THE FEASIBILITY STUDY REPORT

ON

NATIONAL TELECOMMUNICATIONS DEVELOPMENT PROJECT

IN

THE REPUBLIC OF PARAGUAY

DECEMBER, 1981

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

It is with great pleasure that I present this Study Report on National Telecommunications Development Project in Paraguay to the Government of the Republic of Paraguay.

This report embodies the result of a feasibility study which was carried out from July 12th to September 7th, 1981 by a Japanese study team commissioned by the Japan International Cooperation Agency following the request of the Government of the Republic of Paraguay.

The study team, headed by Mr. Masaru Tomioka, Deputy Director of Technical Investigation Division of Radio Regulatory Bureau of Ministry of Posts & Telecommunications, had a series of discussions with officials concerned of the Government of the Republic of Paraguay and conducted an extensive field survey and data analysis.

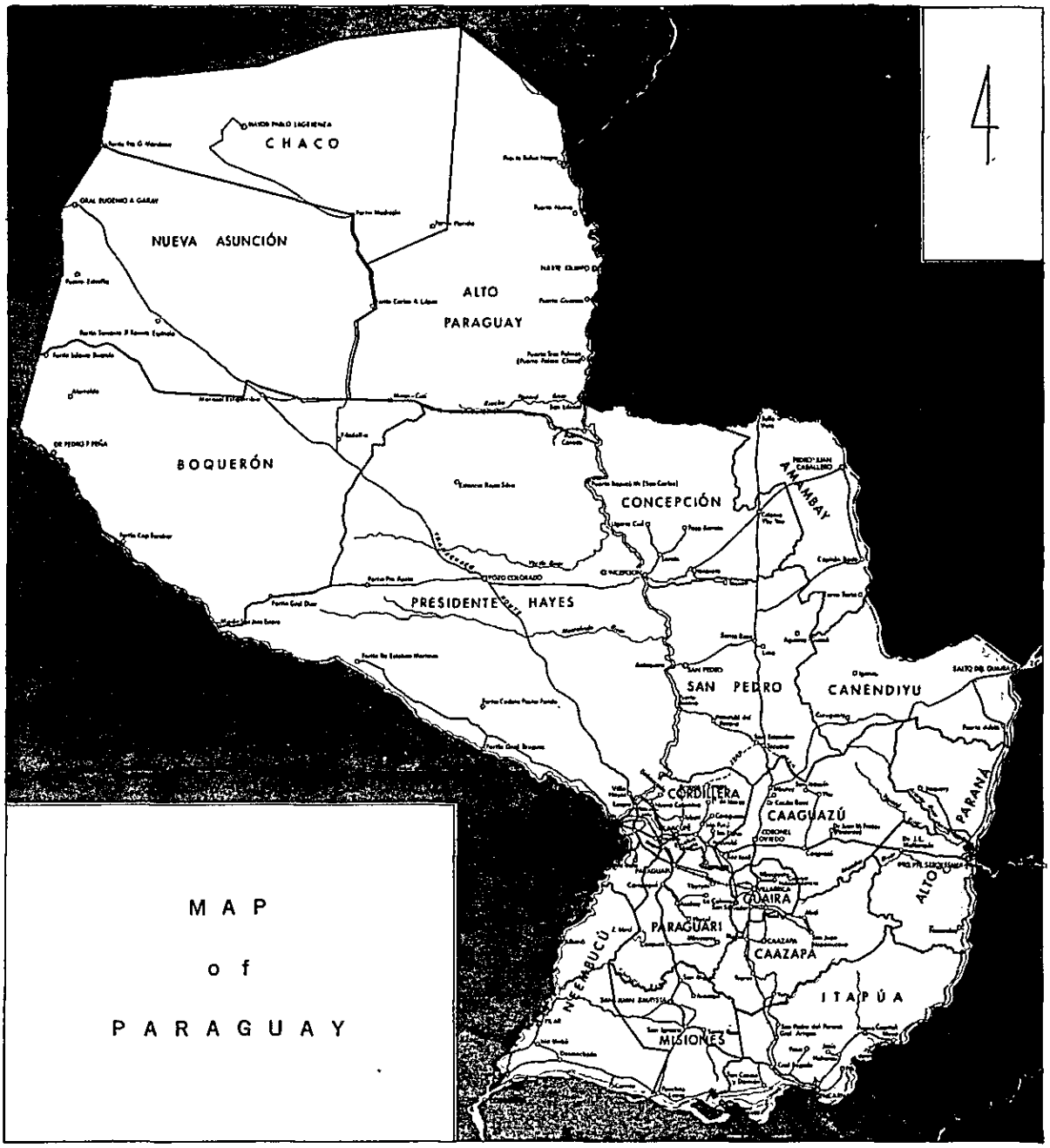
I sincerely hope that this report will be useful as a basic reference for the development of the project.

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

December, 1981

Keisuke Arita

Keisuke ARITA
President
Japan International Cooperation Agency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CONTENTS

Summary

The conclusion on three feasibility study items is summarized as follows;

1. International Subscriber Dialing System Introduction Project

1-1 Objectives and Outline of Survey

Designed to improve operations of international calls which have drastically increased since the start of services by satellite communication and domestic microwave trunk lines and because of the necessity to maintain a balance with other countries of communications that have already started automatic incoming, a survey has been undertaken to study a method and economic feasibility in introducing automatic subscriber dialing service to international calls originating in Paraguay.

The result of the survey concludes that the capital investment can fully be depreciated by rationalization of personnel by automation, by an increase in the traffics, and by other factors and that this project would receive great evaluation socially.

1-2 Traffic Forecast

The following traffic (Table 1) has been forecast to serve as a basis for equipment design.

Table 1

	1982	1986	1990	1995
Chargeable Minutes of Outgoing ISD (Thousand Minutes)	-	1,586	5,574	10,380
Chargeable Minutes of Operator Assisted Outgoing Calls (Thousand Minutes)	3,802	5,022	4,380	4,449
Total Chargeable Outgoing Minutes (Thousand Minutes)	3,802	6,608	9,954	14,829

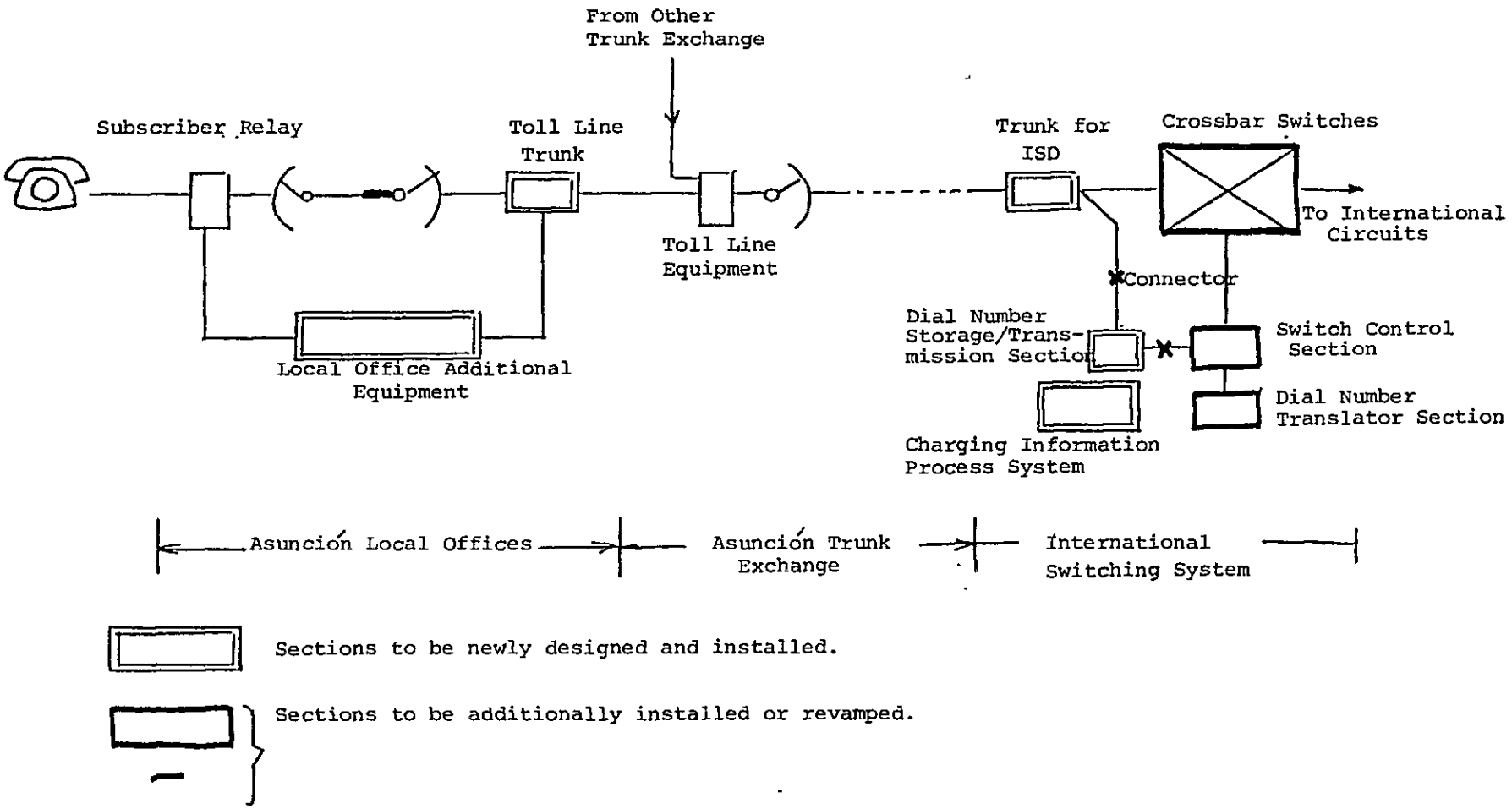
The traffic forecast has been made based on the E Series of the CCITT Recommendations.

1-3 System Outline

The ISD system is shown in the diagram below.

The sections in thick frames require an introduction of new units, or revamping. In addition to them, an additional installation of units commensurate with the increase in the traffic will be necessary. Part of the equipment shall be duplexed, or spare units shall be installed, to increase the reliability to meet a serious system failure.

Concept of ISD System



1-4 Equipment Design

Assuming that the international subscriber dialing service will be started at the end of 1984, or early 1985, this survey covers equipment that will be capable of handling the traffic for the subsequent five years. However, a consideration has been given to meet the traffic increase by merely installing additional units without making drastic revamping in the principal sections of the switching equipment until about 1995 as long as a full-scale equipment improvement program is to be undertaken.

1-5 Project Cost

A trial calculation of the required cost based on the facility plan is as follows:

Foreign currency: Million yen
Local currency: Million guaranis

Remarks	Foreign Exchange Expenditure	Local Expenditure
1. Local Exchanges		
Equipment	377.00	
Works Materials	7.94	
Works Cost	80.90	
Sub-Total	465.84	
2. International Exchange		
Charging Information Processing System (Computer)	411.00	
New Equipment Cost	36.00	
Additional Equipment Cost	127.30	
Revamping Cost	5.04	
Works Cost	26.50	
Sub-Total	605.84	
3. Training		
Training on Local Exchange	3.60	
Training on International Switching Equipment	3.80	
Training on Computer and Related Equipment	25.00	
Sub-Total	32.40	
4. Contingencies	51.79	
5. Consulting Fee	40.94	
6. Local Expenditure		
6-1 Local Operational Expenditure During Works Period		5.929
Training Room Rent		0.191
6-2 Local Operational Cost During Commissioned Maintenance Period		2.820
Sub-Total		8.940
Grand-Total	1,196.81	8.940

The plan can be financed by the following expenditure by partially modifying the local exchange additional equipment anticipating installation of digital exchanges and by selecting suitable computer and related equipment among those that are readily available without designing to a specific requirement, among the requirement items in the plan.

Foreign currency: Million yen

Local currency: Million guaranis

Remarks	Foreign Exchange Expenditure	Local Expenditure
1. Local Office Expenditure	424.12	
2. International Office Expenditure	494.84	
3. Training Cost	32.40	
4. Contingencies	44.80	
5. Consulting Cost	40.94	
6. Local Expenditure		8.940
Grand-Total	1,037.10	8.940

1-6 Proposal in Implementing This Project

In order to minimize an increase in the asset price of the existing equipment, international competition should be encouraged in drawing up a specification and in announcing the invitation to bidding. A supply of consulting organization with a sufficient capability is desired in drawing up a specification, in examining tenders, in works supervision, and in testing.

ANTELCO shall provide the required space for additional equipment in each local office during its telephone network expansion works scheduled for 1982 to 1987.

The introduction policy of not considering overall unconditional release of the ISD service and changes in subscriber Nos. should desirably be restudied in view of the system economy.

1-7 Financial Analysis

In this project, once ISD service is started, additional expenditure for maintenance and operation is not required so much. As the result, the profitability of this project is very high. (No additional personnel is required for this ISD service maintenance, in addition, the personnel cost for international telephone operation department can be saved.)

The Internal Rate of Return (IFRR) for this project is 41.63%. (based on Plan 1)

2. Digital Telephone Switching System Introduction Project

2-1 Purpose and Outline of Study

Taking into account the recent remarkable progress in the electronic technologies and their present worldwide status, a program is going to commence to modernize the Asunción telephone local network.

In planning introduction of digital telephone switching system in the Asunción area, the numbers of telephones demanded and to be installed are forecasted, the facilities plan is made considering transition to digital telephone network in the future, and then telephone business revenue/cost forecast and financial analysis are carried out.

As a result, this project has been proved to be sufficiently feasible.

2-2 Forecast of Telephones Demanded and Installed

The number of telephones demanded is forecasted by approximation with an exponential curve on the basis of the forecasted value (the number of telephones demanded in 1980 through 1987 for each exchange in the Asunción area forecasted by ANTELCO). As a result, the number of telephones demanded in the Asunción area in 1990 is forecasted to be about 177,000.

On the other hand, the number of telephones to be installed in Paraguay is planned so that the target telephone density will be close to the world average (4.45 lines per 100 inhabitants

in 1990). The number of telephones installed in whole Paraguay is first forecasted by using the equation to represent the relationship between telephone density and PIB (Producto Interno Bruto per Capita) forecasted on the basis of the past values in 1975 through 1979 (economic growth rate of about 6.8%). Then, the number of telephones installed in the Asunción area is forecasted considering the concentration to that district.

The resultant forecasted value in 1988 to 1990 is 30,100. Distribution to each exchange in the Asunción area is carried out by using the ratio of the forecasted demand for each exchange to the whole.

2-3 Basic Policy in Digital Telephone Switching System Design

The digital telephone switching equipment introduction is planned considering the pattern of transition to the digital telephone network in the Asunción area.

This project only aims at subscriber telephone switching equipments. Introduction will start from some exchanges considering the maintenance system and operation aspect. The conventional method shall be followed for subscriber cables, and optical fiber cables shall be introduced for transmission between exchanges introduced digital telephone switching equipments. The equipment scale shall be sufficient for expected telephone expansion in 1988 through 1990 and shall be planned so that telephone density in Paraguay will be close to the world average mentioned in subsection 2-2 in view of the

PIB. As a rule, no EMD switching equipments are purchased for expansion after 1988.

2-4 Equipment Plan Outline

The number of equipments planned in this project is as shown in Table 4.

Table 4 Equipment Plan Outline

Item \ Plan			Contents	Remarks
Switching equipment	Digital telephone switching equipment		2 units	CENTRAL I "9" CENTRAL 30
	Expansion capacity		11,000 lines	
	Transfered lines		21,800 lines	
Power supply equipment	Battery, rectifier, etc.		2 sets	
	Engine generator		2 units	One is a mobile type
Number of telephone sets			11,000 sets	
Subscriber lines	Primary cable		19.7 km	Converted to 1,000 p
	Secondary cable		127.1 km	Converted to 100 p
Transmission line	Optical fiber cable	8 M b/s	-	-
		34 M b/s	2 SYS (1)	Number of sections in ( )
	Conventional metallic cable		4,397 circuits (11)	Number of sections in ( )

2-5 Project Cost

Table 5 shows the necessary project costs for this project. In calculating the cost for construction, it is assumed that the construction contract shall be made in 1984, and that the annual price rise rate shall be 6% for foreign currency and 12% for local currency with respect to price levels as of October, 1981.

Table 5 Project Cost

Foreign currency: Million yen

Local currency: Million guaranies

Item \ Currency		Foreign currency	Local currency	Remarks
Installation Cost	Materials cost	4,697.2	65.4	
	Work cost	1,216.5	737.0	
Training cost		75.6	0	
Maintenance assistance cost		110.9	0	
Consultant fee		300.4	0	
Sub-total		6,400.6	802.4	
Contingency		320.0	40.2	Sub-total x 0.05
Total		6,720.6	842.6	

2-6 Financial Analysis Outline

Financial analysis is carried out, assuming the tariff system of the digital telephone switching system to be identical to the current tariff system. The analysis result shows that

the project is feasible because of the high internal rate of return (IFRR) (23.99%) until the end of the project life (20 years after sevice commencement).

3. Rural Telephone System Introduction Project

3-1 Purpose and Outline of Study

The density of population outside the capital Asunción area in Paraguay is very low (about 6 persons per square km) as averaged over the whole country. Telephone service in rural districts is limited to medium to small cities and central areas of towns and villages with relatively high populations. Almost no telephone service is provided in rural districts where farming villages and ranches exist. For promotion of basic industries such as agriculture, stock raising and forestry in Paraguay, the importance of telephone service in these rural districts is concluded to be very great.

ANTELCO plans introduction of the rural telephone systems in about 14 districts in Paraguay for improvement of telephone service in rural districts. For this project, the feasibility of the rural telephone system has been studied in the 5 following districts out of the above 14 districts specified by ANTELCO as having great urgency.

1) San Pedro district
2) Concepción district
3) Hohenau district
4) Villarrica district
5) Carapeguá district

The priority order given by ANTELCO for the above 5 districts is from 1) to 5) above.

The study concluded with respect to the introduction policy, facilities plan and the project cost, that the social need and benefit of the project are great even though the profitability may not be attractive.

3-2 Project Policy

(1) Installation of the following telephones shall be planned for communities without telephones:

1) Telephones for administration, public peace and emergency

2) Public telephones for communities without telephones

3) General subscriber telephones for commerce, manufacturing industry, agriculture, stock raising, etc.

These telephones shall be accommodated in automatic switching equipments of existing exchanges.

(2) Expansion of toll trunk lines shall be planned for manual exchanges where toll call connection is extremely poor.

3-3 Applied Systems

The multiple access subscriber radio system (hereafter called MAS system) and single channel radio system shall be applied for the rural telephone system and for expansion of toll trunk lines for manual exchanges, respectively.

3-4 Demand Fulfillment Plan

The number of rural telephones initially installed by this project is planned to be 90 per one district on the basis of the latent demand for rural telephones investigated by ANTELCO, considering the priority order according to purposes, urgency of installation, profitability and project scale.

With regard to expansion of toll trunk lines for manual exchanges, the object exchanges are selected considering the number of subscribers, current status of toll trunk lines and the future plan of each exchange.

3-5 Basic Design Policies

(1) The service area of the MAS system shall be planned so that one base station (or two base stations depending on the wave propagation conditions) shall be able to cover all service areas of all exchanges in the object district.

(2) Two 8-channel MAS systems shall be installed per one district so as to cope with increasing subscribers and traffic in the future.

(3) For the entrance transmission line between the MAS system base station and the automatic exchanges, the 24-channel UHF (or VHF) multiple radio system shall be used.

(4) The target S/N for the radio circuit between an MAS system base station and an MAS subscriber shall be 35 dB or more.

(5) Such subscribers without a radio channel to the MAS system base station because of poor wave propagation conditions shall be accommodated in the nearest automatic exchange by using the single channel radio system.

3-6 Facilities Plan Outline

The outline of the facilities plan in this project is shown in Table 6.

Table 6 Rural Telephone System - Number of Equipments

System / Item / Area	8 CH MAS system			Single channel radio system		
	Number of base stations	Number of systems	Number of subscribers	Manual Exchanges	Intraoffice public telephones	General subscriber lines
San Pedro	2	2	90	10	-	3
Concepción	2	2	90	3	-	-
Hohenau	2	2	90	7	-	-
Villarrica	2	2	90	10	1	-
Carapeguá	1	2	90	7	-	-
Total	9	10	450	37	1	3

(Note) With regard to the single channel radio system:

"Manual exchange" column shows the total number of toll trunk lines (1 trunk line/exchange) to be expanded for manual exchanges.

"Intraoffice public telephones" column shows the number of public telephone lines in the ANTELCO exchange which are not accommodated in the MAS system but are individually accommodated in the nearest exchange.

"General subscriber lines" column shows the number of general subscriber lines which are individually accommodated in the MAS system but are individually accommodated in the nearest exchanges.

3-7 Project Cost

The necessary cost for this project are shown in Table 7. The prices used as the basis for cost calculation are as of October, 1981. It is assumed that the construction contract will be made at the end of 1983, and that the annual price rise rate shall be 6% for foreign currency and 12% for local currency.

With regard to construction for subscriber stations of the MAS system, 5 subscriber stations for each districts shall be installed on a turn-key base contract and the remaining stations shall be directly installed by ANTELCO employees.

Table 7 Project Cost

Foreign currency: Million yen

Local currency: Million guaranies

Item	Required Cost		Remarks
	Foreign currency	Local currency	
San Pedro	190.3	28.4	
Concepción	185.0	29.2	
Hohenau	220.0	32.8	
Villarrica	222.5	47.5	
Carapeguá	193.8	88.9	
Total for 5 areas	1,011.6	226.8	
Equipment for maintenance center	58.5	0	Including vehicle for maintenance
Training and maintenance assistance cost	27.5	0	Maintenance assistance period: 6 months
Consultant fee	77.0	0	
Sub-total	1,174.6	226.8	Including total for 5 areas
Expected price rise	241.6	114.1	
Contingency	70.8	17.0	5% of the price including expected rise
Total	1,487.0	357.9	

3-8 Financial Analysis Outline

Although the tariff system of the rural telephone system is unknown, the following tariff system being planned by ANTELCO is used for financial analysis of this project:

1) The installation charge shall be 170% of the ordinary telephone installation charge (100,000 guaranies).

2) The rental charge shall be 150% of the ordinary telephone rental charge (1,600 guaranies per month).

3) The local call tariff and toll call tariff shall be the same as those of the ordinary telephone.

According to the analysis result, the internal rate of return (IFRR) until the end of the project life (20 years after the service commencement) is -7.84%, so the investment for facilities construction cannot be fully recovered. As viewed from this calculation result, this project cannot be considered feasible. However, this project is indispensable for promotion of rural industries, and socioeconomic effects of this project are very great. Although there is a limit to charge high rates to balance the project investment and revenue because of possible obstruction of the growth of rural telephones, the installation charge and rental charge should be increased at least to such a degree as to recover the investment and interest.

The remaining shortage in revenue should be covered in the total business balance of ANTELCO.

4. Total Project Cost

The total project cost of three project items is classified as follows:

Table 8 Total Project Cost

Foreign currency: Million yen

Local currency: Million guaranies

No.	Cost / Project Item	Foreign Currency	Local Currency
1.	International Subscriber Dialing System Introduction Project	1,197	9
2.	Digital Telephone switching System Introduction Project	6,721	843
3.	Rural Telephone System Introduction Project	1,487	358
	Total	9,405	1,210

Remarks

The cost estimation is based on the following conditions

1. The cost estimation was done in October 1981
2. The exchange rate: US$1 = G126 = ¥230
3. Price rise rate for foreign currency is 6% per year
4. Price rise rate for local currency is 12% per year.

5. Financial and Economic Analysis

As the result of calculating the internal rate of return shown in Table 9 for checking the profitability of the projects, the project in total is financially and economically feasible enough.

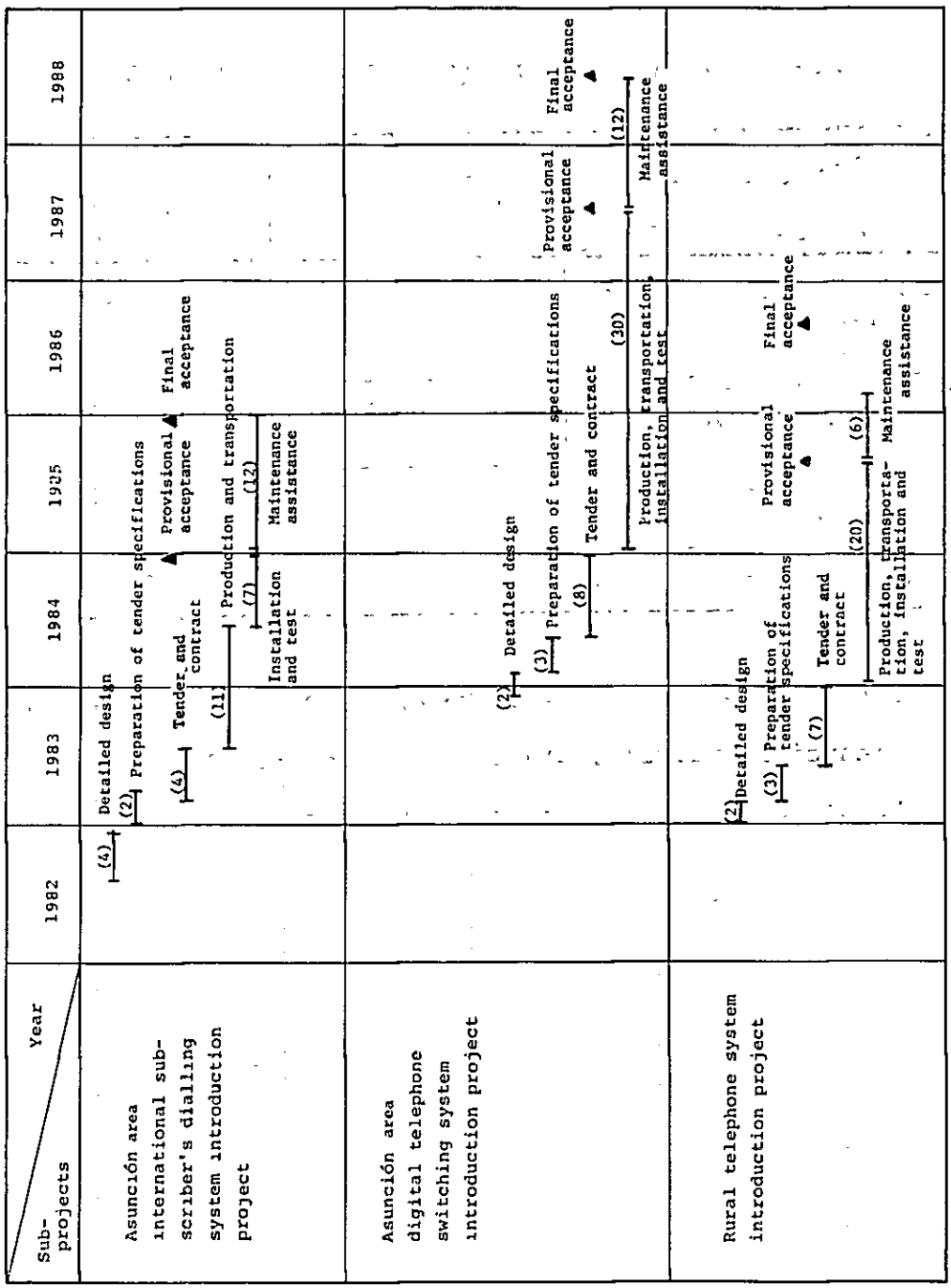
Table 9 The Result of Financial & Economic Analysis

No.	Internal Rate of Return / Project Item	Internal Financial Rate of Return (IFRR)	Internal Economic Rate of Return (IRR)
1.	International Subscriber Dialing System Introduction Project	41.63%	41.85%
2.	Digital Telephone Switching System Introduction project	23.99%	30.44%
3.	Rural Telephone System Introduction Project	-7.84%	-6.02%
	Integration of IFRR & IRR	23.68%	27.86%

Note: IFRR stands for Internal Financial Rate of Return for financial analysis, while IRR stands for Internal Economic Rate of Return for economic analysis.

6. Total Implimentation Schedule

Taking ANTELCO's intension of earliest possible realization of the projects into full consideration, the total implimentation schedule is as follows;



Note 1: Parenthesized figures show required periods (in number of months).

2: The Project Execution Schedule Diagram assumes smooth progress of all works without delay. It is naturally subject to modification according to the work progress status.

CHAPTER I. INTRODUCTION

CHAPTER I. INTRODUCTION

1. Background of the Study

1-1 The Request for Technical Cooperation

The Government of the Republic of Paraguay formulated the 20-year long National Telecommunications Development Project with the cooperation of International Telecommunication Union in 1966.

Since then, the Government of the Republic of Paraguay has continued the entiring efforts for the realization of the project, and has brought the project to the successful completion. Accordingly, the Government of the Republic of Paraguay finds it necessary to formulate a new national development project on telecommunications and broadcasts in order to meet the increasing demand for the new services in the field of telecommunications and broadcasts which are being created by the progress in different ecomonic sectors.

Thus, the Government of the Republic of Paraguay made a request to the Government of Japan for technical cooperation in formulating the new National Telecommunications and Broadcasts Development Project.

1-2 Dispatch of Contact Mission

In response to the request made by the Government of the Republic of Paraguay, the Government of Japan sent a Contact Mission in September, 1980 through Japan International Cooperation Agency.

The Mission identified and confirmed the intension of the Government of the Republic of Paraguay, examined the necessity and possibility of the technical cooperation of Japan, and made recommendations with regard to the basic policies for execution of the study.

1-3 Dispatch of Preliminary Study Team

The Government of Japan, upon receipt of the report from the Contact Mission, sent a preliminary study team through Japan International Cooperation Agency in March, 1981 to obtain approval from the Government of the Republic of Paraguay with regard to the scope, period and method of the study required for study execution and also to gather the data and information required for the study. The Preliminary Study Team had a series of discussions with Paraguayan authorities. As a result, it was determined that the study should be carried out as described below. Please refer to the attached "Agreed S/W" for further details.

1. A long-term (15-year) Master Plan in the five following fields shall be made by March, 1983 in succession to the 20-year National Telecommunications Development Project made by the Government of the Republic of Paraguay with cooperation of ITU in 1966:

(1) Domestic Telecommunications
(2) International Telecommunications
(3) Radio Regulation and Radio Monitoring
(4) Broadcasting
(5) Manpower Development

Along with preparation of the Master Plan, a feasibility study report with regard to the 3 following items whose urgent execution is desired by the Government of the Republic of Paraguay will be provided by March, 1982:

(1) Introduction of international subscriber dialling system to Asunción.

(2) Introduction of digital telephone switching System to Asunción.

(3) Introduction of Rural Telephone System to five districts. (Concepción, Hohenau, San Pedro, Villarrica and Carageguá).

1-4 Dispatch of Feasibility Study Team

Based on the S/W agreed between ANTELCO and the preliminary study team, the Government of Japan sent a feasibility study team with regard to the three items with urgent necessity in July, 1981 prior to dispatch of the Master Plan study team.

2. Purpose and Outline of Feasibility Study

2-1 Purpose

The purpose of this study is to study the feasibility of the 3 following items having top priority in the National Telecommunications and Broadcasts Development Project of Paraguay.

1) Introduction of international subscriber dialling system to Asunción

2) Introduction of digital telephone switching system to Asunción area (Asunción city and neighboring Lambaré and Fernando de la Mora)

3) Introduction of rural telephone system to concepción, Hohenau, San Pedro, Villarrica and Carapegua.

2-2 Outline

(1) International Subscriber Dialing System

ANTELCO desires to introduce the ISD service at an early opportunity. However, considering various conditions which will be required when this project is assumed to be financed by a foreign loan, the earliest limit for the start of the ISD service has been set at the end of 1984.

The ISD survey group analyzed the information and data supplied by ANTELCO and the information obtained by surveying the local facilities and equipment in accordance with the foregoing conditions. The group accomplished the following work:

Analysis of "Past and Present International Telephone Service in Paraguay",

"Design of Systems Needed for Introduction of ISD Service",

"Forecast of Traffic and of Number of Circuits Needed",

"Estimate of System Construction Cost",

"Analysis of Financial and Economic Aspects of the Project", and other work.

(2) Digital Telephone Switching System

Introduction of the digital switching system was to be studied for economic and efficient management of the general subscriber telephone system in the Asunción area.

For this purpose, the method for digital network introduction was clarified, comprehensive study on telephone switching equipment (including toll telephone switching equipment), trunk transmission lines, subscriber lines, power supply equipment and air conditioning equipment, etc. was carried out. Furthermore, the maintenance and administration patterns have been studied.

To identify and confirm the current status, the inside and outside facilities of the exchanges were investigated.

At the same time, financial and economic analysis was conducted to examine the feasibility of the project.

(3) Rural Telephone System

After full consideration of the environmental conditions in the above 5 rural districts, field survey was carried out to examine the proper introduction pattern for each district.

At the same time, financial and economic analysis was conducted to examine the feasibility of the project.

3. Formation of Study Teams and Schedule

3-1 Formation of Study Teams

This study was carried out by two teams, the NTT team in charge of the DTS plan and RT plan, and the KDD team in charge of the ISD plan under the general team

leader from the Ministry of Posts and Telecommunications.

The field survey was effectively conducted with powerful cooperation of the experts sent on long term basis from JICA.

The name and responsibilities of the members are as shown in the following Table.

3-2 Study Schedule

The study teams carried out field survey for 58 days from July 12 to September 7, 1981. The schedule was roughly described in the following table.

The draft was deliberated by the members marked with o in the previous page from November 24 to December 17, 1981.

Study Schedule

No.	Month/Date	Study contents, etc.		
		DTS group	RT group	ISD group
1	7/12 (Sun)	Departure from Tokyo		
2	13 (Mon)			
3	14 (Tue)	Arrival at Asunción, courtesy visit to Japanese Embassy		
4	15 (Wed)	Courtesy visit to ANTELCO, Prearrangement with JICA branch office		
5	16 (Thu)	Discussion with ANTELCO		
6	17 (Fri)	Preparation for survey		
7	18 (Sat)	"		
8	19 (Sun)	Holiday		
9	20 (Mon)	Visits to switching offices in and around Asunción as well as preparation for field survey		
10	21 (Tue)	Preparation for survey	Survey in Concepción district	Survey at main local switching offices
11	22 (Wed)	Hearing of local line traffic status	"	"
12	23 (Thu)	Office equipment survey	"	"
13	24 (Fri)	Explanation of project contents to Japanese Ambassador	"	Explanation of project contents to Japanese Ambassador
14	25 (Sat)	Data arrangement	"	Data arrangement
15	26 (Sun)	Holiday		
16	27 (Mon)	Office equipment survey	Data arrangement	Data arrangement
17	28 (Tue)	"	"	Rate collection and subscriber complaint handling survey
18	29 (Wed)	"	Preparation for field survey	"
19	30 (Thu)	Data arrangement	Survey in Hohenau district	"
20	31 (Fri)	"	"	"
21	8/1 (Sat)	"	"	"
22	2 (Sun)	Holiday		
23	3 (Mon)	Survey of equipment outside the office	"	System design data study
24	4 (Tue)	"	Data arrangement	System design and traffic measurement
25	5 (Wed)	"	"	"
26	6 (Thu)	Data arrangement	"	"
27	7 (Fri)	"	"	"
28	8 (Sat)	"	Preparation for field survey	Measured data summation
29	9 (Sun)	Holiday		
30	10 (Mon)	Meeting with ANTELCO (Director of Planning Bureau, Switching Department Head and Transmission Department Head)	Survey in Villarica district	System design and economic analysis
31	11 (Tue)	Data arrangement	"	"

No.	Month/Date	Study contents, etc.		
		DTS group	RT group	ISD group
32	8/12 (Wed)	Data arrangement	Survey in Villarica district	System design and economic analysis
33	13 (Thu)	"	"	Encarnación toll office survey
34	14 (Fri)	Meeting with ANTELCO (Director of Planning Bureau, Transmission Department Head and Switching Department Head)		"
35	15 (Sat)	Data arrangement	Preparation for field survey	"
36	16 (Sun)	Holiday		
37	17 (Mon)	Data arrangement	Survey in Carapegua district	Conference with counterpart
38	18 (Tue)	Meeting with ANTELCO (Director of Planning Bureau, Transmission Department Head and Switching Department Head)	"	"
39	19 (Wed)	Data arrangement	"	"
40	20 (Thu)	"	"	"
41	21 (Fri)	Meeting with ANTELCO (Director of Planning Bureau, Transmission Department Head and Switching Department Head)	"	Data arrangement
42	22 (Sat)	Data arrangement		"
43	23 (Sun)	Visits to Rural City switching office		
44	24 (Mon)	"		
45	25 (Tue)	"		
46	26 (Wed)	Preparation of survey result interim report		
47	27 (Thu)	"		
48	28 (Fri)	"		
49	29 (Sat)	"		
50	30 (Sun)	Holiday		
51	31 (Mon)	Preparation of survey result interim report		
52	9/1 (Tue)	"		
53	2 (Wed)	Interim Report submission to ANTELCO (Director of Planning Bureau)		
54	3 (Thu)	Survey result outline report to Japanese Embassy and JICA branch office		
55	4 (Fri)	Interim Report submission to President of ANTELCO		Departure from Asunción
56	5 (Sat)			|
57	6 (Sun)			|
58	7 (Mon)			Arrival at Tokyo

Remarks: With regard to the Rural telephone system in San Pedro district, field survey by the specialists despatched by the Government of Japan was conducted in June, 1981.

The leader (Mr. Tomioka) and Coordinator (Mr. Oyama) joined the field survey from July 14 through 27 and from September 1 through 4, and they carried out explanation of the inception report and Interim report.

Study Team Members

No.	Name	Responsibility	Position
1	o Masaru Tomioka	General Team Leader	Deputy Director Technical Investigation Division, Radio regulatory Bureau, Ministry of Posts and Telecommunications
2	o Masashi Shoji	NTT Leader (RT, DTS)	Senior Engineer, International Affairs Bureau, NTT
3	Toshiro Ishiwata	Outside Plant (RT)	Senior Engineer, International Affairs Bureau, NTT
4	Akira Arakawa	Financial and Economic analysis (RT, DTS)	Economist, International Affairs Bureau, NTT
5	Kunio Kuwahara	Tariff System (RT, DTS)	Economist, International Affairs Bureau, NTT
6	o Takeo Matsumoto	NTT Subleader, Switching (DTS)	Senior Engineer, International Affairs Bureau, NTT
7	Mitsuru Tanaka	Outside Plant (DTS)	Senior Engineer, International Affairs Bureau, NTT
8	Keizaburo Otsuka	Transmission (DTS)	Senior Engineer, International Affairs Bureau, NTT
9	Masayuki Nojiri	Switching (DTS)	Senior Engineer, International Affairs Bureau, NTT
10	o Tomoichiro Funabashi	KDD Leader, Traffic Forecast (ISD)	Senior Engineer, International Cooperation Department, KDD
11	Masafumi Utsugi	International Switching Equipment (ISD)	Engineer, Otemachi International Telecommunications Operation & Maintenance Office, KDD
12	Yuji Tomokiyo	Interface to Domestic Line (ISD)	Engineer, Osaka International Telecommunications Operation & Maintenance Office, KDD
13	Masayoshi Tani	Financial and Economic Analysis (ISD)	Economist, International Relations Department, KDD
14	o Masahito Oyama	Coordination	Project Officer, Social Development Cooperation Department, JICA

Notes) NTT: Nippon Telegraph & Telephone Public Corporation

KDD: Kokusai Denshin Denwa Co., Ltd.

RT : Rural Telephone System

DTS: Digital Telephone Switching System

ISD: International Subscriber Dialling System

Members whose names are marked with o participated in the report draft deliberating mission from November 24, 1981 to December 17, 1981.

CHAPTER II. NECESSITY OF THIS PROJECT

CHAPTER II. NECESSITY OF THIS PROJECT

1. International Subscriber Dialling System

Telecommunication service, whether it is telex or telephone, is on its way to automatization as the worldwide trend.

In case of international telephone service, for example, it is far more convenient for a subscriber to directly call a telephone subscriber in a foreign country by dialling himself than to ask an operator for the connection, and the rate is also less. Therefore, automatization of international telephone call connection has a considerable merit.

International transmission routes (satellite circuit and ground microwave circuit) for international telephone service has been implemented in Paraguay in recent years, and the traffic growth is remarkable. In such a background, ANTELCO has tried to maintain and improve the service level by increasing the number of international operators. However, introduction of the ISD system is now recognized as an urgent need for ANTELCO because of the following reasons:

(1) Improvement of service for telecommunication subscribers. (ISD is an excellent service of considerable merit for subscribers in view of its inexpensive rate, quickness of service and ensuring privacy.)

(2) Increase in revenue by job streamlining in ANTELCO (reduction of labor cost for telephone operators) and by traffic increase.

(3) The ISD service for calls from various countries to Paraguay has already been put into practice. It is desirable that telecommunication service should be the same in conditions in both directions (originating and terminating calls).

(4) In view of politics and national economy to strengthen diplomatic relationships between Paraguay and various foreign countries, expansion of modern telecommunication means is desired.

2. Digital Telephone Switching System

The digital telephone switching system, unlike the conventional analog switching equipment, is based on the most advanced electronics technology. Since it enables connecting directly with the digital transmission lines, without digital - analog conversion process and it has the stored program control function, various effects as shown below can be expected.

(1) In addition to the economy of the switching equipment itself, economization of the whole telecommunication network can be achieved by elimination of analog - digital conversion when combining with the digital transmission line.

(2) By digital integration as stated above, the speech quality is improved.

(3) Provision of various new services is facilitated.

(4) In addition to telephone services, it can also be used for data communication and visual communication services. Furthermore, it may be developed into an ISDN (Integrated Services Digital Network) for digital base switching and transmission of various services in the future.

The digital telephone switching system having the above features will play the central role in the future telecommunication network. Introduction of this system is the world-wide trend (70% of developing countries have introduced or decided to introduce this system).

In expanding current switching equipments and renewing the facilities in Paraguay, gradual introduction of digital telephone switching equipments should be tried to construct the new telecommunication network in the future.

3. Rural Telephone System

The population in Paraguay in 1980 was about 3.17 million of which about 75% are living in the east and south east area within 120 Km radius from Asunción, the capital of Paraguay, as the center. The population density outside the Asunción area is very low at about 6 inhabitants per square Km in average.

Therefore, inhabitation dispersion in other districts has been one of the important themes of development projects. However, telephone service in other districts is limited to small or medium cities and central areas of relatively dense-

ly populated towns and villages. In rural districts covering farming villages and ranches supporting basic industries such as agriculture, stock raising and forestry, almost no telephone service has been provided.

In the 5th 5-year (1977 - 1981) socioeconomic development project in progress at present, strengthening of the sales force of agricultural products in national and international markets, promoting inhabitation in rural districts as well as decentralization of admistrative organs are given with the first priority. Telecommunication plays a very important role in these fields, and contributes much to implementation of emergency system and national defence.

Because of the reasons stated above, the introduction of the rural telephone system under this project is indispensable and is very urgent.

CHAPTER III. PLAN FOR INTRODUCTION OF INTERNATIONAL SUBSCRIBER DIALING SERVICE

CHAPTER III. PLAN FOR INTRODUCTION OF INTERNATIONAL SUBSCRIBER DIALING SERVICE

1. Present State of International Telephone Service in Paraguay

1-1 International Telephone Service

Call Types:

At present, ANTELCO is offering the following types of international telephone service:

- Station calls
- Person to person calls

The collect call service is also possible for some countries regarding person-to-person calls. During weekends and at night, discounted rates are applied to calls to inter-American countries.

The traffic condition is generally good, and subscribers applying to telephone operators for call connections are not kept waiting for an extremely long time after calls have been placed. However, the burden on telephone operators is larger compared with connections to other countries when calls to Argentina are placed, because of the relatively poor domestic telephone situation in that country. Many attempts are made before a connection can be made because telephone lines in Argentina are not easily accessible.

1-2 Telephone Charges

The present international telephone rates (charges collectable from users) are shown in Table III-1.

There are the following three types of charges for calls to Brazil and Argentina which are neighboring countries across the borders, depending on call terminating destinations inside the other countries. Traffic to these two countries accounts for the bulk of the international telephone traffic:

- Border rate:

  A rate applied to calls between towns across the border and is most inexpensive. Calls do not go through the international switching office in Asunción.

- Regional rate:

  A rate applied to calls terminating in the states near Paraguay in the neighboring countries. Calls are made through the international exchange office in Asunción. However, in principle, the international exchange office in other countries are by-passed.

- International rate:

  A rate applied to calls other than those mentioned above. Calls go through international exchange offices in both countries.

Telephone rates are changed (increase or decrease) by negotiation with other countries when the agreed rates (quoted in gold francs) are revised. At present, there is no fixed schedule for a revision.

At present, one gold franc is quoted at 53 guarani. The rate links to the exchange rate of US$/guarani and has not been changed over the past ten years, or more. No major change in this respect is forecasted for the future. (The American dollar has been fixed at 126 guarani as an official rate politically for more than ten years in the past.)

The average revenue per minute of international telephone calls is 421 guarani by calculating the total international telephone traffic by dividing by total chargeable minutes. (The figure includes all factors under the present rate structure such as the difference between station and personal calls and traffic distribution by destination. A figure similar to it will be derived by dividing the actual traffic by destination and by rate and by calculating by a weighted mean method after applying the applicable rate to it.

This figure will be used later when forecasting the future revenue.)

Table III-1 International Telephone Rates

(Unit: Guarani)

Destination	Class	Ordinary Rate		Discount Rate	
		First 3 Min.	For Additional	First 3 Min.	For Additional
U. S. A.	PP	2332	583	1748	437
	TT	1749	583	1311	437
Canada, Mexico	PP	2544	636	-	-
Argentina, Brazil	PP	1696	424	1300	325
	TT	1272	424	975	325
Chile, Uruguay	PP	1696	424	-	-
	TT	1272	424	-	-
Bolivia, Colombia, Ecuador, Peru, Venezuela, Guyana, Central American Countries	PP	2544	636	-	-
Spain	PP	1947	487	-	-
	TT	1460	487	-	-
Other European Countries	PP	3180	795	-	-
African Countries	PP	3180	795	-	-
Asian Countries	PP	3180	795	-	-

Notes: 1. The table shows only international rates.
(Border and regional rates are omitted).

2. Discount rates -

To Argentina: From October 1 to March 31.
From 22:00 to 07:00 on weekdays.
From 15:00 on Saturday to 07:00 on Monday on weekends

From April 1 to September 30.
From 21:00 to 06:00 on weekdays.
From 14:00 on Saturday to 06:00 on Monday on weekends.

To Brazil: From 20:00 to 05:00 on weekdays and on Sunday

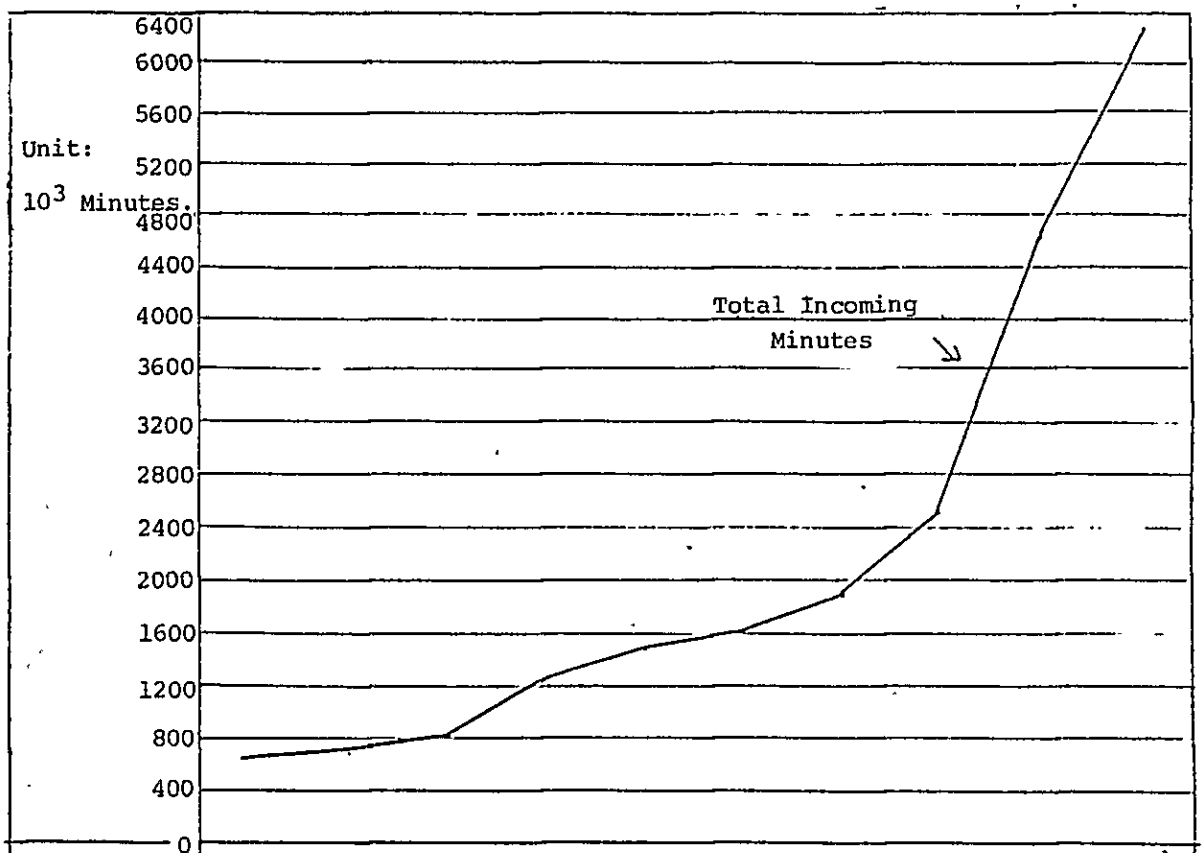
To USA: Sunday only

1-3 International Telephone Traffic

1-3-1 Transition of International Telephone Traffic in Past Ten Years

The international telephone traffic has increased steadily in the past ten years. In particular, the traffic has shown a prominent increase in conjunction with the start of operation of the earth station and completion of domestic microwave trunk networks to Brazil and Argentina in 1978. Figure III-1 shows the growth.

Figure III-1 International Telephone Traffic in Past Ten Years



Year	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Outgoing	272	279	377	618	748	828	988	1489	2586	3283
(Index)	(100)	(102)	(138)	(227)	(274)	(304)	(363)	(547)	(949)	(1205)
Incoming	364	403	449	604	751	785	942	1034	2088	2990
(Index)	(100)	(111)	(123)	(166)	(207)	(216)	(259)	(284)	(574)	(822)
Total Outgoing and Incoming	636	682	826	1222	1499	1613	1930	2523	4674	6273
(Index)	(100)	(107)	(130)	(192)	(236)	(254)	(303)	(397)	(735)	(986)

1-3-2 Distribution of International Telephone Traffic by Destination

The bulk of international telephone traffic originating in Paraguay is calls to Argentina or Brazil, followed by calls to the United States. The traffic destined for these three countries alone account for 84.5% of the entire traffic. This is a natural trend when one considers that Paraguay has a deep cultural relation with Argentina and strong economic ties with Brazil.

Table III-2 International Telephone Traffic by Destination (1980)

(Unit: Minute)

Destination	Outgoing	(%)	Incoming	(%)	Total	(%)
Argentina	1,194,001	(36.4)	873,803	(29.3)	2,067,804	(33.0)
Brazil	1,138,695	(34.7)	1,112,243	(37.2)	2,250,938	(35.9)
Uruguay	66,974	(2.0)	31,028	(1.0)	98,002	(1.6)
Chile	62,692	(1.9)	49,936	(1.7)	112,628	(1.8)
U.S.A.	440,381	(13.4)	515,520	(17.2)	955,901	(15.2)
Panama	27,020	(0.8)	18,648	(0.6)	45,668	(0.7)
Spain	158,230	(4.8)	239,593	(8.0)	397,825	(6.3)
Italy	57,821	(1.8)	36,913	(1.2)	94,739	(1.5)
W. Germany	62,030	(1.9)	34,685	(1.2)	96,715	(1.6)
Sub-Total	3,207,851	(97.7)	2,912,369	(97.4)	6,120,220	(97.6)
SPADE	75,467	(2.3)	77,687	(2.6)	153,154	(2.4)
Total	3,283,318	(100.0)	2,990,056	(100.0)	6,273,374	(100.0)

1-3-3 Distribution of Domestic Outgoing Districts for International Telephone Calls

At present, 80% of international telephone calls originate in Asunción, while the remaining 20% originates in cities throughout Paraguay. The present projects for the introduction of the ISD service is for Asunción only.

1-3-4 Utilization Mode by Telephone Call Type

According to data covering June to August, 1981 (3 months), the ratio between station and personal calls is nearly 50:50. The details to back up this statement are as follows:

Table III-3 Number of Station and Personal Telephone Calls

	June	July	August
Personal Calls	51,925 (51%)	51,002 (51%)	52,299 (48%)
Station Calls	49,245 (49%)	49,006 (49%)	56,919 (52%)
Total	101,170 (100%)	100,008 (100%)	109,218 (100%)

1-4 Circuits

1-4-1 International Telephone Circuits by Destination

Table III-4 shows the present state of international telephone circuits in Paraguay.

Table III-4 Present State of International Telephone Circuits
(Aug., 1980)

Destination	Circuits	Signaling System	Transmission Lines	Operation Mode[1/] Outgoing	Incoming
Buenos Aires	18	N0.5	Satellite	SA	SA, A
Resistencia	24	R2	Microwave	SA	SA, A
Clorinda	4	N0.1	Microwave	M	M
Rio de Janeiro	6 16	N0.5 R2	Satellite Microwave	SA	SA, A
Curitiba	30	R2	Microwave	SA	SA, A
Montevideo	2	N0.1	Microwave	M	M
Santiago	2	N0.5	Satellite	SA	SA
Panama	1	N0.1	Satellite	M	M
New York	12	N0.5	Satellite	SA	SA, A
Madrid	8	N0.5	Satellite	SA	SA, A
Frankfurt	8	N0.5	Satellite	SA	SA, A
Rome	3	N0.5	Satellite	SA	SA, A
SPADE[2/]	12	N0.5	Satellite	SA	SA, A

Note 1/ : Operational Modes - M: Manual, SA: Semiautomatic, A: Automatic

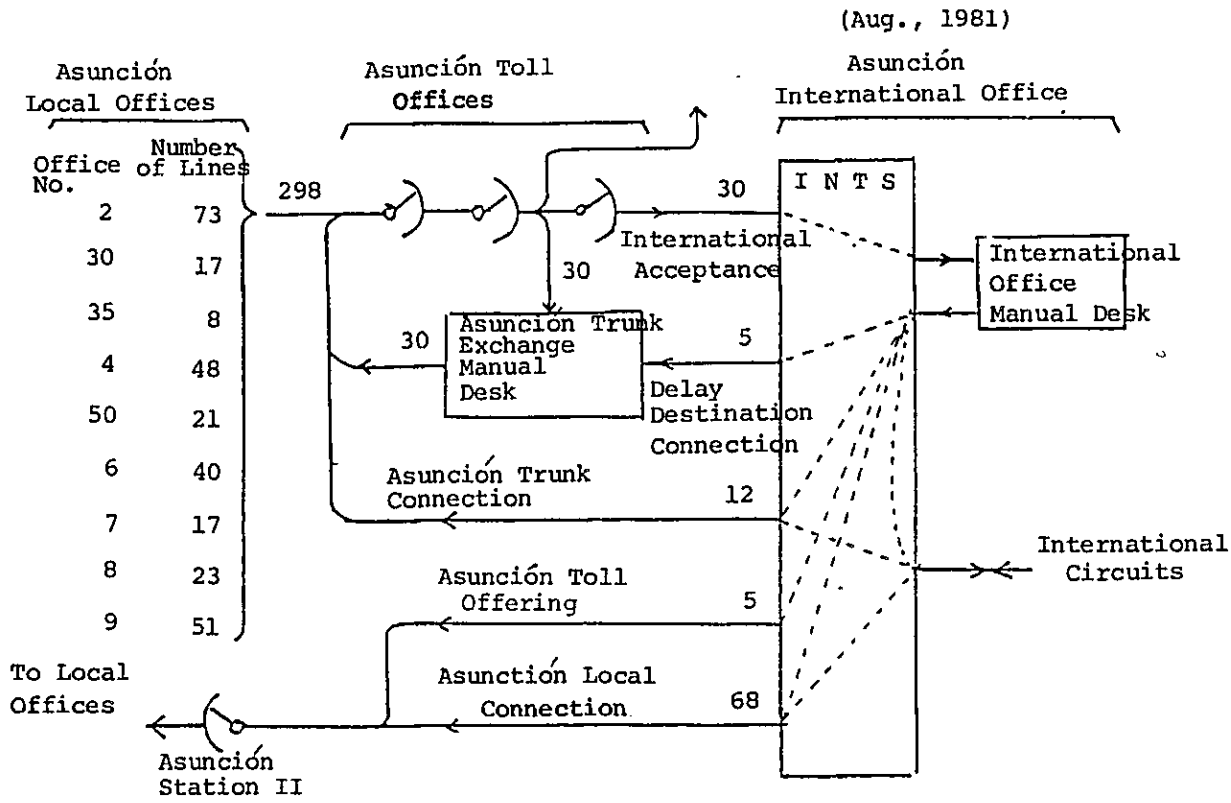
2/ : SPADE Destinations -

Alaska, Canada, Venezuela, Peru, Belgium, Denmark, Scotland, Finland, Greece, Greenland, Holland, England, Iceland, Liechtenstein, Norway, Sweden, Switzerland, Saudi Arabia, Egypt, Hawaii, Iraq, Jordan, Turkey, Syria, Bozwana, Rhesoto, Nambia, Nigeria, Swaziland (Total 29 destinations)

1-4-2 Present Status of Toll Circuits by Local Office

Figure III-2 shows a circuit configuration and numbers of circuits among local offices - trunk exchanges - international offices.

Figure III-2 Outline of International Telephone Connection Routes



In addition to the services shown in Figure III-2, international telephone calls (telefonico fronterizo) are handled among major cities in the bordering territories of Paraguay with cities in adjoining Argentina and Brazil. These telephone services are outside the scope of this survey.

1-5 Operating State of International Telephone Offices

1-5-1 Number and Working System of Telephone Operators

There are about 100 international telephone operators working for ANTELCO in the following four time zones. The time zones shifts are fixed, and operators in these time zones work six hours a day.

			Operators
00:00 - 06:00	(dawn shift)	mostly men	4
06:00 - 12:00	(morning shift)	women	37
12:00 - 18:00	(afternoon shift)	women	29
18:00 - 00:00	(night shift)	mostly men	28
Total			100

* The foregoing work shifts are for weekdays, and the number of personnel is as of August 21, 1981.
* The personnel is reduced by 50% for Saturday afternoons and Sundays.

There are two peak periods in a day, one in the morning (09:00 to 11:00) and the other in the afternoon (15:00 - 17:00). There hardly is time left for the operators to rest their hands during these time zones.

1-5-2 Operating Method

At present, outgoing calls to principal destinations are connected semi-automatically. The Paraguayan operators directly call subscriber telephones in the destination countries and connect the calls. In some instances, manual switching to connect telephone calls by operators in both countries is still operated in limited areas.

Regarding incoming calls to Paraguay, calls from the following countries are entirely handled automatically (subscribers to directly dial subscriber Nos. in the other countries for connection):

West Germany	From November 22, 1979
Argentina	From 1978 (from some telephones only)
Brazil	From January 6, 1979
Spain	From April 12, 1980
U.S.A.	From February 17, 1980

2. Traffic Forecast

Figures III-3 and III-4 show a traffic forecast for 1981 - 1991. The basic traffic for this traffic was calculated based on the E Series Recommendations of CCITT.

ANTELCO's policies vis-a-vis the introduction of the ISD service are as follows:

(1) The ISD service shall be available to all subscribers in the introduction areas of the ISD service.

(2) The ISD service will be introduced inside Asuncion City for the moment. The service shall be expanded to provincial cities with more than 1,000 subscribers at an early opportunity, ultimately intended to cover entire Paraguay.

(3) The destinations from which ISD calls are incoming will be made ISD destinations. Additional destinations with a possibility will be included as ISD destinations.

(4) The ISD charges shall be on the basis of one-minute to one-minute conforming to the present trunk subscriber calls.

(5) The present signaling system will not be changed greatly in conjunction with the introduction of ISD.

(6) Subscriber Nos. will not be changed.

Based on the foregoing policies, the ISD traffic was estimated assuming the following items and considering the performance of the countries already implementing the ISD service and traffic measurement results.

(1) The ISD introduction time is estimated to be 1984 - 1985 assuming that the work for it will progress promptly after the completion of this survey.

(2) The traffic increase due to the introduction of the ISD service is assumed to be 15%.

(3) The ISD utilization rate to these destinations is assumed to be 70%.

(4) Traffic originating and terminating in Asunción is estimated to be 80% of the total traffic.

(5) Outgoing and incoming traffic is estimated to balance.

Figure III-3 Forecast of International Telephone Traffic Originating in Paraguay
(Chargeable Minutes)

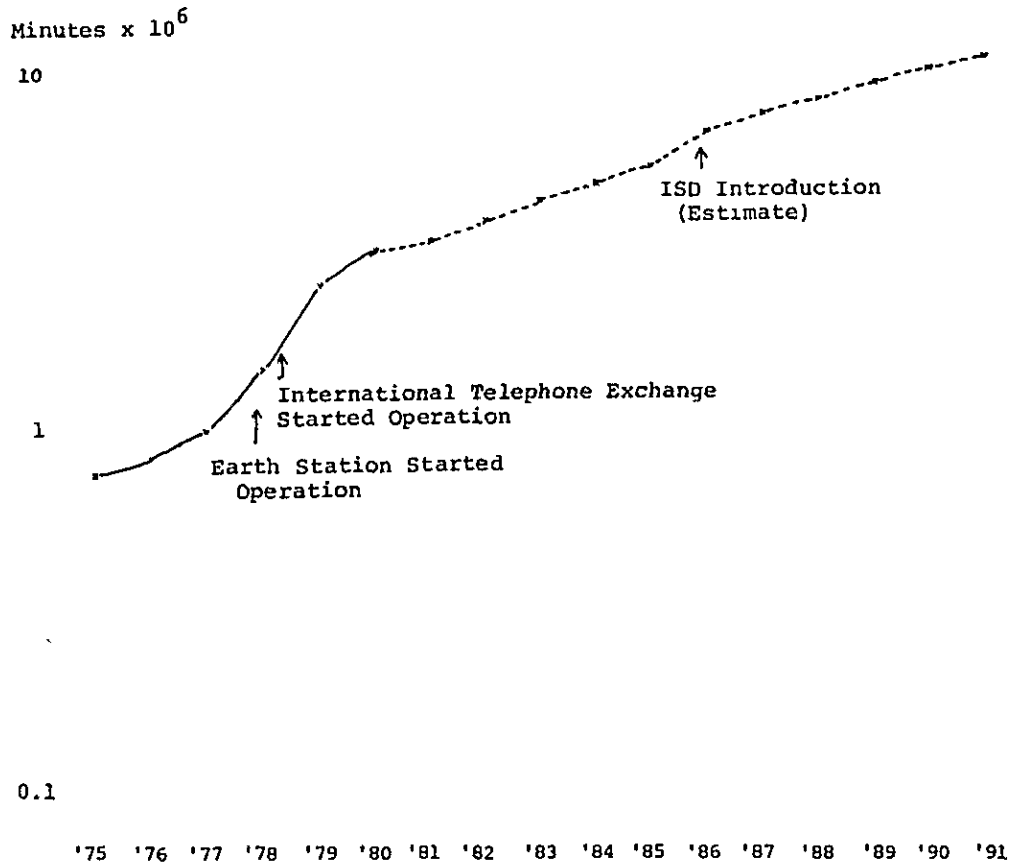


Table III-5 Traffic Forecast (1/6)

Chargeable minutes are estimated minutes only for outgoing calls.

Circuit Name	1981			1982			1983			1984		
	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits
Buenos Aires	967	18.86	26	1,095	21.38	29	1,234	24.6	32	1,383	26.97	35
New York	345	6.73	12	391	7.63	13	441	8.59	14	494	9.63	15
Montevideo	66	1.28	2	74	1.45	2	84	1.63	2	94	1.83	2
Rio de Janairo	794	17.21	24	900	19.49	27	1,014	21.96	29	1,136	24.62	32
Santiago de Chile	69	1.35	5	78	1.53	5	88	1.72	5	99	1.93	6
Madrid	131	2.56	7	149	2.90	7	168	3.27	8	188	3.67	8
Rome	48	1.05	4	55	1.19	4	62	1.34	5	69	1.50	5
Panama	28	0.54	1	31	0.61	3	35	0.69	3	40	0.77	4
Frankfurt (Main)	52	1.01	4	59	1.14	4	66	1.29	5	74	1.45	5
London	44	0.86	4	50	0.98	4	57	1.10	4	63	1.24	4
Paris	24	0.47	3	27	0.53	3	31	0.60	3	34	0.67	3

Table III-5 Traffic Forecast (2/6)

Chargeable minutes are estimated minutes only for outgoing calls.

Circuit Name	1981			1982			1983			1984		
	Chargeable Minutes (1000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (1000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (1000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (1000 Minutes)	BHC (Erlangs)	Required Circuits
Tokyo	21	0.36	3	23	0.40	3	26	0.46	3	29	0.51	3
Lima	-			19	0.38	3	22	0.43	3	24	0.48	3
Zurich	-			21	0.41	3	24	0.46	3	27	0.52	3
SPADE	59	1.03	4	27	0.46	3	30	0.52	3	34	0.59	3
Clorinda	207	6.59	4	235	7.46	4	264	8.40	5	296	9.42	5
Resistencia	235	7.46	13	266	8.45	14	300	9.52	15	336	10.68	17
Curitiba	266	16.9	24	301	19.14	26	339	21.57	29	380	24.18	32
TOTAL ISD Service	-			-			-			-		
Semi-automatic and Manual Service	3,357			3,801			4,272			4,802		
Grand Total	3,357			3,801			4,272			4,802		

Table III-5 Traffic Forecast (3/6)

Chargeable minutes are estimated minutes only for outgoing calls.

Circuit Name	1985			1986			1987			1988		
	Chargeable Minutes (1000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (1000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (1000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (1000 Minutes)	BHC (Erlangs)	Required Circuits
Buenos Aires	1,543	30.10	38	1,909	32.27	42	2,151	36.36	46	2,401	40.57	51
New York	551	10.75	17	682	11.52	19	768	12.98	20	857	14.49	22
Montevideo	105	2.04	3	130	2.19	6	146	2.47	6	163	2.75	7
Rio de Janairo	1,268	27.47	35	1,568	29.45	39	1,767	33.18	43	1,972	37.03	47
Santiago de Chile	110	2.15	6	136	2.30	6	154	2.60	7	171	2.90	7
Madrid	210	4.09	9	260	4.39	9	292	4.94	10	326	5.52	10
Rome	77	1.68	5	96	1.80	5	108	2.03	6	120	2.26	6
Panama	44	0.86	4	55	0.92	4	61	1.04	4	69	1.16	4
Frankfurt (Main)	83	1.61	5	102	1.73	5	115	1.94	6	129	2.17	6
London	71	1.33	5	79	1.38	5	87	1.47	5	96	1.62	5
Paris	38	0.74	4	47	0.80	4	53	0.90	4	59	1.00	4

Table III-5 Traffic Forecast (4/6)

Chargeable minutes are estimated minutes only for outgoing calls.

Circuit Name	1985			1986			1987			1988		
	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits
Tokyo	33	0.57	3	41	0.61	3	46	0.69	3	51	0.77	4
Lima	27	0.53	3	30	0.51	3	34	0.57	3	37	0.62	3
Zurich	30	0.58	3	33	0.55	3	36	0.61	3	40	0.68	3
SPADE	38	0.65	4	42	0.63	4	46	0.70	4	51	0.77	4
Clorinda	331	10.51	6	409	9.75	16	461	10.99	17	514	12.26	19
Resistencia	375	11.91	18	464	11.05	18	522	12.45	20	583	13.89	21
Curitiba	424	26.97	35	525	25.03	34	592	28.20	37	660	31.47	41
TOTAL ISD Service	-			1,586			2,976			4,648		
Semi-automatic and Manual Service	5,358			5,022			4,465			3,582		
Grand Total	5,358			6,608			7,441			8,230		

Table III-5 Traffic Forecast (5/6)

Chargeable minutes are estimated minutes only for outgoing calls.

Circuit Name	1989			1990			1991					
	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits
Buenos Aires	2,634	44.51	55	2,879	48.65	59	3,136	50.97	62			
New York	941	15.90	24	1,028	17.38	25	1,120	18.20	26			
Montevideo	179	3.02	7	195	3.30	8	213	3.46	8			
Rio de Janairo	2,163	40.62	51	2,365	44.41	55	2,576	46.52	57			
Santiago de Chile	188	3.18	7	206	3.48	8	224	3.64	8			
Madrid	358	6.05	11	391	6.62	12	426	6.93	12			
Rome	132	2.48	6	144	2.71	7	157	2.56	7			
Panama	75	1.27	5	154	2.61	7	168	2.73	7			
Frankfurt (Main)	141	2.38	6	154	2.61	7	168	2.73	7			
London	105	1.77	5	115	1.94	6	125	2.03	6			
Paris	65	1.10	4	71	1.20	4	78	1.26	5			

Table III-5 Traffic Forecast (6/6)

Chargeable minutes are estimated minutes only for outgoing calls.

Circuit Name	1989			1990			1991					
	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits	Chargeable Minutes (000 Minutes)	BHC (Erlangs)	Required Circuits
Tokyo	56	0.84	4	61	0.92	4	67	0.96	4			
Lima	40	0.68	3	44	0.75	4	48	0.78	4			
Zurich	44	0.74	4	48	0.81	4	52	0.85	4			
SPADE	56	0.84	4	61	0.92	4	67	0.96	4			
Clorinda	564	13.45	20	617	14.70	21	672	16.02	23			
Resistencia	640	15.24	23	699	16.66	25	762	18.15	26			
Curitiba	724	34.52	44	792	37.74	48	863	34.26	44			
TOTAL ISD Service	5,099			5,574			7,591					
Semi-automatic and Manual Service	4,006			4,380			3,253					
Grand Total	9,105			9,954			10,844					

3. International Subscriber Dialing System

3-1 The numbering plan for international telephone calls shall be as follows:

Acceptance of operator -

assisted international telephone calls	0010 (as at present)
ISD call prefix	002

As a result, the sending number for an ISD call by a subscriber shall be as follows:

002 N_1, N_2, N_3, (Z) A B C ------

——— ------

By CCITT Recommendation

N_1, N_2, N_3 ----- Country Code

Z = 0 Discriminating digit - to be inserted automatically by switching equipment for recognition of automatic calls.

A, B, C ----- National No.

3-2 Detailed Charging System

A charging information process system (computer equipment) will be added to the international trunk exchange to gather source data needed for detailed charging of ISD telephone calls. Charge bills will be issued by the bill issuing system for operator-assisted toll call charges already in operation.

The following record items can be considered for the charging information process system:

(1) Serial Nos. (to identify calls with the same outgoing and incoming Nos.)

(2) Call originator No. (category A No.)

(3) Called subscriber No. (category B No.)

(4) Seized trunk No.

(5) Trunk seized time

(6) Seized RS No.

(7) Time, recognized the answer signal = t_1

(8) Time, recognized the clear-back signal = t_2

(9) Time, recognized the clear-forwards signal = t_3

(10) Charging unit price (weekday rate and discount rate are included)

(11) Call charge

(12) Comments (records of hooking state, information on forced release, information related to corrections to charges made later, etc.)

(13) Outgoing route No. used

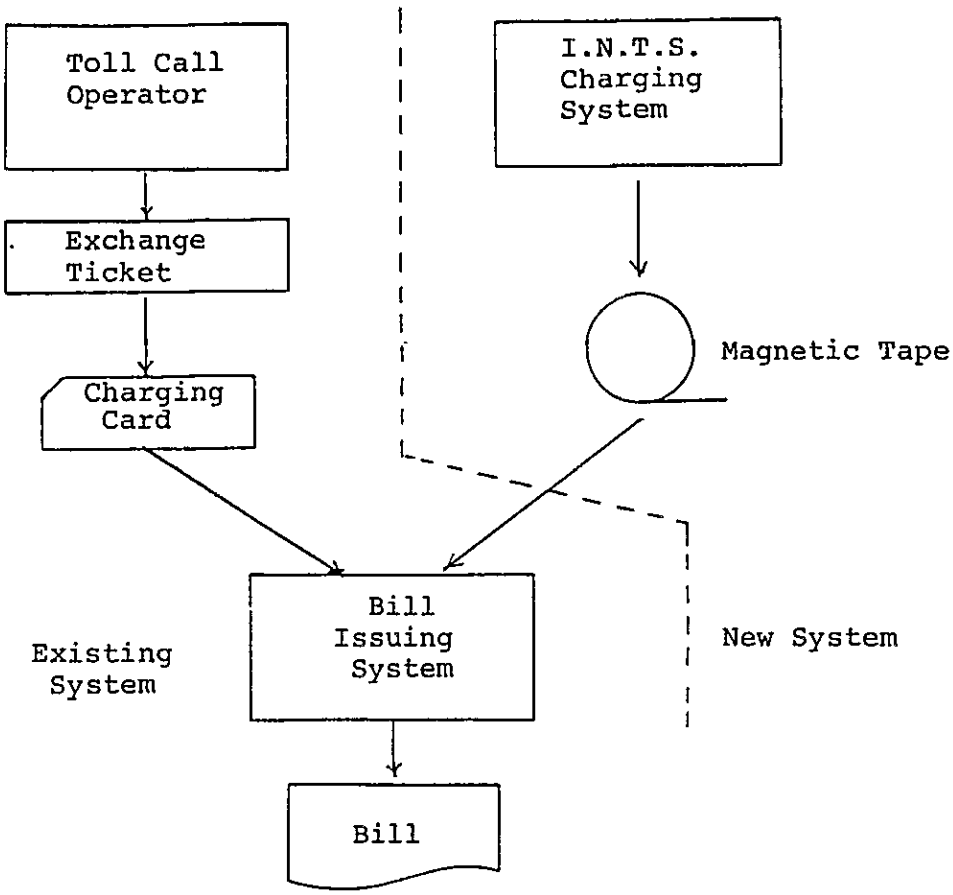
(14) Others

Among the foregoing items, Items (2), (3), (4), (7), (9), and (13) are indispensable items.

Call charges are calculated for $(t_3) - (t_1)$ and will not be affected by hooking, etc.

Figure III-4 shows the concept of the charging system.

Fig. III-4 Concept of Detailed Charging System

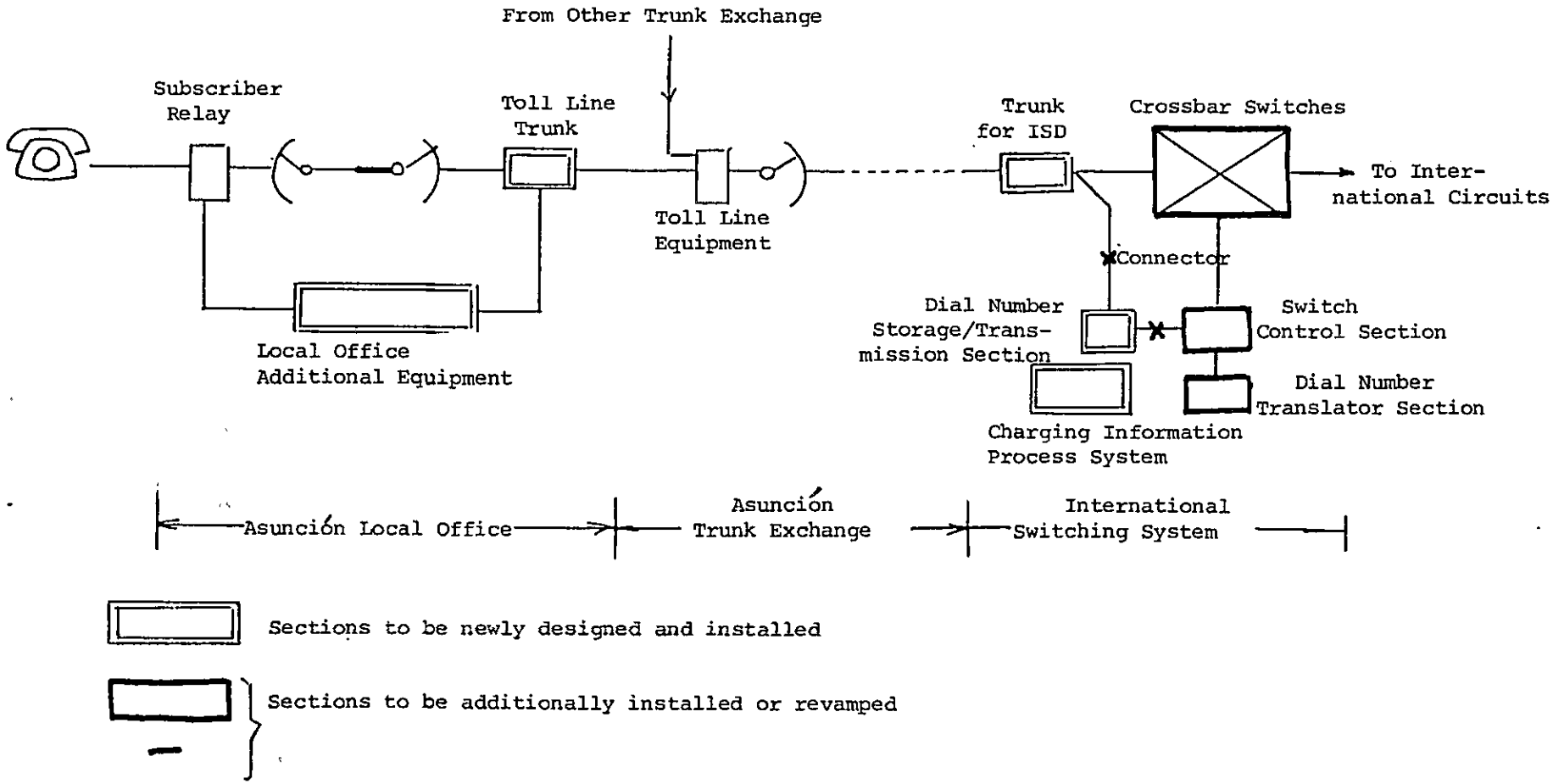


3-3 Integrated Connection System and Signaling System

3-3-1 Integrated Connection System

Figure III-5 shows as integrated connection system.

Fig. III-5 ISD System Concept



3-3-2 Signaling System

The line signals (signals to show the circuit state) between the local exchanges and international exchanges shall be the same system as that currently used.

The following two methods were studied as numerical signals (signals to send called party Nos.)

(1) Method of using multifrequency codes (MF codes) in sending both originating subscribe No. (category A No.) and terminating subscriber No. (category B No.) Advantages of this method:

(a) Sending and receiving of signals between LS and INTS is similar to pulsing signals of the CCITT No.5 signaling system so that signals can be stored by revamping the existing FIV REG.

(b) The existing registers (units to store pulsing signals) can be utilized, and revamping of the testing equipment can be slight.

(c) There will be fewer errors during dial number transfer.

(d) The number transfer time is short so that the required number of registers can be few.

Disadvantages of this method:

(a) The additional equipment to be installed in local exchanges will be complex.

(b) The post dial delay, domestic and international telephone calls after completion of dialing until connection completion, is long.

(2) Method to transfer category A Nos. by MF codes and category B Nos. by dial pulses.

Advantages of this method:

(a) There will be no post dial delay in domestic toll calls after completing dialing until connection completion.

(b) The additional equipment to be installed in local offices can be simple.

(c) The domestic signaling system will not be required to be changed.

Disadvantages of this method:

(a) Registers will have to be installed anew to store dialing pulses in the international office. This will necessitate installation of testing equipment for these registers.

(b) The holding time of new registers will be long, and the required unit number will be large.

(c) The dialing pulse transfer time will be long, and there will be more chances of them receiving distortion during transfer for malconnections.

(d) Design of the charging process system for the international office will be complex.

The question of selecting one method between these two methods closely related to the basic policies of the domestic signaling system in Paraguay. The decision was left with ANTELCO to decide. As a result, the latter method was selected for reasons: ① The present domestic signaling system would not be changed, and ② ISD should ultimately be expanded throughout the country.

Figures III-6 and III-7 show an operational flow chart and signal sequence.

Fig. III-6 Concept of Full Automatic Outgoing Operation

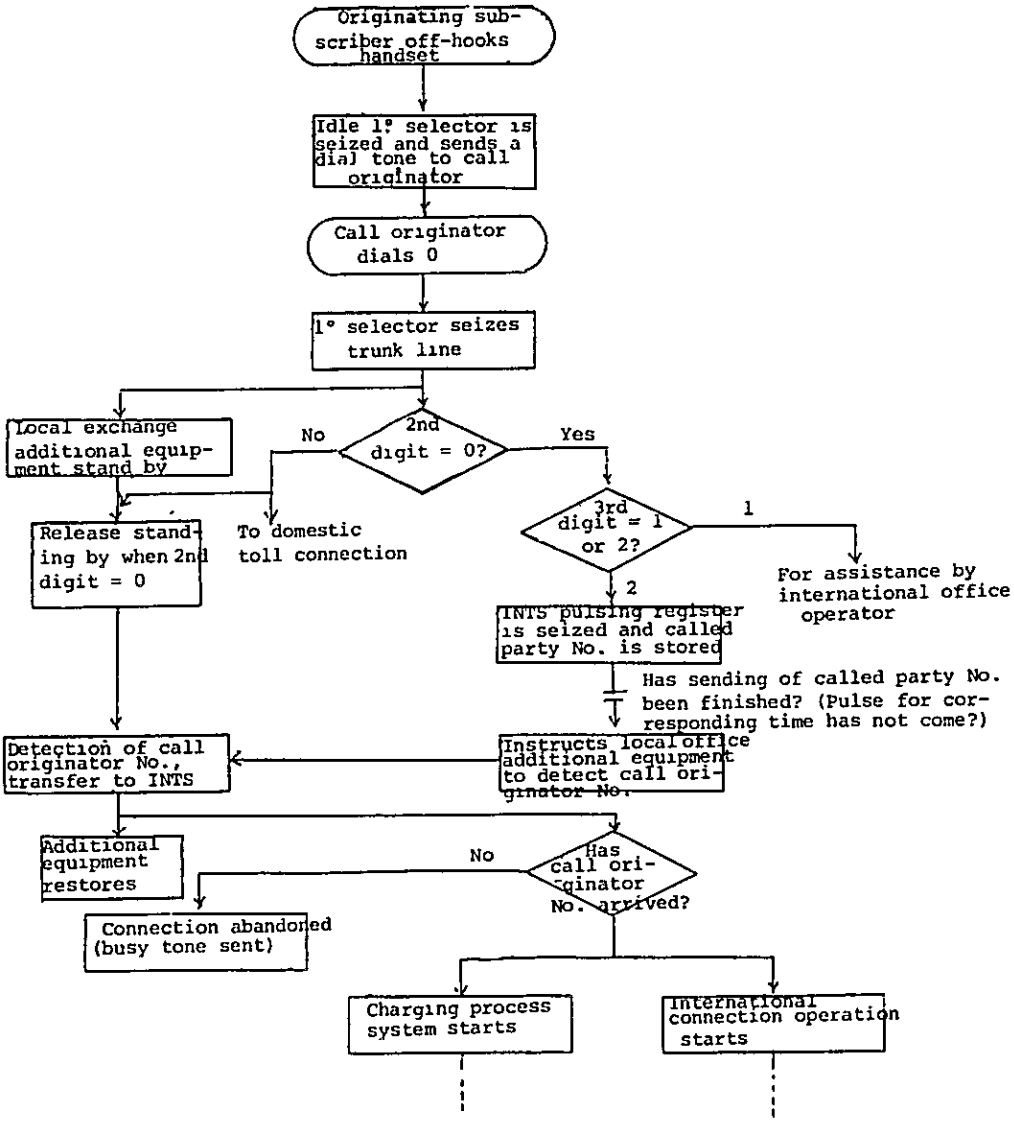
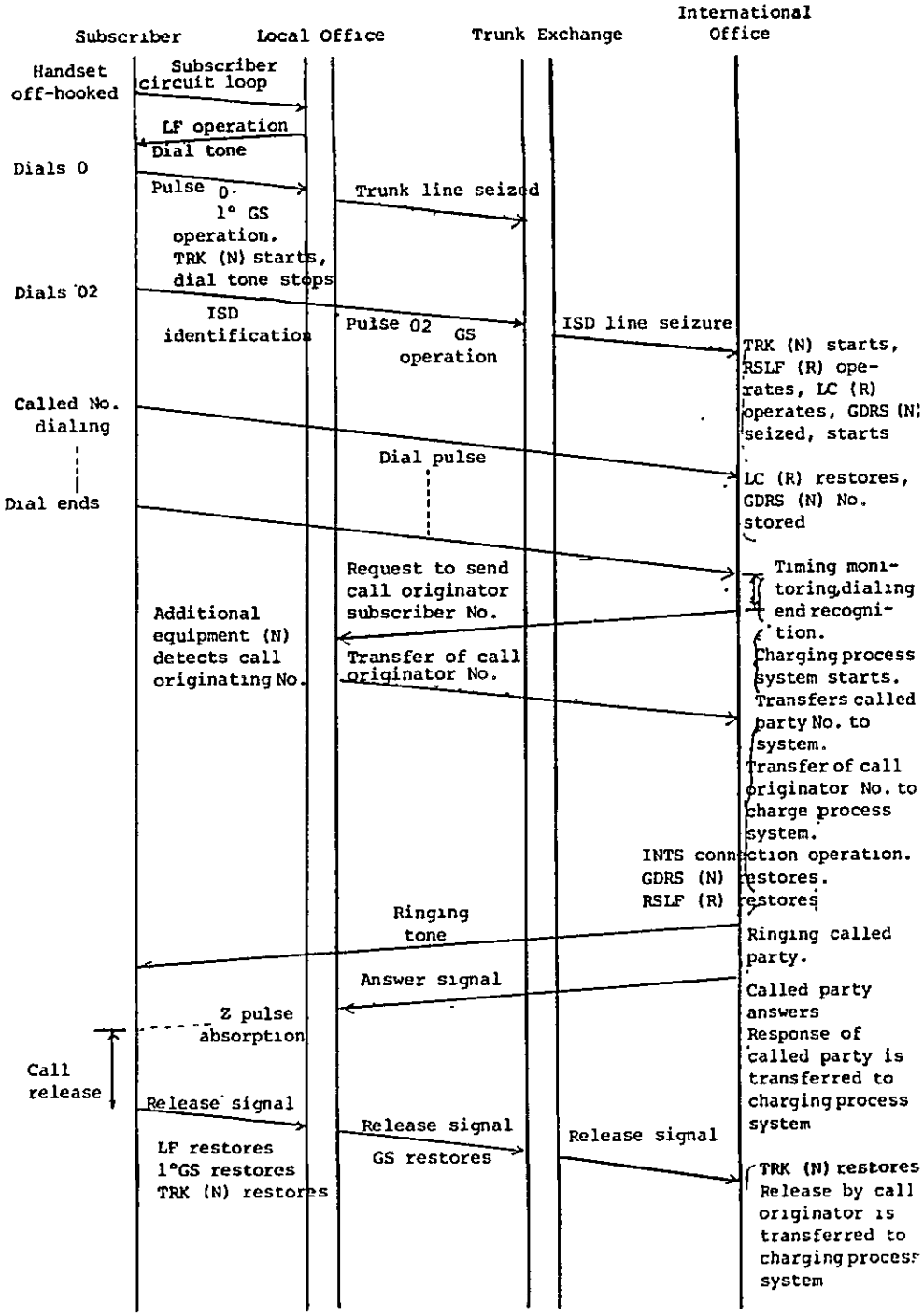


Fig. III-7 Outline of International Subscriber Dialing Signal sequence



Note: (N) - New installation unit
(R) - Unit to be revamped

3-3-3 Connection Control

In the initial phase of the ISD introduction, Asunción will be the only area to receive this service. Therefore call origination by errors by subscribers outside Asunción will have to be controlled. The possibility of erroneous call origination by subscribers in the suburbs of Asunción is particularly high.

Wrong outgoing calls from local offices to be accommodated in the Asunción trunk exchange will be controlled by the international switch because of the characteristics of the existing switching system. Wrong outgoing calls from the local exchanges to be accommodated in the Encarnacion and Colonel Oviedo shall be controlled by these trunk exchanges so as not to lower the utilization efficienty of trunk lines, (In the latter instance, the international switch will make double checking.)

The local office additional equipment controls subscribers with records of frequent payment delinquencies or those who desire control of the ISD service due to private reasons, by adding a subscriber class when sending call originating subscriber Nos. This control can be made on the international switch side.

4. Required Functions

4-1 Required Functions of Local Offices

Each local office in the ISD service area shall install additional equipment having the following functions to transfer call originating subscriber Nos. to the international office. Trunk equipment will be inserted in each trunk line to couple the additional equipment and trunk line.

The additional equipment shall have the following functions:

(1) ISD call identification function

(2) Subscriber No. detection function

(3) Subscriber No. transfer function

(4) Test function

The trunk equipment shall have the following functions:

(1) Signal monitoring

(2) Meter pulse absorption

Each of the foregoing item requires to have a full match with the existing EMD switching equipment.

4-2 Required Functions of Trunk Exchanges

No new functions are required in particular.

Note: ISD control function by the Encarnacion and Colonel Oviedo trunk exchanges is equipped with the EMD subscriber toll dialing system.

4-3 Required Functions of International Office

The functions and equipment required to be added to the international office are as follows:

(1) Incoming trunks for international subscriber dialing

(2) Register senders for ISD

(3) Additional installation of register sender links and register sender link controllers in connection with the installation of the register senders for IDS

(4) Additional installation of various common units commensurate with the traffic volume and resultant revamping

(5) Detection, transfer, and process functions for additional information required in connection with the introduction of the ISD service

(6) Additional installation of terminals boards, circuit switches, and line monitoring equipment commensurate with the additional equipment installed

(7) Addition of testing function needed for the new and additional equipment.

(8) Charging information process system

  (a) Charging information process system central processor

  (b) Charging information collection function (scanning equipment, etc.)

  (c) Charging information external record function (magnetic tape units, etc.)

(d) Charging information process system clock

(e) Charging information retrieval function

(f) Charging information process system fault monitoring and diagnosing functions

5. Equipment Plan

5-1 Basic Policies for Equipment Plan

In answer to inquiries made by various countries, ANTELCO has been stating that Paraguay intends to start the ISD service as soon as possible. Taking the ANTELCO's intention into full consideration, this survey foresees about 1984 and 1985 as a conceivable limit for the ISD introduction. Therefore, any effect caused by the introduction of the service will show after the end of 1985. Analyzing the outgoing international communication state, 70% of outgoing calls is calls to Argentina and Brazil. Furthermore, some of the destinations do not have a good connection state, and there is some apprehension whether ISD calls will grow as statistically forecasted, or at the same rate as that in other countries. Under the circumstances, the equipment plan considers the units for special use of the ISD service based on traffic slightly above the forecast level expected during the introduction phase. The units for international connection are based on a quantity commensurate with the forecasted traffic for 1990.

Since a large-scale expansion and revamping is going to be undertaken based on this survey, a consideration has been given to revamp the basic units (markers, switch frames, etc.) to meet the traffic in 1995 permitting additional units to be simply added for a period of about 15 years after the introduction of ISD depending on the demand and supply in the immediate future.

The additional equipment installed in local offices can be utilized for installation in local offices in regional cities when these cities introduce ISD after digital exchanges are installed in the local offices in Asunción. Asunción.

5-2 Local Office Equipment

The equipment to be newly installed in local offices will be additional equipment with a test function, equipped with a subscriber No. discrimination and number transfer functions. Trunk equipment with a trunk line control function will also be installed. The additional equipment will be determined by the maximum subscriber capacity of each local office, and the trunk equipment, by the number of toll transit lines between the local offices and Asunción trunk exchanges. Table III-6 shows an expansion plan for the local offices in Asunción and the required number of units based on the plan. The toll transit lines will be increased from 298 lines in 1981 to 692 lines in 1987 as a total for the local offices.

Table III-6 Asunción Local Office Subscriber Expansion Plan and Required Additional Equipment

(Required Unit Number = Basic Units + Additional Units)

Local Office No.	Expansion Plan				Required Unit Number	
	'81 Capacity	'85 Capacity	'86 Capacity	'87 Capacity	1986	1987
2	14,000	20,000	20,000	20,000	1 + 3	1 + 3
30	3,200	7,200	7,200	7,200	1 + 1	1 + 1
35	-	3,400	3,400	3,400	1	1
4 and 9	8,000+8,600	22,600	22,600	22,600	1 + 4	1 + 4
5	-	-	3,600	3,600	1	1
50	4,000	6,200	6,200	6,200	1 + 1	1 + 1
6	8,600	8,600	11,600	11,600	1 + 2	1 + 2
67	-	-	-	2,000	-	1
7	3,000	3,000	3,000	4,000	1	1
8	4,600	6,200	6,200	6,200	1 + 1	1 + 1
29	3,000	3,000	4,000	4,000	1	1
Total	57,000	80,200	84,200	90,800	10 + 12	11 + 12

Because the existing local exchanges are EMD systems, revamping of the primary group selectors and control wires and works for the main distributing boards or charging meter section will be required in order to install the additional equipment in the local offices.

Based on the foregoing permise, a trial calculation of expenditure for the local offices as shown in Table III-7 is made. The trial calculation includes the trunk equipment in the additional equipment.

Table III-7 Trial Calculation of Expenditure Needed for Local Offices in Asunción.

(Unit: ¥10,000)

Office No.	Additional Equipment	Works Material Cost	Works Cost	Total
2	5,050	164	1,620	6,834
30	3,350	39	500	3,889
35	2,500	14	200	2,714
4 + 9	5,900	198	2,020	8,118
5	2,500	40	400	2,940
50	3,350	48	500	3,898
6	4,200	100	1,060	5,360
67	2,500	35	350	2,885
7	2,500	37	400	2,937
8	3,350	54	600	4,004
29	2,500	65	440	3,005
Total	37,700	794	8,090	46,584

Notes: 1. Considering the planned introduction of digital exchanges at the end of 1987, the additional equipment in these offices will not be needed after 1987.

By diverting the translator units, the expenditure at the offices Nos. 30, 50, 6, and 8 can be saved. (Saving about ¥34 million).

2. The plan anticipates that ANTELCO will provide space for the additional equipment in the local offices when the telephone office expansion program is implemented during 1982 - 1987.

The spaces required in the local offices are approximately as follows:

Table III-8 Floor Areas for Additional Equipment

Office No.	Space m	Office No.	Space m
2	8 x 1	6	7 x 1
30	6 x 1	67	5 x 1
35	5 x 1	7	5 x 1
4 and 9	9 x 1	8	6 x 1
5	5 x 1	29	5 x 1
50	6 x 1		

A ceiling height of 3.5 m is needed. These spaces are for the floor areas and do not include spaces required for the works and maintenance.

5-2 Trunk Exchange Equipment

Trunk exchanges will not require installation or revamping of equipment in connection with the introduction of the ISD service.

5-3 International Office Equipment

5-3-1 Charging Information Process System (Computer Equipment)

The charging information process system collects source data from the register senders and incoming trunks and stores it in the magnetic tape units after editing it. The following points require a consideration when designing the equipment.

(1) The equipment can be restarted as simply as possible after a fault repair.

(2) The scanner can be expanded in units of 20 incoming trunk lines and 3 register sender units and shall finally be able to accommodate 200 lines and 30 register senders.

Table III-9 presents a trial calculation of expenditure calculated on the foregoing premises.

Table III-9 Trial Calculation of Expenditure Related to Charging Process System

(Unit: ¥10,000)

Item	Unit Price	Quantity	Expenditure
Software design cost (assuming slightly over 100 kilobytes)	20,000	1 set	20,000
Hardware design cost	2,000	1 set	2,000
Central processors	3,000	2 sets	6,000
Magnetic disc units	3,000	2 sets	6,000
Magnetic tape units	2,000	2 sets	4,000
Displays	1,000	2 sets	2,000
Clock	100	1 set	100
Scanner, etc.	1,000	1 set	1,000
Total			41,000

As charging process systems, CAMA (centralized automatic message account system) and two or three similar systems are available in the market. Assuming that a system suitable for the introduction of ISD is utilized after modifying it, a software design change fee of about ¥100 million will be required, substituting the software design fee, and the hardware design fee can be very little.

5-3-2 Switching Equipment

5-3-2-1 New Equipment

Table III-10 shows a trial calculation of cost of new equipment to be added to the international transit switch. By installing the equipment shown in the table, the demand up to 1988 or 1989 can be met.

Table III-10 Trial Calculation of Cost of New Equipment for International Transit Switch

(Unit: ¥10,000)

Item	Unit Price	Quantity	Expenditure
ISD Incoming Trunks			
Design fee	50	1 set	50
Manufacturing cost (60 trunks)	550	1 Frame	550
GD Register senders			
Design fee	500	1 set	500
Manufacturing cost	250	10 Units	2,500
Total			3,600

5-3-2-2 Additional Equipment

As mentioned at the start of this section, the basic units will not require any revamping or expansion inside the switching equipment until 1995. What will be required will be to merely install additional line units. The line units in a quantity sufficient to meet the demand for the immediate future will be installed. Table III-11 is a trial calculation based on this premise.

Table III-11 Units to be Additionally Installed with International Transit Switch

(Unit: ¥10,000)

Item	Unit Price	Quantity	Expenditure
C Marker frame	550	1 Frame	550
C Marker connectors	40	3 units	120
FIV Register senders	250	3 units	750
Register sender link frames	260	7 Frames	780
FIV bothway trunk frames	830	3 Frames	5,810
R2 bothway trunk frames	600	3 Frames	1,800
Incoming primary switch expansion frames	200	4 Frames	800
Outgoing primary switch expansion frames	200	2 Frames	400
Position link switch frames	260	2 Frames	520
International line test frame	300	1 Frame	300
Domestic line test frame	300	1 Frame	300
International circuit supervising board	500	1 Frame	500
TDF terminal boards	1	100 Boards	100
Total			12,730

5-3-2-3 Equipment Revamping

Table III-12 presents a trial calculation of cost needed to revamp exchanges to meet the increase in units described above.

Table III-12 Trial Calculation of Revamping Cost

(Unit: ¥10,000)

Item	Unit Price	Quantity	Expenditure
C Marker revamping			
Design fee	60	1 set	60
Parts cost	5	3 sets	15
Translator revamping			
Design fee	40	1 set	40
Parts cost	6	2 sets	12
Register sender revamping			
Design fee	50	1 set	50
Parts cost	5	11 sets	55
Register sender link revamping			
Design fee	10	1 set	10
Parts cost	1	5 sets	5
Link controller revamping			
Design fee	10	1 set	10
Parts cost	1	4 sets	4
Domestic line test frame revamping			
Design fee	10	1 set	10
Parts cost	1	90 sets	90
Domestic trunk test frame revamping			
Design fee	20	1 set	20
Parts cost	20	1 set	20

- to be continued -

(Unit: ¥10,000)

Item	Unit Price	Quantity	Expenditure
Register sender test frame revamping			
Design fee	30	1 set	30
Parts cost	20	1 set	20
Marker test frame revamping			
Design fee	20	1 set	20
Parts cost	3	1 set	3
Modification and completion of fault recording paper	30	1 set	30
Total			504

5-3-2-4 Works Cost

Table III-13 shows a trial calculation of the works cost required for additional installation and revamping in the international office covering the items described above.

Table III-13 Trial Calculation of Works Cost

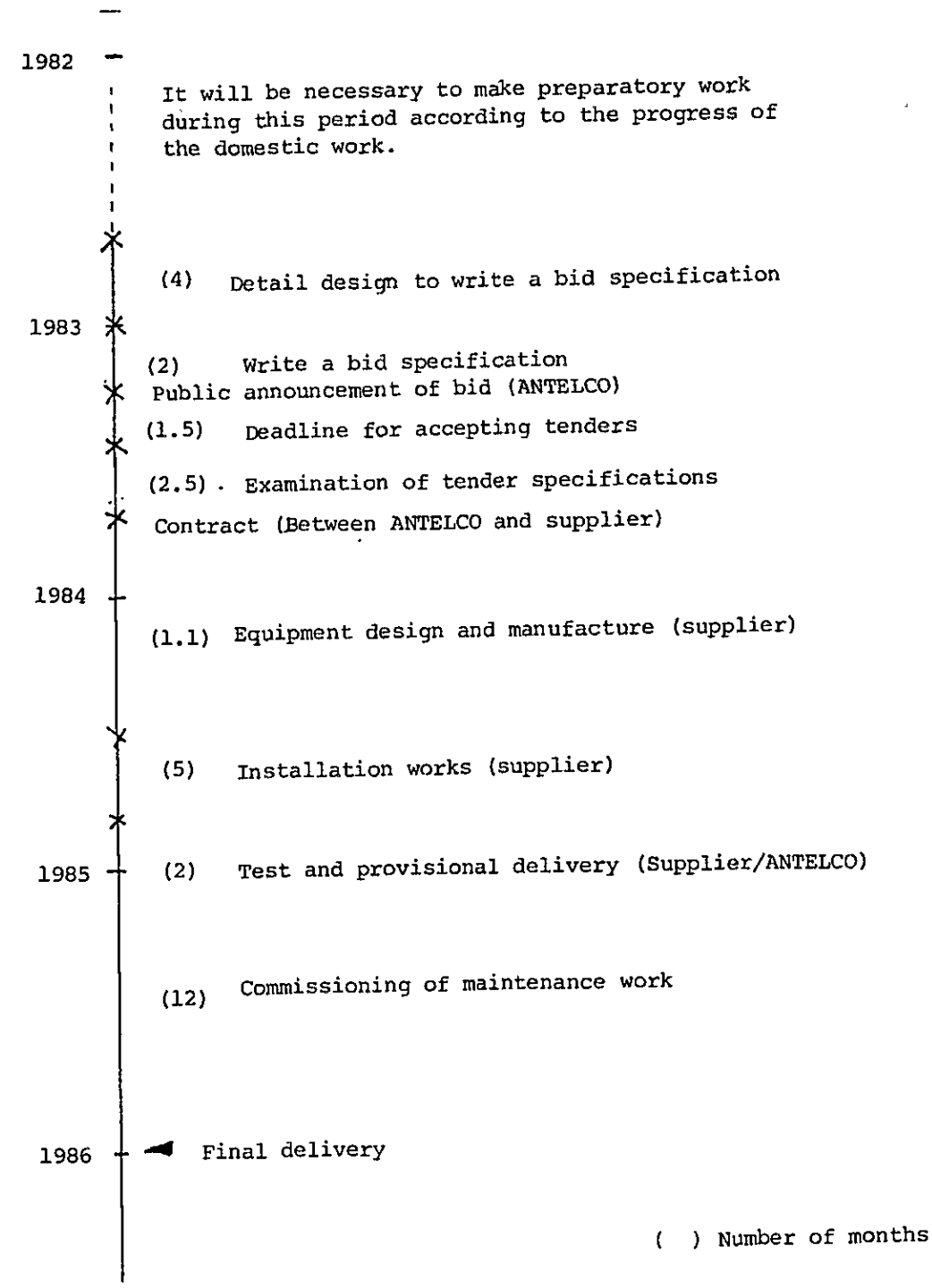
(Unit:¥10,000)

Item	Unit Price	Quantity	Expenditure
Works materials	380	1 set	380
Works design fee	60	1 set	60
Equipment works	60	1 set	60
Cable works	250	1 set	250
Jumper wire works	1,000	1 set	1,000
Revamping works	900	1 set	900
Total			2,650

5.4 Project Schedule

As mentioned in the beginning of this section, ANTELCO desires to start the ISD service as soon as practical. The following schedule would be the best schedule that can be considered at the present time assuming that all the parties concerned will do their utmost to expedite the project.

Figure III-8 Project Schedule (Proposal)



Note: This schedule has been made assuming that all phases of work will progress without delay. Alterations will naturally be required depending on the work progress.

6. Maintenance Structure and Personnel Plan

6-1 Maintenance Structure in Local Offices

The new work required by the installation of the additional equipment in the local offices will be: ① Fault repairs, and ② office data alterations (alterations of subscriber Nos. and classes). In principle, both ① and ② will be performed by weekday attendants. In a total failure while the weekday attendants are not available, temporary repairs shall be made by attendants working on Sundays and Saturdays. For this reason, the additional equipment will have an operating manual in Spanish. The equipment will be as simple as possible vis-a-vis fault detection, repair, and office data alterations. No increase in personnel is particularly required for the ① and ② work. During the first year after the start of operation (provisional delivery), the supplier shall maintain personnel to meet initial failures (commissioned maintenance by fault and defect warranty).

Reference:

The present maintenance structure in the local offices is as follows:

Saturday - Sunday	Primarily for monitoring
*0600 - 1400	1 (manager)
*1400 - 2300	1 (manager) + 2 (assistants)
*2300 - 0600	1 (manager) + 2 (assistants)
Monday - Friday	(Saturday and Sunday are for monitoring only)
*0700 - 1400	Mecanico + Tecnico
*1300 - 2000	(Numbers of persons depend on office scale)

6.2 Maintenance Structure in Trunk Offices

The trunk offices will not require equipment for the purpose of introducing the ISD service. The connection method to the international office and relay method of numbers of the parties called are the same as those for domestic toll calls. The pulse transfer function of the EMD exchanges has cyclical buffers and places no limitation on the number of digits. Furthermore, the transfer of call originator Nos. from local offices to the international office is transmitted by voice-band signals on circuits that have already been connected. Therefore, the maintenance structure due to the ISD Introduction will not be required.

ISD transmission control by the Encarnacion and Colonel Oviedo trunk exchanges shall be handled by normal maintenance work as the EMD exchanges have that function.

6.3 Maintenance Structure in International Office

Basically, the exchange equipment to be newly installed for ISD is the same as that of the crossbar exchange equipment installed at present. Therefore, the present maintenance system shall be continued.

The work required to be done related to the charging information process system (computer equipment) is as follows:

(1) Source data (call information, magnetic tapes) management

Source data will be used to issue bills. The number of tapes to be used differs depending on the cycle of bill preparation.

It will be necessary to decide data sending and receiving method with the billing section. What is required to be decided is whether data will be sent by data transmission, or by hand delivery, and how it can be confirmed.

(2) Office data (destinated Nos., translation files) management

Office data relates to alternative connection, and management is made by the section that manages lines.

(3) Time control

The system time will be maintained by a clock (hardware) and clock (software). Time shall normally be controlled by the hardware. Time changes should be made by a button operation, and a mechanical safeguard shall be provided.

(4) System operating state management

A dual system will be employed to increase the system reliability, and the operating state will have to be grasped.

(5) Software management

The software shall be free of faults and defects semi-permanently, and the supplier shall be asked to repair any abnormality. (Management by ANTELCO will still be required even in this instance).

(6) Fault processing

When the system no longer operates ISD, the exchange maintenance crew shall take steps to tentatively restart the system. All other work shall be attended to by the section dedicated for the work, which will be described later.

A one-year defect-free warranty period shall be offered by the supplier after the equipment operation (after provisional delivery). The supplier shall station personnel during this period for abnormality and faults.

In order to accomplish the work described in (1) to (6) above, ANTELCO shall newly create a section comprising two persons each with software and hardware knowledge.

The work required to be done and sections responsible for the work related to the computer equipment will be as follows:

(1) Exchange maintenance section

(a) Routine monitoring of the system by monitoring lamps.

(b) Restart in a system down time

The equipment shall be designed so as to permit system restart as simple as possible. An operating manual in Spanish shall be made available.

(2) Circuit management section

Management of office data

Contact with the system management section in case of circuit alterations and abolitions, routing changes, etc. that require modification of destinated No. translator file and file management.

(3) System management section (newly created)

(a) Source data management

Exchange of magnetic tapes and sending, receiving, and storage of tapes of the billing section.

(b) Alterations of office data

By contact by the circuit management section, destinated No. translator files shall be modified, and print output showing the results shall be returned to the circuit management section.

(c) Time management

To change the clocks to correct the system clocks and to compensate leap seconds.

(d) Management of system operating state

To manage messages printed out, alarm generation, and failures.

(e) Software management

To store the program list and to record whenever there is a change.

(f) Fault processing

To repair and restart in a system failure.

(g) Patrol monitoring

To patrol the system about once a day to confirm that message print out and clocks are normal.

Reference:

Maintenance structure in International Office.

The present maintenance structure in the international office is as follows:

Monday - Friday

0700 - 1300	1 (manager) + 1 (supervisor) + 2 (Tecnico) + 3 (assistants)
1300 - 1900	1 (manager) + 1 (supervisor) + 2 (Tecnico) + 3 (assistants)
1900 - 0700	1 (manager) + 2 (2 each Tecnico persons and assistants will be pooled and will attend alternately for this purpose)

Saturday/Sunday/Holiday

0700 - 1900	2 (assigned from weekday attendants)
1900 - 0700	2 (assigned from weekday attendants)

7. Training Program

7.1 Training for Local Offices

7.1.1 Training Policy

Emphasis will be placed on acquisition of the operating procedure and practice based on a premise that maintenance and operation of the local office additional equipment will be simplified. There will be a large number of trainees required to receive training. Training will be given to a group of 12 to 13 persons at a time and will be repeated until its completion.

It will be effective to have the trainees participate in in-plant tests at the local offices.

7.1.2 Proposal for Training

(1) The training items and required training hours shall be as follows:

(a)	ISD system and signaling systems	3 Hr
(b)	Outline of functions and operation of local office additional equipment	10
(c)	Procedure for operation and failure processing	8
(d)	Practice	7
	Total	28 Hr

(2) Number of trainees and training location shall be as follows:

About four training sessions in Asunción for about five trainees each from one local office. 12 to 13 trainees per training session are desirable.

7.2 Training for International Office

7.2.1 Training Policy

7.2.1.1 Exchange Equipment

The additional equipment basically does not differ greatly with the existing exchange. Training will be given about the outline of the exchange equipment including the equipment to be additionally installed. Participation to in-plant tests is desirable.

7.2.1.2 Computer Equipment

Emphasis of training will be placed on the outline of the computer equipment configuration and functions and failure recovery process with particular emphasis on operating practice, when training exchange maintenance crew.

Regarding the personnel in the computer equipment section, hardware and software specialists will be trained and brought up aimed at teaching technical knowledge of computer related equipment and at lessening dispatch of specialists and dependence on the supplier.

For this reason, a program will be made incorporating participation to computer basic courses offered by the supplier.

7.2.2 Proposal for Training

7.2.2.1 Exchange Equipment Maintenance Crew

(1) Training items and required training hours shall be as follows:

(a)	ISD system and signaling systems	3 Hr
(b)	Equipment to be newly installed Outline of functions and operation of revamped equipment	10
(c)	Outline of configuration and functions of computer equipment	15
(d)	Failure recovery process for computer equipment	4
(e)	Practice	10
	Total	42 Hr

(2) Number of trainees and training location shall be as follows:
Two training sessions in Asunción, each session accommodating about 12 persons.

7.2.2.2 Computer Equipment Personnel

The training items shall include the following items:

(a) Fundamentals of computer

(b) System configuration and functions

(c) System operation

(d) Interface equipment (including outline of exchange system)

(e) Central processor (hardware and software)

(f) System operation

(g) Failure recovery process

(h) Practice

The training will require about 24 weeks, and four trainees will be trained in the training facilities of the supplier and in Asunción.

8. Expenditure

A trial calculation of the expenditure estimated on the basis of the equipment plan and training program is as follows:

8.1 Equipment Cost (All Charges Included)

(1) Proposal to install additional equipment in all the local offices commensurate with their capacities and to install specially designed and manufactured computer equipment as a charging information process system. (Purchases in foreign currency only)

Table III-14 Equipment Cost - I

Item	Expenditure (¥)
1. Local Offices	
Additional Equipment	377,000,000
Works Material Cost	7,940,000
Works Cost	80,900,000
Subtotal	465,840,000
2. International Office	
Charging Information Process System	411,000,000
Cost of New Equipment	36,000,000
Cost of Additional Installation Equipment	127,300,000
Revamping Cost	5,040,000
Works Cost	26,500,000
Subtotal	605,840,000

Item	Expenditure (¥)
3. Training Expenditure	
Local Offices	3,600,000
International Office Exchange Equipment	3,800,000
International Office Computer Equipment	25,000,000
Subtotal	32,400,000
4. Contingencies*	51,790,000
Total	1,155,870,000

Note: Contingencies have been included to cover inflation for delays in payment time and for expenses that will be paid later. The following assumption was made regarding payment terms:

Materials	At time of contract	20%
	Upon shipment	70%
	At final delivery	10%
		(Expenditure to apply contingencies)
Works and Training	At time of contract	20%
	Payment on work performed	80% (Applicable to Section 1)

(2) Assuming that digital exchanges will be installed in some local offices, the local offices to install digital exchanges will not require additional equipment, and it will be possible to reduce the number of additional translator units for the first two years. (Refer to NOTE 1 in Section 5.2)

Furthermore, the trial calculation shown in Table III-15 is derived by assuming that the existing charging information process system will be utilized after revamping it.

Table III-15 Trial Calculation of Equipment Cost - II

Item	Expenditure (¥)
1. Local Offices	
Additional Equipment	343,000,000
Works Material Cost	7,260,000
Works Cost	73,860,000
Subtotal	424,120,000
2. International Office	
Charging Information Process System	300,000,000
New Equipment Cost	36,000,000
Additional Equipment Cost	127,300,000
Revamping Cost	5,040,000
Works Cost	26,500,000
Subtotal	494,840,000
3. Training Cost	32,400,000
4. Contingencies	44,800,000
Total	996,160,000

(3) A trial calculation shown in Table III-16 will be derived by reducing the truks, etc. to the level of the traffic forecasted until about 1987 under the conditions described in (2) above. If this proposal is adopted, installation of additional equipment will soon become necessary after this project is completed.
Considering the future trend of crossbar switch supplies in Japan at such a time, the cost is expected to be very high. This proposal will be extremely uneconomical from the standpoint of ANTELCO.

Table III-16 Trial Calculation of Equipment Cost - III

Item	Expenditure (¥)
1. Local Offices	424,120,000
2. International Office	
Charging Information	300,000,000
New Equipment Cost	33,000,000
Additional Equipment Cost	101,700,000
Revamping Cost	5,040,000
Works Cost	23,000,000
Subtotal	462,740,000
3. Training Cost	32,400,000
4. Contingencies	42,930,000
Total	962,190,000

8-2 Consulting Fee

If and when consulting services are to be offered in accordance with the proposal, which will be described later, in implementing the project, a trial calculation of the cost for such services will be as shown in Table III-17. Consulting services will be offered twice in six months.

Table III-7 Trial Calculation of Consulting Fee

Item	Expenditure (¥)
Personnel Cost (Senior Engineer, Class A)	13,680,000
General Management Fee	13,680,000
Technical Fee	5,480,000
Travel Expenses	1,600,000
Out-of-pocket Expenses (Per diems, communication expenses)	6,500,000
Total	40,940,000

Office expenses, etc. will be included in local business expenses (local currency portion).

8.3 Table III-18 shows a trial calculation of expenses to be paid in local currency.

Table III-18 Trial Calculation of Local Expenditure

Item	Expenditure (¥)
1. During Implementation of Project	
Personnel Cost	4,000,000
Transportation Expenses	1,050,000
Communication Expenses (Including Equipment and Subscription Charges)	1,800,000
Office Rental	1,000,000
Office Expenses	1,500,000
Training Classroom Rental	350,000
Contingencies	1,500,000
Subtotal	11,200,000
	(6,120,000 guarani)
2. During Period of Commissioned Maintenance	
Personnel Cost	1,200,000
Office Rent	1,200,000
Communication Expenses	360,000
Office Expenses	1,500,000
Contingencies	900,000
Subtotal	5,160,000
	(2,820,000 guarani)
Total	16,360,000
	(8,940,000 guarani)

8.4 Total Expenditure

A trial calculation of each item shown in Table III-19:

Table III-19 Tatal Expenditure Expenditure in Local Currency

(Unit: ¥)

Expense Item	Proposal for Equipment Cost (1)	Proposal for Equipment Cost (2)	Proposal for Equipment Cost (3)
Equipment Cost	1,155,870,000	996,160,000	962,190,000
Consulting Fee	40,940,000	40,140,000	40,140,000
Total Foreign Currency Expend-iture	1,196,810,000	1,037,100,000	1,003,130,000

Expenditure in Local Currency

Item	Expenditure (¥)
Local Business Expenses	13,610,000
	(7,437,000 guarani)
Training Classroom Rent	350,000
	(191,000 guarani)
Contingencies	2,400,000
	(1,312,000 guarani)
Total Domestic Currency	16,360,000
	(8,940,000 guarani)

9. Financial Analysis

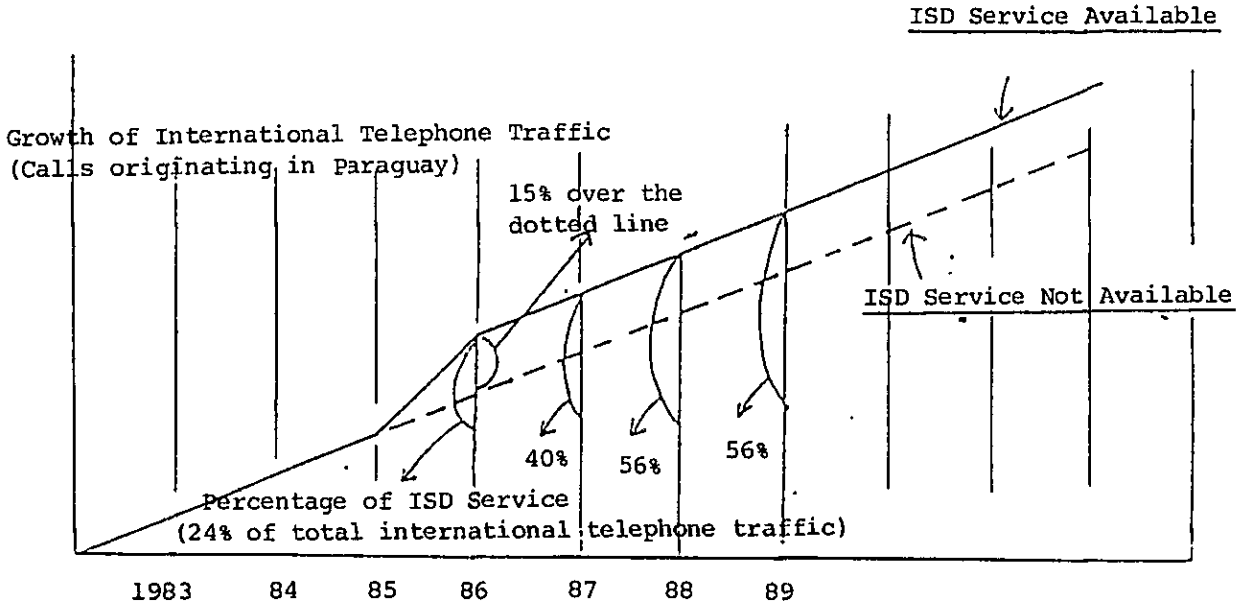
9-1 Business Income (Operating Revenue) from the Project

Assuming that ISD service begins at the end of 1984, total international telecommunications traffic after 1986 is estimated to increase by 15% compared with estimates of traffic without ISD service.

The percentage of ISD calls against total outgoing calls from Asuncion is estimated to ultimately reach 70%. Taking into consideration that outgoing calls from Asuncion account for 80% of the total international telephone traffic, Fig. III-8 shows the estimated percentage of ISD calls against total international telephone traffic.

1986	.....	24%
1987	.....	40%
After 1988	.....	56%

Fig. III-8 International Telephone Traffic



Therefore, the business income from the increased traffic attributable to ISD service after 1985 (equivalent to 15% of the traffic without ISD service) can be considered the business income from the project.

This income figure was arrived at by multiplying the said traffic increment (indicated in minutes) with the estimated per-minute revenue. The estimated per-minute value is found using the following method.

The annual sales of international telephone service as obtained from the data currently available (from the 1980 ANTELCO annual report) are divided by total annual chargeable minutes.

(₲ indicates Guarani)

Sales	₲1, 382, 669, 089, 37
Chargeable minutes	3, 283, 318, 00
Sales per minute	₲ 421, 00

The figure of ₲ 421 is obtained by taking into consideration such factors as the present rate structure and traffic distribution by destination . A similar figure can be obtained by calculating a weighted mean value after dividing the actual traffic by destination and applying respective charges to such traffic.

In using ₲ 421 as a factor in the calculation of the revenue of the project, the following assumptions are made:

- The current international telephone rate structure as well as telephone rates will remain unchanged in the years to come (this has been confirmed by ANTELCO). The international telephone rates are agreed upon on the basis of gold francs with other countries. Paraguay has established its rate by multiplying its gold franc(₲ exchange rate GF 1.00 = ₲ 53.00) with this agreed amount. This rate is linked with the US$/₲ exchange rate and has not changed for the past ten years or longer. No significant change is anticipated for the future.)
- The distribution of traffic by destination will not change radically in the future.

- Simultaneous with the introduction of the ISD Service, ISD calls will be charged per minute. The basic person-to-person call fees will be increased from the amount equivalent to the fee for one minute to that for two minutes. The decrease in income due to the transfer of operator-assisted calls to ISD calls will be offset by the increase in income resulting from these higher basic person-to-person call fees. There will not therefore be a significant change in the total income even though the relative proportion for each type of telephone call may undergo a change.

Table III-20 shows the forecasts for the traffic increase attributed to the ISD service and for the income derived from the traffic increase, calculated on the basis of the method described above.

Table III-20 ISD Income Forecast

	1985	86	87	88	89	90	91	92	93	94
Traffic Increase Attributed to the ISD Service (10^3 min)	0	862	971	1073	1188	1299	1414	1536	1663	1796
Income Derived from Traffic Increase (10^6 ¢)	0	363	409	452	500	567	592	647	700	756

95	96	97	98	99	2000	2001	2002
1934	2078	2227	2382	2542	2708	2880	3057
814	875	938	1003	1070	1140	1212	1287

9.2 Expenditure on the Project

9.2.1 Works Costs (Costs of Plant and Equipment)

The cost of plant and equipment for this project is shown in Table III-21. (Trial calculation based on the idea included in Equipment Cost, Paragraph 1)

Table III-21 Expenditure Plan

Year	Expenditure (¥)	Guarani (₲) Equivalent
1983	241,290,000	131,852,459
84	781,010,000	426,781,421
85	25,920,000	14,163,934
86	148,590,000	81,196,721
Total	1,196,810,000	653,994,535

9.2.2 Maintenance and Operating Cost

The following comments may be made regarding the maintenance and operating cost for the increase in traffic brought about by the introduction of the ISD service.

Maintenance cost:

As described in paragraph 6 - Maintenance Structure and Personnel Plan -, the recruitment of the maintenance personnel for the ISD service system will be required only by the computer charging system section (four persons).

In the other sections, namely, local offices, trunk exchanges, and international switch section, no personnel increase will be required as a result of the introduction of the ISD service. Therefore the maintenance cost comprises expenditures in the computer section (maintenance and operation cost):

1986 ..... ¥35,250,000* = ₲19.3 x 10^6

*In Japan, the normal cost for a computer system in a company is ¥30 million a year. However, considering Paraguay's domestic situation, the cost was estimated at a level of 2/3 of the cost in Japan. The expenditure after 1986 includes an increment due to Paraguay's annual inflation rate of 12%.

Operation Cost:

It is safe to conclude that the operating cost (primarily personnel cost) to meet the increased traffic attributed to the ISD service in the international telephone office may be offset more or less by the savings in personnel costs accompanied by the introduction of the ISD service, as described below.

At present, an average ANTELCO telephone operator earns ₲25,000.-a month. Based on an annual income which includes one month's bonus, the Salary is ₲325,000 a year. In 1986, the number of operators could be reduced by 40 persons as a result of the introduction of the ISD system compared with the number of operators that would be required without the ISD service.

Supposing that the annual rate of wage increase is 15%, earning ¢653,691 a year in 1986, which means that ¢26 x 10^6 (¢653,691 x 40) can be saved in personnel costs for 40 operators.

According to the data in 1980 the operating expenses (primarily personnel costs) of the international telephone office were ¢93,175,330.00 as against the gross income of ¢1,387,688,550.63. In other words, the operating expenses represented 6.7% of the income. The calculation of these operating expenses for 1986 may be made on the assumption that the number of operators will remain the same as that without the ISD service.

In 1986, an income of G2782 x 10^6 (6608 x 10^3 minutes x ¢421) can be expected from the international telephone service. 6.7% of this amount is ¢186 x 10^6. If the portion corresponding to the traffic increase derived from the ISD service (x0.15/1.15) is separated from the said amount, ¢24 x 10^6 will be gained. This additional expense can be offset by the above-mentioned saving in personnel costs amounting to ¢26 x 10^6.

The same rule is applicable to calculations after 1987.

9-2-3 Working Capital

30% of the income increment over the previous year is put aside as a reserve for uncollectable accounts or current assets. The aggregate sum of such a reserve may be added to the income in the final year of the project.

Project Recommendations

In the announcement of an international competitive bid for the project, a broad range of prospective tenders should be invited in order to include the rise in value of existing equipment. Competent consulting firms should be approached for the preparation of tender specifications, the evaluation of tenders, supervising of the work and testing.

The space for installing additional equipment at each local station should be prepared by ANTELCO within the scope of the telephone extension work in the period 1982 to 1987.

Free and unconditional access to the ISD service and the introduction of the ISD service without the need to change the subscriber's number should be put into practice flexibly, taking into account the economics of the system.

9-3 Internal Rate of Return (IFRR)

Calculating the internal rate of return (IFRR) for this project based on the income and expenditure described above, a level of 41.63% is derived as shown in Table III-22. The project life is assumed to be 20 years from 1983 when the ISD service starts operation.

Table III-22 Table III-22 Internal Rate of Return Calculation Table

(Unit: Million guranis)

	Revenue	Expenditure				
	Business Income	Installation Cost	Maintenance and Operating Cost	Working Capital	Total	Business Income-Cost
1983		135			135	- 135
84		438			438	- 438
85	0	14	17		31	- 31
86	363	83	19	109	211	152
87	409		22	14	36	373
88	452		24	13	37	415
89	500		27	14	41	459
90	567		30	20	50	517
91	595		34	8	42	553
92	647		38	17	55	592
93	700		43	16	59	641
94	756		48	17	65	691
95	814		54	17	71	743
96	875		60	18	78	797
97	938		67	19	86	852
98	1003		75	20	95	908
99	1070		84	20	104	966
2000	1140		94	21	115	1025
01	1212		105	22	127	1085
02	1287		118	23	141	1146
03	1364		132	23	155	1209
04	1446		148	25	173	1709

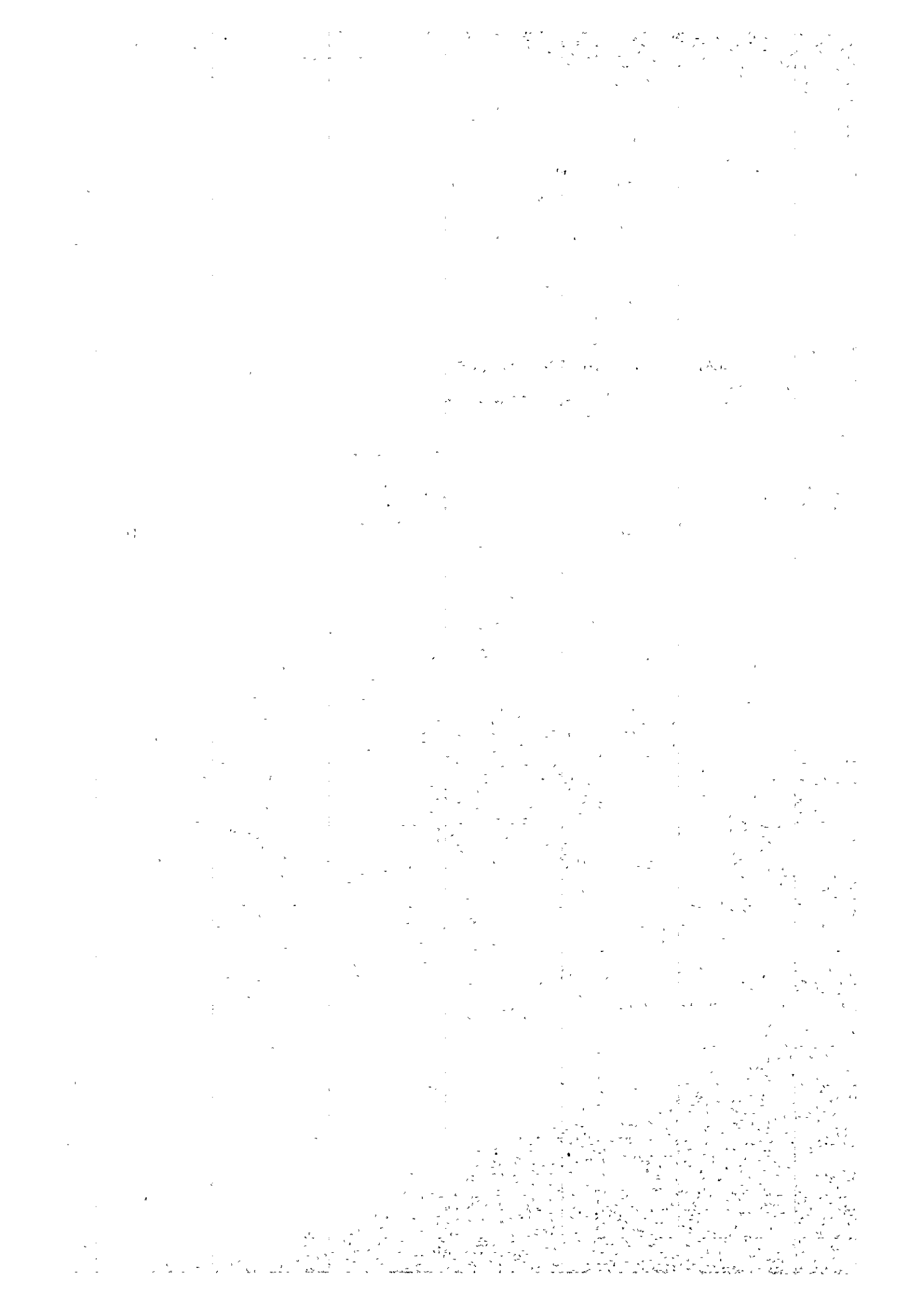
IFRR: 41.63%

Proposals for Implementation of this Project

The ISD service will be charged per minute. In order to provide incentives for the utilization of ISD services at the initial stages of its introduction, the charges for the person-to-person call for the first three minutes will be changed from the charge for three minutes plus one minute (basic person-to-person change) to the charge for three minutes plus two minutes (basic person-to-person charge).

Argentina now presents a difficult telephone call situation and the connection of calls to that country tend to be time-consuming and bothersome. ANTELCO should make a detailed study of the situation in Argentina, explain the project fully to ENTEL of Argentina and solicit their cooperation, with a view to ensuring the improvement of telephone situation in Argentina by the end of 1985 when the ISD service is introduced.

CHAPTER IV. DIGITAL TELEPHONE SWITCHING SYSTEM INTRODUCTION PROJECT



CHAPTER IV. DIGITAL TELEPHONE SWITCHING SYSTEM INTRODUCTION PROJECT

1. Present Status of Telephone Service

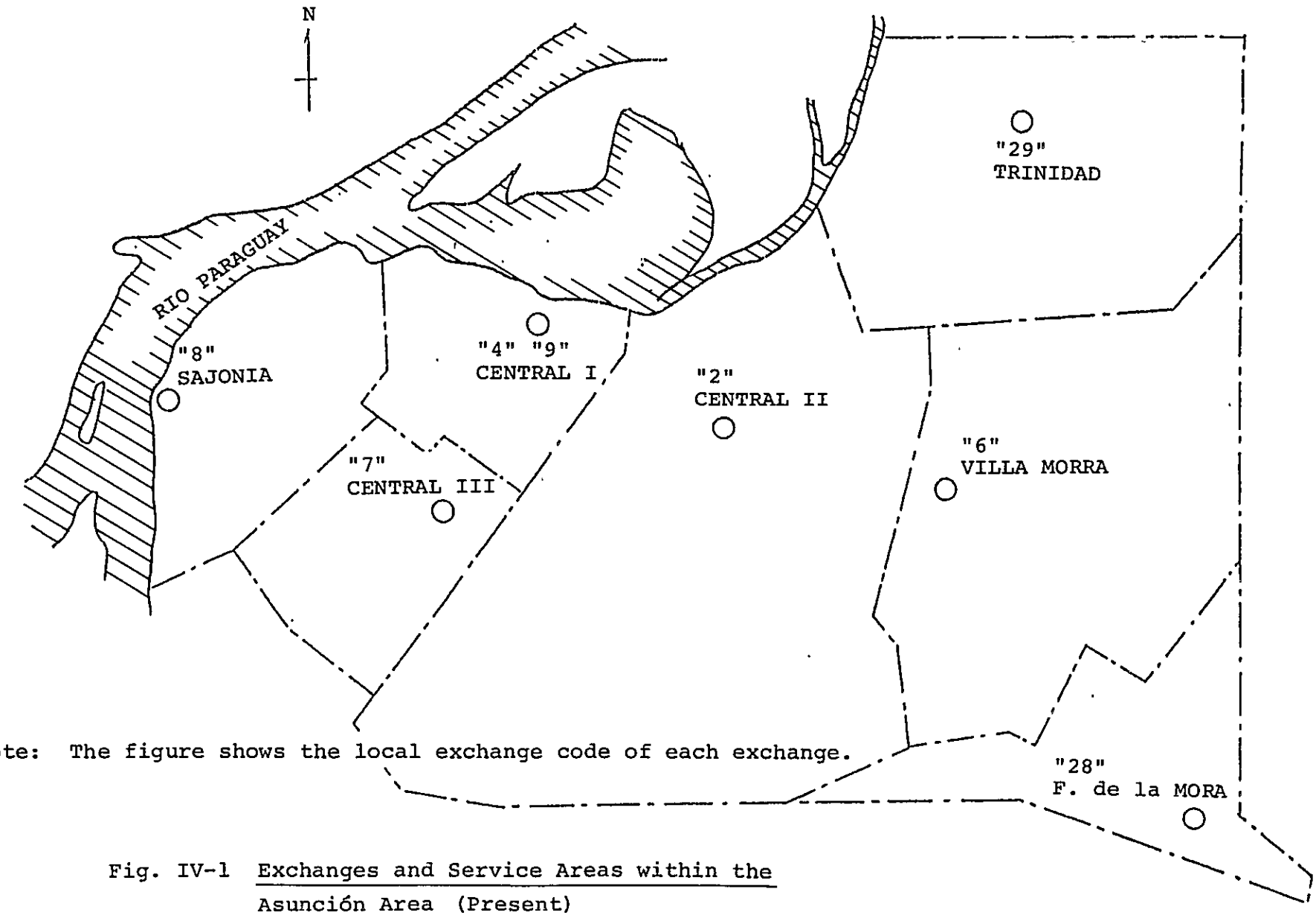
The number of subscriber lines in the Asunción area is 37,829 which is 76.4% of all subscriber lines in Paraguay. Accordingly, the telephone density per 100 inhabitants in the Asunción area is 5.84, which is higher than in the telephone density in whole country. The Asunción area now has 7 local exchanges and 8 switching units, all of which are step-by-step type (HDW and EMD switching equipments). The local exchange code is 1 or 2 digits, and the subscriber number is either 5 or 6 digits including the local exchange code. The location and service area of local exchanges are shown in Figure IV-1, and the capacity of switching equipments and the number of subscriber lines in each exchange in Table IV-1.

The junction cables between exchanges within the Asunción area are laid through the CENTRAL-II and form what is called a star type network, as shown in Figure IV-2. The local trunk lines between switching equipments compose what is called a mesh type network.

The local switching equipment is insufficient to meet the demands for telephone service, and the number of subscriber lines is also inadequate. For these reason, if all the pairs in a multi-pair cable concerned are used, a rubber-coated wire is used to connect to a nearby cable containing surplus conductors.

Such a makeshift measure has many problems such as failure of the rubber-coated wire. Since the switching equipment having local exchange code "4" in the CENTRAL-I which covers the commercial area and has a large service demands is old type equipment (HDW switching equipment), more troubles occur than in the switching equipment of other exchanges, thus reducing the service quality. Moreover, it is difficult to expand the services in the case of the HDW and EMD switching equipments.

As for the toll switching system, an EMD-type toll switching equipment is installed in the CENTRAL-II. At present, toll traffic occurs more frequently between the Asunción area and remote cities than between remote cities. The toll trunk network is star type network centralized in the toll switching equipment installed in the CENTRAL-II. That is, the toll switching equipment has direct trunks to local automatic switching equipments throughout the country, and every toll call is connected through this switching equipment. However, to economize trunk network, it is planned in the subsequent expansion of the telephone service, to install two additional toll switching equipments in Coronel Oviedo and Encarnación by the end of 1987, and to divide the whole country into three districts.



Note: The figure shows the local exchange code of each exchange.

Fig. IV-1 Exchanges and Service Areas within the Asunción Area (Present)

Table IV-1 Capacity of Switching Equipment and Number of Subscribers

Telephone Exchange	Exchange Code	Capacity of Switching Equipment	Number of Subscriber Lines	Switching System
CENTRAL II	2	14,000	11,382	EMD
CENTRAL I	4	8,000	6,225	HDW
	9	5,000	4,462	EMD
F. de la MORA	28	1,800	1,797	EMD
VILLA MORRA	6	6,800	6,056	EMD
CENTRAL III	7	3,000	2,332	EMD
SAJONIA	8	3,600	3,485	EMD
TRINIDAD	29	2,060	1,930	EMD
TOTAL	—	44,260	37,669	—

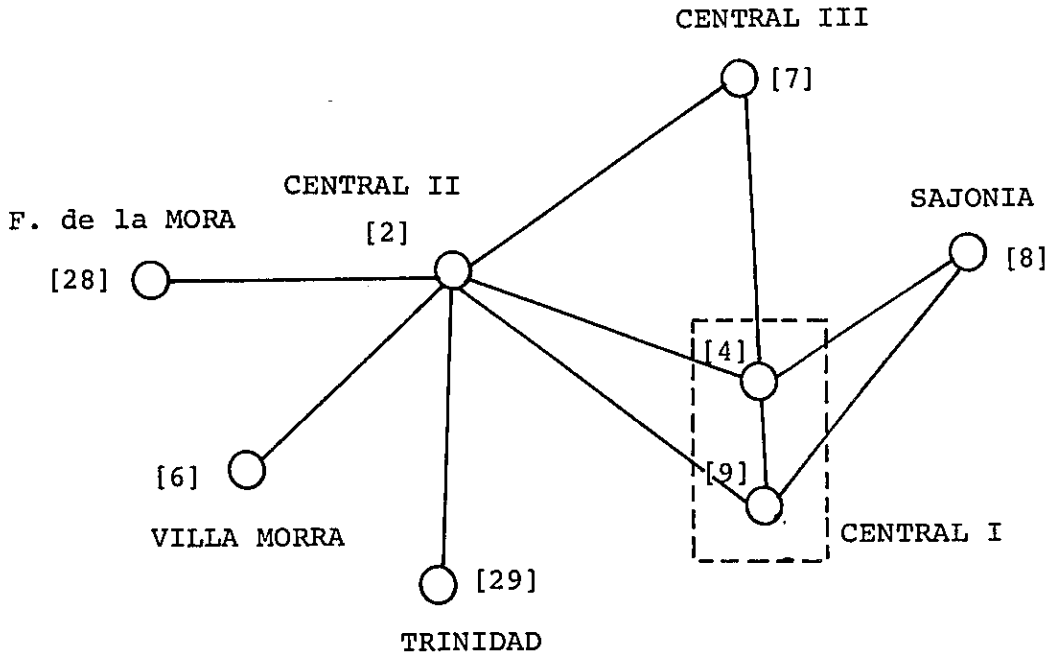


Fig. IV-2 Junction Cable in the Asunción Area

2. Current Expansion Project

The present status of facilities in the telephone exchanges within the Asunción area, and in the exchanges (automatic exchanges) throughout the whole nation except the Asunción area, the existing expansion project, telephone density (the number of subscriber lines per 100 inhabitants) and the service area after the implementation of the expansion project are shown in Table IV-2, IV-3, and IV-4, and Figure IV-3, respectively.

Table IV-2 Present Status of Facilities and Current Expansion Project for the Asunción Area

Item \ Expansion project		End of 1980	3rd expansion project (up to the end of 1982)	4th expansion project (from 1983 to the end of 1987)
Expansion project	Number of newly established exchanges	-	1	3
	Number of newly installed subscriber lines	-	11,000 (12,800)	33,800
Number of exchanges		7	8	11
Equipment capacity		44,260	55,260	89,060

Note: The number in parentheses includes the number of transfered lines.

Table IV-3 Present Status of Facilities and Current Expansion Projects for Rural Automatic Exchanges

Item \ Expansion project		End of 1980	3rd expansion project (up to the end of 1982)	4th expansion project (from 1983 to the end of 1987)
Expansion project	Number of newly established exchanges	-	17	2
	Number of newly installed subscriber lines	-	8,000	14,900
Number of exchanges		36	53	55
Equipment capacity		13,790	21,790	36,690

Table IV-4 Telephone Density per 100 Inhabitants

District \ Period	End of 1980	3rd expansion project (end of 1982)	4th expansion project (end of 1987)
Asunción area	5.84	8.01	11.04
Rural area	0.46	0.81	1.19
Whole country	1.56	2.29	3.22

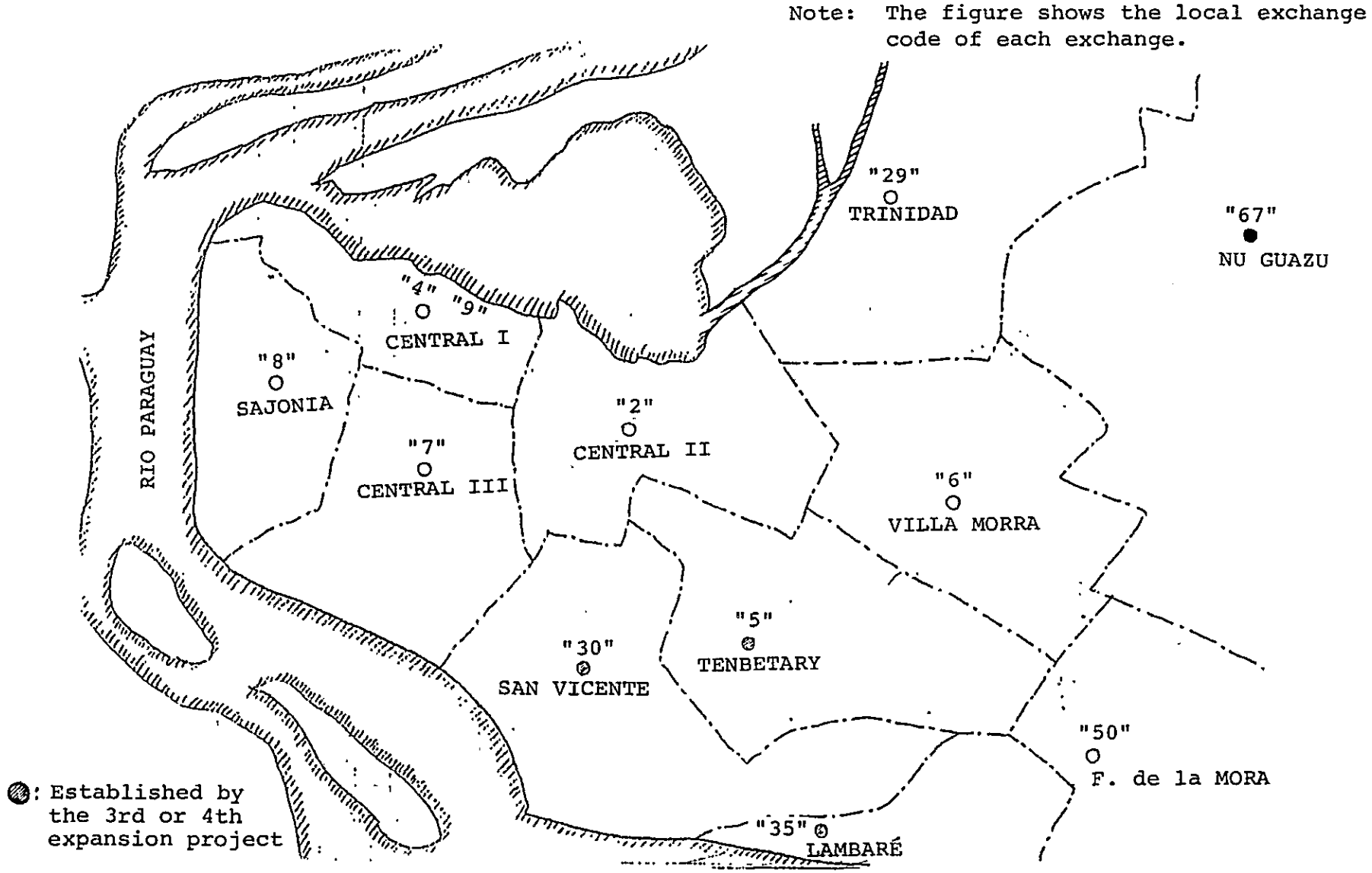


Fig. IV-3 Service Areas of Telephone Exchanges in the Asunción Area (after the Implementation of the 4th Expansion Project)

3. Basic Policy of the Project

The basic policy for introducing the digital telephone switching system to the Asunción area is as follows.

(1) The digital telephone switching equipments are to be installed so that the existing telephone network in the Asunción area may be readily changed to a digital telephone network in the future.

(2) Since the expansion project up to the end of 1987 has been prepared by ANTELCO, this project is to cover the expansion from 1988 to 1990.

(3) The telephone equipment installation plan for the Asunción area is to be prepared so that telephone density in Paraguay will be close to the world average (4.45 lines per 100 inhabitants in 1990) in view of the PIB (Producto Interno Bruto per Capita).

(4) ANTELCO's policy not to purchase EMD switching equipments for the expansion in the Asunción area from 1988 is to be respected.

(5) The installation plan of toll switching equipment is to be excluded from this project because the existing equipment is expected to cover the traffic demands up to 1990, and the capacity of the existing equipment is so large that diversion plan of it cannot be implemented when it is replaced by a digital telephone switching equipment.

(6) With regard to the junction cables between exchanges within the area, only outgoing and incoming trunks of the digital telephone exchanges are to be covered.

(7) For the junction cables between the digital telephone exchanges, digital transmission lines including an optical fiber cable system are to be installed.

(8) The existing system is adequate for the expansion of subscriber line.

4. Basic Data

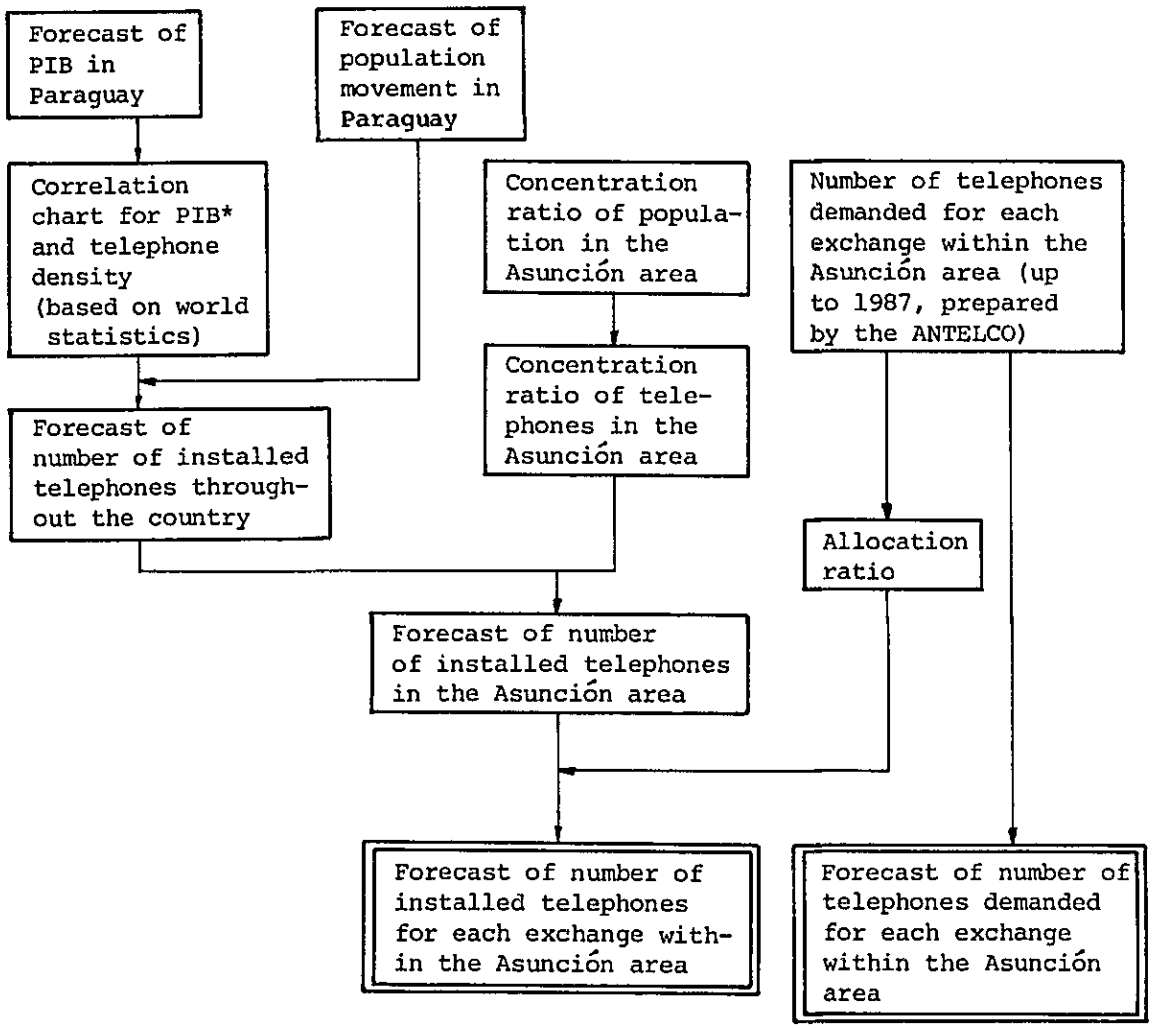
4-1 Telephone Demand Forecast

4-1-1 Forecast of Number of Telephones Demanded

The number of telephones demanded up to 1990 for each exchange is forecasted on the basis of the number of telephones demanded for each exchange up to 1987 within the Asunción area, prepared by ANTELCO.

4-1-2 Forecast of Number of Installed Telephones

The number of installed telephones for each exchange within the Asunción area is forecasted through the procedure shown in Fig. IV-4 on the basis of the basic policy of the project.



* PIB: Producto Interno Bruto per Capita

Fig. IV-4 Flow Chart of Forecasting Procedure for Number of Telephones Demanded and Installed

4-2 Traffic Forecast

Traffic, particularly the calling rate (CR: Traffic per subscriber) for each exchange and the busy hour traffic between switching units (call section), which are to be the basis for estimating the telephone switching equipment, trunk lines, and other installations, are forecasted through the procedure shown in Figure IV-5.

(*1) The basic traffic refers to the traffic during the month or year serving as a reference for forecast. The design values for the 3rd project (to be completed in 1982) now in progress are used here.

(*2) The traffic growth rate used here is that for 1974 - 1978.

(*3) The unit relation (UR) is defined as a combination of originating and terminating telephone sets.

$$\text{Total UR number between switching units} = \left(\begin{array}{l}\text{Total number of subscriber}\\ \text{lines in originating switch-}\\ \text{ing unit}\end{array}\right) \times \left(\begin{array}{l}\text{Total number of subscriber}\\ \text{lines in terminating switch-}\\ \text{ing unit}\end{array}\right)$$

$$\text{Calling rate between switching units (CR)} = \frac{\text{Busy hour traffic (BHT) in call section}}{\text{Total number of UR}}$$

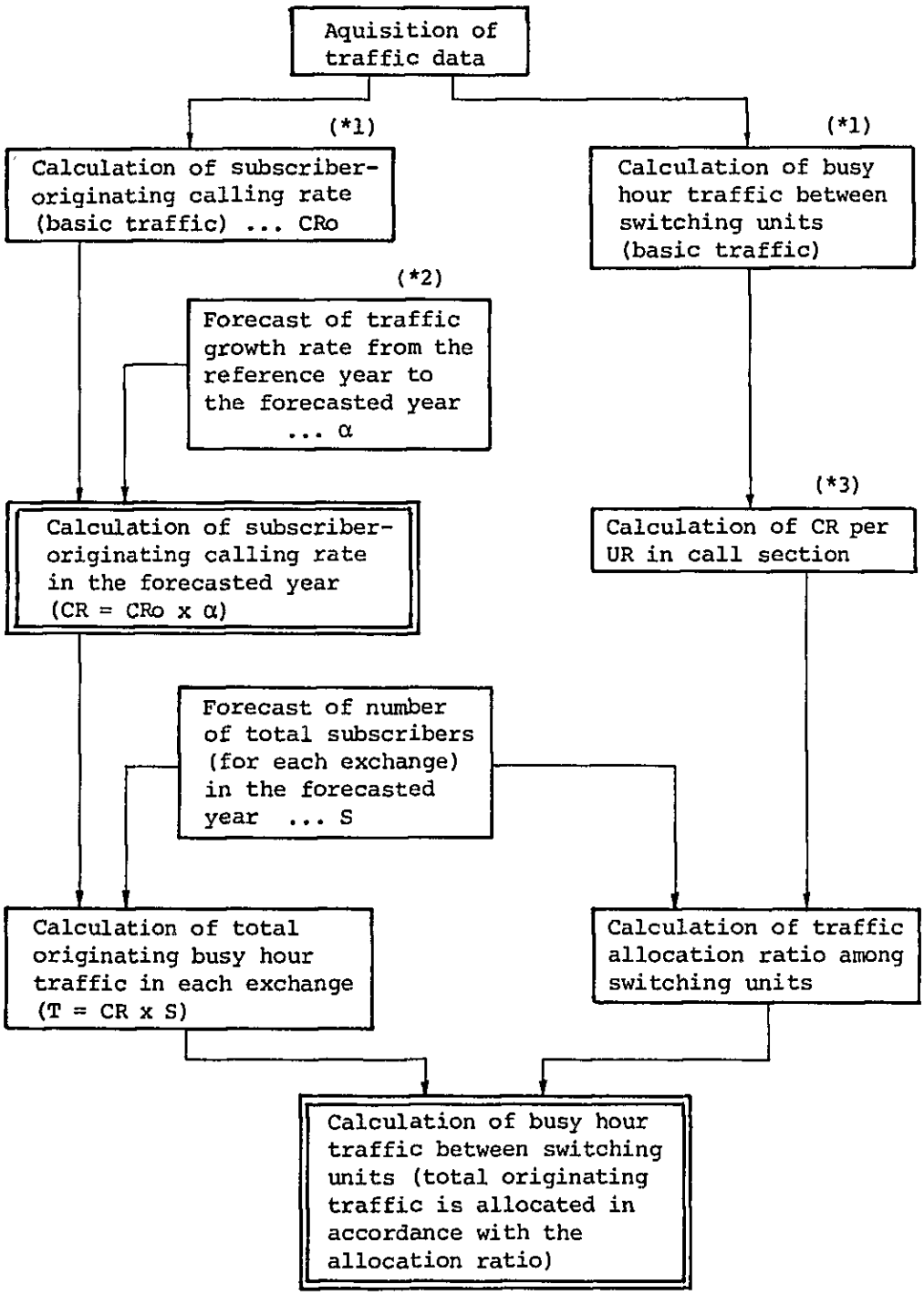


Fig. IV-5 Flow Chart of Forecasting Procedure for Telephone Traffic

5. Forecasted Telephone Demanded

The results of calculation for the number of telephones demanded and the number of installed telephones in accordance with the procedures shown in Figure IV-4 are given in Table IV-5.

Table IV-5 Number of Telephones Demanded and Number of Installed Telephones for each Exchange in the Asunción Area

Exchange name \ Year		1987	1988	1989	1990
CENTRAL II	D	29,520	33,123	36,263	39,700
	I	20,585	22,618	24,702	26,961
CENTRAL 30	D	12,389	14,687	16,878	19,397
	I	8,592	9,821	11,149	12,815
CENTRAL I	D	30,659	34,109	37,192	40,555
	I	21,212	23,213	25,248	27,444
CENTRAL 50	D	7,123	7,907	8,799	9,793
	I	4,923	5,456	6,012	6,650
CENTRAL 6	D	15,772	17,591	19,482	21,576
	I	11,009	12,202	13,444	14,871
CENTRAL 7	D	5,220	5,771	6,348	6,982
	I	3,670	4,067	4,481	4,957
CENTRAL 8	D	8,421	9,259	10,255	11,357
	I	5,818	6,448	7,105	7,859
CENTRAL 29	D	5,095	5,603	6,216	6,896
	I	3,580	3,968	4,372	4,836
CENTRAL 5	D	5,278	5,932	6,694	7,554
	I	3,670	4,067	4,481	4,957
CENTRAL 35	D	3,791	4,794	5,896	7,252
	I	2,775	3,274	3,826	4,594
CENTRAL 67	D	5,263	5,941	6,705	7,567
	I	3,670	4,067	4,481	4,957
Asunción area Total	D	128,531	144,433	160,003	177,251
	I	89,500	99,200	109,300	120,900

Remarks: D and I in the table have the following meaning :

D: Number of telephones demanded

I: Number of installed telephones

6. Forecasted Traffic

The subscriber calling rate in each exchange and the busy hour traffic between switching units, as of 1990, forecasted through the procedures described in IV-4-2 are given in Table IV-6 and Table IV-7, respectively.

Table IV-6 Subscriber-originating Calling Rate

Unit: Erlang (Erl)

Exchange	Originating Calling Rate
CENTRAL II	0.068
CENTRAL 29	0.053
CENTRAL 30	0.053
CENTRAL 35	0.043
CENTRAL I "4", "9"	0.072
CENTRAL 5	0.055
CENTRAL 50	0.045
CENTRAL 6	0.049
CENTRAL 67	0.040
CENTRAL 7	0.048
CENTRAL 8	0.048

Table IV-7 Busy Hour Traffic between Exchanges

Unit: Erlang (Erl)

Originating exchange code \ Terminating exchange code	Capacity	2	29	30	35	4,9	5	50	6	67	7	8	"0"	TOTAL
	Capacity	27,000	4,900	13,200	4,600	27,600	5,000	8,500	15,100	5,000	5,000	7,900	-	
2	27,000	487.78	59.13	171.07	39.05	491.83	59.40	81.17	172.98	40.37	55.76	82.97	94.50	1836.01
29	4,900	59.13	13.29	25.87	6.76	57.79	9.85	11.28	33.41	7.90	8.86	11.99	15.68	261.81
30	13,200	171.09	25.87	87.60	29.11	179.91	24.32	31.31	50.59	16.5	16.98	28.65	42.24	704.17
35	4,600	39.05	6.76	29.11	11.21	45.21	7.59	12.90	13.89	4.37	5.50	9.05	13.80	198.44
4,9	27,600	491.83	57.79	179.91	45.21	562.38	64.87	83.55	174.14	43.90	65.53	107.67	110.4	1987.18
5	5,000	59.40	9.85	24.32	7.59	64.87	15.73	17.85	30.28	7.35	8.35	13.43	16.00	275.02
50	8,500	81.17	11.28	31.31	12.90	83.55	17.85	38.29	38.51	11.68	10.81	17.72	27.20	382.27
6	15,100	172.98	33.41	50.59	13.89	174.14	30.28	38.51	106.04	30.2	20.34	28.16	49.83	748.37
67	5,000	40.37	7.90	16.5	4.37	43.90	7.35	11.68	30.2	12.5	5.14	8.65	15.00	203.56
7	5,000	55.76	8.86	16.98	5.50	65.53	8.35	10.81	20.34	5.14	13.41	13.26	16.00	239.94
8	7,900	82.97	11.99	28.65	9.05	107.67	13.43	17.72	28.16	8.65	13.26	33.08	25.28	379.91
"0"	-	94.50	15.68	42.24	13.80	110.4	16.00	27.20	49.83	15.00	16.00	25.28	-	-
Total		1836.01	261.81	704.17	198.44	1987.18	275.02	382.27	748.37	203.56	239.94	379.91	-	-

7. Selection of Object Exchange

In introducing the digital telephone switching system into the Asunción area, proper selection of the exchanges according to the basic policy of ANTELCO aiming at gradual replacement of the existing HDW and EMD switching equipments with digital telephone switching equipments is the most important factor which determines success or failure of the project.

On the basis of the above recognition; in Paraguay for about two mounths, the feasibility study team made the project plan through repeated discussions with the counterparts as well as technical and economic study of the intention heard from ANTELCO and field survey result.

The survey team established the basic policy to adopt digital telephone switching equipment at either the CENTRAL-I whose service area covers the commercial area and government and public office areas or at the CENTRAL-II equipped with the toll switching equipment which is the gateway office in the network configuration.

Especially, the CENTRAL-I "4" is a very old HDW switching equipment but accommodating important subscribers. Thus, it was also planned to replace with a digital telephone switching equipment.

Replacement of the CENTRAL-I "4" with the digital telephone switching equipment was also suggested to ANTELCO. As regards selection between the CENTRAL-I and CENTRAL-II for replacement with the digital telephone switching equipment, the final conclusion was to be reported from ANTELCO after

returning of the study team to Japan.

However, ANTELCO later proposed the following modifications: A digital telephone switching equipment will be introduced to the CENTRAL-I. New subscriber lines and all subscriber lines of the "9" EMD switching equipment will be accommodated in it.

The "4" HDW switching equipment will be overhauled in the early stage of the 4th expansion project and will be used for another 10 years.

The CENTRAL "30" shall be replaced with a digital telephone switching equipment to accommodate new subscriber lines and all subscriber lines accommodated in the EMD switching equipment.

The EMD switching equipments used as the CENTRAL-I "9" and CENTRAL "30" will be reused when EMD switching equipments in other exchanges in the Asunción area are expanded.

Taking the ANTELCO's afore-mentioned proposal, the study team has prepared the report.

8. Equipment Installation Plan

8-1 Planning Policy

The planning policy for introducing the digital telephone switching system to the Asunción area is described below.

8-1-1 Switching Equipment

As a rule, no EMD switching equipment to be purchased for the expansion of local switching equipments in the Asunción area from 1988. The expansion plan is as follows:

(1) The exchanges in which digital switching equipments are to be installed are selected in consideration of maintenance and operation.

(2) EMD switching equipments are to be removed from the exchanges in which digital telephone switching equipments are to be installed, and reused for other exchanges.

(3) Since the CENTRAL-I "4" has been planned to be used for ten years after overhauling it in the early stage of the 4th expansion project, replacement with a digital telephone switching equipment shall not be carried out in this project.

(4) The toll switching equipment is not covered by this project for the reasons described in IV-3-(5).

On the basis of the above planning policy, the following project plan is proposed for this project.

Project plan: The CENTRAL-I "9" and CENTRAL "30" EMD switching equipments shall be replaced with digital telephone switching equipments and the nubmers of terminals shall be expanded by digital switching equipments.

8-1-2 Power Supply Equipment

(1) The working power supply for the telecommunication equipment to be installed is derived from commercial power lines, and a storage battery is to be used as a standby power supply.

(2) For large exchange, diesel engine generator is to be installed as standby power supply equipment during failure of the commercial power supply; and for smaller exchange, mobile generator is to be used.

(3) The self-holding time of the storage battery is 1 hour for exchange where the diesel engine generator is installed; and 4 hours for exchange where no engine generator is installed, in consideration of time required for dispatching a mobile generator.

8-1-3 Telephone Sets

Telephone sets equal to the number of expanded terminals of the switching equipment are to be acquired.

8-1-4 Subscriber Lines

Subscriber lines are to be installed as described below with emphasis placed on the improvement of aerial lines.

(1) Subscriber network configuration

A wiring scheme using a cross connection box is to be adopted.

(2) Types of subscriber lines and application criteria

The line from a exchange to a cross connection box is the primary cable, and that from a cross connection box to a terminal box is the secondary cable.

(3) Installation quantity

1) Primary cable

For the exchange where the switching terminals are to be expanded, the line expansion should be 130% of terminal expansion 3 years after the commencement of service (1990).

2) Secondary cable

For the exchange where the switching terminals are to be expanded, the total demands 15 years after commencing the service (2002) are to be fulfilled.

(4) DC resistance limit and loss distribution of subscriber line

1) The DC resistance limit have to be 1,300 Ω.

2) The loss distribution have to be 8.7 dB.

8-1-5 Transmission Lines

The transmission line equipment is to be installed as described below on the basis of the basic policy for digital telephone switching system introduction.

(1) The optical fiber cable system is to be adopted for local trunk line between digital switching equipments. There are two kinds of digital transmission systems connecting to digital switching equipment: Optical fiber cable and PCM. For the exchange layout within the Asunción area, the optical fiber cable system requires no repeater in most sections. In contrast to the PCM system which requires repeaters for every 2 km, the optical fiber cable is characterized by easy maintenance and lack of restrictions with respect to electrical characteristics which are inevitable with conventional metallic cables. After considering all these factors, the optical fiber cable system has been selected. The following points are to be taken into consideration in adopting the optical fiber system.

1) In consideration of transmission line increase, the 34 Mb/s system (480 ch) is to be adopted.

2) To avoid overall service interruption in the event of failure, the in-route standby changeover system with a system switching unit is to be adopted.

(2) For the local trunk line connecting a digital switching equipment and an EMD switching equipment, a conventional metallic cable is to be adopted as in the conventional system. The system shall consist of the circuit with three conductors, characterized by relatively simple construction. The accommodation capacity shall be 60%.

(3) The loss distribution have to be 4.5 dB.

8-2 Facilities Plan

The number of equipments calculated on the basis of the planning policy is given in Table IV-8.

Table IV-8 Number of Equipments

Item \ Plan			Contents	Remarks
Switching equipment	Digital telephone switching equipment		2 units	CENTRAL I"9" CENTRAL 30
	Expansion capacity		11,000 lines	
	Transferred lines		21,800 lines	
Power supply equipment	Battery, Rectifier, etc.		2 sets	
	Engine generator		2 units	One is a mobile type
Number of telephone sets			11,000 sets	
Subscriber lines	Primary cable		19.7 Km	Converted to 1,000 P
	Secondary cable		127.1 Km	Converted to 100 P
Transmission line	Optical fiber cable	8 M b/s	—	—
		34 M b/s	2 SYS (1)	Number of section in ( )
	Conventional metallic cable		4,397 circuits (11)	Number of sections in ( )

9. Maintenance, Operation, and Personnel Training

Of the telecommunication equipments to be installed in this project, outside plant (subscriber cable and conventional metallic junction cable), which are constructed with conventional techniques, can be maintained through extension of the existing maintenance system. The maintenance of digital telephone switching system and the optical fiber cable system, which are constructed with innovative techniques, require engineers and technicians who have been trained for the new technology. The number of required engineers who have adequately mastered the basics of the system and technicians who are capable of conducting regular tests, repair of simple faults, and so on, is given in Table IV-9.

Table IV-9 Number of Maintenance Personnel

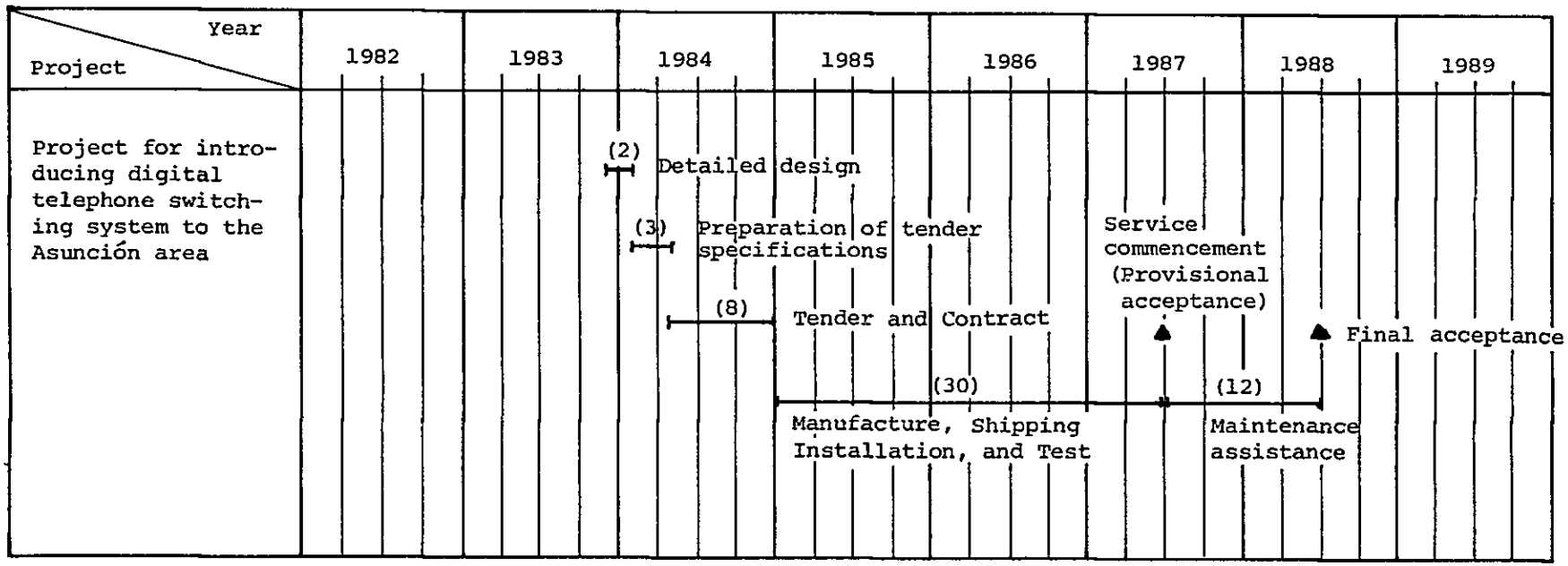
Personnel class / Telephone exchange	Switching division		Transmission division	
	Engineer	Technician	Engineer	Technician
CENTRAL I "9"	2	5	1	3
CENTRAL 30	2	5	1	3
TOTAL	4	10	2	6

10. Project Execution Plan

10-1 Implementation Plan

This project concerns the telephone installation plan for 1988 - 1990. To ensure the smooth installation of telephones after 1988, it is necessary that the facilities are ready for service by the middle of 1987. The schedule for executing this project is shown in Table IV-10.

Table IV-10 Implementation Schedule



10-2 Project Execution Management

This project concerns the first introduction of the digital telephone switching system to Paraguay. In contrast to the existing system, this system involves a number of innovative technologies, and the installation procedures are entirely different from those for the conventional system. Accordingly, consultants should be employed for detailed design, preparation of tender specifications, tender evaluation, work supervision and acceptance tests.

11. Project Cost

11-1 Condition of Cost Estimation

The cost for executing the project is to be calculated as described below.

(1) Facilities for the project shall be constructed on a turn-key base contract.

(2) Consultants shall be employed for detailed design, preparation of tender specifications, tender evaluation, work supervision, and acceptance tests.

(3) The contingency is to be 5% of the total cost.

(4) Two years supply of spare parts shall be provided.

(5) The work to be executed by foreign currency and local currency is as follows:

1) Work to be executed by foreign currency

Switching equipment

Transmission equipment

Power supply equipment

Local cable facilities

Telephone sets

Air-conditioning equipment

Training costs

Consultant fee

2) Work to be executed by local currency

Subscriber equipments (except for telephone sets)

Telephone poles

Manholes and conduits lines

(6) In calculating the installation work cost, it is assumed that the work contract shall be made at the end of 1984, and that the annual price rise rate shall be 6% for the foreign currency and 12% for the local currency with respect to price levels as of October 1981.

11-2 Project Cost

The results of calculating the project cost are given in Table IV-11.

Table IV-11 Project Cost

Foreign currency: Million yen
Local currency : Million guaranies

Item \ Currency classification		Foreign currency	Local currency	Remarks
Installation cost	Materials cost	4,697.2	65.4	
	Work cost	1,216.5	737.0	
Training cost		75.6	0	
Maintenance assistance cost		110.9	0	
Consultant fee		300.4	0	
Sub-total		6,400.6	802.4	
Contingency		320.0	40.2	Sub-total x 0.05
TOTAL		6,720.6	842.6	

12. Revenue Forecast

The revenue has been forecasted on assumption that the tariff system of the digital telephone switching system is the same as the current tariff system.

(1) Installation charge: 130,000 guaranies

(2) Rental charge : 1,600 guaranies/month

(3) Call tariff : Only charged to the excess portion above 90 calls per month.

12-1 Number of Chargeable Subscribers

The number of chargeable subscribers as a result of this project is as shown in Table IV-12.

Table IV-12 Number of Chargeable Subscribers as a Result of this Project

Rate type \ Year / Subscriber		1988	1989	1990	1991 ∿	Remarks
Call tariff	New subscribers	3,234	3,363	3,862	-	Service period 6 months.
	Existing subscribers	21,800 (21,800)	25,034 (21,800)	28,397 (21,800)	32,259 (21,800)	Service period 12 months.
Rental charge	New subscribers	3,234	3,363	3,862	-	Service period 6 months.
	Existing subscribers	21,800 (21,800)	25,034 (21,800)	28,397 (21,800)	32,259 (21,800)	Service period 12 months.
	Total subscribers	25,034 (21,800)	28,397 (21,800)	32,259 (21,800)	32,259 (21,800)	-
Installation charge	New subscribers	3,234	3,363	3,862	-	-

Note: Parenthesized figures show numbers of subscribers transferred from EMD switching equipments to digital telephone switching equipments.

12-2 Revenue per Line

The revenue per one telephone subscriber (revenue per line) in Asunción in 1980 was 7,603 guaranies including the rental charge and call tariff. When considering expected increase of subscribers with low revenue per line in the future and the fact that the revenue per line has reached a saturation point as viewed from the national income, we assume that the revenue per line is constant in calculating the revenue by this project.

12-3 Revenue Forecast

Forecast of annual revenue by this project is as shown in Table IV-13.

For subscribers to be transferred from EMD switching equipments to digital telephone switching equipments, however, the monthly revenue is assumed to be one half the revenue per line because the investiment for the subscriber cables is unnecessary.

Table IV-13 Revenue Forecast

(Unit: Million guaranies)

Rate type \ Year / Sub-scriber type		1988	1989	1990	1991 ∿
Rental charge and call tariff	New subscribers	147.5	153.4	176.2	-
	Existing subscribers	-	295.1	601.9	954.2
	Transferred subscribers	994.5	994.5	994.5	994.5
Installation charge	New subscribers	420.4	437.2	502.1	-
TOTAL		1,562.4	1,880.2	2,274.7	1,948.7

13. Forecast of Maintenance and Operating Costs

The maintenance and operating costs can generally be expressed as follows:

° Maintenance cost (annual amount) = Amount of investment x maintenance cost ratio x personnel expense correction coefficient

° Operating cost (annual amount) = Revenue x operating cost ratio x personnel expense correction coefficient

The various ratio and coefficient in the above equations are assumed as follows:

Maintenance cost ratio = 0.03

Personnel expense correction coefficient = 0.6

(The ratio of material cost to personnel expense was assumed to be 0.3 : 0.7, and the wage level in Paraguay was taken into consideration about personnel expense.)

Operating cost ratio = 0.3

Each cost in this project was calculated by each of the following equations:

Maintenance cost (annual amount) = Amount of investment x 0.03 x 0.6

Operating cost (annual amount) = Revenue x 0.3 x 0.6

Table IV-14 Maintenance and Operating Costs

(Unit: Million guaranies)

Item \ Year	1987	1988	1989	1990	1991 ∿
Maintenance cost	40.8	81.5	81.5	81.5	81.5
Operating cost	0	205.6	259.7	319.1	350.8

14. Financial Analysis

The internal rate of return of this project is calculated on the basis of the following premises:

(1) The annual construction investment amount shall be as shown in Table IV-15.

Table IV-15 Annual Construction Investment Amount

(Unit: Million guaranies)

Year / Cost	1983	1984	1985	1986	1987	1988	TOTAL
Foreign currency	(74.8) 41.0	(93.9) 51.5	(1,343.8) 736.2	(4,131.0) 2,263.1	(537.3) 294.4	(539.8) 295.7	(6,720.6) 3,681.9
Local currency	-	-	-	842.6	-	-	842.6
TOTAL	41.0	51.5	736.2	3,105.7	294.4	295.7	4,524.5

Notes) 1. Parenthesized figures are conversion to million yen unit.

2. The exchange rate is as follows:

1 US dollar = 230 yen = 126 guaranies

(2) The project life shall be 20 years after the commencement of service.

(3) The residual value of the equipments at the end of the project life shall be 0.

(4) The working capital shall be 30% of the increase of the total annual revenue from the total annual revenue in the preceding year.

The internal rate of return (IFRR) calculated on the basis of the above premises is 23.99%. Thus, this project is feasible as viewed from the internal rate of return.

Various values used for calculation of the internal rate of return are shown in Table IV-16.

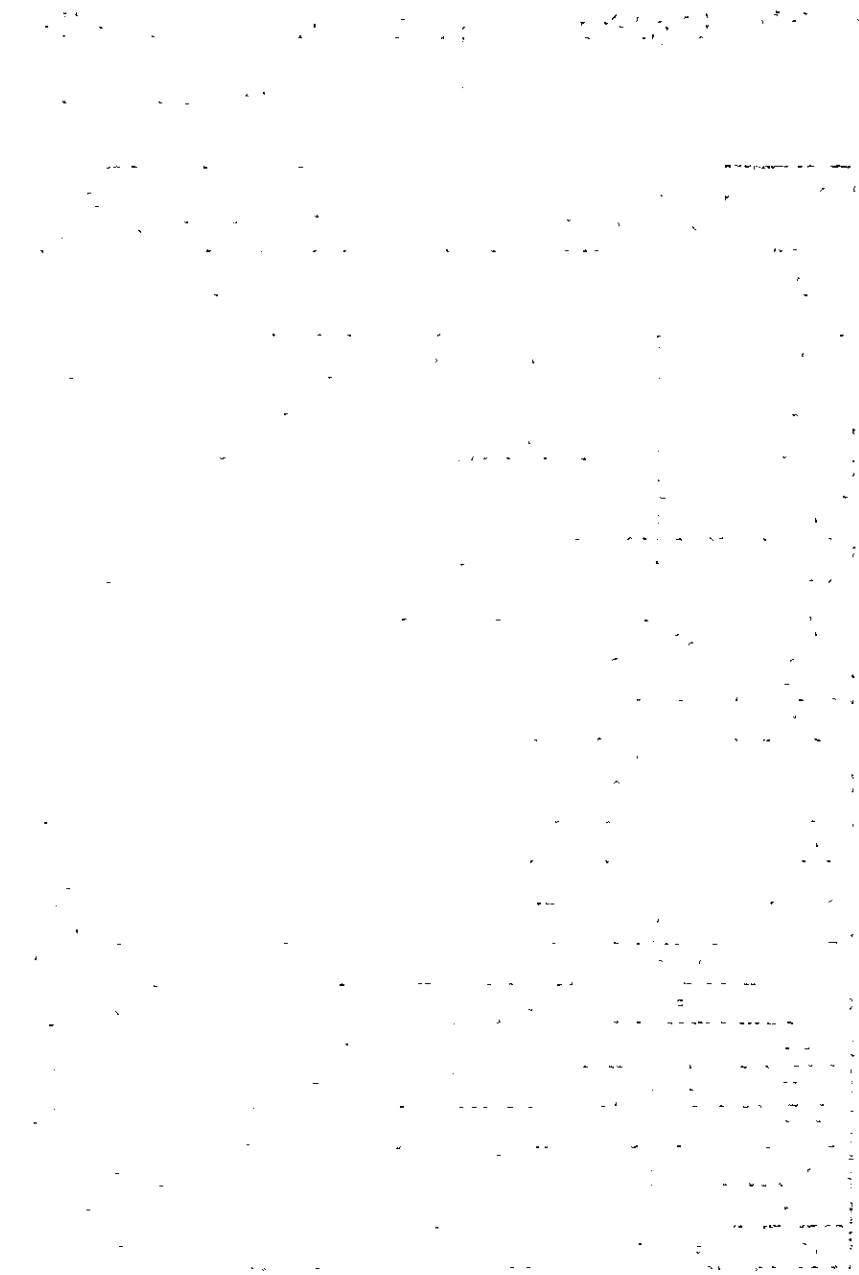
Table IV-16 Internal Rate of Return Calculation Table

(Unit: Million guaranies)

Item / Year	Business income	Cost				Business income - cost
		Installation cost	Working capital	Operating cost	Maintenance cost	
1983	0	41.0	0	0	0	-41.0
1984	0	51.5	0	0	0	-51.5
1985	0	736.2	0	0	0	-736.2
1986	0	3,105.7	0	0	0	-3,105.7
1987	0	294.4	0	0	40.8	-335.2
1988	1,562.4	295.7	468.7	205.6	81.5	510.9
1989	1,880.2	0	95.3	259.7	81.5	1,443.7
1990	2,274.7	0	118.4	319.1	81.5	1,755.7
1991	1,948.7	0	0	350.8	81.5	1,516.4
1992	1,948.7	0	0	350.8	81.5	1,516.4
1993	1,948.7	0	0	350.8	81.5	1,516.4
1994	1,948.7	0	0	350.8	81.5	1,516.4
1995	1,948.7	0	0	350.8	81.5	1,516.4
1996	1,948.7	0	0	350.8	81.5	1,516.4
1997	1,948.7	0	0	350.8	81.5	1,516.4
1998	1,948.7	0	0	350.8	81.5	1,516.4
1999	1,948.7	0	0	350.8	81.5	1,516.4
2000	1,948.7	0	0	350.8	81.5	1,516.4
2001	1,948.7	0	0	350.8	81.5	1,516.4
2002	1,948.7	0	0	350.8	81.5	1,516.4
2003	1,948.7	0	0	350.8	81.5	1,516.4
2004	1,948.7	0	0	350.8	81.5	1,516.4
2005	1,948.7	0	0	350.8	81.5	1,516.4
2006	1,948.7	0	0	350.8	81.5	1,516.4
2007	1,948.7	0	0	350.8	81.5	* 2,198.8

Note: * mark figure is calculated by the following equation:
{(Business income) - (Cost)} + (Total of working capital)

IFRR: 23.99%



CHAPTER V. RURAL TELEPHONE SYSTEM INTRODUCTION PROJECT

CHAPTER V. RURAL TELEPHONE SYSTEM INTRODUCTION PROJECT

1. Current Status of Telephone Service

As of late 1980, the number of subscriber lines installed in the areas other than the capital Asunción is 11,839, which is only 23.9 percent of the total number of subscriber lines (49,508) installed over the whole country. The telephone lines per one hundred inhabitants in those areas is only 0.47, which is an extremely small figure as compared with that for the Asunción area, 5.81. There are 192 telephone exchanges in those areas. Of these exchanges 36 exchanges are automatic, and all others are manual exchanges. All automatic exchanges use the step-by-step switching system (EMD). Between these automatic exchanges subscriber trunk dialing service is available via the toll transit switch installed in Asunción. The toll trunk network is star type. The main trunk lines for the toll trunk network are provided by microwave links, while branch trunk lines are linked with the open wire carrier system. Since one open wire line is shared by five or six existing small-capacity manual exchanges, the toll traffic capacity is presently extremely low.

In order to meet the growing demand for telephone services in those areas, ANTELCO is now proceeding with expansion of terminals in the existing automatic exchanges and automatization of existing manual exchanges. The third expansion program (to be completed in 1982) involves expansion of 5,600 lines for 18 exchanges and automatization of 2,400 lines for 8 exchanges. The fourth expansion program (to be completed in 1987) involves expansion of

13,700 lines for 24 exchanges and automatization of 1,200 lines for 5 exchanges.

These expansion and automatization plans are intended primarily for middle to small cities and towns, however, there are still many sparcely populated farm and pasture villages (about 6 persons per square kilometer) where public telephone service remains unavailable. In those areas people depend entirely on the private radio telephone system.

To provide these rural areas with public telephone services, ANTELCO plans to install the Rural Telephone System in about 14 thinly-populated rural areas.

2. Project Policy

(1) The object of this Project is to introduce the Rural Telephone System into the following five areas, which are specified by ANTELCO among the above-mentioned 14 areas as being qualified for urgent installation of the system:

(1)	San Pedro	(2)	Concepción
(3)	Hohenau	(4)	Villarrica
(5)	Carapeguá		

They are shown in the priority order also given by ANTELCO.

(2) Additional toll trunks are provided for the manual exchanges in the said five areas which suffer from extremely low toll traffic capacity.

(3) The application of the rural telephone service as classified by their operation purposes, and the

priority order of installation are as follows:

1) Telephone equipments for administration, public security, and first-aid activities.

2) Pay telephone stations for villages which have no public telephones.

3) Subscriber telephone for commerce, industry, agriculture, cattle-breeding, and other purposes.

In selecting the object of installation, installation urgency and profitability will be also taken into account as well as the above-mentioned priority order.

(4) Rural Telephones belong to the subscriber terminals of existing automatic exchanges.

3. System to be Applied

We examined the feasibility of the multiple access subscriber radio system (MAS system) and the subscriber line multiplexing system for the Rural Telephone System. MAS system exhibited definite advantage over the subscriber line multiplexing system with respect to economy. The present project adopts the 8-channel MAS system for the Rural Telephone System so as to meet the relatively large telephone demanded per area.

The specifications of the 8-channel MAS system are outlined in Table V-1:

Table V-1 Specifications of the 8-channel MAS System

Item	Per system	Remarks
Number of radio channels	8	UHF or VHF
Max. capacity	Approx. 100	Loss probability is 3/100 when the calling rate is 0.04.
Service area	Appox. 50 Km in radius.	Depends on geographical features.

In view of economy and maintenability, the single channel radio system will be used for the additional toll trunk lines for manual exchanges.

4. Demand Fulfilment Plan

Table V-2 shows the potential demand for public telephone service investigated by ANTELCO for the above-mentioned five areas. As a result of discussions on the construction scale required to meet the potential demand, with consideration of priority, installation urgency, profitability, etc., the plan has set the number of subscribers to be installed initially at approximately 90 per area. The number of MAS subscriber lines to be installed under the present project are also given in Table V-2.

The object sections of toll trunk line installation are planned as shown in Table V-3, taking into account the number of subscribers, current status of toll trunk networks, and future potential of telephone exchanges.

Table V-2 Number of Subscriber Lines under this Project

Category \ Area		Concepción	San Pedro	Villarrica	Carapeguá	Hohenau	Total
Public institution	Village office,	16	17	72	41	38	184
	Police office, Hospital	16	17	25	21	26	105
Pay station	Exchange	8	6	21	5	6	46
		7	4	18 + (1)	5	5	39 + (1)
	School, etc.	89	28	39	92	24	272
		17	12	13	24	24	90
Private user	Farm, Pasture	59	68	31	42	-	200
		50	50 + (3)	25	35	-	160 + (3)
	Factory	-	2	5	-	10	17
		-	2	5	-	7	14
	Cooperative association,	-	5	4	11	32	52
	Retail store, etc.	-	5	4	5	28	42
Total		172	126	172	191	110	771
		90	90 + (3)	90 + (1)	90	90	450 + (4)

Note 1. Numbers in upper rows : Demands estimated by ANTELCO's inquiries.

2. Numbers in lower rows : Subscriber lines to be accomodated with MAS system.

3. Numbers in parenthesis: Subscriber lines to be connected directly to automatic exchanges by means of single channel radio system.

Table V-3 Toll Trunk Line Sections

Area	Automatic exchange	Manual exchange
Concep-ción	Concepción	Paso Horqueta
		Tacuatí
		Paso Barreto
San Pedro	San Pedro	Lima
		Nueva Germania
		Santa Rosa
		Col. Liberación
		Santa Clara
		Elizardo
		Susana
		Cororo
		Rio Verde
		Jejuí
Villarrica	Villarrica	Mbocayaty
		Natalicio Talvera
		Mauricio Jose Troche
		Coronel Martinez
		Paso Yovai
		Gral. Higinio Morinigo
		Maciel
		Moisés Bertoni
		Yegros
		Yuty

Area	Automatic exchange	Manual exchange
Capapeguá	Carapeguá	Caapuću
		Caballero
		Ypane
		Sapucaí
		Quyquyhó
		Barrientos
		Ybytimí
Hohenau	Hohenau	La Paz
		Fram
		Artigas
		San Pedro
		Capitan Mesa
		Pirapó
		Bella Vista

5. Forecasted Traffic

The originating/terminating calling rate forcasted for the Rural Telephone System based on the traffic data regarding the existing subscribers of the said five areas is 0.03 to 0.04 erl, which is also expected to cover the future increase in the traffic.

6. Facilities Plan

6.1 Basic Design Policies

(1) One MAS system base station (two base stations depending on radio propagation conditions) covers the entire local service area of all telephone exchanges in the object rural area.

(2) MAS system subscribers are accommodated at the subscriber terminals of the existing automatic exchanges.

(3) Office buildings, towers, and power facilities of the existing exchanges and radio relay stations are utilized for this project as far as possible.

(4) While the initially projected number of MAS system subscribers is approximately 90 per area, two complete systems of 8-channel MAS system per area are provided for one base station to accommodate the future increase in subscribers and traffic.

If two base stations are to be installed in one area, one MAS system is installed per base station.

(5) For the entrance line between MAS system base station and an automatic exchange, the 24 channel UHF (or VHF) multiplex radio system shall be used.

(6) The target signal-to-noise ratio for the radio channels that link the MAS system base stations with MAS system subscriber equipments is better than 35 dB.

(7) The radio links between the MAS system base stations and subscriber equipments have, in principle, no repeater. If unavoidable due to propagation problems, however, a single channel radio repeater may be used.

(8) The subscriber radio equipment is, in principle, installed in the close vicinity of the subscriber telephone set. If this is not possible due to propagation problems, the radio equipment may be installed apart from the telephone set, with the two pieces of equipment linked by a pair of subscriber drop wires.

(9) The subscribers, for whom a radio channel to the MAS system base station is not available due to bad propagation conditions, are accommodated not to the MAS system but to the closest automatic exchange via the single channel radio system.

(10) The MAS system base stations and other associated facilities to be installed in a telephone exchange are supplied from the power facility of that exchange.

Either of the following three types of power supply equipments is also used for the facilities of the other MAS system base stations, with primary emphasis placed on economy:

1) Commercial AC power source and stand-by engine generator.

2) Dual prime engine generator.

3) Solar batteries.

All pay telephones are powered by solar batteries, and other subscriber equipments are, in principle, supplied from subscribers' private engine generators.

6.2 Outline of Facilities Plan

The facilities plan designed on the basis of the project policy and field investigation results is outlined in Table V-4.

Table V-4 Outline of Facilities Plan

System / Item / Area	8 CH MAS system			Single channel radio system		
	Base stations	Systems	Subscriber equipments	Manual exchanges	Intra-office pay stations	Subscriber lines
Concepción	2	2	90	3	—	—
San Pedro	2	2	90	10	—	3
Villarrica	2	2	90	10	1	—
Carapeguá	1	2	90	7	—	—
Hohenau	2	2	90	7	—	—
Total	9	10	450	37	1	3

Note. The columns under "Single channel radio system" are as follows:

Manual exchanges: Total number of toll trunk lines (one toll trunk line/exchange) to be added to the existing manual exchanges.

Intra-office pay stations : Number of ANTELCO's intra-office pay telephone lines not to be accommodated in the MAS system but independently in the closest exchange.

Subscriber lines: Number of general subscriber lines not to be accommodated in the MAS system but independently in the closest exchange.

7. Installation of Subscriber Equipments

Subscriber equipments are installed under the following policy considering economy and contracting periods:

(1) The staffs of ANTELCO are in charge of installing about five subscriber equipments per area under the supervision of the contractor.

(2) Other subscriber equipment installation work shall be undertaken by ANTELCO staff only. The estimated number of ANTELCO staffs required for the installation work is shown in Table V-5.

Table V-5 Number of Staffs Required

Item	Unit	Contents					Total
Work group	Group	Concepción	San Pedro	Villarrica	Carapeguá	Hoherau	5
Group members (ANTELCO staff)	Persons	3	3	3	3	3	15
Subscriber equipments to be installed	Set	85	85	85	85	85	425
Work days per subscriber equipments	Day	3					3
Total work days	Day	255					255

8. Maintenance Operation and Training

8.1 Maintenance and Operation

Maintenance and operation of the Rural Telephone System is to be conducted under the following policy:

(1) A maintenance center shall be established in Asunción, to repair defective units, etc. sent from local maintenance stations. Unrepairable units or equipment shall be returned to the manufacturer for repair.

(2) In each local maintenance station, defective units shall be replaced with spare units and sent to the maintenance center in Asunción.

(3) Engineers stationed in Asunción are expected to formulate an annual maintenance plan for this system and provide maintenance stations with adequated technicians of each training and guidance.

The estimated number of staffs required for unobstructed implementation of these maintenance plans is shown in Table V-6.

Table V-6 Number of Required Maintenance Staffs

Station served by maintenance personnel		Asunción	Cnel. Oviedo	Encarnación	Total
Maintenance staff	Engineers	1	—	—	1
	Technicians	3	4	2	9
	Total	4	4	2	10
Assigned area		Carapeguá	Concepción San Pedro Villarrica	Honenau	

8.2 Training

As part of the construction and maintenance scheme for the Rural Telephone System, the contractor shall provide the construction and maintenance personnel of ANTELCO with the following training and guidance:

(1) Desk training

(2) Field training

(3) Training through participation in actual construction works

(4) Guidance through maintenance assistance

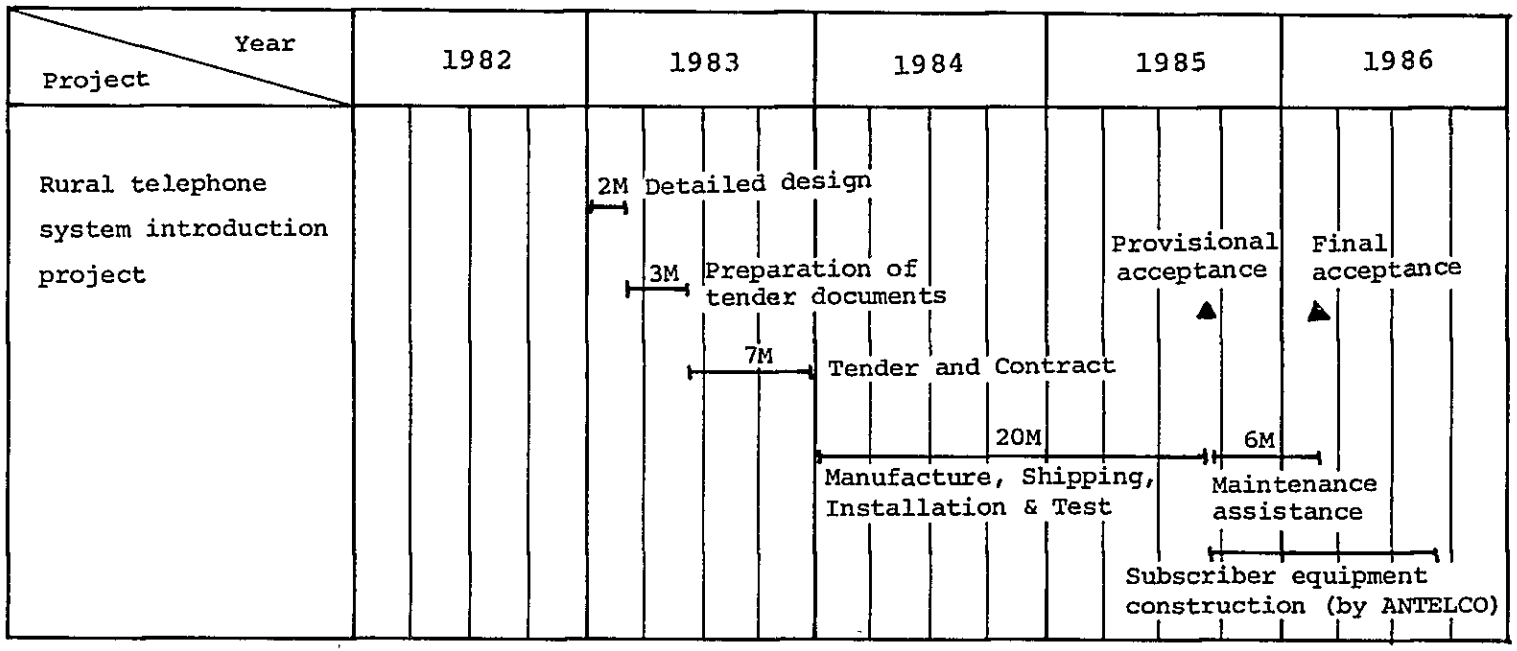
The contractor shall prepare instruction manuals for subscriber equipment installation works.

9. Implementation Plan

Table V-7 shows the implementation schedule for this project. Consultants should be employed to enable unobstructed progress of detailed system design, preparation of tender specifications, evaluation of offers, supervision of construction works, and acceptance tests.

acceptance tests.

Table V-7 Project Implementation Schedule



Note: This schedule is based on the premise that the decision of the implementation of the project is made by late 1982.

10. Estimated Cost

The estimated cost for this project are calculated as follows:

(1) System facilities shall be constructed on a turn-key-base contract. For MAS subscriber equipments, however, only five equipments per area shall be installed on a turn-key-base contract, while all other equipments shall be installed directly by ANTELCO.

(2) Consultants shall be employed for detailed system design, preparation of tender specifications, tender evaluation, supervision of construction work, and acceptance tests.

(3) Spare parts to cover the service requirements for two years shall be prepared.

(4) The contingency shall be limited to 5% of the total system cost.

(5) Construction cost covered by foreign and local currency are as follows:

Foreign currency

Expenses for design, fabrication, transportation, insurance, construction, and tests of imported equipment and materials (Telecommunication equipment, power equipment, self-supporting towers, vehicles, etc.) and for training, maintenance assistance, and consultants (excluding those covered by local currency).

Local currency

Cost for the following construction items:

Buildings

Access roads

Guyed towers

Commercial power receiving lines

Main fuel tanks for diesel engine generators

Aerial poles

Radio equipment hut

Subscriber drop wires

The wages and domestic travelling allowances for the ANTELCO staffs in charge of the construction works are not included in the construction cost.

(6) In calculating the project cost, it is assumed that the contract for the construction shall be made at the end of 1983, and that the annual price rise rate shall be 6% for foreign currency and 12% for local carrency with respect to price levels as of October 1981.

The cost for the implementation of the project are listed in Table V-8.

Table V-8 Total Cost for Rural Telephone System

Unit: Foreign currency: millon yen
Local currency : million guaranies

Table V-8 (1) Concepción Area

Item	Cost	
	Foreign currency	Local currency
Telecommunication equipment, power facilities	185.0	0.6
Towers, aerial poles	0	18.4
Buildings, access roads, etc.	0	10.2
Sub-total	185.0	29.2
Price increase	38.5	16.2
Total	223.5	45.4

Table V-8 (2) San Pedro Area

Item	Cost	
	Foreign currency	Local currency
Telecommunication equipment, power facilities	190.3	0.6
Towers, aerial poles	0	22.5
Buildings, access roads, etc.	0	5.3
Sub-total	190.3	28.4
Price increase	39.7	15.9
Total	230.0	44.3

Table V-8 (3) Villarrica Area

Item	Cost	
	Foreign currency	Local currency
Telecommunication equipment, power facilities	222.5	3.1
Towers, aerial poles	0	22.2
Buildings, access roads, etc.	0	22.2
Sub-total	222.5	47.5
Price increase	46.4	23.8
Total	268.9	71.3

Table V-8 (4) Carapeguá Area

Item	Cost	
	Foreign currency	Local currency
Telecommunication equipment, power facilities	185.4	11.3
Towers, aerial poles	8.4	19.8
Buildings, access roads, etc.	0	57.8
Sub-total	193.8	88.9
Price increase	40.6	40.5
Total	234.4	129.4

Table V-8 (5) Hohenau

Item	Cost	
	Foreign currency	Local currency
Telecommunication equipment, power facilities	220.0	1.2
Towers, aerial poles	0	21.6
Buildings, access roads, etc.	0	10.0
Sub-total	220.0	32.8
Price increase	45.9	17.7
Total	265.9	50.5

Table V-8 (6) Total for 5 Areas

Item	Cost	
	Foreign currency	Local currency
Telecommunication equipment, power facilities	1,003.2	16.8
Towers, aerial poles	8.4	104.5
Buildings, access roads, etc.	0	105.5
Sub-total	1,011.6	226.8
Price increase	211.1	114.1
Total	1,222.7	340.9

Table V-8 (7) Total Cost

Item	Cost		Remarks
	Foreign currency	Local currency	
Concepción Area	185.0	29.2	
San Pedro Area	190.3	28.4	
Villarrica Area	222.5	47.5	
Carapeguá Area	193.8	88.9	
Hohenau Area	220.0	32.8	
Total for 5 Areas	1,011.6	226.8	
Facilities for construction and maintenance center	58.5	0	Including maintenance vehicles
Training and maintenance assistance	27.5	0	Term of maintenance assistance: 6 months
Consultant	77.0	0	
Sub-total	1,174.6	226.8	Including Total for 5 Areas
Price increase	241.6	114.1	
Contingency	70.8	17.0	5% of cost including price increase
Grand-total	1,487.0	357.9	

11. Tariff System

This project uses the MAS system for the rural telephone system.

In the MAS system, a base station is not provided for each exchange but one base station (or two base stations depending on the wave propagation conditions) is planned for each district so as to cover whole service areas of all exchanges. Therefore, telephones in this system may be accommodated in an exchanges different from that to accommodate general telephones.

Since the initial installation cost per subscriber in the MAS system is extremely higher than that for a general telephone, charging all the cost to subscribers will obstruct smooth introduction of rural telephones.

In determining the tariff system for the rural telephone system, the above points shall be taken into consideration. ANTELCO has the following plan now with respect to the tariff system of the rural telephone system:

Installation charge (Tarifa de instalacion)	150-170% of the current charge (100,000 guaranies) for Interior other than the Asunción area
Rental charge (Tasa basica)	150% of the current charge
Exceeding call tariff (Exceso por impulsos)	Same as the current tariff (25 guaranies)

Therefore, the revenue forecast later in V-12 will be based on this tariff system by ANTELCO.

12. Revenue Forecast

Since the tariff system for the rural telephone system is not determined as yet, the following tariff system being planned by ANTELCO is used for revenue forecast:

(1) The installation charge is 170% of the ordinary telephone installation charge (100,000 guaranies), or 170,000 guaranies.

(2) The rental charge is 150% of the ordinary telephone rental charge (1,600 guaranies per month), or 2,400 guaranies.

(3) The local call tariff and toll call tariff are the same as those of ordinary telephones.

12.1 Revenue by Installation Charge

The revenue by installation charge, assuming that the telephones are installed annually by this project as shown in Table V-9, is shown in Table V-11.

Table V-9 Annual Number of Telephones Installed by this Project

Year / Type	1985	1986	Remarks
Telephones for public organizations	40	65	Intended for charging installation charge
General subscriber telephones	82	137	
Sub-total	122	202	
Public telephones	49	81	No installation charge
Total	171	283	

12.2 Revenue by Rental Charge

The revenue by rental charge, assuming that the number of telephones and average number of chargeable months are as shown in Table V-10, is shown in Table V-11.

Table V-10 Number of Telephones and Average Number of Chargeable Months

Year / Item / Type	1985		1986		1987 and on		Remarks
	Number of telephones	Number of chargeable months	Number of telephones	Number of chargeable months	Number of telephones	Number of chargeable months	
Telephones for public organizations	8	4	40	12	105	12	Object of rental charge
	32	2	65	8			
General subscriber telephones	12	4	82	12	219	12	
	70	2	137	8			
Sub-total	20	4	122	12	324	12	
	102	2	202	8			
Public telephones	9	4	49	12	130	12	No rental charge
	40	2	81	8			
Total	29	4	171	12	454	12	
	142	2	283	8			

12.3 Revenue by Local Call Tariff

The local call tariff is charged for the portion exceeding 90 calls per month. In case of the rural telephone system, most calls are toll calls and local calls are extremely few.

It is regarded that excess call tariff of local calls are regarded as negligible.

12.4 Revenue by Toll Call Tariff

The revenue by tariff for incoming toll calls and outgoing toll calls in the rural telephone system are considered to be the increase in revenue by this project. Since the initial installation cost for each subscriber

in the rural telephone system is so much that the revenue of the existing switching equipment and toll transmission facilities is ignored.

(1) Telephones for public organizations and general subscriber telephones.

The toll call tariff per one rural telephone subscriber calculated on assumption of the following conditions is 3,575 guaranies per month:

(a) Originating and terminating calling rate ..... 0.022 erlang

(b) Busy hour concentration ratio 1/8

(c) Average monthly operation days ..... 25 days

(d) Average call duration per one toll call ..... 3.5 minutes

(e) Average revenue per one toll call ..... 47.4 guaranies

(2) Public telephones

The toll call tariff per one public telephone assuming that the number of toll calls per public telephone is 250 calls/month and other conditions are the same as those in (1) above is 11,850 guaranies per month.

The annual revenue by toll calls by this project assuming that the number of telephones and number of chargeable months of the rural telephone system in this project is as shown in Table V-10, is shown in Table V-11.

Growth of revenue by traffic increase in future is not taken into consideration.

12.5 Revenue by Providing Toll Trunk Lines for Manual Exchanges.

When it is assumed that the toll call tariff per one subscriber which is accomodated in the manual exchanges is 3,575 guaranies per month and 80% of it is the increase resulting from this project, the increase of the toll call tariff for 271 subscribers of object manual exchanges is 775,060 guaranies per month.

Table V-11 Annual Revenue of Rural Telephone System

Unit: Million guaranies

Item \ Year		1985	1986	1987 ∿
Installation charge		20.7	34.3	0
Rental charge		0.7	7.4	9.3
Totll call tariff	Public organizations and general subscribers	1.0	11.0	13.9
	Public telephones	1.4	14.6	18.6
	Toll trunk line expansion	3.1	9.3	9.3
	Sub-total	5.5	34.9	41.7
Total		26.9	76.6	51.0

13. Forecast of Maintenance and Operating Costs

For calculation of the maintenance and oepration cost of the rural telephone system, the same maintenance cost ratio and operation cost ratio as were used in the digital switching system introduction project are used.

Maintenance cost (annual amount)

= Amount of investment x 0.03 x 0.6

Operation cost (annual amount)

= Revenue x 0.3 x 0.6

(See IV-13 "Forecast of Maintenance and Operating Costs")

The annual maintenance cost and operation cost calculated by the above equations are shown in Table V-12.

Table V-12 Maintenance and Operating Costs

Unit: million guaranies

Item \ Year	1985	1986	1987 and on
Maintenance cost	7.0	21.1	21.1
Operating cost	1.1	7.6	9.2

14. Financial Analysis

The internal rate of return of this project is calculated on the basis of the following premises:

(1) Annual investment for construction shall be as shown in Table V-13.

Table V-13 Annual Investment for Construction

Unit: million guaranies

Year / Item	1983	1984	1985	1986	Total
Foreign currency	(64.2) 35.2	(1,151.9) 631.0	(145.8) 79.9	(125.1) 68.5	(1,487.0) 814.6
Local currency	——	220.9	43.6	93.4	357.9
Total	35.2	851.9	123.5	161.9	1,172.5

(Notes) 1. Parenthesized figures are converted values into million yen unit.

2. The exchange rate is as follows:

1 US dollar = 230 yen = 126 guaranies

(2) The project life shall be 20 years after service commencement

(3) The residual value of the equipments at the end of the project life shall be 0.

(4) The working capital shall be 30% of the increase in total annual revenue from the preceding year.

The internal rate of return (IFRR) of this project calculated according to the above premises is -7.84%.

This project is not feasible in view of the internal rate of return (IFRR).

The reason is that the charge is relatively low as comprared with the high installation cost per subscriber of this system. Since charging high rates to balance the revenue and expenditure of this project will obstruct smooth growth of rural telephones. There is a certain limit in determining the charges.

However, it is considered necessary to increase the installation charge and rental charge to such levels as to recover at least the investment and interest within the project life. Since this project is indispensable for promotion of rural industries, it is necessary to handle the deficiency in the balance within the whole ANTELCO business balance in addition to the above considerations for rates in introduction.

Various values used for calculation of the internal rate of return calculation are shown in Table V-14.

Table V-14 Internal Rate of Return Calculation Table

(Unit: Million guaranies)

Item / Year	Business income	Cost				Business income - Cost
		Installation cost	Working capital	Operating cost	Maintenance cost	
1983	0	35.2	0	0	0	-35.2
1984	0	851.9	0	0	0	-851.9
1985	26.9	123.5	8.1	1.1	7.0	-112.8
1986	76.6	161.9	14.9	7.6	21.1	-128.9
1987	51.0	0	0	9.2	21.1	20.7
1988	51.0	0	0	9.2	21.1	20.7
1989	51.0	0	0	9.2	21.1	20.7
1990	51.0	0	0	9.2	21.1	20.7
1991	51.0	0	0	9.2	21.1	20.7
1992	51.0	0	0	9.2	21.1	20.7
1993	51.0	0	0	9.2	21.1	20.7
1994	51.0	0	0	9.2	21.1	20.7
1995	51.0	0	0	9.2	21.1	20.7
1996	51.0	0	0	9.2	21.1	20.7
1997	51.0	0	0	9.2	21.1	20.7
1998	51.0	0	0	9.2	21.1	20.7
1999	51.0	0	0	9.2	21.1	20.7
2000	51.0	0	0	9.2	21.1	20.7
2001	51.0	0	0	9.2	21.1	20.7
2002	51.0	0	0	9.2	21.1	20.7
2003	51.0	0	0	9.2	21.1	20.7
2004	51.0	0	0	9.2	21.1	* 43.7

Note: * mark figure is calculated by the following equation:

{(Business income) - (Cost)} + (Total of working capital)

IFRR: -7.84%