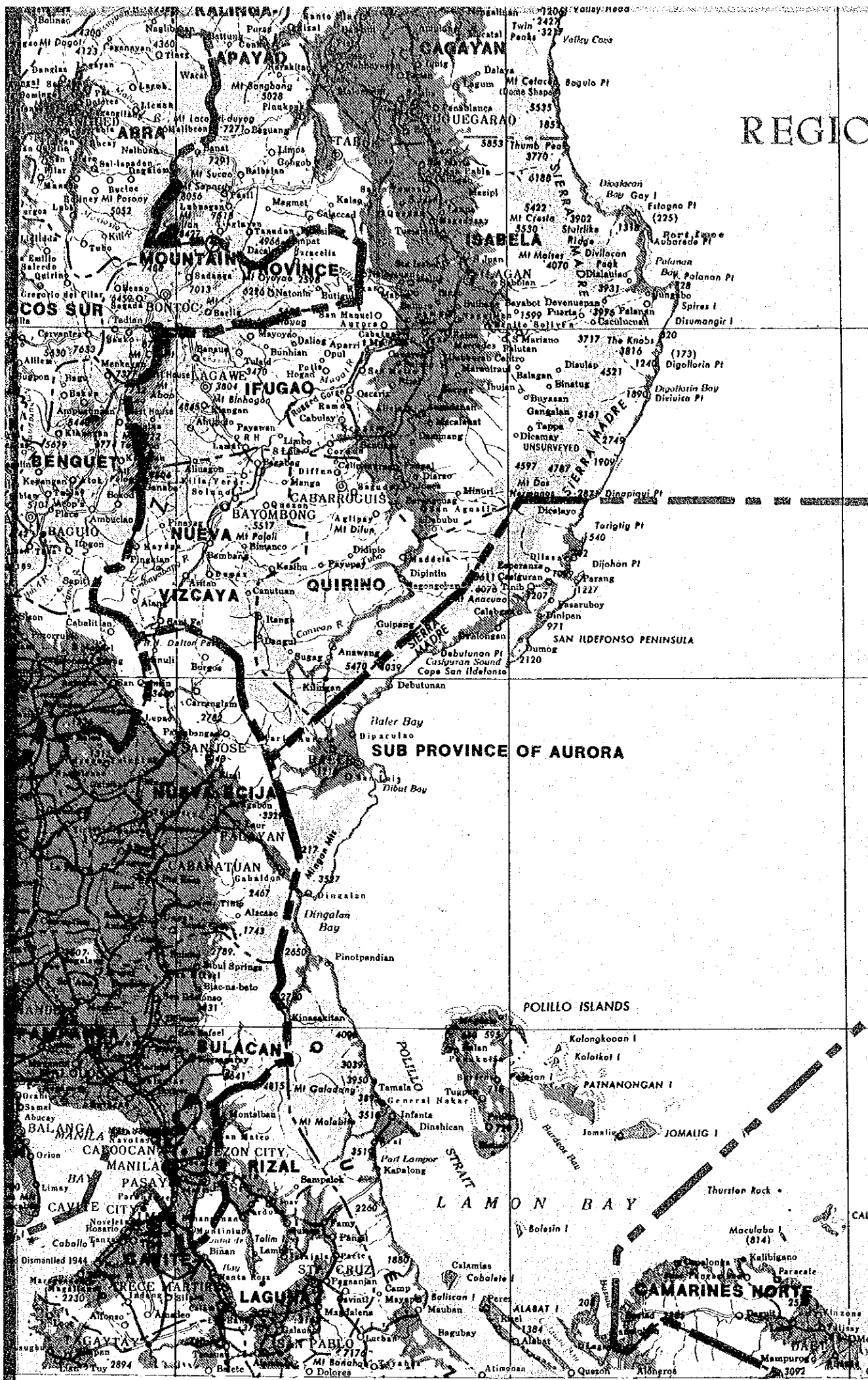
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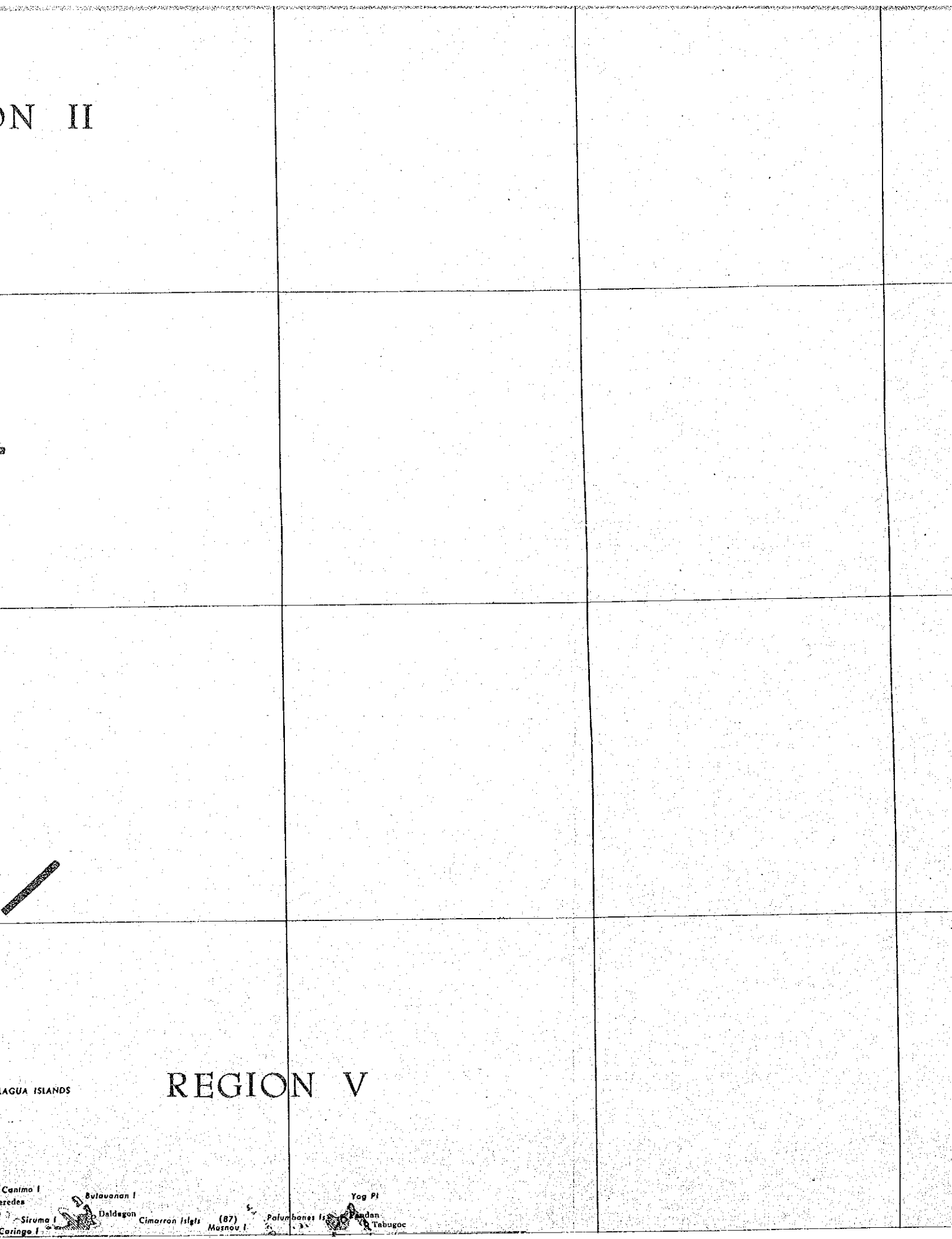
LAMON BAY

Manila-Naic Railway Reported Discontinued 1944

REGION II



REGION V





BUTEL Directorate



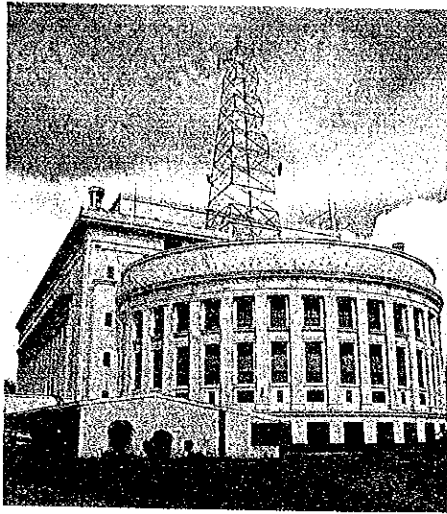
Discussion with General C. S. Carreon, Director, BUTEL



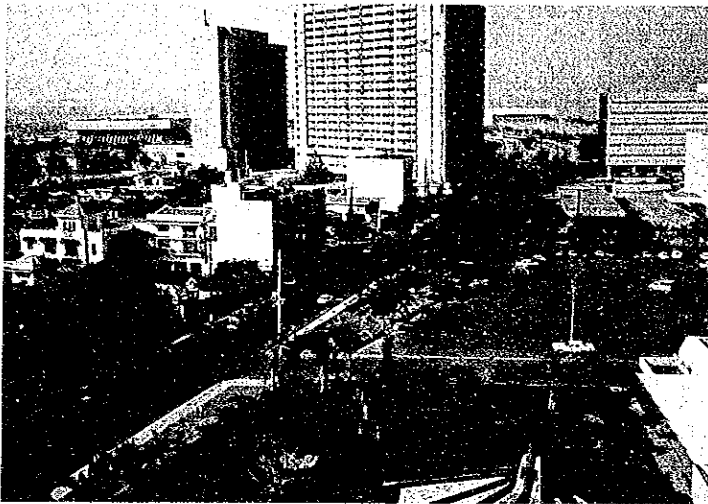
Discussion with MPWTC and BUTEL key persons



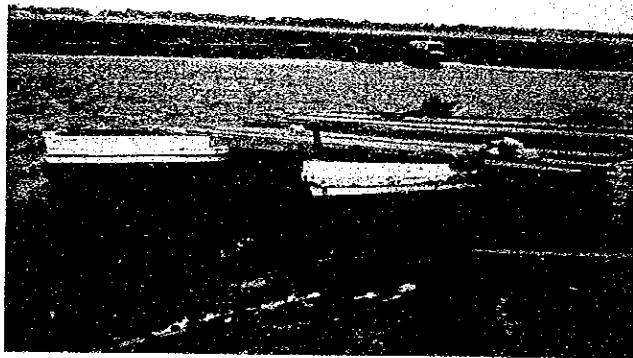
Discussion with BUTEL counter-parts



Building of BUTEL post office in Manila



Manila City



Cagayan River

PREFACE

In response to a request of the Government of the Republic of the Philippines the Government of Japan decided to take up a feasibility study on the telecommunication network project in the northern part of Luzon as part of Japan's technical cooperation programme and the study was conducted by the Japan International cooperation Agency (J I C A).

JICA dispatched to the Philippines a team of 13 experts, headed by Mr Shigeru FUKUDA of the Ministry of Post & Telecommunications from February 26 to May 16, 1978 to make the feasibility study on the project.

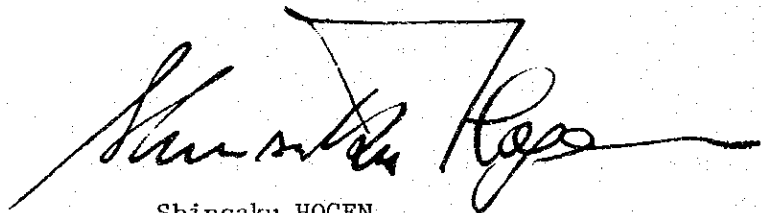
An interim report on the project was submitted to the authorities concerned of the Government of the Philippines by the team.

After careful review of it in Japan, taking account also of the discussions held with the officials of the Philippines this final report has now been prepared for submission to the Philippine Government.

I sincerely hope that this report will contribute to the progress of this project and to the promotion of friendly relations between the Philippines and Japan.

I would like to express my deep appreciation to all the people concerned of the Government of the Republic of the Philippines who extended their close cooperation to our survey team.

December 1978

A handwritten signature in black ink, appearing to read 'Shinsaku Hogen', with a large, stylized flourish extending to the right.

Shinsaku HOGEN

President

Japan International Cooperation Agency

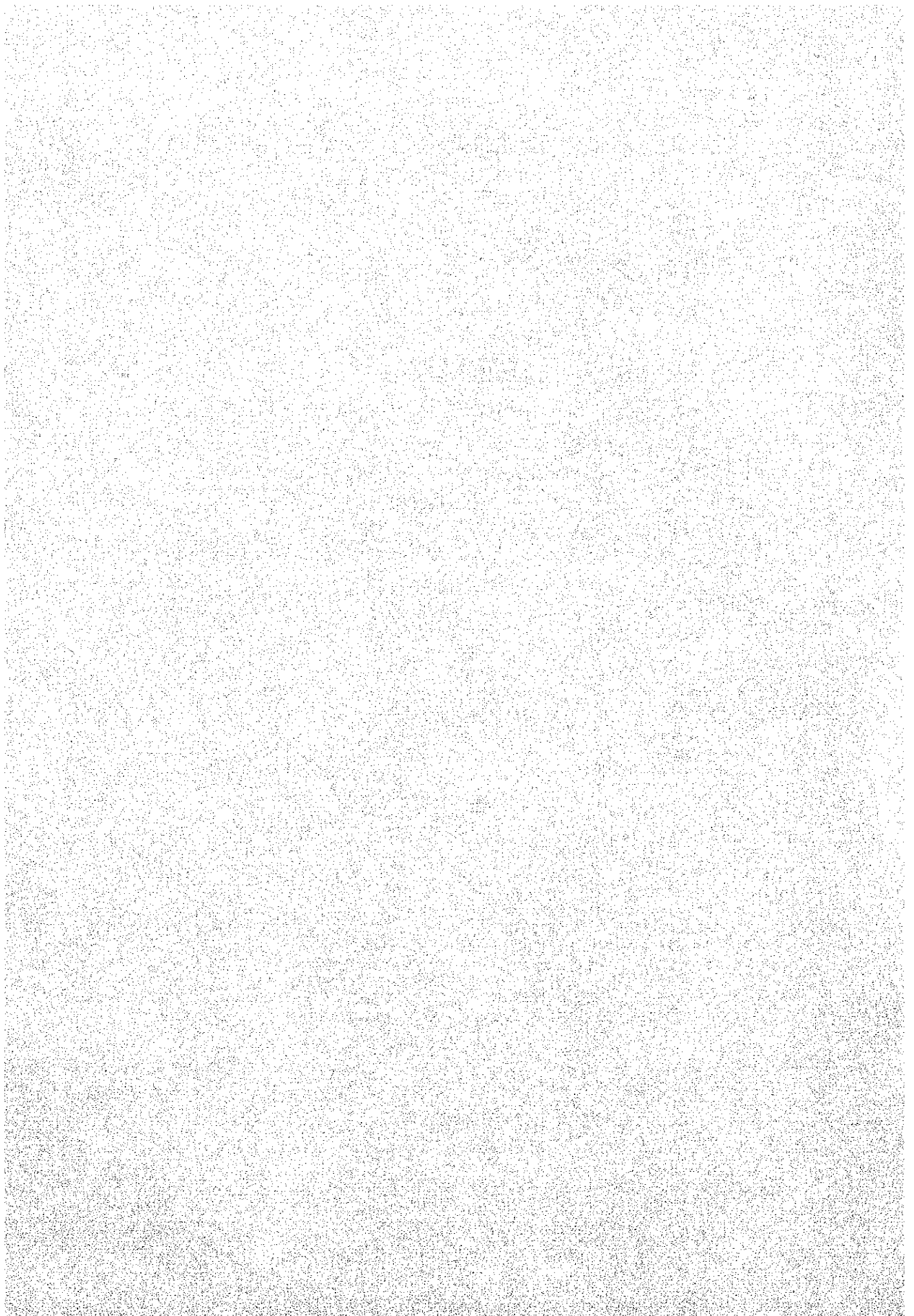
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SUMMARY



1. General

Feasibility survey has been made on the wide-range telecommunication network project for the Northern Part of Luzon by the request of the Government of the Philippines. The survey team was headed by Mr. Shigeru Fukuda, Special Advisor, International Cooperation Division, Minister's Secretariat, Ministry of Posts and Telecommunications and staffed with specialists from the Ministry of Posts and Telecommunications, Nippon Telegraph and Telephone Public Corporation (NTT), and Japan International Cooperation Agency (JICA). The survey consisted of the main survey ranged from February 26th to May 13th, 1978 and a supplementary survey ranged from August 27th to September 17th, 1978.

The scope of the feasibility survey incorporated survey on:

- (1) Present trend of telecommunication service and facilities in the Philippines,
- (2) Telecommunication development plan,
- (3) Management and organization of the Bureau of Telecommunication (hereinafter referred to as BUTEL), and
- (4) Project details including
 - i) Engineering standards
 - ii) Telephone demand forecast
 - iii) Traffic forecast and circuit estimation
 - iv) System design and scheduling
 - v) Installation plan
 - vi) Operation and maintenance after completion of installation
 - vii) Estimated installation expenses
 - viii) Charging rates
 - ix) Economic evaluation

The survey team conducted field survey, collected data and related references, and listened to the opinions of the Government of the Philippines.

2. Outline of Telecommunication Network Project for Northern Part of Luzon

2-1 Background of Project

Although Republic of Philippines has a population of about 45,000,000, its total number of telephones is only 542,000, that is, 1.2 telephones per 100 inhabitants. These values indicating the degree of popularization or spread of telephone are considerably small. In particular, Regions I and II expected to be covered by the present project have a total population

of about 5,500,000 but have only 11,200 telephones, which is 0.20 telephones per 100 inhabitants.

Indeed, the spread of telephone in these regions is extremely low.

It is apparent that such a condition as this is undesirable.

Meanwhile, the Government of Philippines has recognized in its Five-Year Development Plan the necessity and urgency of developing telecommunication for the development of the Philippines.

BUTEL has prepared a 10-Year plan for the development of telecommunication and intends to make a rapid development in telephone and telegraph services. Under these circumstances, the present project has been proposed to cover Regions I and II. Ther project is the first, wide-range telecommunication network project ever planned by BUTEL.

2-2 Division of the Project into Two Phases

The items of project which were initially proposed by BUTEL amounts to about 10 billion yen covered by foreign currency. This amount greatly exceeds about 5.8 billion yen for which the Government of the Philippines requested the Japanese government on a seventh Yen credit, so that it is recommended to divide the project into Phases 1 and 2 and start for the implementation of Phase 1 as soon as possible. As stated earlier, telecommunications in Regions I and II is far behind and it is important to start construction as soon as possible even if the scale of construction may not be sufficient at the beginning.

Since Phase 1 is intended to form the foundation for the advanced telecommunications network in Regions I and II, it is recommended to start Phase 2 at an early time after implementation of Phase 1 still insufficient for the achievement of the intended telecommunication.

2-3 Major Items of Project

The major items to be installed by the project are as follows.

(1) Local exchanges and IPTS's

Item	Phase 1	Phase 2	Total
Number of Local exchanges	19	26	45
Number of IPTS's	19	31	50

(2) Toll switching centers

Item	Phase 1	Phase 2
Secondary center	1	-
Primary center	6	1

(3) Microwave network

20 hops, 732kms (In Phase 1)

(4) Spur routes

Item	Phase 1	Phase 2	Total
UHF	27	16	43
VHF/HF	12	18	30
Total	39	34	73

(5) PCM system and multiplexing equipment

Item	Phase 1	Phase 2	Total
PCM system	1 section	3 sections	4 sections
Multiplexing equipment	about 1600ch	about 1500ch	about 3100ch

(6) Cable

Item	Phase 1	Phase 2	Total
Trunk cable	about 203km	about 254km	about 457km
Local cable	about 300km	about 340km	about 640km

(7) Telegraph

Item	Phase 1	Phase 2	Total
Telex exchange	2 exchanges, 680 lines		2 exchanges, 680 lines
Telex concentrator	1 concentrator, 60 lines	6 concentrators, 340 lines	7 concentrators, 400 lines
Gentex station	13 municipalities (cities)	19 municipalities (cities)	32 municipalities (cities)

2-4 Outlines of Services to be provided by Implementation of the Project

(1) Local telephone service

About 5,000 telephones will be installed in Phase 1 and about 4,000 telephones in Phase 2.

Then, 38 municipalities will come to receive the benefit of telephone service in Phase 1 and 57 municipalities in Phase 2.

(2) Long-distance telephone service

In addition to STD service to be provided between subscribers covered by BUTEL's local telephone offices, STD service will be provided from these BUTEL's telephone offices to Manila and major cities or

municipalities in Regions I and II .

Connection from Manila to the telephone offices to be constructed in this project will be made by delay service.

(3) Telegraph service

The major cities and municipalities in Regions I and II will receive the benefit of telex service.

Telegrams will automatically be sent through telex exchanges to in manila, Baguio and Gentex stations in other cities and municipalities, thereby assuring the rapidity of telegraph and contributing to the benefit of inhabitants.

3. Standards to become the Foundation of the Project

3-1 Switching Engineering Standards

Switching Engineering standards comprise performance standard, which stipulates switching performance, and quality allotment standard based on the performance standard.

The major standards to be employed in this project are as follows.

(1) Rate of being engaged in switching stage

Toll calls:	10.0%
Local calls:	4.0%
Special number calls:	3.0%

(2) Loss probability allotment standard

i) Allotment standard for toll call switching system

The loss probability of the main route is 0.01 per switching stage

ii) Allotment standard for switching within local exchange area

The loss probability of intra-office trunk is 0.02.

(3) Delay time allotment standard for manual service

Waiting probability of outgoing trunk for toll connection

Non-delay service	0.05
delay service	0.1

3-2 Transmission Engineering Standards

3-2-1 Transmission Loss Allotment

Transmission loss allotment is measured relative to the reference equivalent and is as follows.

National Center-Secondary Center:	0dB
Secondary Center-Primary Center:	3.5dB

Primary Center-End Office:	6dB
End Office-Subscriber Sending:	11.5dB
Receiving:	1.5dB

3-2-2 Noise Allotment

Noise standards in respective sections and within exchanges are as follows.

National Center-Secondary Center:

In accordance with the transmission line noise standard set out in CCITT Recommendation (G222) for 2500km.

Secondary Center-Primary Center:	2000pW
Primary Center-End Office:	2000pW
Noise within exchanges:	2000pW

3-2-3 Average Noise in Radio Section

The noise of the main route formed with a microwave system is to be 7500pW/2500km (weighted value). The noise of the radio section between primary center and end office is to be 2000pW (weighted) of 4 sections including multiplex equipment.

3-2-4 Short-Time Breakdown Ratio in Radio Section

For the short-time breakdown ratio of each radio section, the time ratio in which the noise exceeds 10^6 pW in unweighted value is to be less than 0.03%/2500km. The value of 0.03% is ascribable to the radio section (0.01%), radio equipment (0.01%), and power plant (0.01%).

3-2-5 Color TV Signal Transmission Standard

According to CCIR Recommendation for transmission standard:

Video amplitude response:	within 1dB (to 4MHz)
Differential gain:	less than 10%
Differential phase:	less than 5%

3-2-6 Minimum Transmission Loss

In order for a trunk line incorporating repeaters, a singing margin of 7dB should be given in consideration of transmission line loss and Gain variation.

Trunk line net loss must be determined in consideration of this.

3-3 Network Plan

3-3-1 Telephone

In this project, telephone offices are classified into three steps of hierarchy: Secondary center, Primary center, and End office.

Secondary center	1	(After completion of phase 1)
Primary centers	6	(" 1)
	7	(" 2)
End offices (including IPTS's)	41	(" 1)
	103	(" 2)

3-3-2 Telegraph

Telex exchanges will be installed at the centers of the respective regions such as Baguio and Tuquegarao.

Gentex stations will be constructed for telegraph offices and accommodate general telex facilities.

One concentrator will be constructed in Phase 1 and six concentrators in Phase 2 so as to concentrate lines.

3-4 Charging Plan

Message rate system is introduced for charging local calls. Periodic pulse metering method is introduced for charging toll calls. Each province will be used as a tentative unit charging area, and toll calls will be charged by the distance between the provincial capitals.

Charging equipment will be introduced at primary centers. Charging areas will be determined by the area code dialed by the subscriber, and applicable charging pulses from the primary center will be sent to the local exchange.

3-5 Numbering Plan

BOC and BUTEL have their own numbering plans.

In order to develop future telecommunications network more rationally and economically on the basis of the results of the survey conducted this time, the followings are proposed.

- (1) According to BOC's numbering plan, national numbers will be of 8 digits. "5" will be given as the area code of Regions I and II (Code A).
- (2) Trunk codes will be composed of 1 - 4 digits and subscriber code of 4 - 7 digits.
- (3) Charging identification will be made by the first 3 digits or less and route identification by 4 digits or less.

(4) Numbering

<u>Area Code</u>	<u>Subscriber Code</u>	<u>Example</u>
o	△ △ △ X X X X	Manila
o o	△ △ X X X X	
o o o	△ X X X X	Baguio, Dagupan, etc.
o o o o	X X X X	most towns in Regions I and II such as Batac, Aparri and Tabuk.

3-6 Signaling System

For the signaling system, the R₂-MFC signaling system set out by CCITT Recommendation will be employed because of its high reliability in connection and the worldwide trend.

3-7 Transmission Planning Standard

A microwave system will be adopted as the main route for connection of primary centers. Transmission of color TV signal will also be allowed. Transmission between primary center and end office will be made by radio or cable. When the distance primary center end office exceeds 15km, radio will be used in principle. When the distance is less than 15km, a cable will be used in principle.

3-8 Standards for Transmission Facilities

In principle, CCITT and CCIR Recommendations will be met.

3-9 Standards for Telegraph Facilities

Various telegraph standards will be employed to meet those of the existing facilities. Most of the standards meet CCITT Recommendation. Some of the telegraph standards are: 1) transmission speed: 50 bauds, 2) characters: international alphabet No.2, 3) signaling method: method A set out in CCITT Recommendation U1.

3-10 Standards for Outside Plants

The DC resistance limit of a subscriber's line will be 1500Ω. The DC resistance limit of a toll line will be 4000Ω in both cases of DC or AC signals.

3-11 Standards for Power Facilities

The battery capacity of the switching system will be 4 hours in consideration of traffic demand to be made 15 years ahead. The battery capacity of a radio repeater station atop a mountain or hill will be 8 hours in consideration of the traffic 15 years ahead.

However, when the battery of the switching system and that of radio equipment are installed within the same building, the battery capacity will be set as that of the switching system.

Basically the engine generator will automatically start and stop respectively upon failure and recovery of the commercial power.

3-12 Standards for Civil Work

Telephone office and radio repeater station buildings will be made of reinforced concrete and only switching equipment room will be airconditioned. Two types of steel towers will be employed: Selfsupporting tower and guyed mast. Selfsupporting towers will be used on the main route and guyed masts on spur routes.

Access roads to microwave repeater stations atop mountains or hills (unattended stations) will be 3m in width and 1/10 in gradient as standard.

3-13 Principles of Design of Facilities

(1) Switching equipment

Both local and toll switching equipment will be of crossbar type. The type of switching equipment is such that can meet the demand to be made 15 years ahead. The design period of switching equipment will be 5 years.

(2) Radio

For the radio equipment on the main route, a route protection system of one working radio channel plus one protection radio channel will be employed.

The type of radio equipment for use in the spur routes will be such that can cope with the demand to be made 15 years ahead. For the provision of stand-by transmission line, the preset system will be employed.

(3) Carrier

The design period of the carrier equipment will be 5 years in principle.

(4) Telegraph

The telegraph network will be designed to meet the traffic demand

to be made by 1990. Crossbar telegraph exchange will be used, which will be installed at one location in every region. In areas located considerably distant from exchanges but with strong demand a concentrator will be installed.

(5) Cable

The design period of local lines will be 10 years and that of toll lines will be 15 years.

(6) Power plant

Such power facilities as will meet power supply demand 15 years ahead after completion of the construction will be installed. An engine generator will be installed at all stations for standby use. Battery will be installed at all offices and stations excluding IPTS's. The battery capacity will be 4 hours at telephone offices and 8 hours at radio repeater stations atop mountains or hills.

3-14 Interface With Private Operators

BUTEL and private operators should develop their services smoothly while preventing double investment.

Connection between BUTEL's and private operator's subscribers will be made in the TS stage and STD service will be provided for connection from BUTEL's subscribers to private operator's subscribers in Manila and major cities or municipalities in Regions I and II.

4. Demand Forecast

4-1 Telephone

Demand forecast of subscriber telephone is made for the existing telephone service areas covered by respective telephone operators and for telephone service areas expected to be covered by the respective operators by 1987. Demand forecast is made for 1982, 1987, 1992, 1997, and 2002 (which are called the year of demand forecast) ranging over 20 years.

Subscriber telephone demand forecast is made by multiplying the present demand (as of 1977) obtained by field survey by the estimated increment of product per capita (6%/year) and the increment of population in each area in consideration of the numbers of urban and rural households, the number of business offices, the rank, etc., of each area. By this, the estimated telephone demand in 2002 is about 106,000 in Region I and 34,000 in region II.

4-2 Telegraph

The number of telex subscribers and that of Gentex stations in years ranging to 1990 are estimated on the basis of the number of business companies in the respective cities or municipalities and the number of existing telegraph offices in consideration of annual population increment and development of each area.

5. Telephone Installation Plan

In principle, all demands will be met.

However, installation of telephones in relation with this project will be planned so as to meet all demands within 3 years after completion of the installation in Phases 1 and 2 for equalization of installation.

By this plan, the number of telephones to be installed in the range of 1982 - 1987 is 1300 - 1400 per year.

6. Traffic Forecast

6-1 Telephone

Traffic forecast is made in consideration of the features of the respective areas, closeness in relation between cities or municipalities, data of various countries (by CCITT data), the passed and present traffic condition experienced in Japan, etc.

Traffic forecast is made for 1987, 1990 and 1997 so as to meet the design periods.

6-2 Telegraph

Traffic forecast of telex subscribers is made from the busy-hour traffic of general telex subscribers (0.08 Erlang), the average holding time of one telex message (3 minutes), and the estimated number of telex subscribers which is obtained by demand forecast.

For Gentex stations, traffic forecast is made up to 1990 in consideration of the amount of telegrams handled by private operators and population increment per year.

7. Circuit Estimation

7-1 Telephone

The loss probability of each route will be made 0.01. A traversal trunk will be established between primary centers with a traffic exceeding a given value (5 Erlang), and overflow calls are detoured to the basic trunk.

7-2 Telegraph

The scales of telex concentrators and telex exchanges are as given in the table below. Trunk line estimation is made for a loss probability of 0.01, and the number of lines to be demanded by 1987 is obtained for Phase 1 and by 1990 for Phase 2.

Station	Line	
	Phase 1	Phase 2
Telex exchange		
Baguio	480	
Tuguegarao	200	
Telex concentrator		
San Fernando	60	
Laoag		60
Vigan		60
Dagupan		100
Ilagan		40
Santiago		40
Bayombong		40

8. System design

8-1 Switching

The installation procedure of switching facilities is as follows. In Phase 1 the foundation of network will be mainly constructed by installing toll switching facilities, in Phase 2 more local exchange facilities will be installed on the basis of the achievement of Phase 1.

Type of Switch	Phase 1	Phase 2
TS	7	1
LS	19	26
IPTS	19	31

8-2 Transmission

8-2-1 Design Principle

Microwave will be used for the main route, and the entrance cable between the radio repeater and toll exchange will be of toll cable type. Spur routes will be designed in accordance with the transmission standards. In the case of wired system, a loaded cable of about 0.65mm in conductor diameter will be used. When the distance exceeds 11km, both-way repeater will be installed.

When the distance exceeds 20km, the introduction of PCM method is proposed in principle.

8-2-2 Radio

(1) Main route

A transmission route of a maximum of 960 channels will be constructed for the Baquio - Vigan - Laoag - section and Baguio - Byombong - Ilagan - Tuguegarao section by using a 6GHz microwave band (6430MHz - 7110MHz).

Baguio - Manila route will be also constructed by the same 6GHz band as replacement of the present equipments. And for these microwave sections, color TV signal transmission will be available by using a protection channel not used in normal operating condition. The total microwave transmission length will be about 730km. For channel quality, noise allotment of 3pW/km which is set out by the CCIR Recommendation will be met and, in addition, the shour-time breakdown ratio ascribable to the transmission route will meet the objective of 0.001%/2500km.

(2) Spur routes

For the radio transmission routes between offices/stations ranking lower than primary centers, 3-channel/6-channel system using a 400MHz band, 60-channel/120-channel system using a 800MHz band, or 300-channel system using a 2GHz band will be employed depending on the circuit demand. The number of sections and total length of each system are given below.

<u>Band</u>	<u>No. of Sections</u>	<u>Length</u>
150MHZ	30	747.9km
400MHZ	17	338.2km
800MHZ	21	402.6km
2GHz	5	145.7km
Total	73	1,634.4km

The system design of the spur routes is made so that the channel quality should meet the objective of 677pW (61,7dB) per radio section with the channel quality between primary center and end office being expected to be 2000pW/weighted value. Since it is necessary to employ so many frequency bands for the spur routes, it is important to provide the required frequency bands.

8-2-3 Multiplex and PCM Equipment

Necessary multiplex and PCM equipment are planned in accordance with the various standards and design principles. A total of about 1560 channels of equipment will be installed in Phase 1 and total of about 1470 channels of equipment in Phase 2.

8-3 Telegraph

In Phase 1, 2 telex exchanges, one telex concentrator and 13 Gentex stations will be constructed.

In Phase 2, 6 telex concentrators, and 19 Gentex stations will be constructed.

8-4 Cable and Subscriber Facilities

The major items of installation in Phase 1 and Phase 2 are as follows.

Phase 1	[Local line	Installation of subscriber's line	about 300km
		Subscriber's facilities	Number of subscriber's facilities	about 3,450
		Trunk line	Installation of telephone trunk line	about 150km
			Installation of telegraph trunk line	about 50km
Phase 2	[Local line	Installation of subscriber's line	about 340km
		Subscriber's facilities	Number of subscriber's facilities	about 3,020
		Trunk line	Installation of telephone trunk line	about 240km

Phase 2	Trunk line	Installation of telegram trunk line	about 15km
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The standard installation period necessary for the above items of installation will be one year and a half excluding the installation of subscriber's facilities.

8-5 Power Plant

Basically, commercial power will be used, and when the commercial power fails, the engine generator provided for stand-by use will be used. Battery will be employed to make auxiliary role before the engine generator starts operation. When telephone, telegraph, radio, and carrier facilities are installed in the same building, the power facilities will be used in common (for example, rectifier, battery, etc.). When different voltages are required, DC/DC converters will be employed thereby achieving economy and developed maintainability.

8-6 Civil Work

A station building will comprise an equipment room, power room, materials storing room, and underground oil tank. In the case of an attended station, an office room, conference room, and service yard will be added. In consideration of network configuration and maintenance requirements in areas where the telephone office or radio repeater station will be located, following 7 types of station buildings are planned.

- Type A: Station building in which a telephone office and an attended radio station will be accommodated together.
- Type A': Station building in which a telephone office and an unattended radio station will be accommodated together.
- Type B: Station building which will accommodate a telephone office only.
- Type C: Station building for IPTS guided by radio
- Type D: Station building for IPTS guided by cable
- Type E: Station building only for accommodating an attended radio repeater station
- Type E': Station building only for accommodating an unattended radio repeater station

Type of Building	Phase 1		Phase 2	
	Number of Stations	Number of Stations	Number of Stations	Total Area
A	12	7460m ²	-	-
A'	6	2100m ²	10	3500m ²
B	10	3530m ²	16	5120m ²
C	10	300m ²	14	420m ²
D	9	135m ²	16	240m ²
E	3	960m ²	-	-
E'	25	1830m ²	11	540m ²
Total	75	16315m ²	67	9820m ²

The necessary numbers of the respective types of station buildings to be required in this project are given in the in the above table.

Steel towers will be of selfsupporting type mainly for microwave repeater stations and quyed mast type for other stations.

In Phase 1, 22 selfsupporting towers and 31 quyed masts will be constructed. Access roads to radio repeater stations atop mountains or hills will be as follows.

Phase 1: 20 sites (including 3 sites for IPTS), 37km in total

Phase 2: 7 sites (including 2 sites for IPTS), 19km in total

8-7 Connection with DOMSAT Ground Station

One trunk line will be provided from each of 7 cities or municipalities such as Laoag and Baquio to Manila through DOMSAT for the purpose of backup in the event of an emergency. A microwave link will be provided between each of Laoag and Tuguegarao ground stations and BUTEL's radio repeater stations in the respective areas so as to mainly present TV broadcasting service in Regions I and II.

8-8 Interface with Private Operator's Facilities

In this project, STD connection will be made not only between BUTEL's offices but from BUTEL's offices to major offices owned by private operators in Manila and Regions I and II and also delay manual connection will be available from these major offices in Manila and Regions I and II to BUTEL's offices.

Necessary facilities on the BUTEL's side will be installed in this project

but facilities to be installed within the franchise of private operators should be installed by the private operators.

9. Implementation Plan

It is recommended to implement this project on the turn-key basis. Design, preparation of tender specification, tender assessment, supervision of installation work, inspection, should be entrusted to a consultant company. BUTEL should set the project execution headquarters in the main office and respective regional offices of BUTEL for the administration and supervision of installation for smooth accomplishment of installation. The responsibilities to be charged on the project execution headquarters are very heavy and include negotiation with private telephone operators, procurement of sites, assignment of personnel, and procurement of radio frequencies. Installation is scheduled so that service by the accomplishment of Phase 1 will be started in the middle of 1982. For this purpose, the following schedule requirements should be met.

Fall of 1979: Tender to be opened

Middle of 1980: Contract to be closed

July 1980: Installation to be started

For civil work, it is very important to arrange domestic circumstances so that not only the procurement of sites but also the construction of station buildings, steel towers, and access roads should be completed by June 1981.

10. Operation and Maintenance

The present maintenance and operation scheme of Regions I and II is not sufficient for smooth operation and maintenance of the telecommunication facilities to be introduced by this project. For this purpose, it is necessary to reinforce the organization and personnel of Regions I and II. It is necessary to set district offices in Laoag, Vigan, Dagupan, Binalonan, and Baguio under the regional office of Region I and in Aparri, Tuguegarao, Ilagan, Santiago, and Bayombong under the region office of Region II so as to strengthen the organization.

It is also necessary to provide one or two engineers to reside at each district office, toll exchange office, telephone office, and attended radio repeater station. To provide and assign about 100 engineers and about 650 technicians and nontechnical personnel in Phase 1, about 700 technicians and nontechnical

personnel in Phase 2 will be required.

Since this project is so large in scale, training of personnel will be essential. It is desirable to arrange and develop BUTEL's Telecommunication Training Institute and strengthen training instructors by the technical cooperation.

11. Construction Expenses

The construction expenses for this project are estimated on condition that installation will be implemented on the turn-key basis and a consultant will be assigned for the preparation of tender specification, etc. In principle, installation of communication equipment will be implemented by foreign currency and local cables, a part of toll cables, and civil work will be implemented by the domestic currency.

The required expenses are as given in the table below.

	Foreign Currency (million yen)	Domestic Currency (million peso)
Phase 1	5,915	119.9
Phase 2	4,395	102.5
Total	10,310	222.4

12. BUTEL's Financial Condition

The accounting method of BUTEL is not like that of an ordinary enterprise but employs cash accounting as employed by other organizations of the government.

When expenditure can not be covered by incoming, supplementation is made from the general revenue source of the country. The balance sheet of BUTEL shows that its income from its undertaking covers only a part of its expenditure. One of the reasons for this condition is that BUTEL's rate standard is made considerably low from policy. Another reason for the BUTEL's financial condition is that BUTEL provides, as its nature, service to areas of low earning rates.

The income of BUTEL in 1977 was 14,630,000 pesos whereas its outgo was 72,930,000 pesos.

13. Charging System

13-1 Present Charging System

The rate of ordinary telegram is 2.5 pesos per 10 words and 25 centavos for every additional one word.

Urgent telegram is rated twice the ordinary telegram rate.

Telephone charges are:

Rent	For residential telephone	30 pesos/month
	For business telephone	40 pesos/month
Installation fee		15 pesos
Deposit	100 pesos plus rent x 2 (months)	

Local calls are included in the rent, and telephone charge will not vary with the number of local calls.

13-2 Charging System of This Project

The following telephone charging system is proposed.

- (1) Charges for local calls and toll calls are summed up and recorded by a subscriber meter installed.
- (2) Local call One message rate per call
- (3) Toll call Charging by periodic pulse metering method
 - a) Intra-provincial call ... Unit time: 30 sec
 - b) Inter-provincial call
 - Less than 80km Unit time: 20 sec
 - 80 - 150km 12
 - 150 - 250km 8
 - 250 - 450km 6
 - 450 - 750km 4.5
- (4) Charge per call 0.30 pesos

14. Economic Analysis

The revenue and expenditure of this project shows that the revenue is expected to exceed the expenditure in 7 years after the commencement of the service even if depreciation is conducted, which is extremely good when compared with other undertakings of BUTEL.

The internal rate of return is expected to be about 6.3%.

In addition, a considerable effect of benefit to users not included in the profit rate can be expected.

In addition to these quantitative effects, this project provides

- (1) establishment for protection against calamities,
- (2) development in sightseeing business,
- (3) development of second and third industries,
- (4) technology transfer,
- (5) cultural and social integrity,
- (6) maintenance of public order.

15. Others

15-1 Present Telecommunication Policy of the Philippines

At present telephone and telegraph services in the Philippines are operated by about 70 telephone companies and 8 telegraph companies, respectively. Since telecommunication plays an important role for the economic, social development of the Philippines and is inevitable at present, it still has a room for improvement.

Meanwhile, a telecommunication development committee has been formed with the Minister of Public Works, Transportation and Communications, Ministers of Finance and Industry, and the chairman of the boards of Communications by the issuance of The Letter of Instruction in February 1978, and the committee is discussing about rational telecommunication network construction and telecommunication control policy. Although the franchise transmission lines is not clear, it is believed that there is no private operator's plan of transmission lines in the sections covered by this project.

In case any parallel transmission line in Region I and II is constructed, the income to BUTEL will cause a considerable discrepancy, influencing the feasibility of this project.

15-2 Procurement of Frequencies

The necessary frequency bands for the radio transmission routes to be established by this project are as follows.

6430MHz - 7110MHz

138MHz - 171.9MHz

335.4MHz - 363.3MHz

770MHz - 859MHz

2100MHz - 2300MHz

Approval from related authorities for the use of these frequency bands by BUTEL is inevitable. It is also recommended to prepare a national frequ-

ency allocation plan so that effective use of frequencies should be achieved.

16. Recommendation and Conclusion

This project is determined feasible on the premise that the following recommendations will be met.

16-1 STD Connection to Manila, Baguio, Etc.

The availability of STD connection from the local exchanges to be constructed in this project to Manila or major cities in Regions I and II is one of the most important factors that will give much benefit in this project, so that BUTEL should make negotiation at an early time with related private operators for the achievement of the purpose.

16-2 Procurement of Radio Frequencies

Approval from related authorities of the government should be achieved for the procurement of the proposed frequencies for the radio systems.

16-3 Implementation by Domestic Currency

Completion of the construction of office/station buildings, access roads, and steel towers, and sites, etc., to be implemented by the domestic currency is a premise for the installation of this project, so that the Government of the Philippines should compile the necessary budget for the implementation of these works within the scheduled periods. Also, site locations will be required for detailed design and should be determined as soon as possible.

Then BUTEL should make negotiations with the owners of the sites at an early time.

16-4 Training for Maintenance and Operation

Maintenance and operation of the facilities to be constructed in this project will require training of a lot of personnel. However, BUTEL has not proper training facilities and sufficient trainers for the time being. It is necessary for BUTEL to rapidly improve BUTEL's Telecommunications Training Institute and provided necessary trainers as soon as possible.

16-5 Provision of Coordinators at Project Headquarters

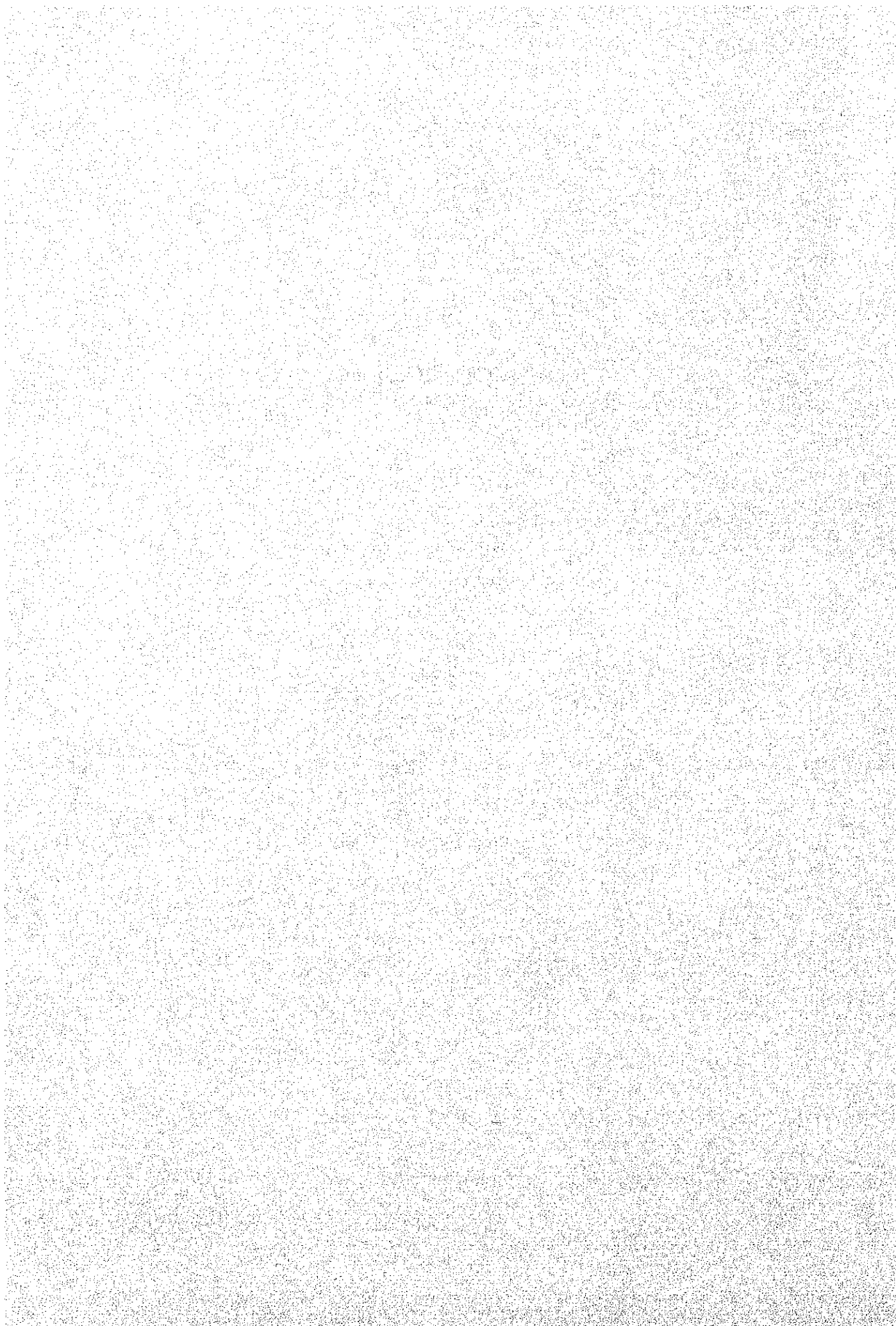
This project will range, on the map, to wide areas but also, techni-

cally, to many fields. It will be related to many non-BUTEL offices/stations, private operators and overseas network. This high-level project will make the first general wide-range telecommunication network project to be undertaken by BUTEL. Although BUTEL is expected to form a headquarters for this project, its operation will range very wide and be complicated, so that it will be necessary to form a coordinator group within the headquarters to achieve smooth progress of the construction.

16-6 Technical Cooperation by Japan

When requested for technical cooperation regarding paragraphs 16-4 and 16-5 above, the government of Japan will be required to provide necessary measures.

I. INTRODUCTION



I. INTRODUCTION

1. Purpose of Survey

The survey was intended to determine the feasibility of the Telecommunication Network Construction Project in Northern part of Luzon in the Republic of the Philippines, which had been planned by the Bureau of Telecommunications (hereinafter referred to as BUTEL) in the Ministry of Public Work, Transportations and Communications (hereinafter referred to as the MPWTC), at the request of the Government of The Philippines.

2. Survey Methods

Listening to those concerned of the Government of Philippines regarding the project and related items, field survey, analysis by references, and discussion of the feasibility of the project from both technical and economic standpoints.

3. Scope of Survey

The following items were examined in the survey.

3-1 General Items

- (1) Present trend of telecommunication facilities and services provided.
- (2) Outline of telecommunication development plan
- (3) Running condition of telecommunication industry
- (4) Administrative running condition of BUTEL
- (5) Organization of BUTEL

3-2 Items on the Project

- (1) Standards to be the foundation of the project
- (2) Demand forecast (Telephone and telegraph)
- (3) Installation plan of telephone sets
- (4) Traffic forecast (Telephone and Telegraph)
- (5) Trunk estimation
- (6) System design
- (7) Project implementation plan
- (8) Operation and maintenance
- (9) Charging system

(10) Economic evaluation of the project

4. Establishment of Survey team and Roles of Survey Team Members.

The survey team was deputed on three times.

The first was for a preliminary survey and, second and third are a feasibility survey and supplementary survey respectively.

The roles and affiliations of members with the respective teams are.

<u>Member</u>	<u>Kind of team</u>	<u>Charge</u>	<u>Affiliation</u>
Shigeru Fukuda	A. B. C.	Leader	International Cooperation Division, Minister's Secretariat, Ministry of Posts and telecomm. (MPT)
Yasukazu Sugiyama	A. B. C.	Sub-Leader Carrier	International Affairs Bureau, Nippon telegraph & Telephone Public Corporation. (NTT)
Morikazu Takahashi	B	Economic evaluation	Communications Policy Devesion, Minister's Secretariat, MPT
Motoaki Uotome	B.C.	Radio	Radio Regulatory Bureau, MPT
Iwayuki Shimizu	A	Radio	Microwave Division, NTT
Masahiro Yoshihara	A	Switching	International Affairs Bureau, NTT
Mitsuharu Ando	B.C	Switching	International Affairs Bureau, NTT
Masami Maeda	B	Architec- ture	Building Engineering Bureau, NTT
Yasuo Suzuki	B.C	Radio	Microwave Division, NTT
Shozaburo Shimamura	B	Radio	International Affairs Bureau, NTT
Makoto Hongo	B.C	Outside plant	International Affairs Bureau, NTT
Masaru Yamazaki	B	Telegraph, Power plant	International Affairs Bureau, NTT
Ikuo Komagata	B	Radio	Nippon Telecom. Consulting Co.
Tatsumi Oku	B	Switching	Nippon Telecom. Consulting Co.

Feb. 27 Salutation to Japanese Embassy, visit to BUTEL and meeting with those of OECF's office in Manila

Feb. 28 Meeting with BUTEL

Mar. 1 do.

Mar. 2 Survey by references

Mar. 3 Meeting with BUTEL

Mar. 4 Survey by references

Mar. 5 Holiday

Mar. 6 Survey by references. Meeting at the Japanese Embassy.

Mar. 7 Meeting with BUTEL

Mar. 8 do.

Mar. 9 do.

Mar. 10 do.

Mar. 11 Preparation for field survey

Mar. 12 Meeting among survey team members

Mar. 13 Radio group: Starts for field survey.
(Leaves Manila to Baguio)
Members arrived later: Leave Tokyo to Manila

Mar. 14 General survey group: Meeting with BUTEL
Radio group: Field survey in Baguio and neighboring sites

Mar. 15 General survey group: Meeting with BUTEL
Radio group: Field survey in Pangasinan Province

Mar. 16 General survey group: Starts for field survey.
Field survey in Pangasinan Province
Radio group: Field survey in Pangasinan Province

Mar. 17 General survey group: Field survey in Pangasinan Province
Radio group: Field survey in Pangasinan Province

Mar. 18 Survey team leader leaves the Philippines for Japan.
Meeting among survey team members
General survey group: Field survey in Pangasinan Province
Radio group: Data analysis

Mar. 19 Holiday
General survey group: To manila

Mar. 20 General survey group: Meeting with BUTEL
Radio group: Field survey in Benguet Province

Mar. 21 Survey team member Katagiri returns to Japan.
General survey group: Meeting with BUTEL

Mar. 22 Radio group: Field survey in Bengued Province
 General survey group: Meeting with BUTEL
 Mar. 23 Radio group: Field survey in Bengued Province
 General survey group: Data analysis
 Radio group: From Bengned Province to Manila
 Mar. 24 Meeting among survey team members
 Mar. 25 Holiday
 Mar. 26 Preparation for field survey
 Mar. 27 Starts for field survey
 General survey group: Visit to the Regional Director's office
 in Region I
 Radio group: Field survey in Pangasinan Province
 Mar. 28 General survey group: Field survey in Bengued Province
 Radio group: Field survey in La Union Province
 Mar. 29 General survey group: Field survey in La Union and Ilocos Sur
 Provinces
 Radio Group: Field survey in Ilocos Sur Province
 Mar. 30 General survey group: Field survey in Ilocos Sur and Abra Pro-
 vinces
 Radio group: Field survey in Ilocos Sur and Abra Pro-
 vinces
 Mar. 31 General survey group: Field survey in Ilocos Norte Province
 Radio group: Field survey in Ilocos Norte Province
 Apr. 1 General survey group: Data analysis
 Radio group: Field survey in Ilocos Norte Province
 Apr. 2 Sunday
 Apr. 3 General survey group: Field survey in Ilocos Norte and Cagayan
 Provinces
 Radio group: Field survey in Ilocos Norte and Cagayan
 Provinces
 Apr. 4 General survey group: Field survey in Cagayan Province
 Radio group: Field survey in Cagayan Province
 Apr. 5 General survey group: Field survey in Cagayan Province
 Radio group: Field survey in Cagayan Province
 Apr. 6 General survey group: Data analysis
 Radio group: Field survey in Cagayan and Kalinga-Apayao
 Provinces
 Apr. 7 Data analysis and meeting among survey team members

Apr. 8 Data analysis

Apr. 9 Holiday

Apr. 10 General survey group: Field survey in Cagayan Province
Radio group: Field survey in Isabela Province

Apr. 11 General survey group: Field survey in Isabela Province
Radio group: Field survey in Kalinga-Apayao and Isabela Provinces

Apr. 12 Survey team member Takahashi (in charge of economic evaluation) arrives in the Philippines
General survey group: Field survey in Isabela and Qurino Provinces
Radio group: Field survey in Isabela Province

Apr. 13 General survey group: Field survey in Nueva-Vizcaya Province
Radio group: Field survey in Nueva-Vizcaya Province
Economic evaluation group: Meeting with BUTEL

Apr. 14 General survey group: Field survey in Nueva-Vizcaya and Ifugao Provinces
Radio group: Field survey in Nueva-Vizcaya and Ifugao Provinces
Economic evaluation group: Meeting with BUTEL

Apr. 15 General survey group: Field survey in Nueva-Vizcaya and Ifugao Provinces
Radio group: Data analysis
Economic evaluation group: Data analysis

Apr. 16 Holiday

Apr. 17 Survey team member Katagiri arrives in the Philippines
General survey group: Field survey in Nueva-Vizcaya Province
Radio group: Field survey in Ifugao Province
Economic evaluation group: Meeting with BUTEL

Apr. 18 General survey group: Survey at Sta. Rosa Telephone office
Radio group: Field survey in Mountain Province
Economic evaluation group: Meeting with BUTEL

Apr. 19 General survey group: Data analysis
Radio group: Field survey in Mountain Province
Economic evaluation group: Meeting with BUTEL

Apr. 20 Meeting with BUTEL

Apr. 21 Meeting with BUTEL

Apr. 22 Data analysis

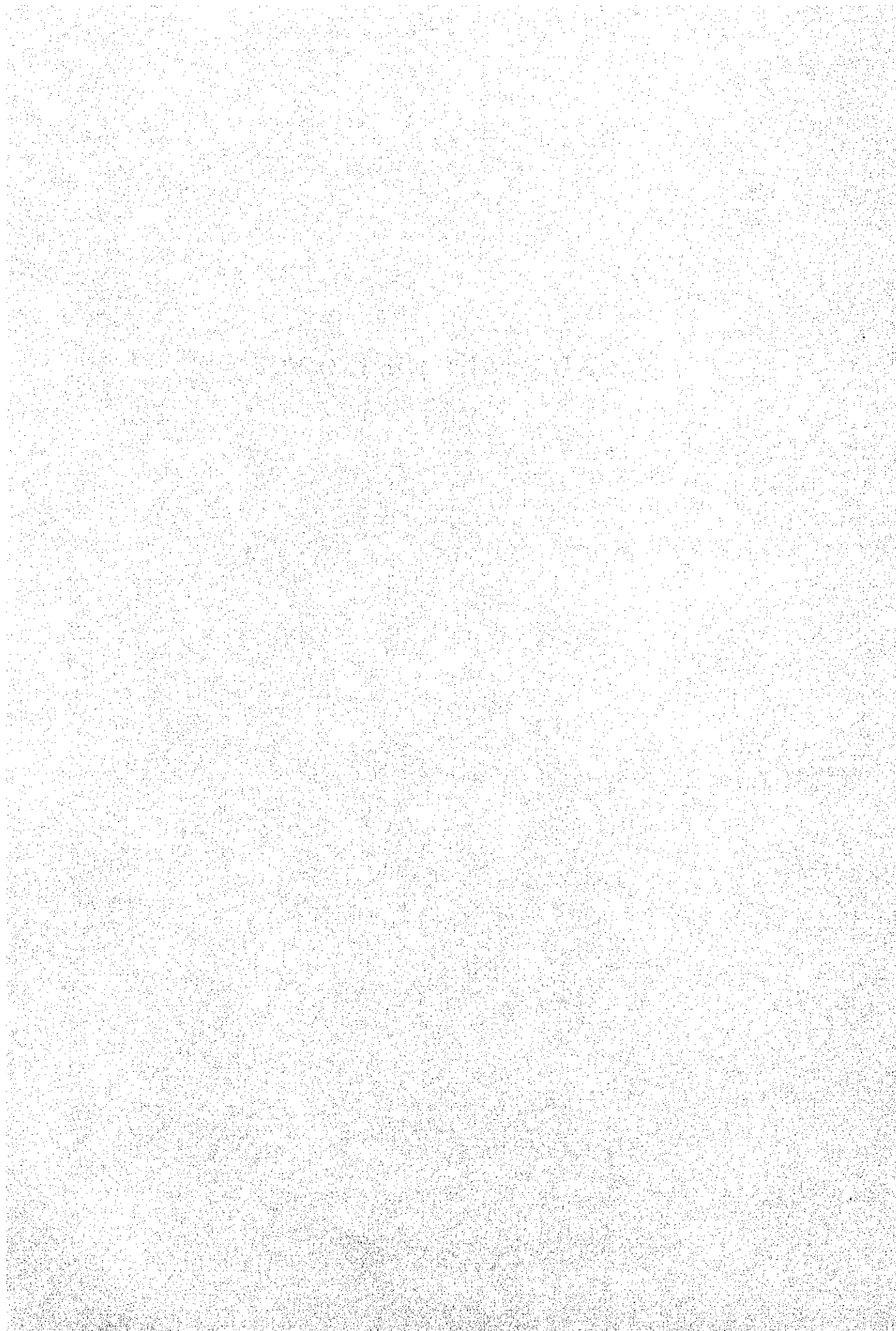
Apr. 23 Holiday
 Apr. 24 Survey at Manila Central Station of BUTEL
 Apr. 25 Survey at Telecommunication Training Institute of BUTEL
 Apr. 26 Meeting with BUTEL
 Apr. 27 Meeting with BUTEL
 Apr. 28 Meeting with BUTEL
 Apr. 29 Meeting among survey team members
 Apr. 30 Survey team leader arrives in the Philippines
 Meeting among survey team members
 May 1 Meeting among survey team members
 Data analysis
 May 2 Meeting with BUTEL
 May 3 Meeting with DOMSAT Co. in Manila
 May 4 Meeting with BUTEL
 May 5 Meeting with BUTEL
 May 6 Preparation of Interim Report
 May 7 Holiday
 May 8 Meeting with PLDT
 May 9 Meeting with BUTEL
 May 10 Preparation of interim report draft
 May 11 Submission of interim report draft to BUTEL and discussion
 May 12 Final meeting with BUTEL
 May 13 Submission of interim report to BUTEL. Leave Manila for Tokyo
 (PR424)

5-3 Explanation and supplementary survey team

Aug. 27, 1978 Leave Tokyo for Manila by PR 421
 Aug. 28 Visit to BUTEL and OECF Manila office
 Aug. 29 Meeting with BUTEL and Field survey in Basco.
 Aug. 30 Explanation of the draft report to BUTEL. and Field survey
 in Basco
 Aug. 31 Meeting with BUTEL, Board of Communications, Telecomm.
 Control Bureau and National Economic Development Authority.
 Field survey in Basco.
 Sep. 1 Visit to Japanese Embassy. Meeting with BUTEL.
 Sep. 2 Data analysis
 Sep. 3 Holiday
 Sep. 4 Field survey in Dau and Tarlac microwave station,

- PLDT-Tarlac telephone office and BUTEL-Tarlac telephone office.
- Sep. 5 Supplementary survey in Bagnio area.
- Sep. 6 Supplementary survey in Tuguegarao and Aparri areas.
- Sep. 7 Supplementary Survey in Diffun, Cabarroguis and Lubuagan areas.
- Sep. 8 Supplementary Survey in Maddela and Cabarroguis area.
- Sep. 9 Supplementary Survey at Santiago telephone office and Solano
 telephone office.
- Sep. 10 Holiday
- Sep. 11 Data filing
- Sep. 12 Meeting with BUTEL.
- Sep. 13 Meeting with BUTEL
- Sep. 14 Meeting with BUTEL
- Sep. 15 Meeting with BUTEL and finalization of the draftpaper
- Sep. 16 Visit to Japanese embassy
- Sep. 17 Leave Manila for Tokyo by NW 004

II. OUTLINES OF THE PROJECT



II. OUTLINES OF THE PROJECT

1. Background of the Project

The development in telecommunications is inevitable for the development of any country. This can be said for the Philippines as well.

At present, the Philippines provide about 531,000 telephone sets and the telephone density in the country is 1.2 sets per 100 inhabitants. This is insufficient for maintaining and progressing economical and social development in the nation.

Let us consider the distribution of telephone sets in the Philippines. 76% of all telephone sets in the Philippines (504,000 sets) are in Metro. Manila. 60% of the rest or 15% of all telephone sets in the country (about 80,000 sets) are in such major cities as Cebu and Davao, etc. Thus, 9% of all telephone sets in the country are spread in other areas. Only 10% of all cities and municipalities of the Philippines have telephone lines for local calling. Regions I and II expected to be covered by the network to be established by the project have a population of about 5,500,000 and 11,200 telephone sets, so that the telephone density in these regions is only 0.20 per 100 inhabitants. Regions I and II include 288 cities or municipalities, of which only 28 cities or municipalities have telephone lines for local calling.

The Government of Philippines has sufficiently recognized the importance of development in telecommunications.

Its five-year development plan ranging from 1978 to 1982 includes the investment of 1,264,000,000 pesos in the first five years and 3,390,000,000 pesos in the next five year so as to make the telephone density 2.18 per 100 inhabitants ten years ahead. It is expected to provide telephone service in about 500 cities or municipalities, telegraphy service in all cities and municipalities, and telex service in 86 cities or municipalities.

The present project is intended to accomplish necessary items in Regions I and II under the above-mentioned background. The present project is a total telecommunication project planned for the first time for Region I and II.

2. Division of the Project into Two Phases

The items initially proposed by the BUTEL are as given in the Report of the Rural Telecommunications Project, Regions I and II. The total construction expense estimated for the project is about 10,000 million yen, which is well over about 5,800 million yen proposed by the Government of the Philippines on seventh yen credit.

It is recommended to divide the project into two phases, Phase 1 and Phase 2, and start Phase 1 at an early time.

The significance is to first accomplish Phase 1 which includes a minimum complete package for a telecommunication system in the regions.

In Phase 1, importance will be put on the installation of the fundamental equipments. In Phase 2, more local exchanges and IPTS than those to be installed in Phase 1 will be installed.

It is desirable to implement Phase 2 as much earlier as possible from the standpoint of investment efficiency as well.

3. Major Items of the Project

The major items of the project to be implemented in the respective phases are as follows.

3-1 Phase 1

3-3-1 Local Exchanges (Automatic Switching)

(1) Ilocos Norte Province

Batac:	800 lines
Dingras:	300 lines
Paoay:	200 lines
Sarrat:	200 lines

(2) Ilocos Sur Province

Cabugao:	200 lines
Narvacan:	200 lines
Tagudin:	200 lines

(3) Abra Province

Bangued:	600 lines
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(4) Mountain Province

Bontoc:	200 lines
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(5) Pangasinan Province

Alaminos:	500 lines
San Fabian:	200 lines
Binalonan:	700 lines

(6) Cagayan Province

Enrile:	200 lines
Solana:	200 lines

- (7) Isabela Province
 - Tunauini: 200 lines
 - San Mateo: 300 lines
 - Alicia: 200 lines
- (8) Quirino Province
 - Cabarroguis: 200 lines
- (9) Nueve Vizcaya Province
 - Bambang: 200 lines

3-1-2 Inter-Provincial Telephone Station

- (1) Ilocos Norte Province
 - Pasquin, Piddig, Espieitu and Currimao
- (2) Ilocos Sur Province
 - Sto. Domingos, Santa and Sta. Maria
- (3) Pangasinan Province
 - Mapandan, San Jacinto and San Quintin
- (4) Batanes Province
 - Basco
- (5) Cagayan Province
 - Ballesteros, Tuao, Sanchez Mira, Gonzaga, Lal-lo and Claveria
- (6) Isabela Province
 - San Manuel
- (7) Ifugao Province
 - Banaue

3-1-3 Toll Telephone Exchange

- (1) Secondary Switching Center
 - Baguio
- (2) Primary Switching Center
 - Laoag, Vigan, Dagupan, Tuguegarao, Ilagan and Bayombong

3-1-4 Main Routes

A 6GHz microwave system is proposed for use as the main route.

- (1) Laoag - Baguio: 7 hops, 230km
- (2) Tuguegarao - Baguio: 10 hops, 350km
- (3) Binalonan - Manila: 5 hops, 180km

3-1-5 Spur Routes (VHF and UHF)

- (1) In Laoag PC area
 - Laoag PC - Pasquin: 13.7km
 - Laoag PC - Dingras: 15.9km

	Dingras - Piddig:	7.0km
	Dingras - Espiritn RS:	14.5km
	Laoag PC - Batac:	17.4km
	Sinnait RS - Currímao RS:	14.6km
(2)	In Vigan PC area	
	Vigan PC - Sulvec RS:	17.8km
	Sulvec RS - Bangued:	9.3km
	Vigan PC - Santa:	10.4km
	Bigbiga RS - Candon RS:	13.2km
	Bigbiga RS - Narvacan:	12.0km
(3)	In Baguio SC area	
	Baguio SC - Sto. Tomas RS:	10.6km
	Sto. Tomas RS - Mt. Mungueto RS:	42.8km
	Mt. Mungueto RS - Mt. Data RS:	23.5km
	Sagada RS - Mt. Data RS:	26.1km
	Bontoc RS - Sagada RS	7.4km
(4)	In Dagupan PC area	
	Dagupan PC - Bugallon:	15.7km
	Bugallon - Sual RS:	18.8km
	Sual RS - Alaminos:	15.7km
	Dagupana PC - Binalonan:	27.1km
	Binalonan - San Quintín:	25.1km
(5)	In Tuguegarao PC area	
	Tuguegarao PC - Nassiping RS	41.7km
	Nassiping RS - Aparri RS	39.9km
	Aparri RS - Lal-lo:	15.9km
	Aparri RS - Ballesteros:	15.9km
	Ballesteros - Sanchez Mira:	33.8km
	Aparri RS - Buguey:	20.1km
	Buguey - Gonzaga RS	17.7km
	Tuguegarao PC - Babalog:	22.4km
	Babalog - Tuao:	30.1km
	Aparri RS - Basco	283.0km
(6)	In Ilagan PC area	
	Ilagan PC - Tumauini:	17.8km
	San Mateo - San Manuel:	16.9km
	San Mateo - Alicia:	15.6km
	San Mateo - Santiago:	21.3km

	Santiago - Cabarroguis:	19.3km
(7)	In Bayombong PC area	
	Diadi RS - Banaue RS	42.9km
3-1-6	PCM System	
	Bayombong - Bambang	17.3km
3-1-7	Multiplexing Equipment	
	About 1,600 channels	
3-1-8	Trunk Cable	
(1)	In Laoag PC area	
	Currimao - Currimao RS:	0.5km
	Laoag PC - Laoag MC:	3.0km
	Laoag PC - Sarrat:	11.0km
	Batac - Paoay	5.3km
	Espiritu RS - Espieitn	0.6km
(2)	In Vigan PC area	
	Sinait RS - Sinait:	3.9km
	Sinait - Cabugao:	10.1km
	Vigan PC - Vigan LS:	0.8km
	Vigan PC - Sto. Domingo:	9.5km
	Narvacan - Sta. Maria	6.1km
	Tagudin RS - Tagudin:	3.3km
(3)	In Baguio SC area	
	Baguio SC - Bagnio MS	2.5km
	Bontoc RS - Bontoc:	1.5km
	Bagnio SC - La Trinidad MC:	6.0km
	San Fernand MC - Bauang MC	10.0km
	Bauany MC - Agoo MC	23.0km
(4)	In Dagupan PC area	
	Dagupan PC - Mangaldan:	8.5km
	Mangaldan - San Fabian:	7.2km
	Mangaldan - San Jacinto:	3.5km
	Mangaldan - Guesangen:	5.7km
	Guesangen - Mapandan:	5.0km
(5)	Tuguegarao PC area	
	Sanchez Mira - Claveria:	24.3km
	Aparri RS - Aparri MC	2.5km
	Gonzaga RS - Gonzaga	0.5km
	Tuguegarao PC - Tuguegarao MC:	2.0km
	Tuguegarao PC - The Bridge:	3.6km

	The Bridge - Solana:	5.6km
	The Bridge - Enrile:	8.4km
(6)	In Ilagan PC area	
	Ilegan PC - Ilagan MC	3.0km
(7)	In Bayombong PC area	
	Banaue RS - Banaue:	1.0km
	Bayombong RS - Bayombong PC:	2.5km
	Bayombong PC - Bambang:	17.3km
3-1-9	Local cable	
	Cable length about 300km	
3-1-10	Telegraph	
(1)	Telex exchange	
	Baguio:	480 lines
	Tuguegarao:	200 lines
(2)	Telex concentrator	
	San Fernando:	60 lines
(3)	Gentex station	
	Laoag:	3 terminals
	Vigan:	2 terminals
	Dagupan:	3 terminals
	Bauang:	1 terminal
	Agoo:	1 terminal
	La Trinidad:	1 terminal
	Bangued:	1 terminal
	Ilagan:	3 terminals
	Santiago:	3 terminals
	Bayombong:	3 terminals
	Aparri:	3 terminals
	Tuguegarao capitol:	1 terminal
	Cabarroguis:	1 terminal
3-1-11	Equipment for Connection to Private Telephone Operators	
	Trunk equipment and traffic counters	
	Manila, Baguio, Dagupan, Laoag, Tuguegarao and Ilagan	
3-2	Phase 2	
3-2-1	Local Exchange	
(1)	Ilocos Norte Province	
	Pagudpud:	200 lines
	Badoc:	300 lines
	Vintar:	200 lines

	Pinili:	200 lines
	Solsona:	200 lines
(2)	Ilocos Sur Province	
	Magsingal:	200 lines
	Sinait:	200 lines
(3)	Benguet Province	
	Mankayan:	300 lines
(4)	Pangasinan Province	
	Bolinao:	200 lines
	Sison:	200 lines
	Bani:	200 lines
	Urbiztondo:	200 lines
	Asingan:	200 lines
	Alcala:	200 lines
	San Nicolas:	200 lines
	Sta. Maria:	200 lines
(5)	Cagayan Province	
	Baggao	200 lines
	Alcala:	200 lines
(6)	Isabela Province	
	San Mariano:	200 lines
	Angadanan:	200 lines
	Gamu:	200 lines
	Naguilian:	200 lines
(7)	Quirino Province	
	Diffun:	200 lines
(8)	Nueva Vizcaya Province	
	Dupax del Sur:	200 lines
	Aritao:	200 lines
	Bagabag:	200 lines

3-2-2 Inter-Provincial Telephone Station

- (1) Ilocos Norte Province
 - Bangui, Marcos, Burgos and Nueve Era
- (2) Ilocos Sur Province
 - Caoayan and Sta. Lucia
- (3) Mountain Province
 - Sagada

- (4) La Union Province
Sto. Tomas
- (5) Bengued Province
Bokod
- (6) Pangasinan Province
Aguilar, Balungao, Bautista and Natividad
- (7) Cagagan Province
Abulug, Buguey, Camalaniugan
Piat, Lazam and Sto. Ninõ
- (8) Kalinga - Apayao Province
Kabugao and Lubuagan
- (9) Isabela Province
Jones, Mallig, San Augustin, Cabagan and Aurora
- (10) Ifugao Province
Mayoyao and Kiangan
- (11) Quirino Province
Maddela
- (12) Nueva Vizcaya Province
Sta. Fe and Dupax del Norte

3-2-3 Toll Telephone Exchange

Primary switching center

Binalonan

3-2-4 Spur Routes (Radio)

(1) In Laoag PC area

Sinait RS - Pinili:	9.3km
Laoag PC - Bobodo RS	23.9km
Bobodo RS - Burgos:	9.9km
Bobodo RS - Bangui:	18.9km

(2) In Baguio PC area

Mankayan RS - Mt. Data RS	8.2km
Mt. Mungueto RS - Bokod RS	18.9km

(3) In Dagupan PC area

Alaminos - Bolinao RS	25.9km
Alaminos - Bani:	13.4km
Dagupan PC - Sto. Tomas:	26.6km
Dagnpan PC - Urbiztondo:	18.3km

(4) In Binalonan PC area

San Quintin - Umingan	6.8km
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Binalonan PC - San Nicolas:	18.6km
Binalonan PC - Sison:	15.6km
Binalonan PC - Alcala:	24.1km
Alcara - Balungao:	17.1km

(5) In Tuguegarao PC area

Nassiping RS - Sto. Niño:	12.6km
Nassiping RS - Lazam:	9.6km
Tuguegarao PC - Alcala:	32.5km
Alcala - Baggao:	11.9km
Tuao - Piat:	6.2km
Babalog RS - Ag-Lalamnan RS	56.2km
Ag-Lalamnan RS - Kabugao RS	15.7km
Babalog RS - Pasonglao RS	17.0km
Pasonglao RS - Tomiangan RS	18.2km
Tomiangan RS - Lubuagan RS	10.2km

(6) In Ilagan PC area

Ilagan PC - Sn Mariano	22.0km
Tumauini - Cabagan:	17.0km
San Manuel - Mallig:	32.3km
Santiago - Jones:	21.8km
Jones - Meddela RS	24.0km

(7) In Bayombong PC area

Banaue RS - Ibulao RS:	15.9km
Ibulao RS - Kiangan	3.8km
Alicia - Mayoyao:	55.8km
Daltonpass RS - Sta. Fe RS:	3.3km

3-2-5 PCM System

Bayombong PC - Bagabag	21.0km
Bayombong PC - Aritao	35.0km
Bayombong PC - Dupax del Sur	33.0km

3-2-6 Multiplexing Equipment

about 1500 Channels

3-2-7 Trunk Cable

(1) In Laoag PC area

Bangui - Pugudpud:	5.5km
Laoag PC - Vintar:	8.5km
Vintar - Baccara:	7.5km
Dingras - Solsona	9.1km
Dingras - Marcos:	7.6km

	Espiritu RS - Nueva Era:	8.1km
	Sinait. RS - Badoc:	6.1km
(2)	In Vigan PC area	
	Sto. Domingo - Magsingal:	5.8km
	Vigan PC - Caoayan:	3.9km
	Candon RS - Sta. Lucia:	10.2km
(3)	In Baguio PC area	
	Sagada - Sagada RS	0.8km
	Mankayan - Mankayan RS:	1.5km
	Bokod - Bokod RS:	2.0km
(4)	In Dagupan PC area	
	Bugallon - Aguilar:	8.3km
	Guesangen - Sta. Barbara:	4.4km
(5)	In Binalonan PC area	
	Alcala - Bautista:	7.9km
	Binalonan PC - Pozzorubio:	10.7km
	Binalonan PC - Asingan:	10.5km
	San Nicolas - Natividad:	5.5km
(6)	In Tuguegarao PC area:	
	Ballesteros - Abulug:	7.8km
	Lal-lo - Camalaniugan:	10.5km
	Kabugao RS - Kabugao	0.5km
	Lubuagan RS - Lubnagan	1.0km
(7)	In Ilagan PC area	
	Ilagan PC - Gamu:	14.4km
	Gamu - Naguilian:	4.0km
	San Mariano - San Mariano RS:	0.8km
	San Manuel - Aurora:	4.3km
	Maddela RS - Maddela	1.5km
	Alicia - Angadanan:	6.9km
	Cabarroguis - Diffun	9.2km
	Jones - San Augustin:	9.0km
	Santiago - Echague	15.0km
(8)	In Bayombong PC area	
	Bayombong - Solano:	5.3km
	Solano - Bagabag:	15.4km
	Bambang - Ineangan:	9.6km

Ineangan - Aritao:	7.8km
Ineangan - Dupax del Norte:	2.4km
Dupax del Norte - Dupax del Sur:	3.3km
Santa Fe RS - Santa Fe:	1.0km

3-2-8 Local cable

Cable length about 340km

3-2-9 Telegraph

(1) Telex concentrator

Laoag:	60 lines
Vigan:	60 lines
Dagupan:	100 lines
Iligan:	40 lines
Santiago:	40 lines
Bayombong:	40 lines

(2) Gentex station

Dingras:	1 terminal
Batac:	1 terminal
Candon:	1 terminal
Narvacan:	1 terminal
Urdaneta:	3 terminals
San Carlos	1 terminal
Lingayen:	1 terminal
Alaminos:	1 terminal
Bontoc:	1 terminal
Tuao:	1 terminal
Alcala:	1 terminal
Sanchez Mira:	1 terminal
Tabuk:	3 terminals
Iligan Capitol:	1 terminal
Naguilian:	1 terminal
Echague:	1 terminal
Banaue:	1 terminal
Bambang:	1 terminal

3-2-10 Equipment for Connection to Private Telephone Operators

Trunk equipent and traffic counters

Binalonan

4. Outline of Service

By the implementation of this project the following service development can be expected.

(1) Local telephone service

A total of 19 local exchanges will be constructed in Phase 1 and a total of 26 local exchanges in Phase 2. Then about 5000 lines can be installed in Phase 1 by the construction of these local exchanges and IPTS's and about 4,000 lines in Phase 2, so that a total of about 9,000 lines can be installed.

(2) Long-distance (toll calls) telephone service

In addition to STD service to be provided between BUTEL offices to be constructed in this project, the following services will be available.

- 1) STD service will be provided from offices to be constructed in this project to the following offices.
 - a) Existing BUTEL offices
 - b) Manila and Major private operators' offices in Regions I and II, such as Baguio, and Dagupan
- 2) Non-delay manual service will be provided from the existing BUTEL offices to the following offices.
 - a) Offices to be constructed in this project.
 - b) Manila and Major private operators' offices mentioned above
- 3) Delay service will be provided from Manila and the above-mentioned major private operators' offices to BUTEL offices to be constructed newly.
- 4) A total of 19 IPTS's will be constructed in Phase 1 and a total of 30 IPTS's in Phase 2.

These IPTS's can be connected not only to BUTEL's offices but also to major offices in Manila, Dagupan, Baguio, etc.

(3) Telegraph

The major cities in Region I and II will be covered by Telex service.

On the other hand, telegram service will be improved by increased telegram processing speed to be achieved by Telex exchange facilities.