CHAPTER 3. TELECOMMUNICATION NETWORK PLANNING

3-1 Telephone Network

3-1-1 Toll trunk network

(1) Construction of toll trunk network within the Master Plan period

The existing plan in which Asunción, Encarnación and Cnel. Oviedo are set as secondary centers will be brought into reality, and the existing network configuration will be maintained.

The expansion of circuits for the purpose of providing for traffic increase with increase in the number of subscribers in various areas, incorporation of automatic exchanges into automatic switching network, and expansion of necessary facilities will be planned.

The toll trunk network to be constructed during the Master Plan period and the distribution of the exchanges to be incorporated into the automatic switching network also during the period are shown in Figs. III-I-1 and III-I-2, respectively.

The following subjects are worthy of close study, and the Master Plan may be modified depending on the outcome of the study.

In Asunción, the local switches are scheduled to be replaced by digital ones. If there is steady traffic between, for example Central I, where large-capacity digital local switches are installed, and other specific areas or local cities, it will be probably economical to install direct group of circuit (non-via TS), whereas the treatment to the numbering plan and charging will be easy in a digital switching system. It is therefore recommended to investigate and analyze the local switch originating calls as classified by destinations.

(2) Future prospect of network configuration

What determines the network form is the demand (number of subscribers) and technology. Namely, the demand determines the size of the network, and the technology its functions. The network functions have been improved steadily in economic performance, service and reliability with the technological advances.

Fig. III-I-3 shows a typical form of the growth of network configuration.

With reference to Fig. III-I-3, pattern (1) is called a star network, the simplest form seen where the demand and traffic are small.

In pattern (2), toll switches are split into regional centers with increase in demand and traffic for economic realization of long-distance circuits. In this case, the toll switch is required to reproduce and send out received address signals and, to choose, at first, the directly interconnecting route and if all such direct circuits are fully occupied, to route the signals via an alternative route.

In pattern (3), the demand is further increased, and the diffusion rate of telephones is considerably high. The number of areas where the toll switches are installed is increased. Here alternative routing is applied for the purpose of improving economy and reliability. The network functions are required to channel a call by selecting idle routes in sequence rapidly and reliabily without degrading speech quality (transmission loss between toll switches: 0 dB). Increase in a number of automatic exchanges and the growth of subscriber population will require the addition or modification of area codes, and the network will be required to perform storage, translation, reproduction and forwarding of address signals in an economic way. For the

purpose of reliable and speedy traffic channeling, it is required to use multi-frequency transmission of address signals between switches. In order to realize all these functions, the common control system is used, which improves not only system economy and quality, but also the successul call rate.

Pattern (4) shows a transient stage on its way to full digitalization. The digitalization has been brought about by long leaps in electronics in recent years. It harmonizes switching and transmission functions for better economy and integrates diverse telecommunication services (telephone, telegraph, data transmission, facsimile, visual communication, etc.).

The problems in the transient stage relates to the coexistence of analog and digital systems and the methods of offering new services. To solve these problems, there are practiced two methods: one in which digital/analog conversion is carried out at the interfacial points between analog and digital systems. And the other, called the overlay method, in which analog network (consisting of analog switches and transmission lines) and digital network (consisting of digital switches and transmission lines) are installed in parallel and are coupled through an interface exchange located at a proper point for routing calls between analog and digital terminals.

The networks will be digitalized gradually through either one of the above two processes. Eventually, all the telecommunication networks will be integrated by digital technology.

The foregoing is a sketchy description of typical network growth modes. The telephone network in Paraguay in this Master Plan period falls under pattern (2) partly fitted with digital switches as for the network configuration after the Master Plan period, studies should be made to fulfill the functions of patterns (3) and (4) simultaneously.

3-1-2 Local telephone network

Described here is the tandem connection network interconnecting local switches in Asunción. Changes in network arrangement expected during the Master Plan period include sequential digitalization of local switches and the introduction of digital switches for international subscriber dialing system. In anticipation of these changes, the local telephone network will be planned as follows.

(1) Interconnection of local switches (LS)

In the existing local telephone network, the exchanges, "29," "35," "50," and "67" are accessible only through the exchanges, "2," "30," "5," and "6." But, they can be connected from the digital exchanges through direct circuits. This will save one step of EMD switching equipment, improve speech quality and make it easy to measure inter-exchange traffic.

As regards the local transit trunks, a plan will be made to introduce digital transmission system, as much as possible, not only for the interlinking of digital exchanges, but also for the interlinking of digital exchange and EMD exchange. This is because the digitalization must sooner or later be carried out within the Master Plan period and also because metallic cables, if installed additionally, will be laid up in future.

(2) Between local switch (LS) and toll switch (TS)

As discussed under para. 3-1-1-(1), studies will be made to extend toll circuits directly from digital local switches.

(3) Between LS and international transit switch (INTS)

Plan will be made to connect local digital switching system to INTS through a direct group of circuits and not by way of EMD TS, permitting to connect overflow traffic through EMD TS in case traffic peaks.

This is because there is no reason justifying the passage through EMD TS from the viewpoint of functions and because the direct connection to INTS, on the other hand, brings about such benefits as improvement in speech quality and reduction in connection delay time.

(4) Tandem switch (MS)

In Asunción, traffic is sufficient enough to establish direct interconnections among local exchanges from the economic viewpoint. In the step-by-step system, there are such exchanges that cannot be connected without being switched via a tandem exchange because of limitations imposed by numbering plan and switching functions.

But, this is of no consequence to the digital switching system, and the circuits can be installed with no regard to the numbering plan. As explained above, it is preferable both economically and functionally to install circuits directly to local offices. Thus, the local telephone network in Asunción will be of the mesh type.

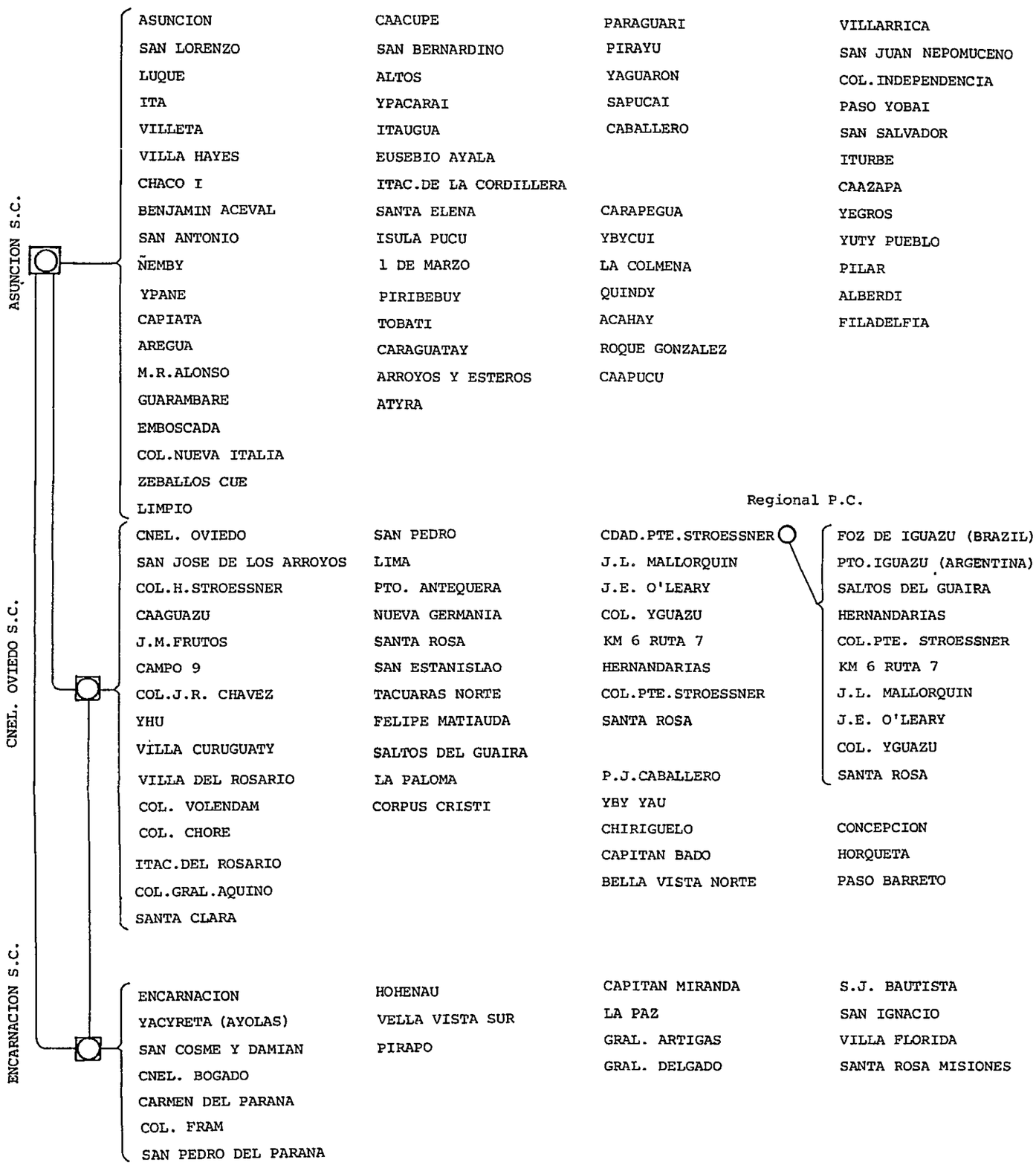


Fig. III-I-1 National telecommunication network (Year 1979)

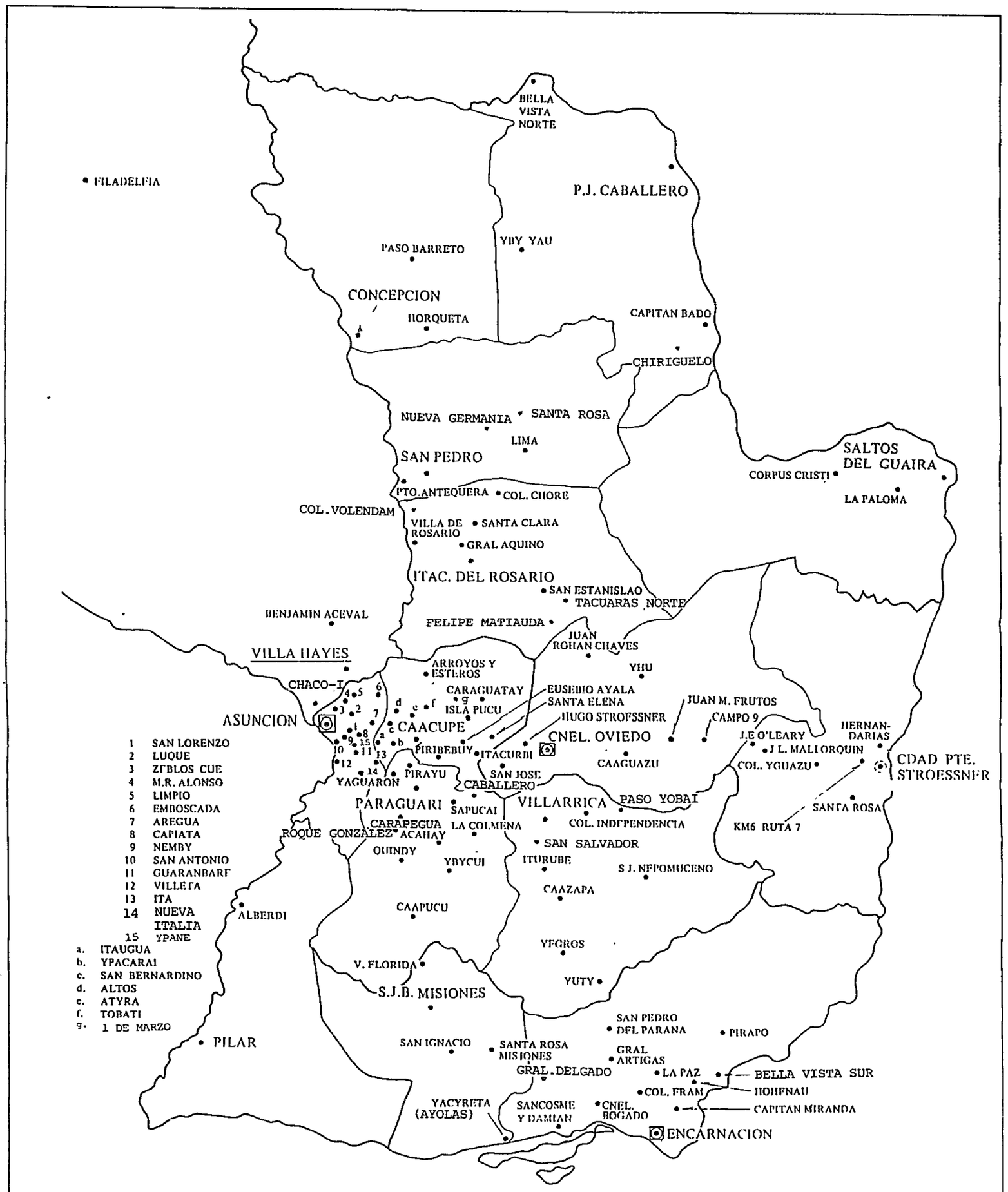
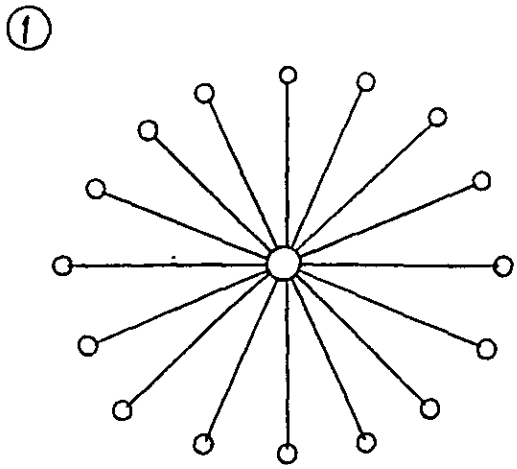
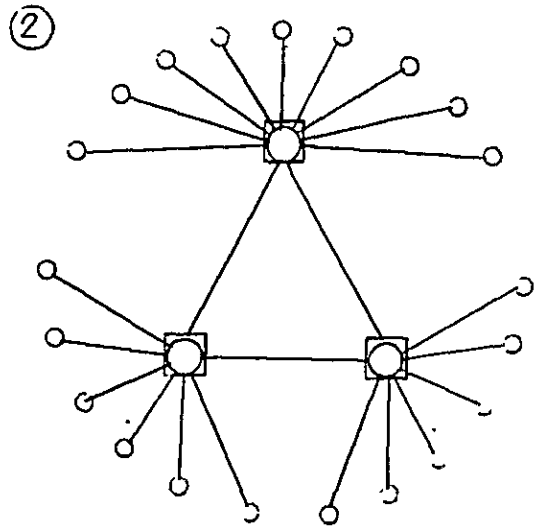
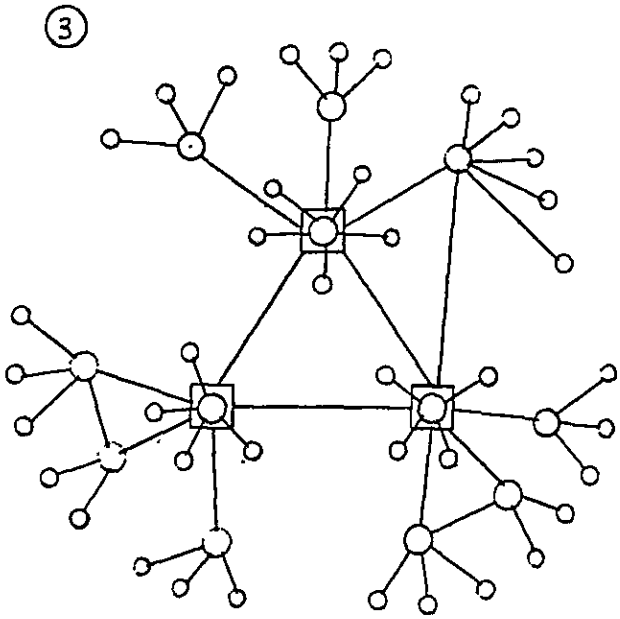


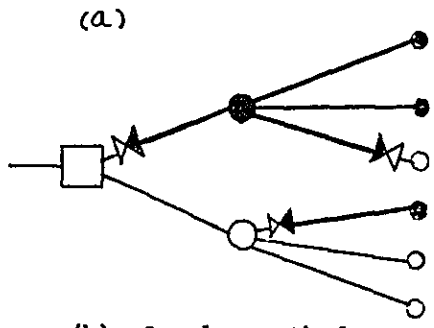
Fig. III-I-2 Location of automatic telephone exchanges



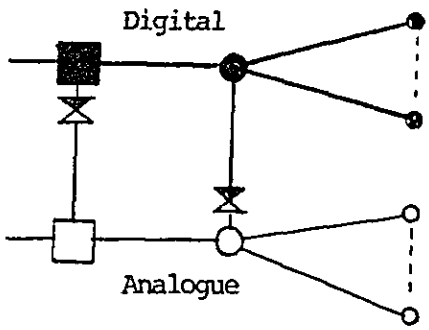




④ This shows partially the case of introduction of digiral systems to the existing analogue network.



(b) Overlay method



Notes: □: Secondary center (analogue)
○: Primary center (analogue)
∘: Local switch (analogue)
■: Secondary center (digital)
●: Primary center (digital)
•: Local switch (digital)
⋈: Conversion between analogue and digital

Fig. III-I-3 Improvement process of telephone network

3-2 Numbering Plan

The purpose of the numbering plan is to assign a proper number to each of the subscribers for its own network. The numbers so assigned should be handy for the subscribers, and should also facilitate the economic network construction in keeping with future demand and should be applicable to all incoming international calls.

3-2-1 Basic considerations for numbering plan

A telephone number serves as a switching control signal between subscriber's station and telephone network, and at the same time is used for identification and billing of subscribers. The basic considerations to be given to the numbering plan usually include:

(1) The numbering system must remain unchanged for a practically long period, and must have an ample capacity to meet to the expected future increase in subscriber population and the needs for new services.

*1 According to CCITT GAS 1 Manual, it is recommended that the numbering system be given a capacity enough to cover the demand for fifty years to come.

*2 The distribution and assignment of numbers should be made not to cause capacity shortages locally.

(2) The numbers should not change depending on the calling places. Namely, any subscriber can be identified with a single number, and to be accessed from any place in the country by dialing it. (GAS 1)

(3) The number structure must be simple and convenient to subscribers. (GAS 1)

(4) The numbering system should not complicate route identification, charging identification, translation and other switching functions. (GAS 1)

(5) The maximum digits for national numbers should be determined.
According to the CCITT Recommendations, it is requested that for those countries where the final national number system has not been determined yet, the national numbers should be determined not to exceed (12 - N) in number of digits (N: number of digits of country code for the country). Since Paraguay's country code is 3 digits, the maximum number of digits permitted for the national numbers is 9. (GAS 1)

3-2-2 Number structure in general

Trunk prefix + Trunk code + Exchange code + Station number

Exchange code + Station number = Subscriber number

Trunk code + Subscriber number = National significant number

Notes: 1. The trunk code sometimes is also called area code.

2. The exchange code sometimes is also called office code.

3. The station number sometimes is also referred to simply as subscriber number.

(1) Local dialing call

The switching of local dialing calls is carried out by a subscriber number. Exchange codes are assigned where there are plural numbers of exchanges or has a

plural number of groups of station numbers. Namely, the exchange codes are used to identify the exchanges or the groups.

(2) Toll dialing call

In case of toll dialing, trunk prefix + national significant number are used.

The CCITT recommends that the trunk prefix as one digit, preferably "0." The trunk codes are used to designate geographical divisions into which the telephone service in a country is divided.

3-2-3 The capacity of numbering system

(1) Macroscopic capacity

The number of subscriber is expected to reach several hundreds of thousands in 1997. If the national significant numbers are standardized to be expressed in 7 digits, several millions of subscribers can be covered. Thus, the seven-digit national significant number system is sufficiently enough from the viewpoint of the macroscopic capacity.

Note: Numbering capacity of seven-digit national significant number system

- "0" is not used as A code.
- Neither "0" nor "1" is used for the first digit of the subscriber number.

Thus, the calculated numbering capacity of the seven-digit national significant number system is 7.2×10^6 ($= 9 \times 8 \times 10^5$).

When the seven-digit national significant number system is applied, a comparison of the demand and number capacity of the areas classified by A codes is as shown in Table III-1-1.

The macroscopic study results show the reference for the further detailed study, and the number of digits shall be determined according to the study on the numbering capacity for the individual area as shown below.

(2) Number capacity in Asunción

The demand in Asunción is estimated as about 300,000 in 1997. Meanwhile, in Asunción, it is planned to introduce digital switches during the Master Plan period, and a number change can be carried out without extra investment in equipment.

Therefore the numbering system will be developed within the Master Plan period, and will be formulated to modify the subscriber number into a seven-digit system, and will be made to ensure sufficient number capacity so that the number change is not required in future.

(3) Numbering capacity in local districts (excl. Asunción)

During the Master Plan period, EMD switching system still remains in service in local districts as it is now, and will continue to work with a minimum necessary numbering capacity from the economic viewpoint.

Accordingly, the standard station number will be of 3 digits, and will be modified into a four-digit system when the number capacity falls short.

In most offices, at present, station numbers are of 3 digits, and numbering capacity will be enough by introducing a four-digit number system if necessary.

3-2-4 Numbering method

Modification of the existing national significant numbers may be inconvenient not only for the authorities concerned, but also for the subscribers involved.

For ANTELCO, changes in the national significant number mean additional investment in the tandem office equipment and charging equipment for adaptation to a new number plan. The subscribers will have to change their letterheads, advertizing and marketing media with an increased cost.

The numbering system should therefore have a sufficient number capacity and a uniform number of digits, simple and easy for subscribers.

But, step-by-step switching system is hard to realize this in an economical way. It is therefore recommended to introduce a suitable numbering plan when a common control switching system such as digital switches are introduced.

(1) Numbering plan in Asunción

According to the plan stated in item 3-2-3 (2) "Numbering capacity in Asuncion", it is planned to introduce a seven-digit system for the subscriber number in Asunción.

A general configuration of the numbering method in this case is shown below. (nine-digit system for national significant number in case of two digits of trunk code.)

A	B	C	D	E	F	G	H	J
2	1	Δ	Δ	Δ	X	X	X	X

Trunk code — Exchange code — Station number

Subscriber number

Table III-I-2 shows a general method of numbering for the exchanges in Asunción.

In addition, Central I needs a special numbering consideration. At present, the first digit of exchange code is 4 and 9. If the subscriber number is converted into seven-digit system, the number capacity will be enough, and the use of "9" becomes unnecessary. It is therefore, recommended to reserve the number "9" which becomes idle for new services which will be introduced in future.

(2) Numbering plan for districts other than Asunción

Here is shown a case where the national significant number is standardized into an seven-digit system.

	A B C (D)*	E F G H	*D code is to be reserved until exchange code is required or national significant number is standardized into an eight-digit system.
Large exchanges	A B	X X X X	
Small exchanges	A B C	X X X X	
	Trunk code	Station number	
	Exchange code		

1) For the purpose of standardizing the number of digits for national significant number, the station number will be standardized into a four-digit system.

2) For those exchanges where the number of subscribers will exceed 5,000 in future, the trunk code will be of two digits (AB), and one-digit exchange code will be assigned.

3) For those exchanges the number of subscribers is unlikely to exceed 5,000, a three-digit trunk code (ABC) will be assigned.

4) At present, twelve message areas are established in Paraguay. Therefore, it is desired that message area shall be identified by using within two digits of "AB" code.

The plan mentioned above is hard to realize economically so far as EMD switches are in service. Therefore, it should be realized by taking advantage of the introduction time of a common control system such as digital switching system.

A numbering plan required for the increase of subscriber and the establishment of new exchanges in this Master Plan is shown Table III-I-2.

In addition, items that require future study in relation to the numbering plan are as follows.

1) Balancing the use of the "A" code

a) The A code for Villa Hayes, Chaco-I and Benjamin Aceval should be changed from "2" to "9".

b) The area with "A" code "5" covers a number of districts, and has many exchanges involved. To avoid confusion, it will be necessary to number the exchanges as classified by districts.

These should be implemented for a better numbering system while taking into account their relations with the accounting areas, charging system and introduction of digital switch (TS).

2) Numbering for operator-assisted call

At present, the operator-assisted toll call is received by dialing the service code "010". If this code is used, the connection is made through

TS. This is uneconomical, and also imposes limitations on the numbering plan because "AB" code "10" in the national significant number is occupied. It is therefore recommended to shift "010" into a special code system (1XY) in the near future.

3) Numbering plan for special services

In future, new and various services are forecasted to be realized with the advance of the telecommunication network. It is therefore recommended to make preparation for study of numbering plan for special and new services. Give an example below for reference.

a) "1XY" system

In this system "1" is used as the first digit. The system will be applied to universal and additional services, for example, operator-assisted call, emargency services (police, fire alarm, etc.), information services (time signal, weather, etc.), etc.

b) "0ABC" system

In this system "0" is used as the first digit. This system is applied for the purpose of internetwork connection, for example, the connection from a national telephone network to the international telephone network, from a telephone network to a data communication network.

c) "Additional pushbutton" system

This system is composed of three(3) digits in which additional pushbuttons (#, *) of pushbutton telephone set are used as the first digit.

This system will be applied to new services realized by use pushbutton telephone.

Table III-I-1 Numbering Capacity

A code	Distrito No.	(demand in 1997)x2=(1)	National significant number		(2) ÷ (1)
			Digit	Capacity(2)	
2	Capital	600,000	8	8×10^5	1.3
	1	33,500	7	7×10^5	19
	15	2,500			
3	6	8,700	7	8×10^5	42
	12	10,200			
4	5-S	1,800	7	8×10^5	65
	9	6,700			
	14	3,800			
5	3	17,500	7	8×10^5	13.7
	5	17,300			
	7	10,700			
	4	13,000			
6	11	23,900	7	8×10^5	33
7	2	23,600	7	8×10^5	32
	8	1,600			
8	1	1,200	7	8×10^5	62
	8	5,400			
	10	6,200			
9	15	1,200	7	8×10^5	666

Table III-I-2 Numbering Plan

TS	"Centrales automáticas"	System	Capacity (1986)	Numbering plan (∿ 1986)									Capacity (1997)	Numbering plan (1987 ∿ 1997)									Note
				A	B	C	D	E	F	G	H	J		A	B	C	D	E	F	G	H	J	
ASUNCION	CENTRAL 1 (4)	HDW→D	8,000	2	1	4	1		x	x	x		59,600	2	1	4	0	Δ	x	x	x	x	
							∫																
							9		x	x	x												
	(9)	EMD→D	14,600			9	0		x	x	x												
							∫																
							5		x	x	x												
						9	6	0	x	x	x												
								∫															
								8	x	x	x												
	CENTRAL 2	EMD→D	20,000			2	2		x	x	x		63,000			2	0	Δ	x	x	x	x	
							∫																
							7		x	x	x												
						2	0	0	x	x	x												
								∫															
								8	x	x	x												
						2	1	0	x	x	x												
								∫															
								4	x	x	x												
	CENTRAL 29	EMD→D	4,000			2	9	0	x	x	x		12,000			2	9	Δ	x	x	x	x	
								∫															
								3	x	x	x												
	CENTRAL 30	EMD→D	7,200			3	1		x	x	x		39,200			3	0	Δ	x	x	x	x	
							∫																
							4		x	x	x												
						3	0	0	x	x	x												
								∫															
								3	x	x	x												
	CENTRAL 35	EMD→D	3,400			3	5		x	x	x		17,400			3	5	Δ	x	x	x	x	
							∫																
							8		x	x	x												
	CENTRAL 5	EMD→D	3,600			5	2		x	x	x		12,600			5	5	Δ	x	x	x	x	
							∫																
							5		x	x	x												
	CENTRAL 50	EMD→D	6,200			5	0	0	x	x	x		18,000			5	0	Δ	x	x	x	x	
								∫															
								6	x̄	x	x												
	CENTRAL 6	EMD→D	11,600			6	0		x	x	x		40,600			6	0	Δ	x	x	x	x	
							∫																
							5		x̄	x	x												
						6	6	0	x̄	x	x												
								∫															
								6	x̄	x	x												

TS	"Centrales automáticas"	System	Capacity (1986)	Numbering plan (∿ 1986)									Capacity (1997)	Numbering plan (1987 ∿ 1997)									Note
				A	B	C	D	E	F	G	H	J		A	B	C	D	E	F	G	H	J	
ASUNCION	CENTRAL 67	EMD→D	2,000			6	7		x	x	x		15,000			6	7	Δ	x	x	x	x	
	CENTRAL 7	EMD→D	4,000			7	0		x	x	x		14,000			7	0	Δ	x	x	x	x	
							5																
							3		x	x	x												
	CENTRAL 8	EMD→D	6,200			8	0		x	x	x		21,200			8	0	Δ	x	x	x	x	
							5																
							6		x	x	x												

TS	"Centrales automáticas"	System	Capacity (1986)	Numbering plan (∿ 1986)									Capacity (1997)	Numbering plan (1987 ∿ 1997)									Note
				A	B	C	D	E	F	G	H	J		A	B	C	D	E	F	G	H	J	
ASUNCION	SAN LORENZO	EMD	1,400	2	2			x	x	x	x		8,200	2	2		x	x	x	x	x		
	LUQUE	EMD	1,800	2	3			x	x	x	x		7,500	2	3		x	x	x	x	x		
	ITA	EMD	400	2	4				x	x	x		2,400	2	4			x	x	x	x		
	VILLETA	EMD	300	2	5				x	x	x		1,200	2	5			x	x	x	x		
	VILLA HAYES	EMD	400	2	6				x	x	x		1,400	2	6			x	x	x	x		
	CHACO-I	M.E											100	2	6	7			x	x	x		
	BENJAMIN ACEVAL	CPR	50	2	6	8			x	x	x		600	2	6	8			x	x	x		
	SAN ANTONIO	EMD	200	2	7				x	x	x		1,200	2	7			x	x	x	x		
	NEMBY	M.E	90	2	7	8				x	x		200	2	7	7			x	x	x		
	YPANE	M.E	90										90	2	7	8			x	x	x		
	CAPIATA	EMD	400	2	8				x	x	x		2,200	2	8			x	x	x	x		
	AREGUA	EMD	200	2	9	1			x	x	x		1,700	2	9	1		x	x	x	x		
	M.R. ALONSO	EMD	600	2	9	2			x	x	x		1,500	2	9	2		x	x	x	x		
	GUARAMBARE	EMD	200	2	9	3			x	x	x		600	2	9	3			x	x	x		
	EMBOSCADA	M.E	M	2	9	4			x	x	x		200	2	9	4			x	x	x		
	COL. NUEVA ITALIA	M.E	M	2	9	5			x	x	x		100	2	9	5			x	x	x		
	ZEBALLOS CUE	M.E		2	9	6			x	x	x		300	2	9	6			x	x	x		
	LIMPO	M.E	M	2	9	7			x	x	x		300	2	9	7			x	x	x		
CNEL. OVIEDO	CONCEPCION	EMD	600	3	1				x	x	x		7,700	3	1		x	x	x	x	x		
	HORQUETA	EMD	150	3	1	8			x	x	x		400	3	1	8			x	x	x		
	PASO BARRETO	M.E	M										200	3	1	7			x	x	x		
	P.J. CABALLERO	EMD	2,200	3	6			x	x	x	x		8,000	3	6		x	x	x	x	x		

TS	"Centrales automáticas"	System	Capacity (1986)	Numbering plan (∿ 1986)									Capacity (1997)	Numbering plan (1987 ∿ 1997)									Note
				A	B	C	D	E	F	G	H	J		A	B	C	D	E	F	G	H	J	
ASUNCION	PIRIBEBUY	EMD	200	5	1	5			x	x	x		1,400	5	1	5		x	x	x	x		
	TOBATI	EMD	200	5	1	6			x	x	x		1,000	5	1	6		x	x	x	x		
	ARROYOS Y ESTEROS	EMD	M										200	5	1	6	8		x	x	x		
	ATYRA	EMD	M										300	5	1	6	7		x	x	x		
CNEL. OVIEDO	CNEL. OVIEDO	EMD	1,200	5	2	1		x	x	x	x		8,200	5	2	1	x	x	x	x	x		
	SAN JOSE	CPR	100	5	2	1	8		x	x	x		600	5	2	1	8		x	x	x		
	C.H. STROESSNER	EMD	90	5	2	1	7		x	x	x		100	5	2	1	7		x	x	x		
	CAAGUAZU	EMD	600	5	2	2		x	x	x	x		3,500	5	2	2		x	x	x	x		
	J.M. FRUTOS	EMD	90	5	2	2	7		x	x	x		300	5	2	2	7		x	x	x		
	CAMPO 9	EMD	100	5	2	2	8		x	x	x		400	5	2	2	8		x	x	x		
	COL. J.R. CHAVEZ	M.E	M										200	5	6	1			x	x	x		
	YHU	M.E	M										200	5	6	2			x	x	x		
	VILLA CURUGUATY	M.E	M										300	5	6	3			x	x	x		
ASUNCION	PARAGUARI	EMD	400	5	3	1			x	x	x		2,800	5	3	1		x	x	x	x		
	PIRAYU	M.E	50	5	3	1	8		x	x	x		300	5	3	1	8		x	x	x		
	YAGUARON	CPR	200	5	3	1	7		x	x	x		1,500	5	3	3		x	x	x	x		
	CARAPEGUA	EMD	400	5	3	2			x	x	x		1,400	5	3	2		x	x	x	x		
	YBYCUI	EMD	150	5	3	2	8		x	x	x		1,000	5	3	4		x	x	x	x		
	LA COLMENA	EMD	100	5	3	2	7		x	x	x		300	5	3	2	7		x	x	x		
	QUINDY	EMD	100	5	3	2	6		x	x	x		700	5	3	2	6		x	x	x		
	ACAHAY	EMD	M										300	5	3	2	5		x	x	x		
	SAPUCAI	M.E	M										200	5	7	1			x	x	x		
	CABALLERO	M.E	M										100	5	7	3			x	x	x		
	ROQUE GONZALEZ	M.E	M										100	5	7	2			x	x	x		
	CAAPUCU	M.E	M										200	5	7	6			x	x	x		
	VILLARRICA	EMD	1,000	5	4	1		x	x	x	x		7,100	5	4	1	x	x	x	x	x		
	SAN JUAN NEPOMUCENO	EMD	90	5	4	1	7		x	x	x		600	5	4	1	7		x	x	x		
	COL. INDEPENDENCIA	EMD	200	5	4	1	8		x	x	x		600	5	4	3		x	x	x	x		
	PASO YOBAI	M.E	M										100	5	4	3	8		x	x	x		
	SAN SALVADOR	M.E	M										100	5	4	1	6		x	x	x		
	ITURBE	M.E	M										300	5	4	1	9		x	x	x		
	CAAZAPA	EMD	200	5	4	2			x	x	x		800	5	4	2		x	x	x	x		
	YEGROS	M.E	M										200	5	4	2	8		x	x	x		
	YUTY PUEBLO	M.E	M										200	5	4	2	7		x	x	x		

TS	"Centrales automáticas"	System	Capacity (1986)	Numbering plan (∿ 1986)									Capacity (1997)	Numbering plan (1987 ∿ 1997)									Note
				A	B	C	D	E	F	G	H	J		A	B	C	D	E	F	G	H	J	
CNEL. OVIEDO	CDAD. PTE. STROESSNER	EMD	5,000	6	1			2	x	x	x		15,200	6	1		x	x	x	x	x		
								5															
								5	x	x	x												
								8	x	x	x												
	J.L. MALLORQUIN	EMD	90	6	1	7	1		x	x	x		200	6	1	7	1		x	x	x		
	J.E. O'LEARY	EMD	90	6	1	7	2		x	x	x		300	6	1	7	2		x	x	x		
	COL. YGUAZU	CPR	150	6	1	7	3		x	x	x		300	6	1	7	3		x	x	x		
	KM 6 RUTA 7	CPR	200	6	1	7	4		x	x	x		400	6	1	7	4		x	x	x		
	HERNANDARIAS	EMD	600	6	3				x	x	x		3,000	6	3			x	x	x	x		
	COL. PTE. STROESSNER	EMD	400	6	4				x	x	x		800	6	4			x	x	x	x		
	SANTA ROSA (PARANA)	CPR	100	6	4	8			x	x	x		100	6	4	8			x	x	x		
CDAD. PTE. STROESSNER (Regional P.C.)	CDAD. PTE. STROESSNER	EMD	5,000	9	1			x	x	x	x			9	1		x	x	x	x	x		
	FOZ DE IGUAZU (BRAZIL)			9	2									9	2								
	HERNANDARIAS	EMD	600	9	3				x	x	x			9	3			x	x	x	x		
	COL. PTE. STROESSNER	EMD	400	9	4				x	x	x			9	4			x	x	x	x		
	SALTOS DEL GUAIRA	EMD	300	9	5				x	x	x			9	5			x	x	x	x		
	PTO. IGUAZU (ARGENTINA)			9	6									9	6								
	KM 6, RUTA 7	CPR	200	9	1	7	4		x	x	x			9	1	7	4		x	x	x		
	J.L. MALLORQUIN	EMD	90	9	1	7	1		x	x	x			9	1	7	1		x	x	x		
	J.E. O'LEARY	EMD	90	9	1	7	2		x	x	x			9	1	7	2		x	x	x		
	COL. YGUAZU	CPR	150	9	1	7	3		x	x	x			9	1	7	3		x	x	x		
	SANTA ROSA (PARANA)	CPR	100	9	4	8			x	x	x			9	4	8			x	x	x		
ENCAR NACION	ENCARNACION	EMD	4,000	7	1			x	x	x	x		13,000	7	1		x	x	x	x	x		
	SAN COSME Y DAMIAN	EMD	200	7	3				x	x	x		300	7	3	1			x	x	x		
	CNEL BOGADO	EMD	400	7	4				x	x	x		1,000	7	4			x	x	x	x		
	CARMEN DEL PARANA	EMD	90	7	4	8			x	x	x		300	7	4	8			x	x	x		
	COL. FRAM	EMD	90	7	4	6			x	x	x		90	7	4	6				x	x		
	SAN PEDRO DEL PARANA	EMD	90	7	4	7			x	x	x		200	7	4	7			x	x	x		
	HOHENAU	EMD	200	7	5				x	x	x		1,100	7	5			x	x	x	x		
	BELLA VISTA SUR	EMD	100	7	5	7			x	x	x		400	7	5	7			x	x	x		
	PIRAPO	EMD	200	7	5	8			x	x	x		400	7	5	8			x	x	x		
	CAPITAN MIRANDA	M.E	M										100	7	6	1			x	x	x		
	LA PAZ	M.E	M										200	7	6	2			x	x	x		
	GRAL. DELGADO	M.E	M										100	7	6	3			x	x	x		
	GRAL. ARTIGAS	M.E	M										200	7	6	4			x	x	x		
	YACYRETA (AYOLAS)	EMD	800	7	2			x	x	x	x		1,200	7	2			x	x	x	x		

TS	"Centrales automáticas"	System	Capacity (1986)	Numbering plan (∿ 1986)									Capacity (1997)	Numbering plan (1987 ∿ 1997)									Note
				A	B	C	D	E	F	G	H	J		A	B	C	D	E	F	G	H	J	
CNEL. OVIEDO	YBY YAY	M.E	50	3	6	8			x	x	x		200	3	6	8			x	x	x		
	CHIRIGUELO	M.E	M	3	6	7							100	3	6	7			x	x	x		
	CAPITAN BADO	EMD	200	3	7				x	x	x		900	3	7			x	x	x	x		
	BELLA VISTA NORTE	EMD	200	3	8				x	x	x		700	3	8			x	x	x	x		
	ITAC. DEL ROSARIO	EMD	200	4	1				x	x	x		1,400	4	1			x	x	x	x		
	COL. GRAL AQUINO	M.E	50	4	1	8			x	x	x		300	4	1	8			x	x	x		
	SANTA CLARA	M.E	M										200	4	1	7			x	x	x		
	SAN PEDRO	EMD	400	4	2				x	x	x		2,400	4	2	1		x	x	x	x		
	LIMA	M.E	M										200	4	2	3			x	x	x		
	PTO. ANTEQUERA	M.E	M										200	4	2	4			x	x	x		
	NUEVA GERMANIA	M.E	M										100	4	2	5			x	x	x		
	SANTA ROSA	M.E	M										100	4	2	6			x	x	x		
	SAN ESTANISLAO	EMD	200	4	3				x	x	x		2,500	4	3	1		x	x	x	x		
	TACUARAS NORTE	EMD	M										100	4	3	2			x	x	x		
	FELIPE MATIAUDA	EMD	M										100	4	3	3			x	x	x		
	VILLA DEL ROSARIO	EMD	200	4	4				x	x	x		800	4	4			x	x	x	x		
	COL. VOLENDAM	EMD	M										100	4	4	7			x	x	x		
	COL. CHORE	M.E	M										200	4	4	8			x	x	x		
	SALTOS DEL GUAIRA	M.E	300	4	6				x	x	x		1,700	4	6			x	x	x	x		
	LA PALOMA	M.E	90	4	6	8	1		x	x	x		100	4	6	8	1		x	x	x		
	CORPUS CRISTI	M.E	100	4	6	8	2		x	x	x		100	4	6	8	2		x	x	x		
ASUNCION	CAACUPE	EMD	800	5	1	1		x	x	x	x		3,800	5	1	1		x	x	x	x		
	SAN BERNARDINO	EMD	400	5	1	2			x	x	x		2,600	5	1	2		x	x	x	x		
	ALTOS	M.E	M										100	5	1	2	8		x	x	x		
	YPACARAI	EMD	400	5	1	3			x	x	x		1,900	5	1	3		x	x	x	x		
	ITAUGUA	EMD	150	5	1	3	8		x	x	x		600	5	1	3	8		x	x	x		
	EUSEBIO AYALA	EMD	200	5	1	4			x	x	x		1,600	5	1	4	x	x	x	x	x		
	ITAC. DE LA CORDILLERA	CPR	150	5	1	4	8		x	x	x		500	5	1	4	8		x	x	x		
	SANTA ELENA	EMD	90	5	1	4	7		x	x	x		100	5	1	4	7		x	x	x		
	ISLA PUCU	M.E	M										100	5	1	4	6		x	x	x		
	1° DE MARZO													5	1	4	5		x	x	x		
	CARAGUATAY	M.E	M										300	5	1	4	9		x	x	x		

TS	"Centrales automáticas"	System	Capacity (1986)	Numbering plan (∿ 1986)									Capacity (1997)	Numbering plan (1987 ∿ 1997)									Note
				A	B	C	D	E	F	G	H	J		A	B	C	D	E	F	G	H	J	
ENCAR-NACION	S.J. BAUTISTA	EMD	400	8	1				x	x	x		1,200	8	1			x	x	x	x		
	SAN IGNACIO	EMD	400	8	2				x	x	x		1,400	8	2			x	x	x	x		
	VILLA FLORIDA	EMD	200	8	3				x	x	x		500	8	3	1			x	x	x		
	SANTA ROSA MISIONES	EMD	200	8	1	8			x	x	x		600	8	4	1			x	x	x		
ASUNCION	PILLAR	EMD	800	8	6			x	x	x	x		4,800	8	6			x	x	x	x		
	ALBERDI	EMD	200	8	7				x	x	x		1,200	8	7			x	x	x	x		
	FILADELFIA	EMD	200	9	1				x	x	x		1,200	9	1			x	x	x	x		

Notes: 1) In the system column, "M.E" means movable exchange.

2) In the capacity column, "M" means manual exchange.

3-3 Non-telephone Telecommunication Networks

The conventional major telecommunication services are mainly transmiting and switching of voice signals. But socio-economic expansion and internationalization in future will bring about diversified needs for non-telephone telecommunication services such as transmission of data, documents and picture, and other types of information. The measures to be taken by ANTELCO for the moment in order to meet these needs will be to construct and expand the telex network, to plan data communication service and to introduce digital transmission and switching systems actively in order to establish an ISDN (Integrated services digital network) into which various communication networks are integrated.

3-3-1 Telegraph and telex networks

(1) A telex exchange using digital switch will be installed at Asunción for the purpose of expanding domestic and international telex message switching.

(2) The domestic public telegrams will be processed by the gentex system using the telex network.

The telex terminal equipment for transmission and reception of domestic telegrams will be installed at automatic exchanges called end offices, and major business offices. The telegrams handled at the manual exchanges will be delivered to or from automatic exchanges by making use of a mini facsimile over a telephone network. The transmission of telegram between end office and business office may be handled by telephone.

The network arrangement for telegraphic service is shown in Fig. III-I-4.

(3) TDM (time division multiplexer) will be installed as shown in Fig. III-I-5 for the purpose of realizing

economic transmission system to meet the demand of telex subscribers, and will be connected to the telex exchange at Asunción. Where the traffic between TDM concentration office and local end office (automatic) is comparatively heavy, or where distant telex terminals cannot be accommodated directly, the existing VFT (voice frequency telegraphy equipment) will be used.

(4) Figs. III-I-4 and III-I-5 show a network plan for domestic telegraphic and telex services.

3-3-2 Data communication network

For the purpose of meeting the future needs for diversified data communication services, data communication circuit switching will be carried out by making use of telex switches with data communication function.

The packet switching network will be studied some day after the Master Plan study when socio-economic developments in Paraguay has come to need it. As needs may arise to urge early development of data communication network, the configuration and functions of the packet switching network and an example of data communication system which ANTELCO may be able to establish and provide service are shown in the annex to this report. (Refer to ANNEX, I-4 and Fig. A I-1 to Fig. A I-14).

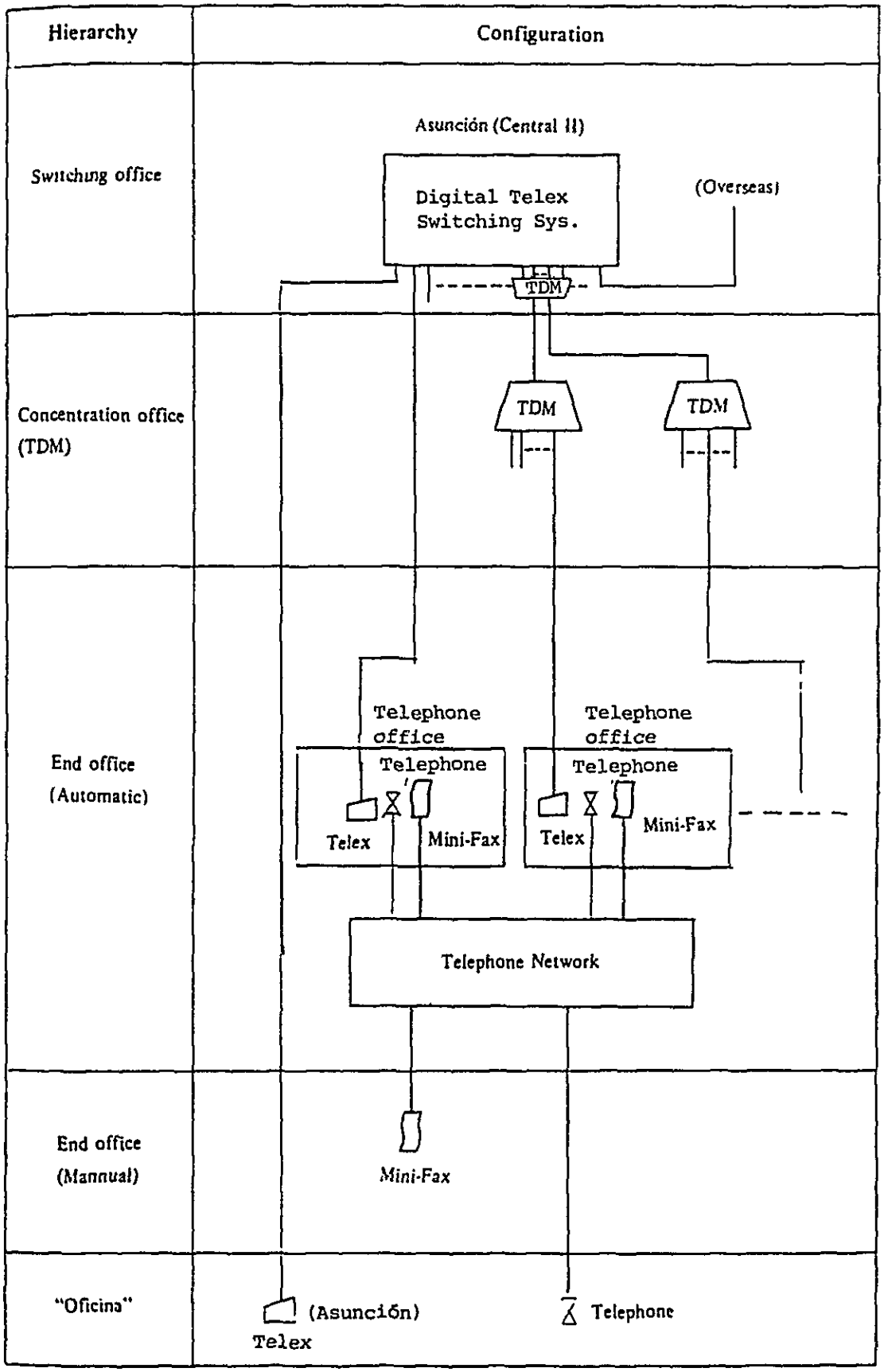


Fig. III-I-4 Office hierarchy of telegraph and telex services

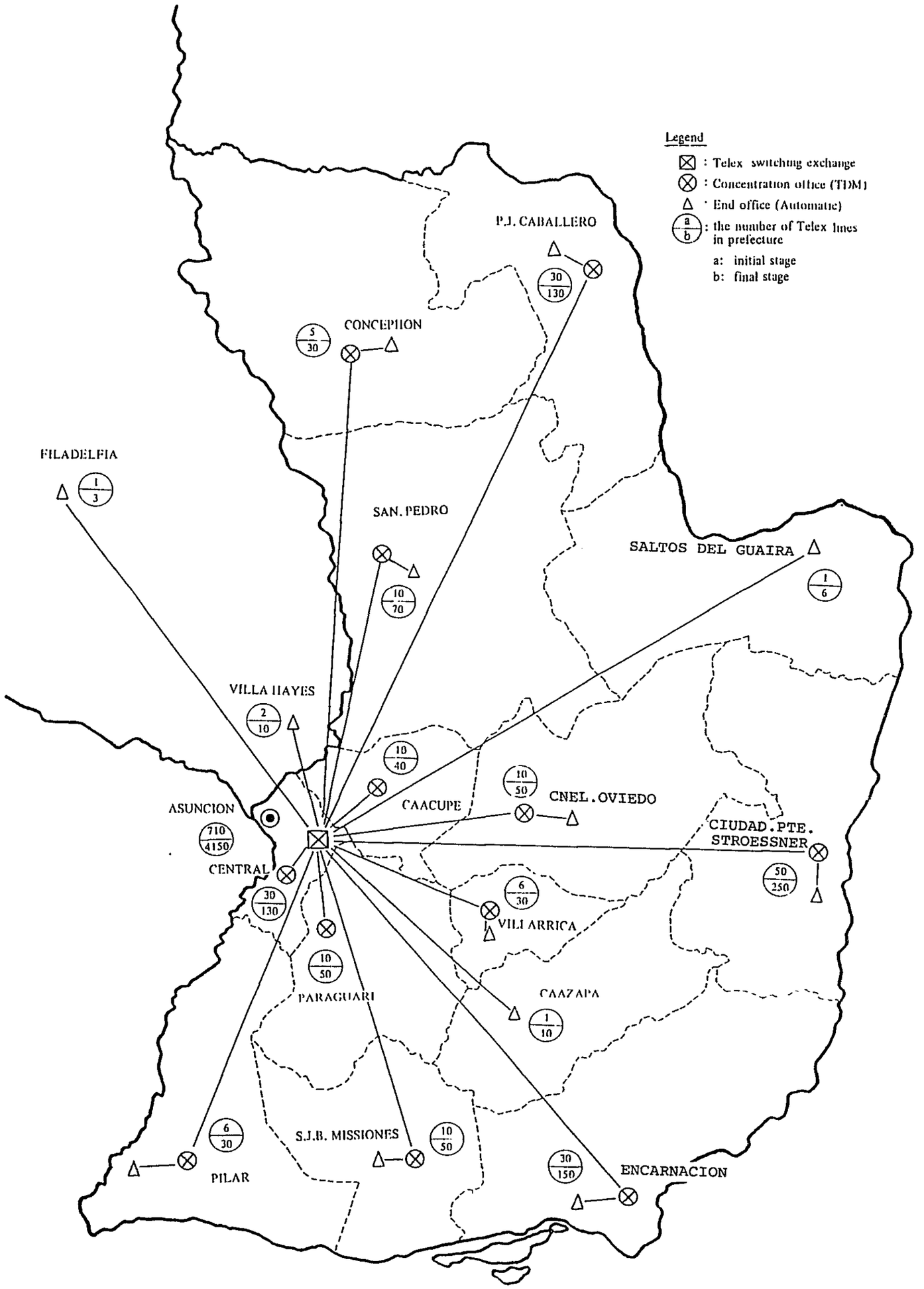


Fig. III-I-5 Domestic telegraph & telex network

CHAPTER 4. ENGINEERING STANDARDS

4-1 Telephone Traffic

In general, telephone traffic engineering standards give engineering specifications that ensure the quality of telephone service to the subscribers in terms of completion and rapidity of call connection.

It is composed of design standard and control standard. The design standard specifies the equipment capabilities to ensure a specified level of service quality, while the control standard specifies the criteria upon which to judge the justifiability of actual service quality.

The provisions in the telephone traffic engineering standard refer to a case where the equipment is in good working order and the traffic is normal. Where the telephone system is required to maintain a specific level of service quality even when the system components are damaged by floods, lightning or other natural hazards or when the traffic gets out of order, it is necessary to establish separate standards along with measures against such troubles.

(1) Prerequisites for traffic engineering standard

1) Reference traffic

In order to establish the technical specifications for switching performance and the methods of figuring out the capacity of equipment to be installed, it is necessary to determine, first of all, the traffic upon which such specifications and methods are to be formulated. This traffic is called the reference traffic, and is defined as the mean of the 30 highest days of busy-hour traffic during a 12-month period. This is based upon the CCITT's recommendations for the reference traffic of international circuits.

The traffic used for the calculation of the quantities of equipment and circuits is an forecasted quantity; namely, it means the reference traffic expected at the time when the equipment and circuits will be necessary. What underlines the traffic forecast is the reference traffic data measured in the past. In actuality, however, the daily traffic measuring is difficult, and it is often practiced to forecast the reference traffic from the traffic data of the days predetermined statistically.

2) Ineffective call and its handling

An ineffective call is also called a lost call, which is denied access to the called party for some reasons.

The ineffective call is handled together with successful call in calculating the reference traffic, reference number of calls, and mean holding time.

3) Overload and its handling

The overload refers to such a load on a telephone system that runs in excess of the reference traffic set for that system. The overload condition is very difficult to forecast. If we are to design and provide the system equipments to meet such rare occasions, it will be against economics. For those overloads which are predictable, the reference traffic and equipment calculation requirements should be reviewed by taking into account their magnitude and probability of occurrence in order to ward off a severe decline in service quality due to such overloads.

(2) Switching performance

1) Switching performance, and the factors

The switching performance means the service quality that the calling party will experience all the way from the moment of his will and action to place a call through all due processes to the termination of his call to the called party. The factors that affect the switching performance are largely classified into connection loss and connection delay time.

a) Connection loss

Connection loss is a state where subscriber originating call becomes a loss on the way to called party, being encountered by a possible circuit, switch and called party busy, or called party no answer.

b) Connection delay time

The connection delay time is a time delay needed for a calling party from the moment of call origination to the time when the calling party can send a selecting signal, and from the time the last digit of telephone number is dialed up to the time the called party responds. In other words, it means the time the calling party must wait until the called party responds.

The foremention quality standard should be determined so that it can be satisfactory to telephone users considering the characteristics of switching services (automatic or manual local call connection, automatic or manual long-distance call connection, special service code connection, international call connection, mobile radio call connection etc.) and that it will not cause too much unfavour for equipment engineering economy.

2) Establishment of connection loss standards

a) Dial tone stage

Considering the service levels in various countries and an economy of investment, the maximum connection loss should not be more than 0.5%.

b) Switching stage

The reasonable connection loss varies depending on each state of connection, and should be determined with the consideration of the number of switching stage, the satisfaction of users, and engineering economy.

c) "Called party line busy" rate

The rate of "called party line busy" can be determined, as a target of improvement through an amplification of telephone service, based on the past experience data if possible. It can be well determined to some reasonable value of less than 15%.

3) Establishment of connection delay time standards

a) Dial tone delay

The dial tone delay standard is determined with the consideration of user dialing behavior, degree of satisfaction to subscriber and service levels etc. in other countries as well as the functioning time of the equipment.

It is convenient to measure and control the dial tone delay in terms of probability distribution,

such as "probability of cases exceeding 3 sec. in delay is less than 1%."

b) Post-dialing delay in full-automatic service

The post-dialing delay in full-automatic service is the time from the completion of dialing to the arrival of ring-back tone. The automatic switching service is available for toll call connection, local call connection and service code call connection. These are also subclassified according to whether the switching system is of a step-by-step type or a common control type. All these connection processes are different physically, and each post-dialing delay should be determined with a due consideration given to respective functional characteristics.

c) Answer time delay

This is a time elapse between the appearance of signal on a switchboard and the response by an operator. The answer time delay is determined based on the degree of subscriber satisfaction to the service, standard level of operator work efficiency, and the time of operation to be required. In most countries, the answer time delay is specified in terms of the distribution of responses taking more than a certain time, e.g. 11 sec. The frequency distribution often is determined differently depending on the type of switchboard, and the associated call distribution system.

d) Operator-assisted call time delay

The operator-assisted call connection service is classified into non-delay connection service and delay connection service. For the former,

it is proper to specify the delay from the operator response to the arrival of ringing tone. For the latter, the maximum waiting time acceptable by subscribers should be specified. For these items, target values for improvement should be set referring to the service levels in other countries.

As an example, the standard specifications for switching performance are indicated in Table III-I-3. It is recommendable to take consideration of the current service level and to establish a switching performance, with reference to the proposed specifications in mind to meet demand with an actual situation of national need.

(3) Establishment of loss probability allocation standard

In each switching system, there are sub-systems where a possible call loss can be produced. It is necessary to distirbute the loss probability along such sub-systems so that the sum of the overall loss probabilities will not exceed the probability of busy state specified.

In Paraguay, the telephone network has not so many numbers of hierarchy levels and of relevant circuit links in tandem, and its transmission line capacity has a comparatively large margin. Accordingly, a satisfactory connection service quality can be obtained if a loss probability is specified for 1% for each of both toll and local call connection stages. Since a traffic control system has not yet to be established in Paraguay, an ample margin for the standard should be provided to absorb a possible traffic change and traffic forecast error.

(4) Connection delay time allocation standard

In an automatic switching system, factors that delay the connection include times required for the transmission of address signal, switching time, ringback tone waiting time and common equipment access time etc. In a manual switching system, the operator operation can be divided into several work steps in the performance of each specific job, and each work step has factors that delay the connection time.

For the purpose of maintaining an acceptable level of service quality, it is required to allocate delay time to each work steps in a manner that will fulfill the overall switching performance requirements.

Connection delay time varies depending on the network arrangement and switching system in case of automatic call connection, and depending on the type of service, specific operator procedures, in case of manual call connection. At present, therefore, it cannot be specifield uniformly. It is therefore, recommenced to establish a connection standard as a provisional target for upgrading telephone switching service.

Table III-I-3 Switching performance

Items				Measure	Standard value
Loss probability in connection	Dial tone stage busy			probability of busy	0.5%
	Switching stage busy	long distance call connection		probability of busy	10.0%
		local call connection	6D	probability of busy	4.0%
			4D 5D	probability of busy	3.0%
		special service code connection		probability of busy	3.0%
	Subscriber busy			probability of busy	less than 15%
Connecting time	Dial tone delay			time distribution ratio	more than 3 seconds 1%
	Automatic service	long distance call connection		time	15 seconds
		local call connection	4D	time	2 seconds
			5D	time	4 seconds
			6D	time	6 seconds
		special service code connection		time	3 seconds
	Answering time of operator	local board		time distribution ratio	more than 11 seconds 5%
		directory assistance board		time distribution ratio	more than 11 seconds 15%
		toll board		time distribution ratio	more than 11 seconds 15%
		test board		time distribution ratio	more than 11 seconds 10%
	Combined line and recording board			time distribution ratio	more than 71 seconds 15%
	Delay board	long distance		waiting time	less than 90 minutes
		near distance		waiting time	less than 40 minutes

Note: Standard value shows an example.

4-2 Telephone transmission

The telephone transmission engineering standard has the following aims.

1) To ensure good transmission quality for the majority of calls.

2) To ensure encho and circuit stability.

3) To comply with the CCITT's Recommendations for international connection.

4) To give the guidance in designing various transmission systems to be used in the national network.

All these should be achieved at the lowest possible cost.

(1) Routine plan and trunk network

The transmission standard is formulated based on the network configuration shown in Fig. III-I-1.

The three secondary centers, Asunción, Encarnación and Cnel. Oviedo, are interconnected with high-speed four-wire transmission circuits with low losses. The toll switches at these centers perform four-wire switching. During the project period, the toll calls incoming to and outgoing from Asunción will be exchanged through the existing four-wire/two-wire switch, then connected to the local switches. The international calls will be connected over four-wire circuits up to local switches via TD international switch.

(2) Relevant CCITT Recommendations

The national part of international connection must comply with the relevant CCITT Recommendations. The most important recommendations are;

G121: Recommendations concerning reference equivalent

G122: Recommendations concerning stability and echo loss

G101: Recommendations concerning the international connections

G105: Recommendations concerning the general characteristics of four-wire trunk circuits

(3) Corrected reference equivalent (CRE), and its distribution

1) International connections

CCITT Recommendations are given in G121 with respect to the national part of international connections. Namely, it is specified that national sending CRE from the subscriber station to the first virtual international switching point be less than 25 dB and that the receiving CRE be less than 14 dB.

2) National connection

The CRE of a call between two parties within a country must be less than 39 dB when routed over backbone network. This requirement automatically fulfils the international connection requirements referred to above. The loss distribution of national system has already been specified in the master plan formulated by ITU in 1967. During the project period up to 1997, there are no new plans concerning toll switches and toll trunk networks, and the requirements set forth in the ITU master plan will be left intact. Namely, the loss between local switches will be set at 15.6 dB max. (1.8 N max.). (Fig. III-I-6)

a) Call connection within Asunción

According to the present Master Plan, the local switches in Asunción are scheduled to be digitalized totally (TD switch). Thus, it is required to newly establish a transmission loss allocation standard. The permissible minimum loss assigned to TD switch is limited by the impedance characteristics of subscriber line and transit circuit. The minimum loss of TD switch determined from a viewpoint of impedance matching requirements is shown in Fig. III-I-7. For the intra-office traffic the loss should be set at 4 dB considering the speech quality. (Fig. III-I-8)
For the local junction connection, the loss is usually set at 4 to 8 dB. (Fig. III-I-9)

b) Toll connection in Asunción

The toll calls from or to Asunción will be exchanged by a toll switch with two-wire circuits as they are now. According to the ITU plan, the PC-LE loss assigned to Asunción is required to be 0.55 N, including an intra-office loss of 0.1 N. It will be maintained, and the loss between the local switch and TS switch will be set at 4 dB. (Figs. III-I-10 and III-I-11)

c) International call connection in Asunción

The international calls of Asunción are carried from local switches to an international office via four-wire circuits. At the international office, the calls are exchanged by four-wire switching. The maximum loss between the local switch and virtual international switching point will be set at 4 dB. In this case, the echo and

stability requirements fall in with those specified in the ITU plan. (Fig. III-I-12)

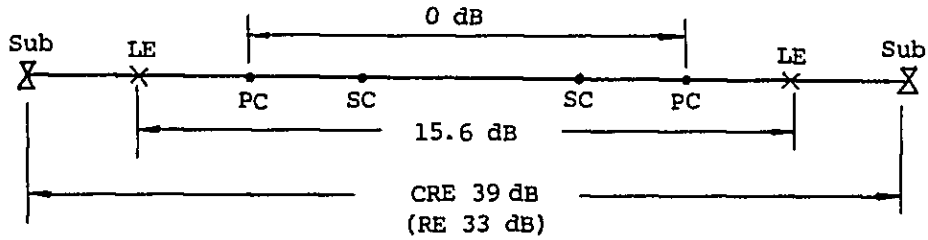


Fig. III-I-6 Maximum overall CRE of national network

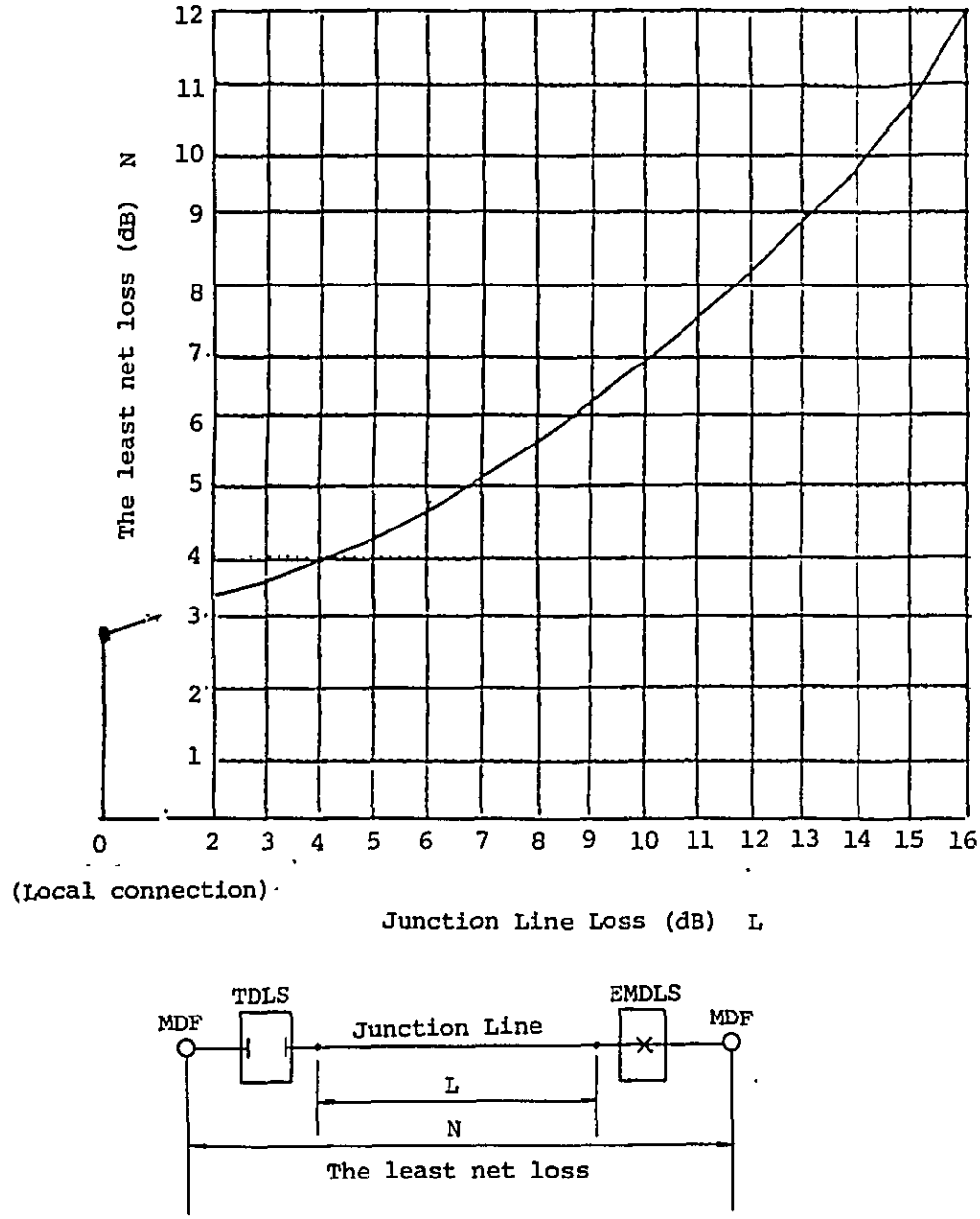


Fig. III-I-7 The least net loss of local connection and TD -EMD junction connection by metallic pair cable

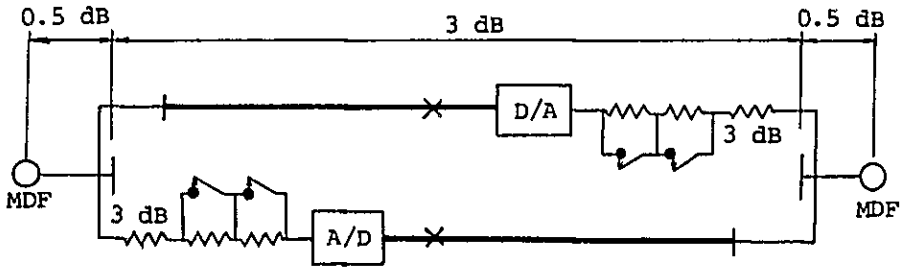


Fig. III-I-8 Intra-office connection

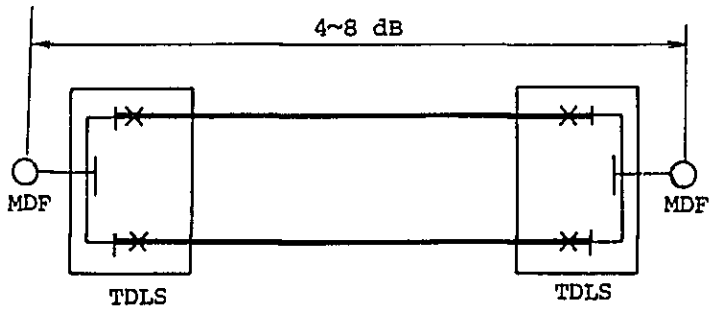


Fig. III-I-9 Junction connection

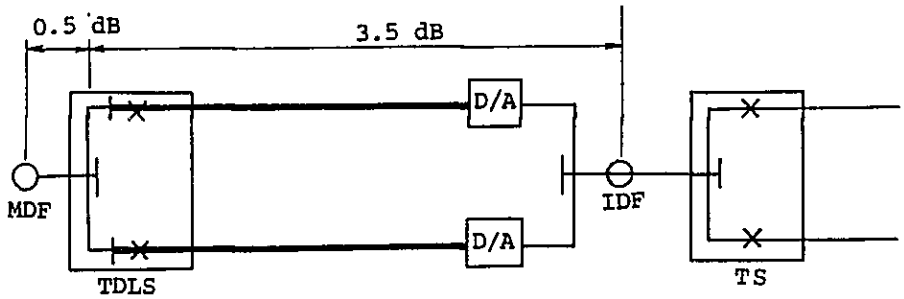


Fig. III-I-10 Toll junction connection (outgoing)

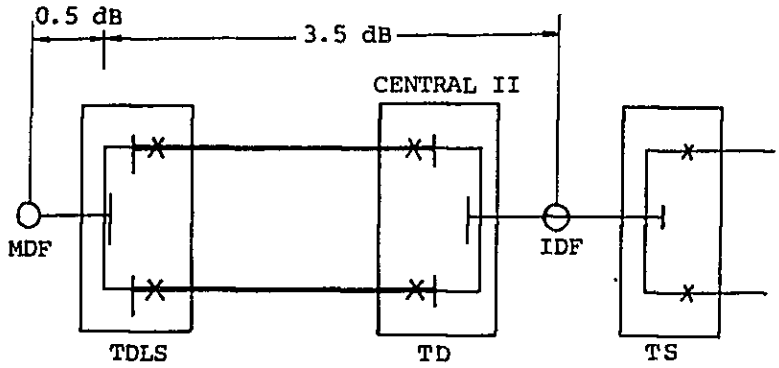


Fig. III-I-11 Toll junction connection (incoming)

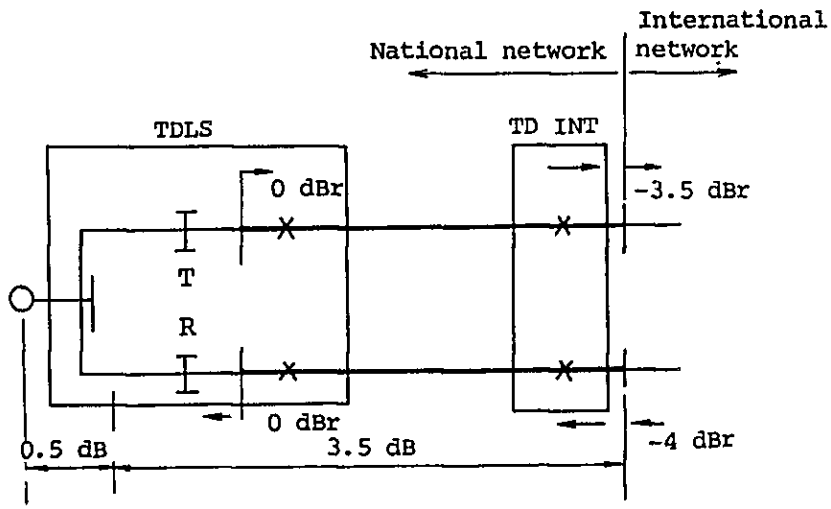


Fig. III-I-12 International connection

4-3 Engineering Standards for Non-telephone Communication Network

The non-telephone communication networks in Paraguay include the existing telex switching network and a packet switching network which may be installed after the present project. No doubt, the packet switching network will become the mainstay for the non-telephone communication services. And, ANTELCO is recommended to closely study operating systems, tariff schedule, domestic and international requirements, etc. to provide for future developments.

(1) Technical matters

Numbering plan, interface (electrical and physical requirements, protocol), network performance and transmission quality, etc. are to be studied.

(2) Matters concerning network configuration

What must be considered from the viewpoint of network arrangement includes encoding system, network synchronization system, transmission system, signaling system and switching system. Every country has been stepping up efforts to establish engineering standards for these systems for the purpose of realizing ISDN (integrated services digital network) in accordance with CCIT Recommendations.

It is therefore recommended in view of these international developments that ANTELCO will establish engineering standards in accordance with CCITT Recommendations.

The CCITT Recommendations concerning interface requirements between packet switching network and terminals are as follows.

CCITT Recommendations

Packet switching network - Computer	(X.75)
Packet switching network - Non-packet terminal	(X.28)
Packet switching network - International packet network	(X.75)
Packet switching network - Teletex terminal	(X.25)
Packet switching network - Facsimile equipment	(X.25)
Packet switching network - Asynchronous terminal	(X.28)

A packet network and a subscriber connecting diagram are shown in the ANNEX as reference.
(ANNEX. I-4 and Fig. A I-1 to Fig. A I-9)

CHAPTER 5. DEMAND FORECAST

5-1 Subscriber Telephone

5-1-1 Demand growth, and its prospect

While the demand trends in the past elude evaluation for want of demand-supply control data, the telephone density, the subscribers on a waiting list, PIB, etc. all suggest that the potential demand for telephone service is quite high in Paraguay.

In the future, the growth of socio-economic activities and the improvement of living standard will expand and actualize the potential demand.

5-1-2 Preconditions for demand forecast

(1) There will be no significant changes in rate system.

(2) The socio-economic conditions will remain stable.

5-1-3 Results of demand forecast

(1) National total macroscopic demand

As forecast in Table III-I-4 and Fig. III-I-13, the demand in 1997 will be about 434,000.

(2) Demand for each telephone office (Asunción)

As shown in the ANNEX (Table A I-5), the number of subscribers in Asunción will be 268,000 in 1997.

(3) Demand for each telephone office (other than Asunción)

As shown in the ANNEX (Table A I-5), the demand will be about 166,000 in 1997.

Table III-I-4 Telephone demands through the country

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Telephone demands through the country (x 1000)	105.7	117.9	131.1	145.7	161.3	178.1	196.5	215.9	236.5	258.4	281.3	305.6	329.8	355.3	381.1	407.1	433.6

Note: The details are shown in the ANNEX (Table A I-5 and Table A I-12).

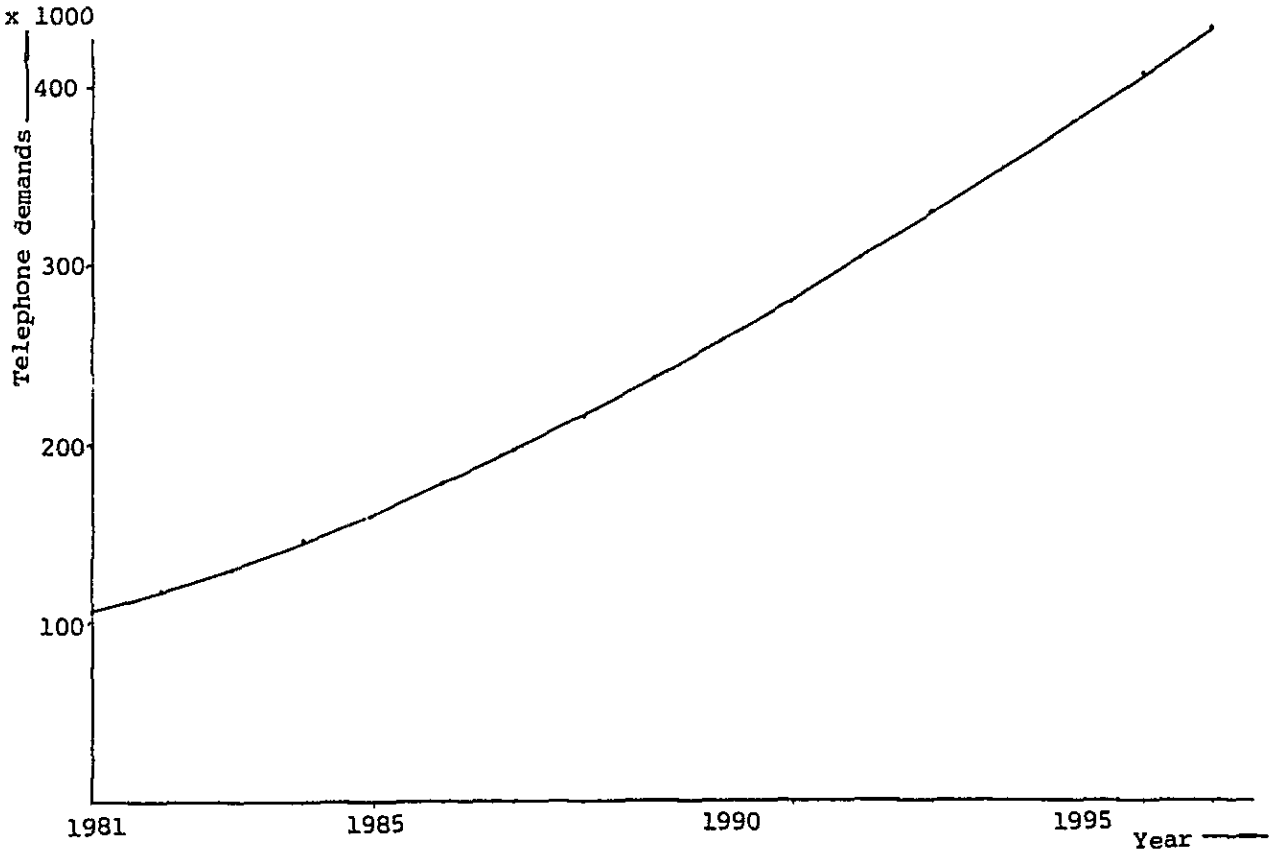


Fig. III-I-13 Telephone demands through the country

5-2 Mobile Radio Communication

5-2-1 Land mobile radio telephone

The forecast of demand for land mobile radio telephone service has been made with respect to passenger cars, buses and jeeps.

The number of motor vehicles has been forecast according to the following assumptions because sufficient statistical data are not available.

(1) In 1979, the total number of motor vehicles, inclusive of unregistered ones, was four times as many as the number of registered motor vehicles.

(2) The number of motor vehicles is estimated from the number of registered motor vehicles in 1979, and its annual growth rate will be equal to the growth rate of GNP.

The results of forecast are shown in ANNEX, Table A I-8.

During the Master Plan period, the land mobile radio telephone service will be limited to Asunción and Central where the vehicular traffic is heavy, because it must pay its way.

The land mobile radio telephone service calls for heavy equipment investment, and the area other than above are discarded because the vehicular traffic there is not enough to warrant the service extension.

The demand source for mobile radio telephone service will be the motor vehicles (passenger cars, buses and jeeps) of the government authorities, public institutions, and private businesses in Asunción and Central. The ratio of the said motor vehicles to the total of motor vehicles will be 17%.

The demand factor (maximum number of demand per 100 demand source vehicles) is set at 7.65 in consideration of the diffusion rate in other countries, and the demand will increase in number along a modified exponential curve after the commissioning of the service.

Judging from the leveling of construction work, the starting year of the land mobile radio telephone service will be 1990.

Table III-I-5 shows the demand forecast of land mobile radio telephone service.

Table III-I-5 Land mobile telephone service demand forecast

Year	1990	1991	1992	1993	1994	1995	1996	1997
Demand source (unit 1,000)	50.6	55.5	60.8	66.6	72.9	79.8	87.3	95.4
Demand	258	555	888	1,259	1,669	2,123	2,619	3,167

Reference: Demand factor $y = 7.65 - 7.14 \times 0.931^{t}$

where $t = 0$ in 1990.

5-3 Non-telephone Services

5-3-1 Telegraph service

The numbers of telex terminals and mini facsimiles required for public telegraph service have been calculated according to the following method.

(1) Preconditions

1) Every automatic telephone office will be equipped with telex terminals enough to handle national public telegraphic traffic to be commensurated in its service area.

2) Every manual telephone office will be equipped with mini facsimiles enough to handle national public telegraphic traffic to be commensurated in its service area. (A mini facsimile will be used for telegraphic communication between manual and automatic offices, and the automatic office which presides over subordinate manual offices will also be equipped with a mini facsimile.)

(2) Method of calculation

1) Annual macroscopic demand forecast of telegrams is made by multiplying the number of per capita annual telegrams (telegram usage rate) determined from past data by the annual forecast population growth.

2) Forecast of telegram demand by office is made by multiplying the annual macroscopic demand by country-wise population ratio and office-wise coverage ratio which have been used also in the telephone demand forecast.

3) Telegraphic traffic is determined by multiplying the office-wise telegram demand by the average number of characters per telegram and transmission time factor.

The busy-hour traffic concentration factor is assumed to be 1/8, and the number of telex terminals or mini facsimiles necessary to cover the busy-hour traffic at a loss probability of 1/100 is calculated.

5-3-2 Telex service

The prospective customers of telex service are assumed to be establishments having 5 employes or more and showing an annual turnover of 10 million Guaranies or more. The demand has been forecast according to the following method.

1) In around 1997, the needs for data communication will increase, and the telex demand growth will be saturated. This is because the telex switches planned to be installed in the project are capable of handling data communication circuits; the demand increase in data communication and the commissioning of the packet data switching network some day after 1997 will cause some of the telex users to go for new services.

2) The saturation level of telex demand has been determined by multiplying the total number of establishments expected in 1997 by the ratio of those having 5 employes or more and showing an annual turnover of 10 million Guaranies or more and the telex diffusion rate (0.55).

3) Based on the assumptions above and the past data on telex diffusion rate, the annual transition of the telex terminal growth has been forecast using a logistic regression curve as shown in Table III-I-6.

5-3-3 Facsimile service

In the facsimile communication, the messages and patterns can be transmitted recordably. In the future, the facsimile terminals will find their way not only in public government offices and private companies, but also in the homes. It is therefore recommended that ANTELCO will initiate facsimile communication service. At present, the demand trends are up in the air, and we cannot be categorical about the number of terminals, etc. For the time being, however, the telefax system should be introduced by making use of telephone network. In the future, when the packet switching network is complete, between terminals of different clases, broadcasting call, and other various services will be introduced, even more amplifying the demand for facsimile communication service.

5-3-4 Data communication

In line with ANTELCO's policy, the data communication service will not be introduced during the project period, and its demand forecast is omitted here. (Refer to CHAPTER 2, sub-para. 2-1-7)

Table III-I-6 Demand forecast for telex and facsimile

Area	Item	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Remarks
Nation-wide	(A) Telex for public telegraph	79	79	79	79	108	111	115	115	115	117	119	127	131	132	132	
	(B) Telex for subscribers	860	1020	1170	1350	1780	2060	2330	2640	2970	3320	3630	4040	4380	4735	5050	
	(C) Fax for public telegraph	191	191	191	191	196	196	196	196	196	196	196	196	196	196	196	
Asunción area	(A) Telex for public telegraph	26	26	26	26	28	28	28	28	28	28	28	28	28	28	28	
	(B) Telex for subscribers	700	835	958	1106	1458	1687	1908	2162	2432	2719	2973	3309	3587	3874	4140	
	(C) Fax for public telegraph	9	9	9	9	12	12	12	12	12	12	12	12	12	12	12	
Areas other than Asunción	(A) Telex for public telegraph	53	53	53	53	80	83	87	87	87	89	91	99	103	104	104	
	(B) Telex for subscribers	160	185	212	244	322	373	422	478	538	601	657	731	793	816	910	
	(C) Fax for public telegraph	182	182	182	182	184	184	184	184	184	184	184	184	184	184	184	

CHAPTER 6. DEMAND FULFILLMENT PLAN

6-1 Subscriber Telephone

(1) A plan will be made to fully meet the telephone demand in Asunción and other major cities (cities with telephone demands of 1,000 or more in 1997) in 1997.

(2) For other areas, a plan will be made to fulfill more or less 90% of the demand in 1997.

(3) The resultant telephone service level will be as summarized in Table III-I-7; in 1997, the number of telephone lines per 100 people will be 8.0 on the national average (as against 1.7 as of 1981), 24.4 in Asunción (as against 6.2 in 1981), and 3.5 in the areas other than Asunción (as against 0.5 in 1981).

(4) The demand fulfillment plan by exchange is shown in ANNEX, Table A I-12.

Table III-I-7 Telephone service level

		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
(1)	Population (x 1000)	3168	3263	3370	3473	3576	3681	3788	3897	4007	4118	4231	4344	4459	4574	4690	4807	4926	5047
	Subscribers (x 1000)	49.5	54.7	68.7	76.9	86.3	96.6	107.7	120.1	139.1	160.0	183.1	208.5	236.0	265.7	297.7	331.5	367.3	405.0
	Density (per 100 population)	1.6	1.7	2.0	2.2	2.4	2.6	2.8	3.1	3.5	3.9	4.3	4.8	5.3	5.8	6.3	6.9	7.5	8.0
(2)	Population (x 1000)	649	669	690	712	734	758	782	807	832	859	886	914	942	972	1002	1033	1065	1098
	Subscribers (x 1000)	37.7	41.2	53.4	59.0	65.7	73.0	80.8	89.5	101.7 [10.2]	115.1 [18.9]	129.8 [29.8]	145.8 [41.2]	163.1 [58.4]	181.7 [73.0]	201.6 [92.9]	222.6 [113.9]	244.8 [136.0]	268.0 [159.2]
	Density (per 100 population)	5.8	6.2	7.7	8.3	9.0	9.6	10.3	11.1	12.2	13.4	14.7	16.0	17.3	18.7	20.1	21.5	23.0	24.4
(3)	Population (x 1000)	2519	2594	2680	2761	2842	2923	3006	3090	3175	3259	3345	3430	3517	3602	3718	3774	3861	3949
	Subscribers (x 1000)	11.8	13.5	15.3	17.9	20.6	23.6	26.9	30.6	37.4	44.9	53.3	62.7	72.9	84.0	96.1	108.9	122.5	137.0
	Density (per 100 population)	0.5	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.1	1.4	1.6	1.9	2.0	2.3	2.6	2.9	3.2	3.5

(1) ... Through the country

(2) ... Asunción area (including F. de la Mora, Lambaré)

(3) ... Except for Asunción area

[ ] ... Push-button dial telephones (included in the number without parentheses)

6-2 Public Telephone

(1) A plan will be made to encourage the installation of public telephones with center around Asunción.

(2) The number of public telephones per 1,000 inhabitants in 1997 will be 0.87. (Refer to ANNEX, I-2)

6-3 Mobile Radio Communication

6-3-1 Land mobile radio telephone

A plan will be made to fully meet the annual demand for land mobile radio telephone service.

At the end of the Master Plan period (1997), the number of subscribers will be about 3,200.

6-4 Telegraph and Telex

(1) Every automatic switching office will be installed with a telex terminal for public telegraph use. The manual offices will also be furnished with a telex terminal when they are automatized. As a result, the total number of telex terminals for public telegraph will be 132 toward the end of the project.

(2) The manual offices and their superordinate automatic offices will be furnished with a mini facsimile for public telegraph. The installation of the facsimile terminals will be phased to level the annual construction volume. The mini facsimile terminals for public telegraph use will reach 196 in number toward the end of the project period.

(3) A plan will be made to fully meet the annual demand for telex service for subscribers.

6-5 Facsimile Service for Subscribers

The facsimile service will be extended to subscribers upon request by making use of telephone network if the demand arises during the project period. At present, however, the demand will be little. The terminal equipment will be built up in keeping with the actualization of demand.

6-6 Data Communication

1,200 bit/s MODEM will be prepared for data communication circuit switching service by the new telex switch. The required accommodation capacity of the switch is small, and the demand eludes projection. Accordingly, the equipment buildup will be planned as the demand arises.

CHAPTER 7. FACILITIES PLAN

7-1 Subscriber Telephone

(1) The number of additional telephone lines to be installed according to the demand fulfillment plan is as listed in Table III-I-8.

(2) For the exchanges equipped with digital switches in Asunción, push-button dial telephones will be installed upon request. (Refer to Table III-I-7)

Table III-I-8 Additional subscriber telephone lines

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Total
Asunción (x 1000)	12.2	13.4	14.6	16.1	17.2	18.6	19.9	21.0	22.2	23.2	178.4
Except Asunción area (x 1000)	6.9	7.5	8.4	9.3	10.2	11.1	12.0	12.8	13.6	14.5	106.3
Total (x 1000)	19.1	20.9	23.0	25.4	27.4	29.7	31.9	33.8	35.8	37.7	284.7

7-2 Public Telephone

The number of additional public telephones to be installed in accordance with the demand fulfillment plan is as listed in Table III-I-9. As shown in the table, the annual increase will be about 300.

Table III-I-9 Additional public telephones

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Total
Additional public telephones	300	300	300	300	300	300	300	300	300	295	2995

The number of public telephones by telephone office is shown in ANNEX, Table A I-11.

7-3 Rural Telephone

Considering the household density in the rural districts in Paraguay, the rural telephone system to be introduced should preferably be of the multiple access subscriber radio system (MAS system).

To cover all the unserved areas across the country, the MAS system will have to be installed in about 45 areas.

In the Master Plan, the rural telephone system will be introduced to the following 25 areas according to the basic policies stated in CHAPTER 2.

(1) First five-year period

14 areas incl. those to be covered by the already contracted projects.

(2) Second five-year period

5 additional areas.

(3) Third five-year period

6 additional areas.

In the second and third periods, the installation works of additional subscribers for the already served areas will also be pushed forward. The rural telephone system equipment plan for the second and third periods will be as outlined below.

(1) The ratio of subscriber telephones to public telephones in the rural telephone system will be 7 to 3 on the average.

(2) The calling rate of subscriber telephone will be 0.022 Erl., and that of the public telephone will be 0.073 Erl. Thus, the average compounded calling rate will be 0.037 Erl.

(3) The loss probability within the rural telephone system will be 3/100.

For every rural telephone service area, there will be installed 90 or 180 telephones (incl. both public and subscriber telephones). Namely, one or two complete sets of 8-channel MAS system will be installed.

(4) The target S/N ratio of the radio circuit linking between MAS base station and MAS subscriber station will be 35 dB or higher.

(5) The entrance circuit between the MAS base station and automatic telephone exchange will employ a 24-channel UHF or VHF multiple radio communication system.

(6) In the area where commercial power supply is not available, the public telephones and the telephones for public institutions will be powered by solar battery, and other subscriber telephones will be powered by an uninterrupted power supply system consisting of a privately owned engine generator, rectifier and a battery.

(7) It is assumed that the radio base station is installed at a distance from the telephone office. Its construction will be planned to cover the building, power facilities, tower, and entrance circuit. If the siting conditions are favorable, the construction cost may be slashed more or less.

(8) The additional installation of switches at the telephone offices for accommodating the rural telephone subscribers will be planned as included in the local exchange expansion plan.

The annual introduction of rural telephones will be planned to smooth out the construction works, particularly the works for the installation of subscriber's terminals.

The areas to which the rural telephone system is to be introduced, the number of subscribers, and other data are given in Tables III-I-10 through III-I-12.

Table III-I-10 Rural telephone system introduction plan

Year	Rural area	Number of systems	Number of RF channels	Number of subscribers
1983 ~ 1987	San Pedro	2	16	90
	Concepción	2	16	90
	Hohenaú	2	16	90
	Villarrica	2	16	90
	Carapeguá	2	16	90
	Cdad. Pte. Stroessner	1	8	50
	Eusebio Ayala	1	4	20
	Saltos del Guairá	1	8	50
	Itaquyry	1	4	20
	Filadelfia	1	4	29
	Rep. I A (Pte. Hayes)	1	4	29
	Rep. III (Pte. Hayes)	1	4	29
	Fn. Zalazar	1	4	29
	Fn. Sanches	1	4	29
1988	P.J. Caballero	2	16	180
1989	Pilar	1	8	90
1990	Central	2	16	180
1991	San Estanislao	1	8	90
1992	Sta. Rosa (Misiones)	1	8	90
1993	Caaguazú	1	8	90
1994	J. E. O'Leary	1	8	90
1995	Alberdí	1	8	90
1996	Bella Vista Norte	1	8	90
1997	Capt. Bado	1	8	90
	Curuguaty	1	8	90
Total	25 areas	32	228	1,905

Table III-I-11 Rural telephone system extension plan

Year	Rural area	Additional systems	Additional RF channels
1989	Cdad. Pte. Stroessner	1	8
1991	Eusebio Ayala	-	4
1992	Saltos del Guairá	1	8
1993	Itaquyry	-	4
1994	Filadelfia	-	4
1995	Rep. I A (Pte. Hayes)	-	4
	Rep. III (Pte. Hayes)	-	4
1996	Fn. Zalazar	-	4
	Fn. Sanches	-	4
Total	9 areas	2	44

Table III-I-12 Rural telephone subscribers extension plan

Year	Number of additional subscribers	Note (Additional subscribers by area)	
1988	115	San Pedro	90
1989	115	Concepción	90
1990	115	Hohenaú	90
1991	115	Villarrica	90
1992	115	Carapeguá	90
1993	115	Cdad. Pte. Stroessner	130
1994	115	Eusebio Ayala	70
1995	115	Saltos del Guairá	130
1996	115	Itaquyry	70
1997	120	Filadelfia	61
Total	1,155	Rep. I A (Pte. Hayes)	61
		Rep. III (Pte. Hayes)	61
		Fn. Zalazar	61
		Fn. Sanches	61
		Total	1,155

7-4 Local Switching

The local switching facilities planning policy is as described below.

(1) The local switching facilities will be expanded so that the demand fulfillment plan will be implemented in a balanced way.

(2) Digital switches and advanced equipment will be introduced considering the telecommunication technologies tendency and providing various services in an economical way in future.

(3) In introducing the new technologies, due consideration will be given to the efficiently use of existing facilities.

A switching capacity expansion plan (by "DISTRITO") according to the provision (1) above is given in Table III-I-13.

The following is a list of the various associated plans, and a brief description of each.

7-4-1 Introduction of digital switching system

(1) Necessity of digital switching system

The digital switching system has an electronic components circuit as hardware and stored program as software. Functionally, it is very flexible, because it permits easily addition and modification of the functions for new servides, traffic control system and charging system and others.

The digital switching system also is highly reliable, and can save the maintenance and operation manpower substantially. In addition, its installation space and power consumption are extremely small as compared

with other switching system. Taking altogether, the digital switching system is highly economical, and its capability, reliability and payability are expected to improve by leaps and bounds in future.

In support of this, there is every sign that the countries the world over are stepping up efforts to establish a high-reliability, multi-functional telecommunication network in which digital switches and digital transmission lines are integrated.

In view of this, considering economics and merit in future, successive introduction of digital switching system will be planned in this Master Plan.

(2) Digital switching system introduction plan

A plan will be made to introduce a digital switching system at every exchange in Asunción to make completion by the year 1997 in a manner to ensure the switching capacity required by the demand fulfillment plan and to consider the removed EMD switches uses.

1) Method of introduction

a) In Asunción, no EMD switches will be purchased for switching system expansion from 1987 onward.

b) From 1987 on, the digitalization will be promoted at an annual average rate of one exchange.

c) The introduction of digital switching system to the exchange will be carried out along with the replacement of its existing facilities on the occasion of expansion work.

d) The EMD switching equipment to be replaced by the digital switching system will be re-used for the expansion of EMD exchanges in Asunción and "interior".

The reuse of the removed EMD switching equipment will be explained in detail in the paragraph relating to the expansion of EMD switching equipment.

2) Leveling of installation work intervals and scale

When the demand is growing, a long interval left between the previous expansion work and the next will lead to excessive advance investment, degradation in equipment utilization, and resultant diseconomy. On the other hand, if the work interval is too short, the engineering design and installation work load will be increased to send up the expenditure. In addition, the equipment will get overloaded easily to the obstruction to the service when the demand increases rapidly.

For these reasons, the expansion work of the exchanges in which digital switching system is to be introduced will be planned at an interval of 3 to 4 years. Still more, in this case leveling of scale of installation work will be taken into consideration.

3) New telephone services

The popularization of telephones will improve the efficiency of socio-economic activities, which in turn will give birth to new needs for better or diversified uses of telephone.

Compared with existing switching equipment, the digital switching system can easily be modified for additional functions, making it possible to offer new telephone services at low costs.

The introduction of new services will make the users satisfactory, and at the same time will produce an income. It is therefore recommended

to promote the marketing survey for new telephone services, to study the tariff, charging method, etc. for carry the new services into execution, in order to pave the way for their early implementation.

A plan will be made to spread push-button which facilitate the introduction of new telephone services in the future.

4) Introduction plan

Starting 1987, the digitalization will be pushed forward at an average rate of one exchange a year. The annual average increase in digital switching system capacity will be about 28,000, and the digital switching system capacity in 1997 when all the exchanges in Asunción will complete digitalization will reach 312,600.

Table III-I-14 shows a digital switch introduction plan for Asunción (incl. EMD switch expansion plan).

7-4-2 Expansion of EMD switches

(1) EMD switching equipment in Asunción

In Asunción, digitalization of exchanges will be promoted one-by-one. However, those exchanges which wait digitalization will be expanded by EMD until their digitalization is executed. In this case, the EMD switching equipment required for expansion will be removed from the exchanges which have been digitalized.

In Asunción, the digitalization will change the capacity of EMD switching equipment from 90,800 in 1986 (incl. HDW 8,000 in Central I) to zero in 1997. Namely, the

EMD switching equipment will be decreased at an annual average rate of about 8,000.

Table III-I-15 shows an annual plan for expansion, removal and reuse of EMD switching equipment in Asunción.

(2) Expansion of EMD switching equipment in "interior"

For those exchanges which are planned to complete the automatization by 1986, installation work will be planned with EMD switching equipment to get on with the fulfillment plan. The EMD switching equipment required for this plan will be transferred from the exchanges in Asunción which have been digitalized.

Neverthless to make up for the deficiency new EMD switches will be purchased. Table III-I-16 shows the annual transition of EMD installation capacity in each district according to the fulfillment plan. It is found that the capacity of the EMD 110,000 subscribers are additionally required in ten years from 1988 to 1997. (For the equipment installation plan for each exchange, refer to ANNEX, Table A I-12)

The annual expansion work are compared in Table III-I-17 between the EMD switching equipment removed from digitalized exchanges and those newly purchased.

(3) EMD switching equipment reuse plan

According to the existing plan the installed capacity of EMD switching equipments in Asunción will reach 90,800 in 1986. If HDW (8,000 terminals) is excluded, reusable for "interior" districts are 82,800.

The capacity of the EMD switching equipment removed from Asunción and that of the EMD switching equipment necessitated by the exchange in "interior" are compared

in Fig. III-I-14 on the assumption that the EMD switching equipment from Asunción will be removed to the exchange in "interior" the year after being superseded by digital switches.

In Fig. III-I-14, the losses due to the age of the equipment and segmentalization are not reckoned with, and it is taken for granted that the replacement parts for maintenance will be purchased.

7-4-3 Introduction of movable exchange

A plan will be made to introduce movable exchanges for the switchover of manual exchanges into automatic ones and the replacement of the existing line concentrators with ordinary switching systems.

The movable exchanges save building costs, facilitate installation work, and dispense with labor costs because of unmanned-maintenance-operation. They are particularly economical as small exchanges to be installed in a remote area.

Movable exchanges with a maximum capacity of 600 terminals permitting expansion in steps of 100 terminals are supposed in the formulation of the Master Plan. However, it is not economical, under certain circumstances, to repeat small scale construction works at short intervals. In this Master Plan, the installation plan and the estimation of investment cost have been made so that the initial installations will overfulfill the level of demand which is required to be achieved by the end of the Master Plan period according to the fulfillment plan, as a study result on the schedule of movable exchange capacity expansion plan. It is necessary to re-study the initial capacity according to the exchange model to be introduced, from the economical viewpoint in making the realization plan.
Table III- I- 18 shows an installation plan of movable exchanges.

The following is a supplementary explanation on the automatization and system change.

(1) Automatization

A plan will be made to automatize those existing manual exchanges where the number of subscribers to be covered according to the demand fulfillment plan will exceed 50 during the Master Plan period. For automatization, movable exchanges will be used. For those exchanges where the demand growth is not so large, the automatization will be pushed forward reusing the line concentrators discussed later.

All the 38 manual exchanges will be automatized according to the ways discussed above during the Master Plan period.

Table III-I-19 lists the exchanges to be automatized and their years of automatization.

(2) System change

In the areas where line concentrators are installed, if the demand increases call for the expansion of the capacity of switching, the movable exchanges referred to in the foregoing paragraph will be introduced for system change.

Listed in Table III-I-20 are 12 exchanges for which system change will be made.

The small exchanges like the existing manual ones, of which demand forecast by macroscopic method is very difficult to be accurate, and their actual demand is changeable. Thus, it will be necessary to provide flexible measures for the exchanges planned above as the subjects of automatization and system change, and the future demand trends should be incorporated into such measures.

7-4-4 Manual switching offices

Automatization of those manual exchanges which are serving an extremely small number of subscribers will not pay for itself. Accordingly, those small manual exchanges whose coverage will not exceed 50 in terms of subscribers numbers will be left as they are now. If the future technological progress justifies the automatization of such small exchanges, the plan will have to be reviewed.

If the existing manual exchanges are installed in capacity according to the demand fulfillment plan and in the manner discussed above, and if those manual exchanges with a covered subscribers more than 50 are automatized, the manual exchanges which numbered about 140 as of the end of 1981 will be reduced by about 30 by 1987, and will also be reduced by about 40 in 10 years after 1988.

Namely, toward the end of the period, about 70 manual offices will remain. The total installed capacity of manual exchanges will remain almost unchanged during about 10 years from 1987 to 1997, because expansion will nearly balance with removal due to automatization.

Accordingly, the expansion of the manual exchanges will be achieved with the equipment removed from those exchanges which will be automatized by 1986.

New installation of the manual exchanges should be planned separately with due consideration given to the demand movements. Table III-I-21 shows the changes in the subscriber accommodation capacity of manual exchanges as classified by "DISTRITO". For the capacity expansion plan for each exchange, refer to ANNEX, Table A I-12 (separate volume).

7-4-5 Information board and toll board

A plan will be made for the information boards and toll boards in Asunción.

(1) Information board

With increase in the number of subscribers, the calls to the information board for information will increase, and additional information boards will have to be installed. The existing information boards are overaged, and their replacement will also be considered.
The number of positions of the information boards is calculated according to the following requirements.

1) Increase in the number of telephone subscribers:

The number of subscribers in Asunción is expected to grow nearly sixfold in 1997 as compared with the number in 1981.

2) Information board calling rate: The information board calling rate will decrease by degrees with the penetration of telephone service into light-load users; in 1997, it will be reduced to about 80% of the current level.

3) Increase in traffic to information board: It is expected that in 1997, the above two will combine to send up the traffic to the information boards to nearly five times of the current level.
In November 1981, the daily traffic was about 6,400 calls on the average of 10 heavy traffic days. But in 1997, it will grow to about 32,500.

4) Busy-hour traffic concentration factor: It is assumed that the information board will have to field 10% of daily traffic within an hour during the busy hours.

5) Standard call handling time: The time allowed for the operator to handle a call is assumed to be 36 sec. (based on NTT's standard).

6) Labor efficiency: The ratio of the operator's call handling time to the total hours is set at 75%.

7) Peak load per operator: The number of calls to be handled by an operator during one busy hour is 75 according to the conditions 5) and 6) above.

From the above, the number of operator's positions required in 1997 is calculated at 44. The annual transition of the operator's positions is as shown in Table III-I-22 (Necessary number of information desk's positions).

(2) Toll board

The traffic to be handled at the toll board increases with increase in the number of subscribers, and decreases with increase in the ratio of automatized exchanges and also improvement in the automatic toll switching service (increase in the ratio of successful calls).
Generally speaking, the traffic to the toll board is least subject to violent changes.
At present, the traffic to the toll board is hard to forecast for want of data.
However, the existing toll boards are expected to run out their service lives toward the end of the Master Plan period, and a plan will be made to replace them and expand about 20%.

The new models of information boards and toll boards to be introduced for replacement or expansion will be of the digital switching system controlled type highly adaptable to various services expected in future and to improve operation efficiency.

It will be studied to reuse the information boards and toll boards removed from Asunción as mentioned above and the manual switch boards for international telephone service removed by the ISD introduction plan (refer to PART III, SECTION II, 3-1-2), at exchanges in "Interior" after repairing or remodeling.

Table III-I-13 Capacity expansion plan
(Automatic exchange)

Upper : capacity
Lower : installation

(1) Capital

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Total
ASUNCION	90.800	101.800	116.800	133.800	145.800	172.800	201.800	224.800	254.600	382.600	296.800	312.600	
	-	11.000	15.000	17.000	12.000	27.000	29.000	23.000	29.800	28.000	14.000	16.000	221.800

(2) Interior

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Total
1 ASUNCION	6.680	12.480	12.680	13.080	14.880	19.780		21.980	25.480	27.180	28.980	
		5.800	200	400	1.800	4.900		2.200	3.500	1.700	1.800	22.300
2 ENCARNACION	5.370	5.670	9.070	9.470	9.970	13.270	13.470	13.770	17.070	17.470	17.570	
		300	3.400	400	500	3.300	200	300	3.300	400	100	12.200
3 CAACUPE	2.590	6.040		6.190	6.390	10.290		10.490	11.690	14.790		
		3.450		150	200	3.900		200	1.200	3.100		12.200
4 VILLARRICA	1.490	1.690	4.690				6.890	7.290	7.690	9.790	10.090	
		200	3.000				2.200	400	400	2.100	300	8.600
5 CNEL. OVIEDO	2.180	2.280	5.880	6.080		6.780	10.580		10.680	13.780	13.980	
		100	3.600	200		700	3.800		100	3.100	200	11.800
6 CONCEPCION	1.150		3.350		3.600		6.600			6.800	8.300	
			2.200		250		3.000			200	1.500	7.150
7 PARAGUARI	1.400	3.350		3.450	4.350	5.750		6.550	6.650	8.350	9.150	
		1.450		100	900	1.400		800	100	1.700	800	7.750
8 S.J. BAUTISTA MISIONES	2.000			3.200				4.500	4.900			
				1.200				1.300	400			2.900
9 ITAC. DEL ROSARIO	650	1.050		2.150	2.950	3.050		4.550		4.650	5.750	
		400		1.100	800	100		1.500		100	1.100	5.100
10 PILAR	800			2.800				4.800				
				2.000				2.000				4.000
11 CIUDAD PTE. STROESSNER	5.430	7.830		8.630	12.080	12.580	13.380	16.380		17.380	20.480	
		2.400		800	3.450	500	800	3.000		1.000	3.100	15.050
12 P.J. CABALLERO	2.650			5.150			7.750			8.150	9.950	
				2.500			2.600			400	1.800	7.300
14 VILLA DE SAN PEDRO	400	1.000			1.900				2.700	2.900	3.000	
		600			900				800	200	100	2.600
15 VILLA HAYES	650		850	2.350		2.550			3.450	3.750		
		200		1.500		200			900	300		3.100
Sub SALTOS DEL GUAIRA	490		1,090				1.590			1.690	1.990	
			600				500			100	300	1.500
Total	33.930	49.330	62.330	72.680	81.480	96.480	109.580	121.280	131.980	146.380	157.480	
		15.400	13.000	10.350	8.800	15.000	13.100	11.700	10.700	14.400	11.100	123.550

Table III-I-14 Digital switching system introduction plan

CENTRAL \ Year		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
CENTRAL 2	Capacity	20.000		°32.000				°47.000			°63.000		
	Installation			°12.000				°15.000			°16.000		
CENTRAL 1	Capacity	8.000 14.600	8.000 °19.600				°42.600			°59.600			
	Installation		°5.000				°15.000			°17.000			
CENTRAL 5 (TEMBETARY)	Capacity	3.600			6.600				°9.600			°12.600	
	Installation				3.000				°3.000			°3.000	
CENTRAL 6 (V.MORRA)	Capacity	11.600			°22.600				°32.600				°40.600
	Installation				°11.000				°10.000				°8.000
CENTRAL 7 (B.OBRERO)	Capacity	4.000				7.000				°11.000			°14.000
	Installation					3.000				°4.000			°3.000
CENTRAL 8 (SAJONIA)	Capacity	6.200				°11.200			°16.200			°21.200	
	Installation					°5.000			°5.000			°5.000	
CENTRAL 50 (FDO.DE LA MORA)	Capacity	6.200					°10.200			°15.000			°18.000
	Installation						°4.000			°4.800			°3.000
CENTRAL 29 (TRINIDAD)	Capacity	4.000				°8.000				°12.000			
	Installation					°4.000				°4.000			
CENTRAL 30 (S. VICENTE)	Capacity	7.200	°13.200					°27.200			°39.200		
	Installation		°6.000					°14.000			°12.000		
CENTRAL 35 (LAMBARE)	Capacity	3.400			6.400				11.400			°17.400	
	Installation				3.000				5.000			°6.000	
CENTRAL 67 (SU GUAZU)	Capacity	2.000		5.000			13.000						°15.000
	Installation			3.000			8.000						°2.000
TOTAL DIGITAL	Number of new exchange	0	2	1	1	2	1	0	1	1	0	1	1
	Total Capacity	0	32.800	64.800	87.400	106.600	139.800	168.800	193.400	230.200	258.200	283.600	312.600
	Capacity of installation	0	32.800	32.000	22.600	19.200	33.200	29.000	24.600	36.800	28.000	25.400	29.000
EMD	Capacity of removal		21.800	17.000	5.600	7.200	6.200	0	1.600	7.000	0	11.400	13.000
	Total Capacity	90.800	69.000	52.000	46.400	39.200	33.000	33.000	31.400	24.400	24.400	13.000	0

Notes: ° : bigital switching

No mark: EMD

Table III-I-15 EMD installation and removal plan in ASUNCION

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Capacity in use	90,800	69,000	52,000	46,400	39,200	33,000	33,000	31,400	24,400	24,400	13,000	0
remove		21,800	20,000	11,600	10,200	14,200	0	6,600	7,000	0	11,400	13,000
installation			,3000	6,000	3,000	8,000	0	5,000	0	0	0	0
Total removable capacity to interior		21,800	38,800	44,400	51,600	49,800	49,800	51,400	58,400	58,400	69,800	82,800
Over aged switches						*8,000						

* Central I HDW

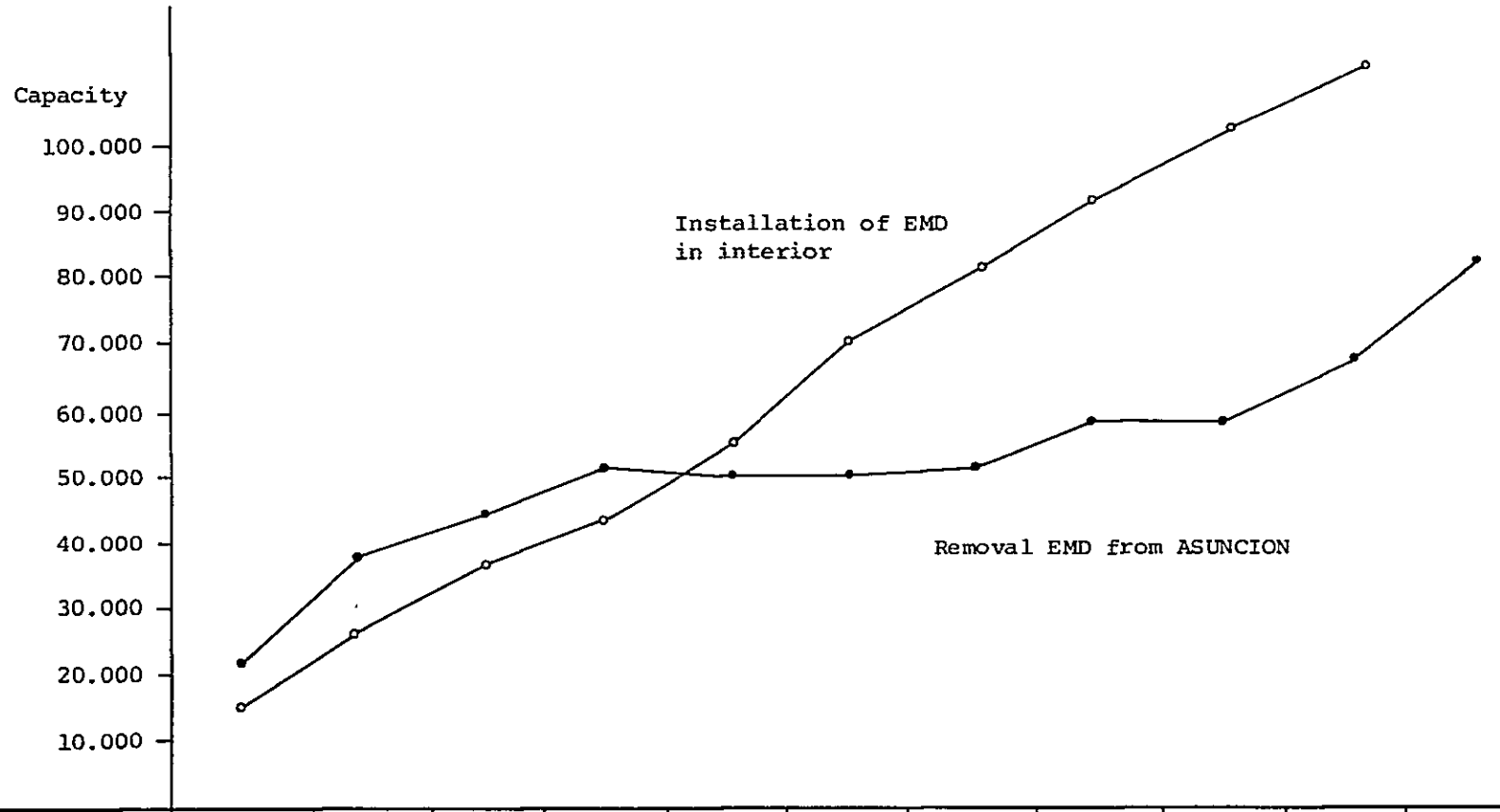
Table III-I-16 EMD installation plan in interior

DISTRITO		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	TOTAL
1	ASUNCION	5.700	200	400	1.500	4.800		2.200	3.300	(100) 1.500	1.500	(100) 21.100
2	ENCARNACION	(100) 200	3.200	300	200	3.300	100	300	3.000	300	100	(100) 11.000
3	CAACUPE	(100) 3.150		150		3.700			1.200	2.700		10.900
4	VILLARRICA		(100) 2.400				2.200	200		2.000	200	(100) 7.000
5	CNEL. OVIEDO	100	3.600			200	(100) 3.700			3.000		(100) 10.600
6	CONCEPCION		(200) 2.000		150		3.000			100	1.500	(200) 6.750
7	PARAGUARI	(200) 1.550			700	1.300		700		1.400	700	(200) 6.350
8	S.J. BAUTISTA MISIONES			(100) 1.100				1.300	400			(100) 2.800
9	ITAC. DEL ROSARIO	400		900	(100) 600			1.500			600	(100) 4.000
10	PILAR			2.000				2.000				4.000
11	CIUDAD PTE. STROESSNER	(200) 2.200		800	3.450		800	3.000		1.000	3.100	(200) 14.350
12	P.J. CABALLERO			2.400			2.500			(100) 200	(100) 1.1700	(200) 6.800
14	VILLA DE SAN PEDRO	(200) 400			700				700			(200) 1.800
15	VILLA HAYES			(600) 900					900			(600) 1.800
SUB	SALTOS DEL DUAIRA		(200) 400				500				300	(200) 1.200
TOTAL		(800) 13.700	(500) 11.800	(700) 8.950	(100) 7.300	13.300	(100) 12.800	11.200	9.500	(200) 12.200	(100) 9.700	(2.500) 110.450

Notes. ( ): to be added for rural telephone service

Table III-I-17 EMD installation work

		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Total
By use of removed EMD	ASUNCION	3.000	6.000	3.000	8.000	0	5.000	0	0	0	0	25.000
	Interior	14.500	12.300	9.650	7.400	5.750	0	1.600	7.000	0	9.800	68.000
By use of new supplied EMD	Interior	0	0	0	0	7.550	12.900	9.600	2.500	12.400	0	44.950
Total		17.500	18.300	12.650	15.400	13.300	17.900	11.200	9.500	12.400	9.800	137.950



Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Removal EMD from Asunción (Total)	21.800	38.800	44.400	51.600	49.800	49.800	51.400	58.400	58.400	69.800	82.800
Installation of EMD in interior (Total)	14.500	26.800	36.450	43.850	57.150	70.050	81.250	90.750	103.150	112.950	
Balance	7.300	12.000	7.950	7.750	-7.350	-20.250	-29.850	-32.350	-44.750	-43.150	

Fig. III-I-14 Trend of EMD's installation and remove

Table III-I-18 Movable exchange installation plan

Item \ Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Total
Automatization	300x5	200x2	90x2	90x3 200x6	90x2 200x1 300x1	100x2	90x1 100x1	100x1 200x3	90x2 100x1 200x2	100x7 200x2	90x10 100x12 200x16 300x 6
System change	300x1 600x1	300x1 600x1	200x1 300x2	200x1 300x1	200x2		100x1	100x1 200x1	100x1		100x 3 200x 5 300x 5 600x 2
Total	300x6 600x1	200x2 300x1 600x1	90x2 200x1 300x2	90x3 200x7 300x1	90x2 200x3 300x1	100x2	90x1 100x2	100x2 200x4	90x2 100x2 200x2	100x7 200x2	90x10 100x15 200x21 300x11 600x 2

Notes: 1. For example, "200 x 2" means; capacity (200) x number of movable exchanges.

2. 90; Removed concentrator by system change.

Table III-I-19 Automatization plan

Capacity/expansion

DISTRITO	Central	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Notes
1	COL. NUEVA ITALIA										100/100	
	EMBOSCADA				100/100					200/100		
	LIMPIO	100/100				200/100					300/100	
2	CAPITAN MIRANDA						100/100					
	GRAL. ARTIGAS				100/100				200/100			
	GRAL. DELGADO									100/100		
	LA PAZ			100/100					200/100			
3	ALTOS							100/100				
	ARROYOS Y ESTEROS				100/100					200/100		
	ATYRA	100/100				200/100				300/100		
	CARAGUATAY	100/100				200/100				300/100		
	ISULA PUCU				100/100					200/100		
4	ITURBE	200/200							300/100			
	PASO YOBAI										100/100	
	SAN SALVADOR									100/100		
	YEGROS		100/100					200/100				
	YUTY PUEBLO		100/100					200/100				
5	YHU					100/100					200/100	
	VILLA CURUGUATY					200/200						
	COL. JUAN RAMON CHAVEZ					100/100					200/100	
6	PASO BARRETO				100/100					200/100		
7	ACAHAY	100/100				200/100				300/100		
	CAAPUCU			100/100					200/100			
	CABALLERO							100/100				
	REQUE GONZALEZ DE S.CRUZ										100/100	
	CAPCAl				100/100					200/100		
9	SANTA CLARA					100/100					200/100	
	TACUARAS (NORTE)										100/100	
	FELIPE MATIAUDA										100/100	
	COLONIA CHORE				100/100					200/100		
	COLONIA VOLENDAM										100/100	
12	CHIRIGUELO						100/100					
14	LIMA				100/100					200/100		
	NUEVA GERMANIA										100/100	
	PTO. ANTEQUERA				100/100					200/100		
15	SANTA ROSA								100/100			
	CHACO - 1									100/100		
Total		/600	800/200	1,000/200	1,900/900	2,800/900	3,000/200	3,400/400	3,900/500	5,300/1,400	6,400/1,100	

Table III-I-20 (1) System change plan

Capacity/Expansion

DISTRITO	CENTRAL	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
I	NEMBY								200/200		
	ZEBALLOS CUE				200/200						300/100
2	CARMEN DEL PARANA		200/200						300/100		
	SAN PEDRO DEL PARANA				200/200						
3	SANTA ELENA *							100/100			
4	SAN JUAN NEPOMUCENO		300/300						600/300		
5	C. H. STROESSNER *								100/100		
	JUAN M. FRUTOS			200/200						300/100	
	LA PALOMA *									100/100	
11	JUAN E. O'LEARY					300/300					
	JUAN L.MALLORQUIN					200/200					
15	BENJAMIN ACEVAL	200/200				200/200				600/200	
Total		200/200	700/500	900/200	1300/400	2000/700		2100/100	2800/700	3200/400	3300/100

* : The plan shall be executed in consideration of the trend of demands.

Table III-I-20 (2) ESK expansion plan

Capacity/Expansion

DISTRITO	CENTRAL	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
7	PIRAYU	100/100			200/100					300/100	
9	COL. GRAL AQUINO			200/200							300/100
12	YBY YAU			100/100						200/100	
Total		100/100		400/300	500/100					700/200	800/100

Table III-I-21 Expansion and remove of manual exchange capacity

DISTRITO	Capacity (1981)	Year / Items	1982-1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Total of 10 years
ASUNCION	135	Expansion	140	20	10	20	35	40	20		20			165
		Remove	70	60			50						50	160
ENCARNACION	190	Expansion	85	45		20		10	50					125
		Remove	90			50	50		60			50		210
CAACUPE	305	Expansion	130		30	20	25					30		105
		Remove	190	110			110			50				270
VILLARRICA	205	Expansion	125	20	50		30	40	20	30		10		200
		Remove	40	60	110							60	50	280
CNEL. OVIEDO	170	Expansion	85	50		20	45		20			40	10	95
		Remove	100					160						50
CONCEPCION	80	Expansion	25	25	25		5	10	20				10	95
		Remove	50				50							50
PARAGUARI	370	Expansion	135	70	20		55	10	40	20		40	10	265
		Remove	260	50		60	60			60			60	290
S.J. BAUTISTA MISIONES	155	Expansion	55	20		20	40		10			10		100
		Remove	70				60							60
ITAC. DEL ROSARIO	130	Expansion	100	60	60		25			60		20		225
		Remove	80				60	60					180	300
PILAR	65	Expansion	30		10	40		45		10		40		145
		Remove												
CIUDAD PTE. STROESSNER	185	Expansion												
		Remove	185											
P.J. CABALLERO	175	Expansion	20	5		20					10			35
		Remove	160						50					50
VILLA DE SAN PEDRO	60	Expansion	85	90	20	20	40		20	20		20		230
		Remove					120				60		60	240
VILLA HAYES	70	Expansion	15	20			15		20			10		65
		Remove	50									60		60
Total	2,295	Expansion	1,030	425	225	180	315	155	220	140	30	220	30	1,940
		Remove	1,345	280	110	110	560	220	110	110	60	170	400	2,130
Number of exchanges	140	Expansion		25	15	10	30	15	14	10	3	18	5	145
		Remove	30	5	2	2	10	4	2	3	1	3	8	40

Table III-I-22 Necessary number of information desk's positions

Items \ Year	1981	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	remark
(1) Number of subscribers in Asunción (x 1,000)	41.2	89.5	101.7	115.1	129.8	145.9	163.1	181.7	201.6	222.7	244.8	268.0	
(2) Increase ratio of number of subscribers	1.0	2.17	2.47	2.79	3.15	3.54	3.96	4.10	4.89	5.41	5.94	6.50	
(3) Decrease ratio of calling rate	1.0	0.98	0.96	0.94	0.92	0.90	0.88	0.86	0.84	0.82	0.80	0.78	
(4) Increase ratio of the call to information desks	1.0	2.13	2.37	2.62	2.90	3.19	3.48	3.79	4.11	4.44	4.75	5.07	(2)x(3)
(5) Number of calls a day	6,400	13,600	15,200	16,800	18,600	20,400	22,300	24,300	36,300	28,400	30,400	32,500	6,400 x(4)
(6) Number of calls in busy hour	640	1,360	1,520	1,680	1,860	2,040	2,230	2,430	2,630	2,840	3,040	3,250	(5)x0.10
(7) Necessary number of information desk's seats	10	18	20	23	25	28	30	33	35	38	41	44	$\frac{(6) \times 36}{3,600 \times 0.75}$

Notice: On the premise that:
- concentration rate of busy hour call. : 10%
- handling time per call. : 36 seconds
- labor efficiency. : 75%
- Number of calls a day (1981) : the average of high 10 day's calls in November 1981

7-5 Toll Switching

The toll switch is a main point of the national telephone network. Its functions and reliability have a great bearing on the service quality and economics of the telephone network construction.

The ideal functions required of a toll switch include a high flexibility in the numbering plan (e.g., easy and economical change of the number of digits of trunk code), high degree of freedom of circuit selection and alternative routing, high-speed switching, and application of high-reliability signal system.

In view of these, the toll switches have been improved from the conventional step-by-step type to the common control type, and then to the digital type thanks to the marked progress of electronics technology.

In Paraguay, EMD toll switches are now in use. While it is highly desirable to upgrade the existing toll switches for the purpose of constructing an ideal telephone network, its early realization is hard considering the equipment investment economy (the existing facilities must be used effectively) and a considerable time required for the upbringing of maintenance engineers and other personnel.

During the Master Plan period, therefore, the EMD switches will continue to be in use. Namely, the toll switching system will be planned as follows.

(1) With the exception of the toll exchanges to be installed according to the projects going, no further toll exchanges will be installed during the Master Plan period.

(2) The installed capacity of toll exchanges will be expanded in keeping with the traffic increase due to increase of subscriber and in a manner to incorporate new automatic exchanges into the automatic long-distance network.

The toll switching system expansion plan according to the aforesaid considerations will be as summarized in Table III-I-23.

Table III-I-23 Toll switch expansion plan

Item	Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
ASUNCION	Necessary Trunk line		1,770	2,060	2,280	2,570	2,830	3,070	3,410	3,720	4,280	4,280
	Capacity	1,700	2,700				4,000				5,500	
	Expansion		1,000				1,300				1,500	
CNEL.OVIEDO	Necessary Trunk line		900	1,040	1,160	1,310	1,480	1,640	1,840	1,980	2,160	2,330
	Capacity	900		1,500				2,200				3,000
	Expansion			600				700				800
ENCARNACION	Necessary Trunk line		410	460	510	570	620	670	730	780	840	860
	Capacity	450			700				1,000			
	Expansion				250				300			

Note: "Necessary trunk line" shows the number of incoming trunk line only.

7-6 Subscriber Line

(1) The outside plants will be expanded in keeping with the expansion of the switching facilities.

(2) The installed capacity of primary cables will be 130% of installed terminal capacity by 1992, and will be 150% from 1993 on.

(3) The installed capacity of secondary cables will be 150% of the installed terminal capacity.

(4) The subscriber line installation plan is as shown in Table III-I-24.

Table III-I-24 Outside plant installation plan (subscriber cable)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Total
Primary cable (Km/1000p)	35.8	38.5	36.6	26.7	57.2	62.7	62.9	58.7	34.9	37.4	451.4
Secondary cable (Km/100p)	367.7	366.3	329.2	255.1	498.6	557.3	542.4	503.3	377.9	367.0	4,164.9

7-7 Junction Line

(1) A plan will be made to reinforce the junction lines interconnecting the telephone offices in Asunción multi-exchange area.

(2) The transmission systems will be arranged in a star-form with Central II at the center. But the circuits beared by transmission systems will be connected in a mesh form.

(3) The number of circuit required is calculated based on the traffic rate used for the third additional contract, and in consideration of the demand increase due to subscriber extension, trend analysis of calling rates, and the improvement in routing function of digital switches.

(4) The network at the end of the first five-year period (1983-87) is shown in Fig. III-I-15.

(5) The number of circuits required for the second and third five-year periods (1988-97) is shown in Table III-I-25. (Refer to ANNEX, I-3)

(6) The transmission system for the junction line will be as follows.

1) A digital transmission system will be employed between digital exchanges.

2) The interface between the digital switch and junction line is 2 Mb/s.

3) Between digital exchange and EMD exchange, both the metallic cable and digital transmission

system are applicable. In case of metallic cable system, large-scale extension of cable, which will be no further use after both exchanges be digitalized, to fulfill the traffic demand, and different pad control to achieve the adequate loss between exchanges in compliance with their distance will be required.
Thus, the digital transmission system will be employed from the viewpoint of economics and better transmission qualities.

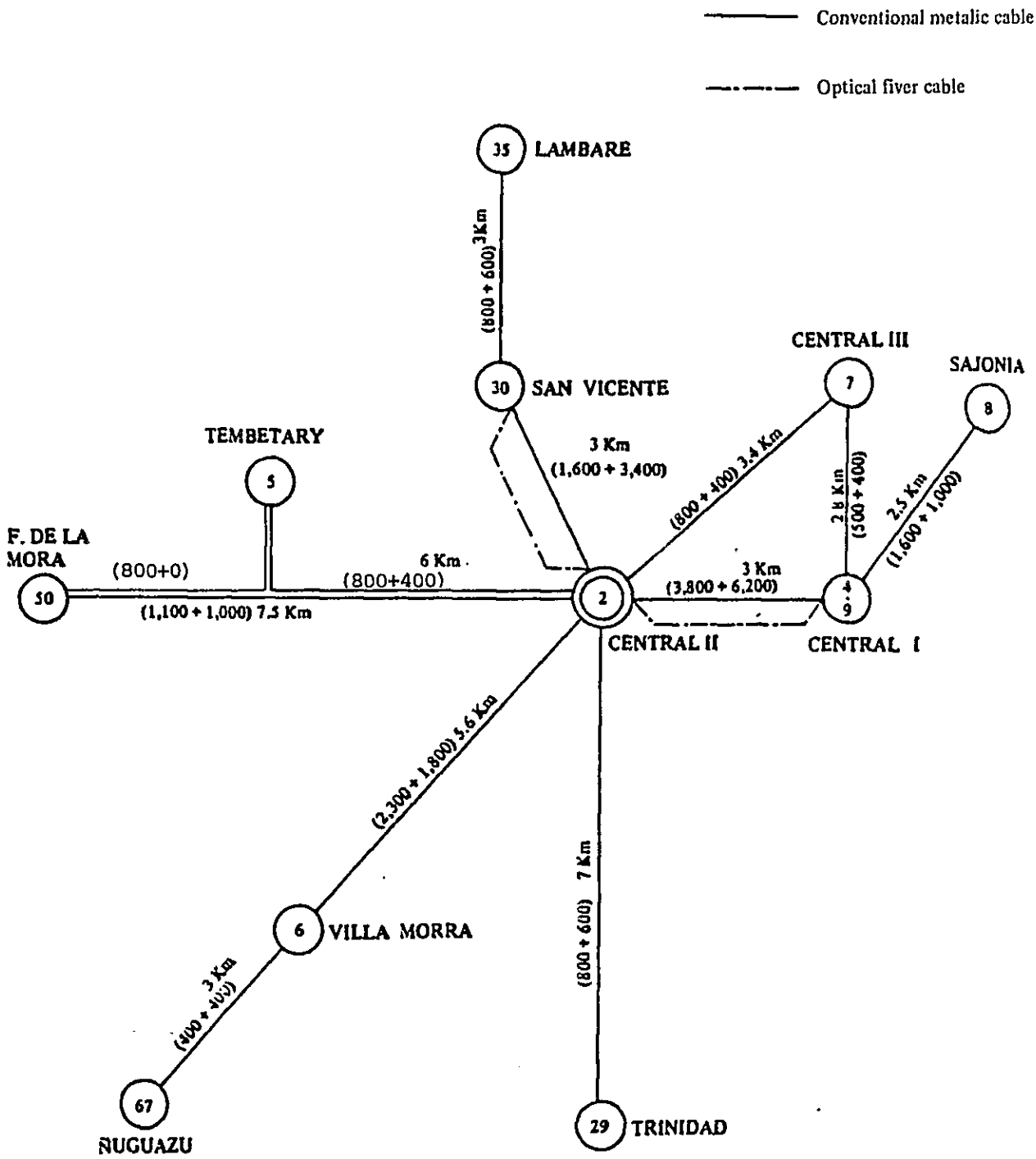
4) Metallic cables will be used to interconnect the EMD switches. No additional cable installation for traffic demand will be necessary.

(7) The digital transmission system is available either on optical fiber cable or metallic cable.
Taking the economics, maintenability and future circuit requirements in the round, the optical fiber transmission system (140 Mb/s) will be employed between offices of (I), (II), (30) and (6) where a large number of circuits are required. For other offices, the cable PCM system will be employed.

(8) The construction work will be planned in an intensive way taking the pace with first digital exchange commencement.

(9) The construction schedules for the second and third five-year periods are shown in Table III-I-26 and Fig. III-I-16.

(10) The metallic cables which will be replaced by the optical fiber cables will be reused as subscriber loop.



Note: Numbers with parenthesis show the number of conventional metalic cable pairs.

Example: (800 + 600)

- No. of pairs installed by the Digital telephone switching system introduction project.
- No. of pairs at the end of 4th and 5th contracts.

Fig. III-I-15 Asunción junction cable route (1987)

Table III-I-25 Required junction circuits between "CENTRAL"s in Asunción

CENTRAL-CENTRAL	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1 - 2	1,710	1,830	2,180			2,230			2,560	2,940		
- 29	240	260			320				370			
- 6	640	760		830				950	1,050			1,170
- 7	230	250			310	360						380
- 8	340	370			440	460			510		560	
- 30	370	470				500	700		740	950		
- 35	210	230		300			350	470	530			
- 50	360	400							540			580
- 5	280	310		390		500						
- 67	170	190	260			470			530			
2 - 29	240		300		350				400	430		
- 6	700		850	1,230						1,250		1,410
- 7	230		290		370		420		440			450
- 8	340		410		560					590	670	
- 30	430	580	640				900			1,200		
- 35	250		320	430			500	610			650	
- 50	330		410			450			500	560		600
- 5	270		370	430			500					
- 67	170		310			480	540			590		
29 - 6	100			140	160				170			180
- 7	40				60							70

CENTRAL-CENTRAL	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
29 - 8	50				80				90		100	
- 30	60		90		100		110		120	150		
- 35	50				60			80	90			
- 50	50				70				80			90
- 5	40			50	70				80			
- 67	30		40		50	80			90			
6 - 7	70			120				140				
- 8	100			140	160			170			190	
- 30	120	160		180			210	230		280		290
- 35	80			130				160				170
- 50	180			200		210		220				250
- 5	120			200				190			210	
- 67	70			110		130		170				
7 - 8	50			70				90				100
- 30	50	60		70		100			110			
- 35	30			40	50			60			70	
- 50	50				60	70			80			90
- 5	40			50	60			70	80		90	
- 67	30				50	60			70			
8 - 30	70	90			100		120	130		150	160	
- 35	50			60	70			90			100	
- 50	70				90	100		110			120	130
- 5	60			70	90			100				
- 67	40		50		70	90		110			120	

CENTRAL-CENTRAL	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
30 - 35	70	90		110			170	190				
- 50	80	110				120	140		150	180		190
- 5	70	100		110			180					
- 67	50	70	80			110	160			200		
35 - 50	50			60		80		90	110			
- 5	40			60				90			100	
- 67	30		40	50		70		90			100	
50 - 5	100			120		150					160	170
- 67	40		60			110			120			
5 - 67	30		40	50		90		100			110	
Total	9,770	10,610	11,920	13,210	13,970	14,990	16,010	16,710	17,850	19,220	19,690	20,210

Note: The number of required junction circuits is calculated for the years when the expansion of telephone exchanges concerned is planned.

Table III-I-26 Asunción area junction facilities plan

Item \ Year	1988		
Optical fiber Cable	CENTRAL I	- CENTRAL II	14C x 3Km
	CENTRAL 30	- CENTRAL II	10C x 3Km
	CENTRAL 6	- CENTRAL II	10C x 5.6Km
Optical fiber cable system (140Mb/s)	CENTRAL I	- CENTRAL II	(6+1) Sys
	CENTRAL 30	- CENTRAL II	(4+1) Sys
	CENTRAL 6	- CENTRAL II	(4+1) Sys
Cable PCM system (2Mb/s)	CENTRAL II	- CENTRAL 29	(58+1) Sys
	CENTRAL II	- CENTRAL 50	(80+1) Sys
	CENTRAL II	- CENTRAL 5	(71+1) Sys
	CENTRAL II	- CENTRAL 7	(56+1) Sys
	CENTRAL I	- CENTRAL 8	(80+1) Sys
	CENTRAL 30	- CENTRAL 35	(75+1) Sys
	CENTRAL 6	- CENTRAL 67	(73+1) Sys

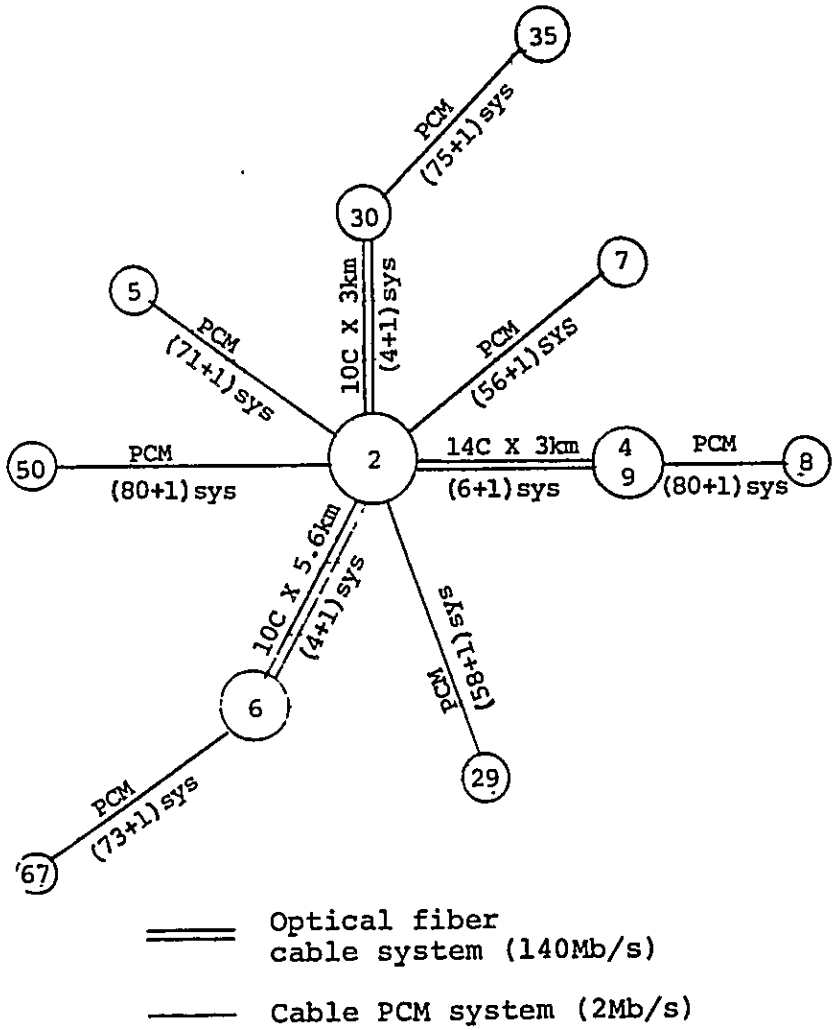


Fig. III-I-16 Asunción area junction network (1997)

7-8 Toll Transmission Line

7-8-1 Expansion of toll trunk network

Discussed here is the expansion of toll trunk circuits necessary for the expansion or introduction of subscriber telephone service, mobile radio communication service, telegraph and telex service, etc.
For the first five-year period (1983 - 87), the expansion of toll trunk circuits has already been planned and is under execution.
The number of toll trunk circuits and toll transmission network toward the end of 1987 are as given in Table III-I-27 and Fig. III-I-17.
The expansion of the toll trunk circuit during the second and third five-year periods (1988 - 97) will be planned as follows.

(1) The number of trunk circuit required during the 1988 - 97 period is as shown in Tables III-I-27 and III-I-28. (Refer to ANNEX, I-3)

(2) For the majority of spans, the installed capacity of the long-distance trunk circuits can be increased simply by expanding the carrier multiplex equipment for the existing microwave circuits (in some spans, the radio channels will have to be increased).
But, the Cnel. Oviedo-Rep. Pte. Stroessner span alone cannot be reinforced by this way. For this reason, a new microwave circuit will have to be installed between Encarnación and Cdad. Pte. Stroessner to divert part of traffic from the Cnel. Oviedo-Cdad. Pte. Stroessner span through Encarnación.
By the construction of this microwave circuit, the microwave circuits interconnecting Cnel. Oviedo,

Cdad. Pte. Stroessner and Encarnación are made into a loop, which in conjunction with the looping of the microwave circuits interlinking Asunción, Cnel. Oviedo and Encarnación planned for the first five-year, will greatly improve the reliability of long-distance toll transmission system.
The Master Plan here presupposes that the microwave circuit under construction by MOPC between Asunción and Mcal. Estigarribia will be transferred to ANTELCO's operation and maintenance in future and will be available to the public telecommunications in Chaco.

(3) As regards the short-distance toll transmission lines, the circuits will be built up according to the following plan.

1) The radio transmission system will be applied as economical considering the geographical distribution of telephone offices and the traffic between offices.
In Central, however, some areas will use the cable PCM system for the purpose of avoiding radio wave congestion.
The open wire carrier system will be applied to those areas where the circuit demand will remain low in the future and which will defy other transmission systems from the economic viewpoint.

2) The carrier multiplex equipment for the existing transmission systems will be expanded. For those spans where the circuit capacity will run short, existing system will be replaced with a large-capacity transmission system.

3) As for Asunción, San Lorenzo and Luque, a transmission circuit will be installed between Luque

and San Lorenzo to add to the transmission circuits (Asunción-Luque and Asunción-San Lorenzo) to be constructed in the first five-year period, making up a loop transmission circuit to interconnect these three cities.

(4) A standby SG will be installed for the system with a transmission capacity of 300 channels or more.

(5) The facilities which will be removed as a result of system change will be re-used effectively.

The facility installation plan for the second and third five-year periods are shown in Table III-I-29, and the arrangement of toll transmission system at the end of 1997 is shown in Fig. III-I-18.

7-8-2 Television program transmission network

For the purpose of transmitting TV programs of the educational TV broadcasting stations and commercial TV stations expected to be opened during the project period, the TV program transmission network will be amplified.
At present, exclusive TV microwave systems are generally used for the transmission of TV programs. In some spans, however, spare systems are used. In the future, TV broadcasting hours will be extended, and exclusive TV program transmission systems will be planned for educational TV stations (1 group) and commercial TV stations (2 groups).
For collecting the TV program materials, the standby system will be used as in the past.
For the sake of economy, additional TV program transmission circuits will be installed along the existing telephone transmission circuits.
For the expansion of TV program transmission circuits for the

first five-year period (1983 - 87), a plan has been ready for implementation.
Fig. III-I-19 shows the TV program transmission network as available at the end of 1987.
Table III-I-30 shows the construction schedule for the second and third five-year periods, and Fig. III-I-20 shows the TV program transmission network toward the end of 1997.
There is no room for additional radio channels between Asunción and Rep. Paraguarí and between Rep. Capt. Miranda and Encarnación. Thus, it will be necessary to increase the radio channels installable in parallel by separation of transmission and reception antennas or by using a new frequency band.
As regards Encarnación, it may be practical to install a TV program transmission line from Rep. Capt. Miranda direct to TV stations and to install one TV monitoring line alone between Rep. Capt. Miranda and Encarnación.
As regards Villarrica, it may be a practical alternative to install a TV program transmission line from Cnel. Oviedo or Rep. Paraguari direct to TV stations.

7-8-3 Measures for the improvement of transmission line reliability

For the Master Plan, it will be planned as a first step toward improving the reliability of transmission lines to loop (dualize) the long-distance toll trunk circuits and some of short-distance toll trunk circuits.

(1) First five-year plan

Looping of the transmission circuit interconnecting Asunción, Cnel. Oviedo and Encarnación.
This will be implemented as a link of the transmission line expansion program to cope with the increase in demand for circuits.

(2) Second and third five-year plans

1) Looping of transmission lines interconnecting Cnel. Oviedo, Cdad, Pte. Stroessner and Encarnación

This will be implemented as a link of the transmission line expansion program to cope with the increase in demand for toll circuits.

The microwave route should be so selected that the existing microwave stations (Rep. Pte. Stroessner, Rep. Capt. Miranda) will not be used in common.

The implementation of this plan should be carried out in tune with the progress of the Cdad. Pte. Stroessner-Encarnación Road (Route 6) Development Project.

2) Dualization of the Cnel. Oviedo-P.J. Caballero transmission route

An over-the-horizon microwave transmission system (capacity: 180 CH) will be planned between Cnel. Oviedo and P.J. Caballero.

For the purpose of looping the Cnel. Oviedo-P.J. Caballero transmission route, it is desirable to install a line-of-sight microwave circuit between Saltos del Guaira and P.J. Caballero. But there is no road development plan for this section, and the line-of-sight microwave circuit plan is discarded from the viewpoint of maintenance.

The introduction of above-mentioned line-of-sight microwave circuit should be studied when the road in the area is improved.

3) Dualization of the transmission lines between Asunción and Pilar.

Considering the scale of the circuits between Asunción and Pilar and the investment costs for their dualization, a UHF/VHF transmission system will be planned between Asunción and Pilar.

Namely, a UHF/VHF 60-CH transmission system (with an initial installed capacity of 24 channels) will be installed between Alberdí and Pilar, and at the same time the circuits between Asunción and Alberdí will be expanded.

4) Looping of the transmission circuits interlinking Asunción, Luque and San Lorenzo
This plan will be implemented as a link of the transmission circuit expansion program to cope with the increase in the demand for toll circuits.

As regards the microwave circuit to be newly installed between Asunción and Mcal. Estigarribia, the open-wire carrier system will be used as a backup circuit for some time now.
In the future when the circuit demand has grown up, the over-the-horizon transmission system, satellite communication system, etc. will be studied.
The time schedule for the implementation of transmission line reliability improvement plans will be determined to smooth out the work volume.
The work schedule for the plans above is shown in Table III-I-31 (those shown in Table III-I-29 are excluded).

Table III-I-27 Required channels between automatic telephone offices

District No.	Section	Installed channels (Unit: Group) 1987	Required channels (Unit: Group)										Detail of required channels in 1997 (Unit: channel)			
			1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Telephone	Tg.Telex Data	Land mobile	Total
1	ASUNCION - ALBERDI	3	2	2	2	2	2	2	3	3	3	3	33			33
	" - AREGUA	1	2	3	3	3	4	4	5	6	6	7	76	4		80
	" - CAPIATA	3	4	5	6	7	8	10	11	12	14	15	174	7		181
	" - EMBOSCADA	-	-	-	-	1	1	2	2	2	2	2	15			15
	" - GUARAMBARE	2	2	2	2	3	3	3	3	3	3	4	38	1		39
	" - ITA	3	4	4	6	7	8	9	10	11	12	14	136	8	15	159
	" - LIMPIO	-	1	2	2	2	2	2	2	2	2	2	21	1		22
	" - LUQUE	25	16	19	24	28	31	35	40	45	50	55	613	17	31	661
	" - SAN ANTONIO	2	2	3	3	3	4	4	4	5	5	6	61	2		63
	" - SAN LORENZO	15	20	22	26	31	35	40	45	51	56	63	728	20		748
	" - VILLETA	3	3	3	4	4	4	5	6	6	7	7	75	3		78
	" - M.R. ALONZO	5	4	5	6	6	7	8	9	10	11	12	129	8		137
	" - ZEBALLOS CUE	1	2	2	2	2	2	2	2	2	3	3	27			27
	" - ÑEMBY	-	-	-	-	-	-	-	-	2	2	2	15			15
	" - NUEVA ITALIA	-	-	-	-	-	-	-	-	-	-	1	13			13
	SAN ANTONIO - ÑEMBY	(30 pairs)	(30)	(30)	(30)	(30)	(30)	(30)	(30)	-	-	-				
2	ENCARNACION - CAPT.MIRANDA	-	-	-	-	-	-	1	1	1	1	1	13			13
	" - HOHENAU	3	3	3	3	3	3	4	4	4	5	5	57			57
	" - COL.PIRAPO	1	2	2	2	2	2	2	2	2	2	2	25			25
	" - CNEL.BOGADO	5	3	3	4	4	4	4	5	5	6	6	68			68
	" - GRAL.ARTIGAS	2	-	-	-	1	1	2	2	2	2	2	15			15
	" - LA PAZ	-	-	-	1	1	1	1	1	1	1	1	13			13
	" - SAN COSME Y DAMIAN	3	2	2	2	2	2	2	2	2	2	2	21			21
	" - SAN PEDRO DEL PARANA	-	-	-	-	2	2	2	2	2	2	2	19			19

District No.	Section	Installed channels (Unit: Group) 1987	Required channels (Unit: Group)										Detail of required channels in 1997 (Unit: channel)			
			1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Telephone	Tg.Telex Data	Land mobile	Total
2	ENCARNACION - CARMEN DEL PARANA	1	1	2	2	2	2	2	2	2	2	2	23			23
	" - COL BELLA VISTA	1	2	2	2	2	2	2	2	2	2	2	23			23
	" - COL FRAM	1	1	1	1	1	1	1	1	1	1	1	11			11
	" - GRAL.DELGARO	-	-	-	-	-	-	-	-	-	1	1	11			11
	CNEL. BOGADO - SAN PEDRO DEL PARANA	-	1	1	1	-	-	-	-	-	-	-				
3	ASUNCION - CAACUPE	4	5	5	6	7	8	9	10	11	13	14	153	14		167
	" - EUSEBIO AYALA	4	2	2	3	3	3	3	4	4	4	5	51			51
	" - ITAUGUA	1	2	2	4	4	4	4	4	5	5	6	42	4	18	64
	" - PIRIBEBUY	1	2	2	2	3	3	3	4	4	4	5	52			52
	" - SAN BERNARDINO	3	3	4	4	5	6	7	8	9	10	11	122	4		126
	" - TOBATI	1	2	2	2	2	3	3	3	3	4	4	41			41
	" - YPACARAI	5	4	4	5	5	6	7	8	8	10	10	113	6		119
	" - ARROYOS Y ESTEROS	-	-	-	-	1	1	1	1	1	1	1	9			9
	" - ATYRA	-	1	1	1	2	2	2	2	2	2	2	17			17
	" - CARAGUATAY	-	1	1	1	1	1	2	2	2	2	2	15			15
	" - ISLA PUCU	-	-	-	-	1	1	1	1	1	1	1	11			11
	" - ITAC. DE LA CORDILLERA	-	-	-	2	2	2	2	2	2	2	2	21			21
	" - STA ELENA	-	-	-	-	-	-	-	1	1	1	1	11			11
	" - ALTOS	-	-	-	-	-	-	-	1	1	1	1	11			11
	EUSEBIO AYALA - ITAC.DE LA CORDILLERA	1	2	2	-	-	-	-	-	-	-	-				
	" - STA.ELENA	1	1	1	1	1	1	1	-	-	-	-				

District No.	Section	Installed channels (Unit: Group) 1987	Required channels (Unit: Group)										Detail of required channels in 1997 (Unit: channel)			
			1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Telephone	Tg.Telex pata	Land mobile	Total
4	ASUNCION - VILLARRICA	8	6	6	6	7	9	10	12	13	15	17	185	14		199
	" - CAAZAPA	2	2	2	2	2	2	3	3	3	3	3	28	6		34
	" - COL INDEPENDENCIA	1	2	2	2	2	2	2	2	3	3	3	28			28
	" - ITURBE	-	1	1	2	2	2	2	2	2	2	2	19			19
	" - S.J. NEPOMUCENO	1	1	2	2	2	2	2	2	2	2	2	24			24
	" - YEGROS	-	-	1	1	1	1	1	1	2	2	2	13			13
	" - YUTY PUEBLO	-	-	1	1	1	1	1	1	2	2	2	13			13
	" - PASO YABAI	-	-	-	-	-	-	-	-	-	-	1	11			11
	" - SAN SALVADOR	-	-	-	-	-	-	-	-	-	1	1	9			9
5	CNEL. OVIEDO - CAAGUAZU	5	4	5	6	7	8	9	11	12	14	14	168			168
	" - HUGO STROESSNER	1	1	1	1	1	1	1	1	1	1	1	13			13
	" - VILLA CURGUATY	-	-	-	-	-	1	1	1	1	1	1	13			13
	" - SAN JOSE DE LOS ARROYOS	1	1	2	2	2	2	2	2	3	3	3	30			30
	" - COL.J.R. CHAVEZ	-	-	-	-	-	1	1	1	1	1	1	13			13
	" - SALTOS DEL GUAIRA	5	2	3	3	3	4	4	4	5	5	6	64			64
	" - CAMPO 9	-	-	2	2	2	2	2	2	2	2	2	24			24
	" - J.M.FRUTOS	-	-	-	2	2	2	2	2	2	2	2	19			19
	" - YHU	-	-	-	-	-	1	1	1	1	1	1	13			13
	SALTOS DEL GUAIRA - LA PALOMA	1	1	1	1	1	1	1	1	1	1	1	13			13
	" - CORPUS CRISTI	2	1	1	1	1	1	1	1	1	1	1	11			11

District No.	Section	Installed channels (Unit: Group) 1987	Required channels (Unit: Group)										Detail of required channels in 1997 (Unit: channel)			
			1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Telephone	Tg.Telex Data	Land mobile	Total
5	CAAGUAZU - CAMPO 9	1	1	-	-	-	-	-	-	-	-	-				
	" - J.M.FRUTOS	1	1	1	-	-	-	-	-	-	-	-				
6	CNEL OVIEDO - CONCEPCION	10	5	6	7	9	10	12	14	16	18	20	231	4		235
	" - HORQUETA	1	1	2	2	2	2	2	2	2	2	2	21			21
	" - PASO BARRETO	-	-	-	-	1	1	1	1	1	1	1	13			13
7	ASUNCION - PARAGUARI	7	4	4	5	6	7	8	9	10	11	12	129	14		143
	" - CARAPEGUA	8	2	2	3	3	3	4	4	4	5	5	58			58
	" - QUINDY	1	2	2	2	2	2	2	2	3	3	3	32			32
	" - YAGUARON	-	2	2	2	3	3	3	4	4	5	5	56			56
	" - YBYCUY	1	2	2	2	2	2	3	3	3	3	4	38			38
	" - ACAHAY	-	1	1	1	1	2	2	2	2	2	2	17			17
	" - CAAPUCU	-	-	-	1	1	1	1	1	1	1	1	13			13
	" - LA COLMENA	1	1	1	1	2	2	2	2	2	2	2	17			17
	" - PIRAYU	1	1	1	1	2	2	2	2	2	2	2	17			17
	" - SAPUCAI	-	-	-	-	1	1	1	1	1	1	1	13			13
	" - CABALLERO	-	-	-	-	-	-	-	1	1	1	1	11			11
	" - ROQUE GONZALEZ	-	-	-	-	-	-	-	-	-	-	1	11			11
8	ENCARNACION - S.J.BAUTISTA	3	3	3	3	4	4	4	5	5	5	6	64			64
	" - SAN IGNACIO	5	3	3	3	3	4	4	4	5	5	5	60			60
	" - STA.ROSA MISIONES	1	2	2	2	2	2	2	2	2	2	3	26			26
	" - VILLA FLORIDA	1	2	2	2	2	2	2	2	2	2	3	26			26
	" - YACYRETA (AYOLAS)	5	3	3	4	4	4	4	5	5	6	6	67			67

District No.	Section		Installed channels (Unit: Group) 1987	Required channels (Unit: Group)										Detail of required channels in 1997 (Unit: channel)			
				1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Telephone	Tg.Telex Data	Land mobile	Total
9	CNEL OVILDO	- ITAC. DEL ROSARIO	3	2	2	2	2	3	3	3	4	4	5	50			50
	"	- VILLA DEL ROSARIO	2	2	2	2	3	3	3	3	4	4	4	47			47
	"	- SAN ESTANISLAO	3	2	2	3	3	3	4	4	5	6	6	70			70
	"	- COL.GRAL. AQUINO	-	-	-	1	1	1	2	2	2	2	2	17			17
	"	- STA.CLARA	-	-	-	-	-	1	1	1	1	1	1	11			11
	"	- COL.CHORE	-	-	-	-	1	1	1	1	1	1	1	11			11
	"	- TACUARAS NORTE	-	-	-	-	-	-	-	-	-	-	1	11			11
	"	- F.MATIAUDA	-	-	-	-	-	-	-	-	-	-	1	11			11
	"	- COL. VOLENDAN	-	-	-	-	-	-	-	-	-	-	1	11			11
10	ASUNCION	- PILAR	4	3	4	5	6	6	7	8	9	10	12	125	10		135
11	CNEL. OVIEDO	- CDAD PTE. SIROESSNER	31	24	27	31	36	41	46	53	59	65	72	858	3		861
	"	- HERNANDARIAS	5	3	3	4	4	4	5	6	6	7	7	83			83
	"	- COL. PTE. STROESSNER	5	3	3	3	3	3	4	4	4	4	4	48			48
	CDAD PTE. STROESSNER	- COL.YGUAZU	2	2	2	2	2	2	2	2	2	2	2	21			21
	"	- HERNANDARIAS	3	2	2	2	3	3	3	4	4	4	5	50			50
	"	- J.E.O'LEARY	1	1	1	1	1	2	2	2	2	2	2	15			15
	"	- J.L. MALLORQUIN	1	1	1	1	1	2	2	2	2	2	2	15			15

District No.	Section	Installed channels (Unit: Group) 1987	Required channels (Unit: Group)										Detail of required channels in 1997 (Unit: channel)			
			1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Telephone	Tg.Telex Data	Land mobile	Total
11	CDAD PTE. SIROESSNER - KM6. RUTA7	1	2	2	2	2	2	2	2	2	2	2	19			19
	" - STA ROSA	1	1	1	1	1	1	1	1	1	1	1	13			13
	" - COL PTE. STROESSNER	4	1	1	2	2	2	2	2	2	2	2	18			18
12	CNEL.OVIEDO - P.J. CABALLERO	20	9	10	11	12	14	15	17	19	21	21	248	4		252
	" - BELLA VISTA NORTE	3	2	2	2	2	2	2	2	2	2	2	22			22
	" - CAPT.BADO	3	2	2	2	2	2	2	2	2	2	3	26			26
	" - YBY YAU	-	-	-	1	1	1	1	1	1	1	1	13			13
	" - CHIRIGUELO	-	-	-	-	-	-	1	1	1	1	1	11			11
	P.J. CABALLERO - YBY YAU	1	1	1	-	-	-	-	-	-	-	-				
14	CNEL.OVIEDO - VILLA DE SAN PEDRO	3	2	3	3	4	4	4	5	6	6	7	76	3		79
	" - LIMA	-	-	-	-	1	1	1	1	1	1	1	13			13
	" - PTO. ANTEQUERA	-	-	-	-	1	1	1	1	1	1	1	13			13
	" - NUEVA GERMANIA	-	-	-	-	-	-	-	-	-	-	1	11			11
	" - STA.ROSA	-	-	-	-	-	-	-	-	1	1	1	11			11
15	ASUNCION - VILLA HAYES	3	3	3	3	4	4	4	5	5	6	6	64	3		67
	" - BENJAMIN ACEVAL	-	1	2	2	2	2	2	2	3	3	3	32			32
	" - COL. FILADELFIA	1	2	2	2	2	2	3	3	3	3	4	35	3		38
	" - CHACO-I	-	-	-	-	-	-	-	-	-	1	1	11			11

District No.	Section	Installed channels (Unit: Group) 1987	Required channels (Unit: Group)										Detail of required channels in 1997 (Unit: channel)			
			1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Telephone	Tg.Telex Data	Land mobile	Total
	ASUNCION - CNEL.OVIEDO	61	65	77	85	93	103	111	120	129	137	144	1,685	37		1,722
	" - ENCARNACION	34	31	35	38	41	44	48	51	54	56	59	635	72		707
	CNEL.OVIEDO - ENCARNACION	17	9	10	11	11	12	13	14	15	16	16	185	3		189
	ASUNCION - CDAD PTE STROESSNER	-	4	4	5	5	6	7	8	8	9	10		116		116
	" - SALTOS DEL GUAIRA		1	1	1	1	1	1	1	1	1	1		7		7
	" - P.J. CABALLERO		2	2	3	3	3	4	4	4	5	5		52		52
	" - CONCEPCION		1	1	1	1	1	1	1	1	1	1		10		10
	" - SAN PEDRO		1	1	1	1	1	2	2	2	2	2		22		22
	" - S.J.BAUTISTA		1	1	1	1	1	1	2	2	2	2		16		16
	ENCARNACION - CDAD.PTE STROESSNER		1	1	1	1	1	1	1	1	1	1		3		3
	CDAD PTE. STROESSNER - SALTOS DEL GUAIRA	3	2	2	2	2	2	2	3	3	3	3	33			33

Table III-I-28 International circuits via microwave network

Section \ Year	1987	1992	1997
ASUNCION - BUENOS AIRES	5G	5G	7G
ASUNCION - RESISTENCIA	3G	3G	4G
ASUNCION - CURITIBA	4G	5G	5G
ASUNCION - RIO DE JANEIRO	5G	5G	6G
ASUNCION - BRAZIL (EMERGENCY)	10G	15G	20G
(FRONTIER CIRCUITS) PILAR - RESISTENCIA	1G	max. 1 SG	max. 1 SG
CDAD.PTE. STROESSNER - FOZ DO IGUACU	2G	max. 1 SG	max. 1 SG

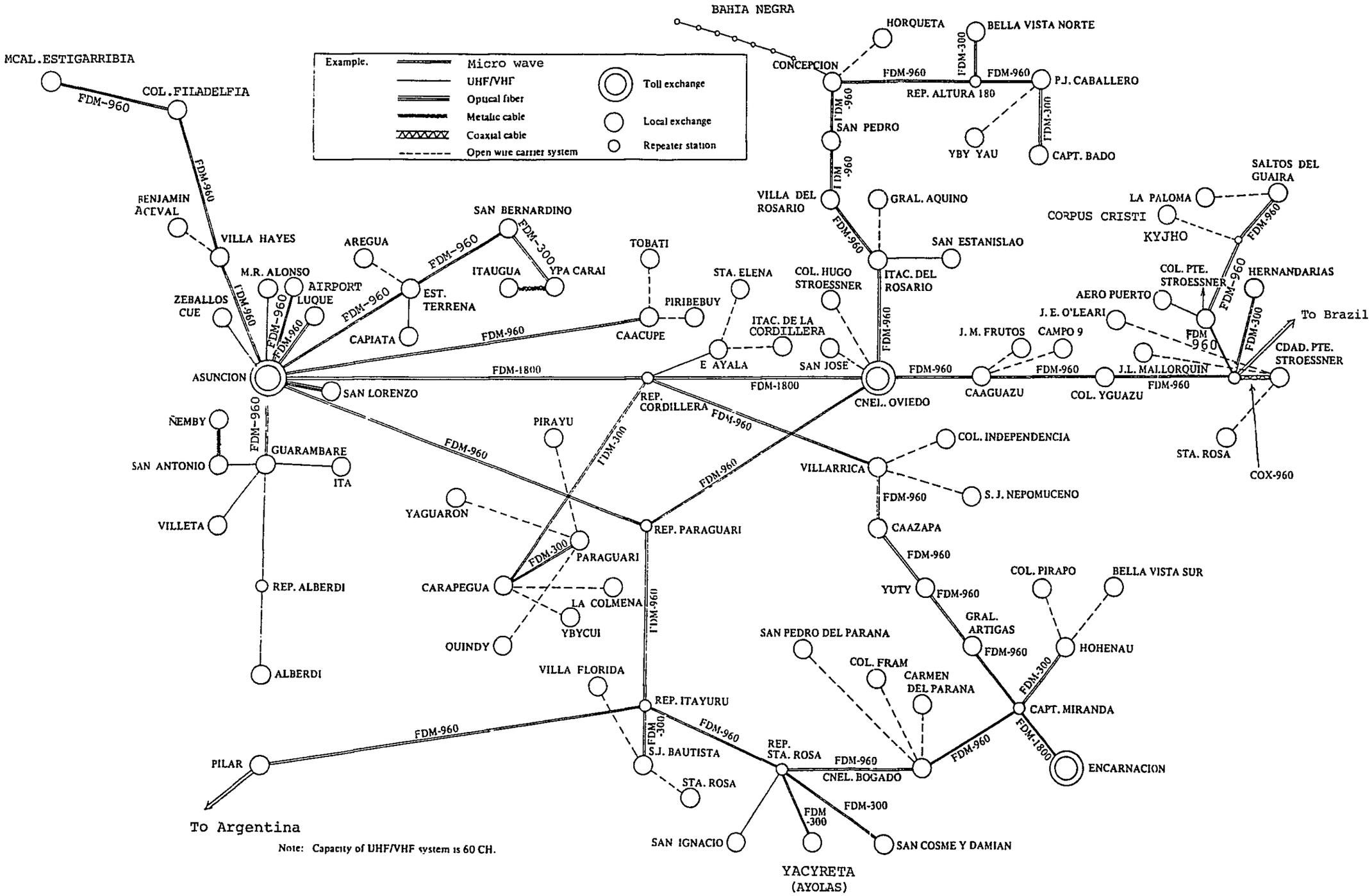


Fig. III-I-17 Trunk network between automatic exchanges (1987)

Table III-I-29 Trunk network expansion plan (1988 - 1997)

Year	Item	System	Section	No. of system
1988	Installation	FDM-960	LUQUE - SAN LORENZO	1 + 1
	RF channel expansion	FDM-1800	ASUNCION - REP.CORDILLERA	1
	Modification	FDM-1800	REP. CORDILLERA - VILLARRICA	
		FDM-1800	VILLARRICA - REP.CAPT.MIRANDA	
	MUX expansion	FDM-960	ASUNCION - EST.TERRENA	
		FDM-960	EST.TERRENA - SAN BERNARDINO	
		FDM-300	SAN BERNARDINO - YPACARAI	
		FDM-960	ASUNCION - LUQUE	
		FDM-1800	REP.CORDILLERA - CNEL.OVIEDO	
		FDM-300	ITA YURU - S.J.BAUTISTA	
		FDM-960	ITA YURU - STA.ROSA	
		FDM-960	STA.ROSA - CNEL.BOGADO	
		FDM-960	CNEL.BOGADO - REP.CAPT.MIRANDA	
		FDM-1800	REP.CAPT.MIRANDA - ENCARNACION	
		FDM-300	REP.CAPT.MIRANDA - HOHENAU	
		FDM-300	REP.STA.ROSA - SAN COSME	
		FDM-300	REP.STA.ROSA - YACYRETA (AYOLAS)	

Year	Item	System	Section	No. of system
1988	Installation	UHF/VHF-60	ASUNCION - LIMPIO	1
		UHF/VHF-60	HOHENAU - COL.BELLA VISTA	1
		UHF/VHF-60	HOHENAU - COL.PIRAPO	1
		UHF/VHF-60	GRAL.ARTIGAS - SAN PEDRO DEL PARANA	1
		UHF/VHF-60	CAACUPE - ATYRA	1
		UHF/VHF-60	EUSEBIO AYALA - CARAGUATAY	1
		UHF/VHF-60	EUSEBIO AYALA - ITAC.DE LA CORDILLERA	1
		UHF/VHF-60	VILLARRICA - COL.INDEPENDENCIA	1
		UHF/VHF-60	VILLARRICA - ITURBE	1
		UHF/VHF-60	CARAPEGUA - ACAHAY	1
		UHF/VHF-60	CARAPEGUA - GUINDY	1
		UHF/VHF-60	CARAPEGUA - YBYCUI	1
		UHF/VHF-60	REP.STA.ROSA - STA.ROSA	1
		UHF/VHF-60	S.J.BAUTISTA - VILLA FLORIDA	1
		UHF/VHF-60	CARAPEGUA - LA COLMENA	1
		UHF/VHF-60	PARAGUARI - PIRAYU	1
		UHF/VHF-120	CAACUPE - PIRIBEBUY	1
		UHF/VHF-120	CAACUPE - TOBATI	1
		UHF/VHF-120	ITA - YAGUARON	1
		PCM - 30	EST.TERRENA - AREGUA	3
		PCM - 30	EST.TERRENA - CAPIATA	3
		Open wire carrier system	COL.YGUAZU - J.L. MALLORQUIN	1

Year	Item	System	Section	No. of system
1988	Installation	Open wire carrier system	COL.YGUAZU - J.E. O'LEARY	1
		Open wire carrier system	CDAD.PTE.STROESSNER - KM.6, RUTA7	1
	Withdrawal	UHF/VHF-60	EST.TERRENA - CAPIATA	1
		Open wire carrier system	EST.TERRENA - AREGUA	1
		Open wire carrier system	HOHENAU - COL.BELLA VISTA	1
		Open wire carrier system	HOHENAU - COL.PIRAPO	1
		Open wire carrier system	CNEL.BOGADO - SAN PEDRO DEL PARANA	1
		Open wire carrier system	EUSEBIO AYALA - ITAC. DE LA CORDILLERA	1
		Open wire carrier system	VILLARRICA - COL.INDEPENDENCIA	1
		Open wire carrier system	PARAGUARI - QUINDY	1
		Open wire carrier system	CARAPEGUA - YBYCUI	1
		Open wire carrier system	S.J.BAUTISTA - STA.ROSA	1
		Open wire carrier system	S.J.BAUTISTA - VILLA FLORIDA	1
		Open wire carrier system	CARAPEGUA - LA COLMENA	1
		Open wire carrier system	PARAGUARI - PIRAYU	1
		Open wire carrier system	CAACUPE - PIRIBEBUY	1
		Open wire carrier system	CAACUPE - TOBATI	1

Year	Item	System	Section	No. of system
1988	Withdrawal	Open wire carrier system	PARAGUARI - YAGUARON	1
1989	Installation	FDM-960	CDAD.PTE.STROESSNER - ENCARNACION	1 + 1
		FDM-960	REP.CORDILLERA - CARAPEGUA	1 + 1
		FDM-300	GUARAMBARE - ITA	1 + 1
	MUX expansion	FDM-960	ASUNCION - GUARAMBARE	
	Installation	UHF/VHF-60	CNEL.BOGADO - CARMEN DEL PARANA	1
		UHF/VHF-60	VILLARRICA - S.J. NEPOMUSENO	1
		UHF/VHF-60	CNEL.OVIEDO - S.J. DE LOS ARROYOS	1
		UHF/VHF-60	CONCEPCION - HORQUETA	1
		UHF/VHF-60	CAAGUAZU - J.M. FRUTOS	1
		UHF/VHF-60	ASUNCION - BENJAMIN ACEVAL	1
	MUX expansion	UHF/VHF-60	GUARAMBARE - SAN ANTONIO	
	Installation	Open wire carrier system	J.M. FRUTOS - CAMPO 9	1
		Open wire carrier system	CAAZAPA - YEGROS	1
	Withdrawal	FDM-300	REP.CORDILLERA - CARAPEGUA	1 + 1
		UHF/VHF-60	GUARAMBARE - ITA	1
		Open wire carrier system	CNEL.BOGADO - CARMEN DEL PARANA	1
		Open wire carrier system	VILLARRICA - S.J. NEPOMUSENO	1

Year	Item	System	Section	No. of system
1989	Withdrawal	Open wire carrier system	CNEL.OVIEDO - S.J.DE LOS ARROYOS	1
		Open wire carrier system	CONCEPCION - HORQUETA	1
		Open wire carrier system	CAAGUAZU - J.M. FRUTOS	1
1990	Installation	FDM-300	REP.CORDILLERA - EUSEBIO AYALA	1 + 1
		FDM-300	ASUNCION - M.R. ALONZO	1 + 1
	Modification	FDM-1800	CNEL.OVIEDO - REP.PTE. STROESSNER	
	MUX expansion	FDM-960	ASUNCION - CAACUPE	
		FDM-960	ASUNCION - CNEL.OVIEDO	
		FDM-300	CARAPEGUA - PARAGUARI	
		FDM-960	ASUNSION - MCAL.ESTIGARRIBIA	
	Installation	PCM-30	YPACARAI - ITAUGUA	3
	MUX expansion	UHF/VHF-60	GUARAMBARE - VILLETA	
	Installation	Open wire carrier system	ENCARNACION - LA PAZ	1
		Open wire carrier system	CARAPEGUA _ CAAPUCU	1
	Withdrawal	UHF/VHF-60	ASUNCION - M.R. ALONZO	1
		UHF/VHF-60	REP. CORDILLERA - EUSEBIO AYALA	1
1991	Modification	FDM-1800	CNEL.OVIEDO - ITAC.DEL ROSARIO	
		FDM-1800	ITAC. DEL ROSARIO - SAN PEDRO	

Year	Item	System	Section	No. of system
1991	MUX expansion	FDM-960	SAN PEDRO - CONCEPCION	
		FDM-960	CONCEPCION - ALTURA 180	
		FDM-960	ALTURA 180 - P.J. CABALLERO	
		FDM-300	ALTURA 180 - BELLA VISTA NORTE	
		FDM-300	P.J. CABALLERO - CAPT.BADO	
	Installation	UHF/VHF-60	ASUNCION - EMBOSCADA	1
		UHF/VHF-60	CONCEPCION - PASO BARRETO	1
		UHF/VHF-60	SAN PEDRO - LIMA	1
	Installation	Open wire carrier system	EUSEBIO AYALA - ISLA PUCU	1
		Open wire carrier system	CAACUPE - ARROYOS Y ESTEROS	1
		Open wire carrier system	PARAGUARI - SAPCAI	1
		Open wire carrier system	SAN ESTANISLAO - COL.CHORE	1
		Open wire carrier system	SAN PEDRO - PTO. ANTEQUERA	1
1992	RF channel expansion	FDM-1800	REP.CAPT.MIRANDA - ENCARNACION	1
	MUX expansion	FDM-1800	ASUNCION - REP.CORDILLERA	
	Installation	PCM-30	EST.TERRENA - CAPIATA	3
	Installation	Open wire carrier system	COL.YGUAZU - J.L. MALLORQUIN	1
		Open wire carrier system	COL.YGUAZU - J.E. O'LEARY	1

Year	Item	System	Section	No. of system
1992	Installation	Open wire carrier system	CNEL.OVIEDO - VILLA CURUGUATY	1
		Open wire carrier system	CNEL.OVIEDO - COL.J.R. CHAVEZ	1
		Open wire carrier system	CAAGUAZU - YHU	1
		Open wire carrier system	ITAC.DEL ROSARIO - STA.CLARA	1
1993	Installation	FDM-300	ITA.DEL ROSARIO - SAN ESTANISLAO	1 + 1
	RF channel expansion	FDM-1800	REP.CORDILLERA - CNEL.OVIEDO	1
	MUX expansion	FDM-960	ASUNCION - ITAYURU	
		FDM-960	ITA YURU - PILAR	
	Installation	UHF/VHF-60	ITAC.DEL. ROSARIO - GRAL.AQUINO	1
	Installation	Open wire carrier system	ENCARNACION - CAPT.MIRANDA	1
		Open wire carrier system	P.J. CABALLERO - COL.CHIRIGUELO	1
	Withdrawal	UHF/VHF-60	ITAC.DEL. ROSARIO - SAN ESTANISLAO	1
		Open wire carrier system	ITAC.DEL ROSARIO - GRAL.AQUINO	1
1994	RF channel expansion	FDM-960	ASUNCION - LUQUE	1
	MUX expansion	FDM-960	ASUNCION - EST. TERRENA	
		FDM-960	ASUNCION - GUARAMBARE	
		FDM-960	LUQUE - SAN LORENZO	
		FDM-1800	REP. CORDILLERA - VILLARRICA	

Year	Item	System	Section	No. of system
1994	MUX expansion	COX-960	REP.PTE. STROESSNER - CDAD.PTE. STROESSNER	
		FDM-300	REP.PTE. STROESSNER - COL.PTE. STROESSNER	
		FDM-300	REP.PTE. STROESSNER - HERNANDARIAS	
		FDM-960	REP.PTE. STROESSNER - SALTOS DEL GUAIRA	
	Installation	UHF/VHF-120	GUARAMBARE - VILLETA	1
	Installation	Open wire carrier system	SAN BERNARDINO - ALTOS	1
		Open wire carrier system	PARAGUARI - CABALLERO	1
	Withdrawal	UHF/VHF-60	GUARAMBARE - VILLETA	1
1995	Installation	UHF/VHF-120	GUARAMBARE - SAN ANTONIO	1
	MUX expansion	UHF/VHF-60	ASUNCION - ZEBALLOS CUE	
	Withdrawal	UHF/VHF-60	ASUNCION - SAN ANTONIO	1
1996	Installation	Open wire carrier system	ITURBE - SAN SALVADOR	1
		Open wire carrier system	CNEL.BOGADO - GRAL.DELGADO	1
		Open wire carrier system	VILLA HAYES - CHACO-I	1
1997	Installation	UHF/VHF-60	SAN PEDRO - NUEVA GERMANIA	1
	Installation	Open wire carrier system	COL. INDEPENDENCIA - PASO YOBAI	1
		Open wire carrier system	GUARAMBARE - NUEVA ITALIA	1
		Open wire carrier system	CARAPEGUA - LOQUE GONZALEZ	1

Year	Item	System	Section	No. of system
1997	Installation	Open wire carrier system	SAN ESTANISLAO - TACUARAS NORTE	1
		Open wire carrier system	SAN ESTANISLAO - F. MATIAUDA	1
	Installation	Open wire carrier system	ITA.DEL. ROSARIO - COL. VOLENDAN	1

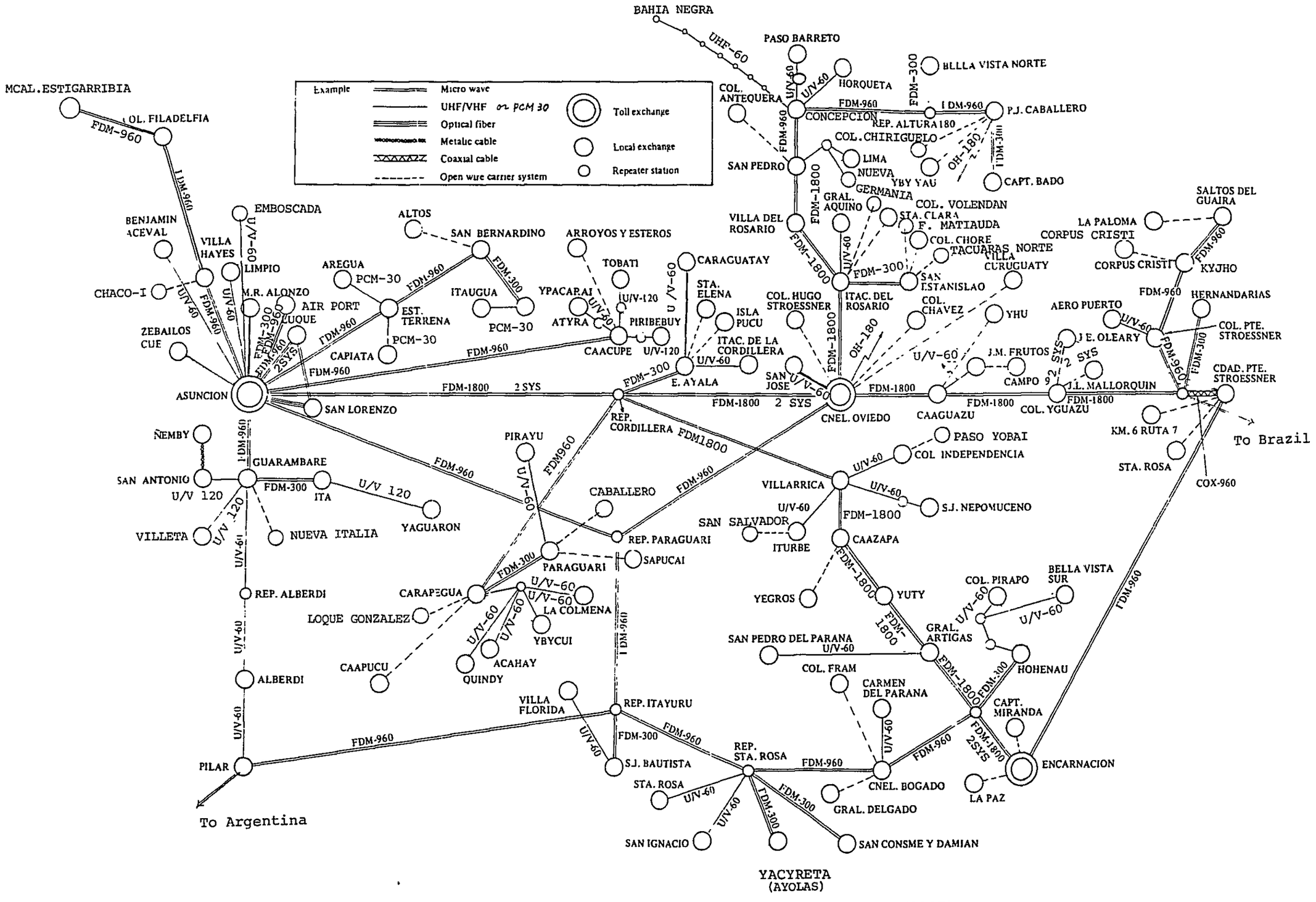


Fig. III-I-18 Trunk network between automatic exchanges (1997)

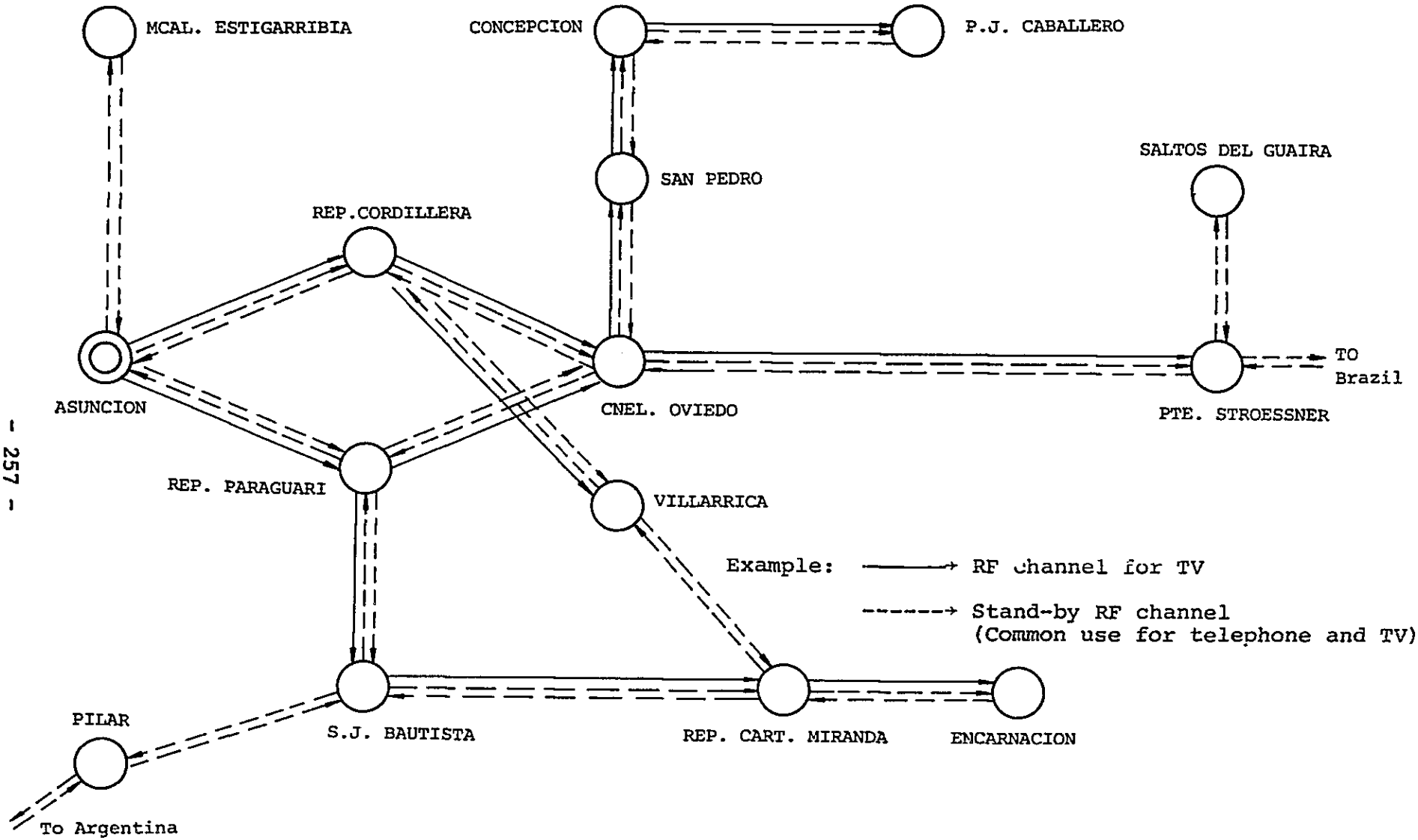


Fig. III-I-19 Television program transmission network (1987)

Table III-I-30 Television transmission network expansion plan (1988 - 1997)

Year	Item	Section	No.of RF channel
1991	Installation	ASUNCION - REP.PARAGUARI	1 + 1
	RF expansion	REP.PARAGUARI - ITA YURU	1
	"	ITA YURU - PILAR	2
	"	ITA YURU - REP.CAPT. MIRANDA	1
	Installation	REP.CAPT.MIRANDA - ENCARNACION	1 + 1
1992	RF expansion	REP.PARAGUARI - CNEL.OVIEDO	1
		CNEL.OVIEDO - REP.PTE. STROESSNER	1
		REP.PTE.STROESSNER - SALTOS DEL GUAIRA	1
1993	RF expansion	CNEL.OVIEDO - P.J. CABALLERO	1
1994	RF expansion	ASUNCION - MCAL.ESTIGARRIBIA	1
	"	CNEL.OVIEDO - REP.CORDILLERA	1
		REP.CORDILLERA - VILLARRICA	1

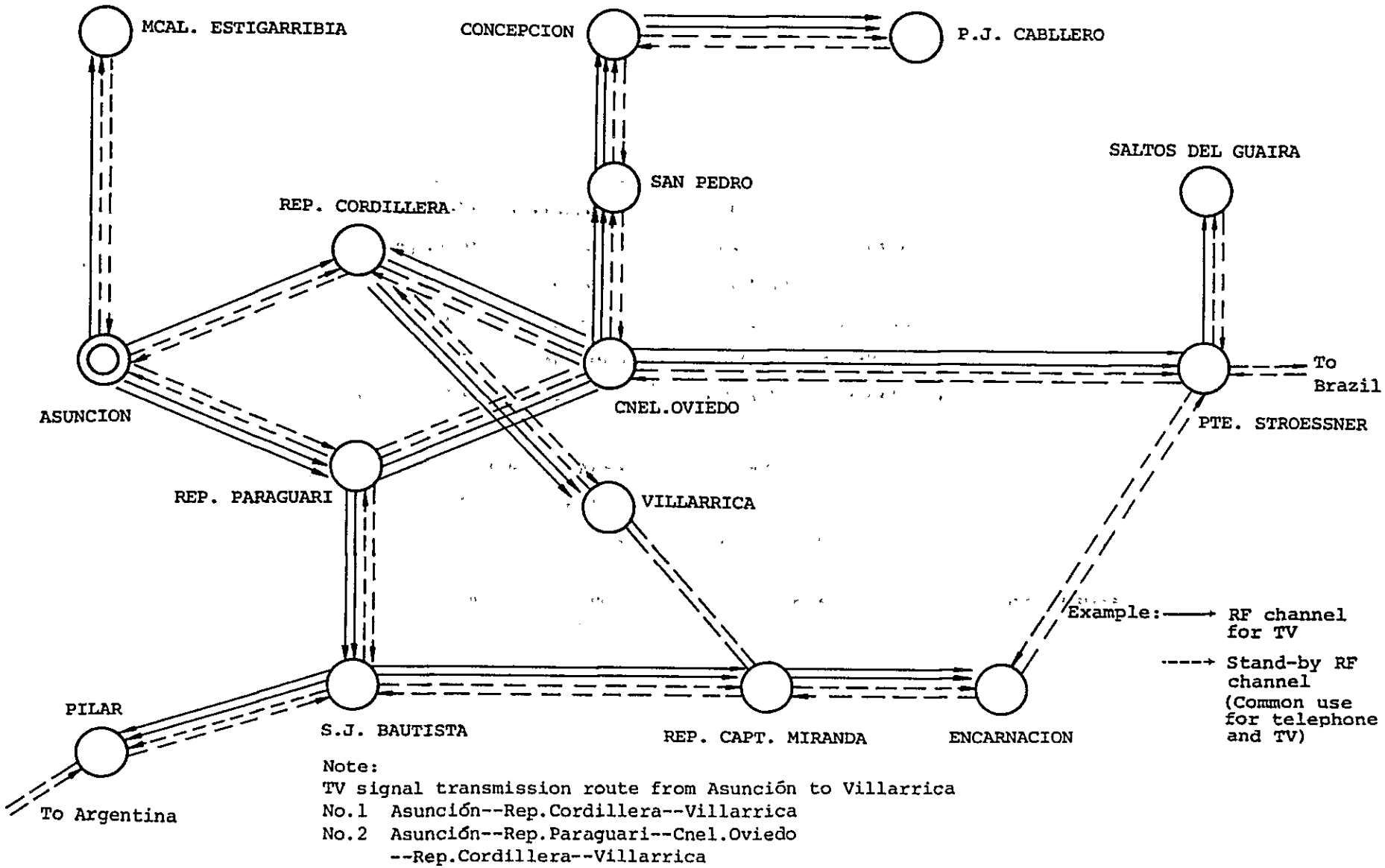


Fig. III-I-20 Television program transmission network (1997)

Table III-I-31 Trunk line stabilization plan
(multiple route)

Year	Item	System	Section	No. of systems
1994	Installation	UHF/VHF-60	ALBERDI – PILAR	1
	MUX expansion	FDM-960	ASUNCION – GUARAMBARE	
	MUX expansion	UHF/VHF-60	GUARAMBARE – ALBERDI	
1996	Installation	OH-180	CNEL. OVIEDO – P.J. CABALLERO	1
	Installation	UHF/VHF-120	CNEL. OVIEDO (ENTRANCE)	1
	Installation	UHF/VHF-120	P.J. CABALLERO (ENTRANCE)	1
	MUX expansion	FDM-960	P.J. CABALLERO – CONCEPCION	
	MUX expansion	FDM-960	CONCEPCION – SAN PEDRO	
	MUX expansion	FDM-960	SAN PEDRO – ITAC. DEL ROSARIO	

7-9 Mobile Radio Communication

7-9-1 Land mobile radio telephone

Asunción and Central will be integrated into a single service area, and a land mobile radio telephone exchange will be installed in Asunción.
The land mobile radio telephone service will be operated on an automatic dialing system, and the mobile radio telephones within the service area can communicate with each other and can communicate with any subscriber telephone within the country.
Automatic communication channel switching function will be employed for the purpose of holding on a call moving from cell (cover-area of base radio station) to cell.

The system configuration is as outlined below.

(1) There will be installed one land mobile radio telephone switching office and one radio circuit control office in Asunción.

(2) One cell site (base radio station) will be installed in Asunción, and three in Central.
It is assumed that the coverage of a cell site will be about 10 km in radius in the urban area and about 20 km (10 km to 30 km depending on topography) in other areas.

(3) The buildings for land mobile radio telephone switching office, radio circuit control office and base stations, towers and power facilities are planned as shown in Table III-I-32.

(4) The radio channels assigned to the base stations are as shown in Table III-I-33.

The calling rate of land mobile radio telephone is set at 0.026 Erl. (total of originating and terminating calls), and the loss probability at 3/100. The data used for the calculation of calling rate and the number of channels are shown in ANNEX, Table A I-14.

(5) The entrance circuits between the land mobile radio telephone switching office and base stations will be planned as part of the expansion plan for trunk and junction lines.

This service will be commenced in 1990.

7-9-2 Ship communication

For the purpose of improving the operation and maintenance efficiency in accordance with the basic policies stated in CHAPTER 2, the existing operation center, transmitting station and receiving station, and the entrance circuits interconnecting them will be upgraded on a wholesale scale. VHF-band transmitter and receiver facilities will be installed in Pilar, Concepción and Bahia Negra in order to extend ship communication service to the ships navigating the Paraguary River near such areas. The radio telephone circuits of these three local stations will be accommodated by the operation center in Asunción by way of toll transmission circuits. In order to avoid the dog-in-the-manger preemption of the toll circuit when the ship communication traffic is small, measures will also be taken to make the telephone offices near the base stations field the ship communication calls. The major facilities to be installed are as listed in Table III-I-34.

This plan will be carried out in 1991.

Table III-I-32 Building, tower and power facilities plan for land mobile telephone system

Station \ Facilities		Building	Tower	Power supply
Automatic mobile exchange center	CENTRAL I	Existing	-	o
Mobile control station	CENTRAL I	Existing	-	o
Mobile base station	CENTRAL II	Existing	Existing	o
	LUQUE	Existing	Existing	o
	ITAUGUA	Existing	o	o
	ITA	Existing	Existing	o

Note: o To be newly installed.

Table III-I-33 Land mobile telephone radio channels

(1) Required speech channels

Year	1990	1991	1992	1993	1994	1995	1996	1997
Number of speech channels	11	20	29	39	49	61	73	87

(2) Radio channels for base station

Year / Radio channel / Base station	1990			1995		
	Speech	Paging & access	Total	Speech	Paging & access	Total
CENTRAL II	20	2	22	29	2	31
LUQUE	20	2	22	29	2	31
ITAUGUA	11	2	13	16	2	18
ITA	10	2	12	13	2	15
Total	61	8	69	87	8	'95

Table III-I-34 Main facilities for ship communication system

Station	Facilities	Quantity
Operation center (Asunción)	Control operation position with remote control system	4
	VHF Transmitter-receiver	2
	VHF Antenna system	2
Transmitting station (Asunción)	10 KW HF Transmitter	6
	Antenna matrix switch	1
	Inverted cone antenna	2
	Short range Log. Periodic antenna	2
	Broadband dipole antenna	2
	Remote control system	1
	250 KVA Stand-by Generator	1
Receiving station (Asunción)	HF Receiver	6
	Inverted cone antenna	1
	Broad band dipole antenna	1
	Antenna multicoupler	2
	Remote control system	1
	20 KVA Stand-by Generator	1
Entrance (Asunción)	UHF-24 CH system with stand-by	2
Base radio station (Pilar)	VHF Transmitter-receiver (with stand-by)	1
	VHF Antenna system	1
Base radio station (Concepción)	VHF Transmitter-receiver (with stand-by)	1
	VHF Antenna system	1
Base radio station (Bahia Negra)	VHF Transmitter-receiver (with stand-by)	1
	VHF Antenna system	1

7-10 Telegraph and Telex

7-10-1 Preconditions

(1) As regards the telex switching facilities, the introduction of digital switching equipment has been committed in the first five-year plan (1983-87). In the Master Plan here, the telex facilities for the demand from the second five-year plan onward (1988-) will be planned. Namely, additional facilities necessary for a total of 3,011 terminals expected to be installed newly from 1989 and thereafter will be planned on presupposition that all the facilities necessary for a total 2,171 telex terminals for public and subscriber use, forecast in CHAPTER 5 for the year 1988, will have been fully installed by the last year of the first five-year plan.

(2) The telex terminals for national public telegraph and for subscribers will be installed gradually on the occasion when the manual telephone exchanges will be automatized, and the service area will be expanded gradually.
As regards Asunción, the "Oficina" planned by ANTELCO will also be installed with telex terminals for national public telegraph service for the purpose of upgrading the service.

(3) Mini- facsimiles for transferring telegrams between the manual and automatic offices will be installed. The service start years will be assigned to prefectures for the purpose of smoothing out annual work volume.

7-10-2 Outline of installation plan

(1) Telex switching equipment

In Asunción, the telex switching equipment will be expanded by 1,806 circuits each in 1989 and 1994, or 3,612 circuits in two years, to have a total capacity of 5,500 circuits together with the existing facilities.

(2) Telex concentrating equipment

The TDM devices in the concentrating office will be expanded according to the traffic demand forecast to 14 sections or 28 sets in all by 1997.
Table III-I-35 shows an installation schedule for telegraph and telex facilities.

7-11 Data Communication Equipment

The 1,200 bits/s MODEM to be connected to the telex switching equipment will be used for data communication service. The MODEM will be prepared when the demand for it has surfaced. This is because the future demand is not certain and also because the equipment costs are small compared with other telecommunication facilities.

Table III-I-35 (1/2) Telegraph & telex facilities installation plan

(Service commencement base)

Facilities \ Year	1988	'89	'90	'91	'92	'93	'94	'95	'96	'97	Total
Switching sys. (line)		1806L					1806L				3612 L
T D M		2	2	8			2	10	2	2	28
Telex		275	307	331	351	313	416	348	350	320	3011
Mini facsimile		29	31	30	26	27	20	12	12	9	196

(Note)

Necessary facilities to meet the demand up to 1988 are assumed to be installed under the forth construction contract.

Table III-I-35 (2/2) Telegraph facilities installation plan

(Implementation base)

Year / Pre-fecture	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Switching Asunción	1200L	Forth construction contract			1888L	3694L 1806L					5500L 1806L				
Concentrator (TDM)															
Concepción	VFTx1 5											TDMx1 22 22	TDMx1 22 0	TDMx1 22 0	TDMx1 22 0
P.J. CABALLERO	TDMx1 25	TDMx1 25 0	TDMx1 25 0	TDMx1 25 0	TDMx1 25 0	TDMx1 25 0	TDMx1 25 0	TDMx1 25 0	TDMx2 71 46	TDMx2 71 0	TDMx2 71 0	TDMx2 71 0	TDMx2 71 0	TDMx2 71 0	TDMx2 71 0
San Pedro	VFTx1 14			TDMx1 32 32	TDMx1 32 0	TDMx1 32 0	TDMx1 32 0	TDMx1 32 0	TDMx2 78 46	TDMx2 78 0	TDMx2 78 0	TDMx2 78 0	TDMx2 78 0	TDMx2 78 0	TDMx2 78 0
Caacupe	VFTx1 10							TDMx1 36 36	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0
Cnel.Oviedo	VFTx1 10				TDMx1 36 36	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx2 82 46	TDMx2 82 0
Cdad.Pte. Stroessner	TDMx2 49		TDMx3 138 89	TDMx3 138 0	TDMx3 138 0	TDMx4 184 46	TDMx4 184 0	TDMx4 184 0	TDMx5 230 46	TDMx5 230 0	TDMx5 230 0	TDMx5 230 0	TDMx6 276 46	TDMx6 276 0	TDMx6 276 0
Villarrica	VFTx1 6												TDMx1 40 40	TDMx1 40 0	TDMx1 40 0

Year / Prefecture	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Paraguarí	VFTx1 10				TDMx1 36 36	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx1 36 0	TDMx2 82 46	TDMx2 82 0	TDMx2 82 0
S.J. Bautista	VFTx1 12				TDMx1 34 34	TDMx1 34 0	TDMx1 34 0	TDMx1 34 0	TDMx1 34 0	TDMx1 34 0	TDMx1 34 0	TDMx1 34 0	TDMx1 34 0	TDMx1 34 0	TDMx2 80 46
Pilar	VFTx1 6												TDMx1 40 40	TDMx1 40 0	TDMx1 40 0
Encarnación	TDMx2 92	TDMx2 92 0	TDMx2 92 0	TDMx2 92 0	TDMx2 92 0	TDMx2 92 0	TDMx3 138 46	TDMx3 138 0	TDMx3 138 0	TDMx3 138 0	TDMx3 138 0	TDMx3 138 0	TDMx4 184 46	TDMx4 184 0	TDMx4 184 0
Central	TDMx1 30	TDMx2 92 62	TDMx2 92 0	TDMx2 92 0	TDMx2 92 0	TDMx2 92 0	TDMx2 92 0	TDMx2 92 0	TDMx3 138 46	TDMx3 138 0	TDMx3 138 0	TDMx3 138 0	TDMx3 138 0	TDMx3 138 0	TDMx3 138 0
Asunción	TDMx6 196	TDMx7 258 62	TDMx8 347 89	TDMx9 379 32	TDMx12 485 106	TDMx13 531 46	TDMx14 577 46	TDMx15 613 36	TDMx19 797 184	TDMx19 797 0	TDMx19 797 0	TDMx20 819 22	TDMx25 1037 218	TDMx26 1083 46	TDMx27 1129 46
Total (TDM)	TDMx12 196L	TDMx14 258L 62L	TDMx16 347L 89L	TDMx18 379L 32L	TDMx24 485L 106L	TDMx26 531L 46L	TDMx28 577L 46L	TDMx30 613L 36L	TDMx38 797L 184L	TDMx38 797L 184L	TDMx38 797L 184L	TDMx40 819L 22L	TDMx50 1037L 218L	TDMx52 1083L 46L	TDMx54 1129L 46L

(Note) The upper number of slash (/) is accumulated number of line, the lower number of slash (/) is additional number of lines.