2.6 Phase of the Development Plan

This report is scheduled for submission to the Government of Mendoza in October, 1987. The report then will be incorporated into its policies. It will not be until after 1991 that the telecommunications operating entity will have prepared its implementation plan and be ready to implement the development plan.

Accordingly, the years from now until 1990 will be set as the period for the on-going project, and the 15 years from 1991 to 2005 will be divided into three phases of five years each for the sake of planning.

On-going projects : ~1990
Phase 1 : 1991~1995
Phase 2 : 1996~2000
Phase 3 : 2001~2005

2.7 Relation of the Development Plan with On-going Project

It is necessary to determine the development plan on the basis of facility expansion plans currently being promoted by each telecommunications operating entity and already decided expansion plans. However, since no data concerning the on-going project and other established plans were available, the expansion plan from 1991 through 2005 is established based on the present state of facilities on the supposition that there would be no expansion plans until 1990.

Consequently, if any expansion plan should be put into practice before 1990, the development plan will have to be partially amended.

CHAPTER 3 TELECOMMUNICATIONS NETWORK BASIC PLAN

3.1 Numbering Plan

3.1.1 Basic consideration for 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, should also facilitate economical network construction in keeping with future demand, and should be applicable to all incoming international calls.

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

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

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

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

(4) The numbering system should not complicate translation for route identification and charging identification on 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 numbering system has not been determined yet, the national numbers should be determined so as not to exceed (12−N) digits (N : number of digits of the country code). Since Argentina's country code is two-digit, the maximum number of digits permitted for the national number is 10. (GAS 1)
(Recommendation E. 163)

3.1.2 General numbering structure

The general numbering structure is as follows.

$$\text{Trunk prefix} + \underbrace{\text{Trunk code} + \underbrace{\text{Exchange code} + \text{Station number}}_{\text{Subscriber number}}}_{\text{National significant number}}$$

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.

3.1.3 Present number structure

The numbering structure of Argentina is based on the form presented in Section 3.1.2.

(1) Basis of present numbering plan

- Toll discriminating number is "0".
- International prefix is "00".
- The province of Mendoza is given trunk codes "61" and "62".
- Special service codes consist of 2 to 3 digits beginning with "1".

(2) Present numbering plan

- Trunk and exchange codes now in use are as shown in Table III-3-1.
- Special service codes now in use are as shown in Table III-3-2.

3.1.4 Studies on numbering capacity

Estimated total number of subscribers in 2005 is approximately 320,000. At present, uniform 8-digit national significant numbers are in use in the province of Mendoza except certain areas with 7 digits. From the standpoint of charging information identification, the areas with 7-digit system must promptly be changed to be provided with the 8-digit numbering system. Supposing all numbers are changed to 8 digits, the numbering capacity would reach approximately 1.6 million which would be sufficient to cover the macro telephone demand in 2005.

On the other hand, there is the chance that the numbering plan will be reviewed in the future. The main reasons for this are twofold: it is desirable for local exchange codes to have considerable capacity for possible introduction of new services in the futrue, for instance, direct inward dialing system to PBX; and also, many exchanges are of a comparatively small size, so that trunk codes require more capacity than the case in urban areas provided the existing charging system is continued in the future.

3.1.5 New numbering plan

(1) Methods for establishing new numbering plan

There are two methods for establishing new numbering plan as shown below:

(a) The present 8-digit uniform numbeing plan will remain unchanged, and the capacity of each area will be increased by redistributing trunk codes presently in reserve.

(b) The capacity will be increased with uniform 9-digit numbeing by adding one more digit to the existing trunk codes where applicable.

Table III – 3 – 1 Existing numbering plan in Mendoza

Numbering plan "061"

B A	1	2	3	4	5	6	7	8	9	0
1										
2		Godoy Cruz	MDZ VII	MDZ III	MDZ IV	MDZ V	Hipodromo		MDZ II	
3	Dorrego								Loria	Las Heras
4										
5										
6										
7										
8										
9	R. de la Cruz	F.L. Beltran		Lavalle	R. del Medio	Ch. de Coria	Maipu	L. de Cuyo		
0										

Numbering plan "062"

B A	1	2	3	4	5	6	7	8	9	0
1										
2		Tunuyan			E. Bustos			Tupungoto		
3		S. Martin		Rivadavia		Palmira				
4										
5	← General Alvear →									
6										
7		S. Rafael					Malargue			
8										
9										
0										

Table III－3－2 Special service code

Code	Service
19	Operator
113	Clock service
114	Fault report
110	Directory service
109	Faultman's ringback

The CCITT recommends that the numbering plan allows for estimated demand 50 years later. According to the method (a), another change would be needed within the next 50 years.

Therefore, in reviewing the numbering system, the uniform 9－digit numbering as described in (b) above should be adopted. However, there is no immediate rush for this change. For economy's sake, after completing the replacement of SXS, the change should be carried out on a nationwide scale after giving ample time to make it known by everyone. Table III－3－3 shows the relations between each trunk code and the numbering capacity under the uniform 9－digit numbering system.

(2) New numbering plan

Table III－3－4 shows a plan for granting the number for the year 2005 provided that the uniform 9－digit numbering system is implemented by then. Regarding the special service code, it is recommended to take over the numbering system now in use for providing it with 3 digits and include the police and the fire stations at an early date which are presently not given the code.

Table III - 3 - 3 Trunk code, capacity and telephone demand in the year 2005

Trunk code	Subscriber number capacity (in thousand)	Demand in the year 2005	
		Number of subscribers	Number of central offices
61x	8,000	245,470	19
621	800	-	-
622	800	9,930	19
623	800	25,430	13
624	800	2,990	11
625	800	9,120	11
626	800	-	-
627	800	29,800	13
628	800	-	-
629	800	-	-
620	800	-	-
Total	16,000	322,740	86

(3) Numbers for new services

Numbers for new services comprise numbers for additional services within a telephone network and for connecting services to other networks.

Generally "0" + (A to N) or "1" + (A to N) is used for numbers for new services.

The new numbering plan also adopts this numbering system for new services.

Table III-3-4 Numbering plan in phase 3 (1/5)

Exchange	Area	Trunk code		Subscriber number						
		A	B	C	D	E	F	G	H	J
Gral. Paz	Mendoze	6	1	2	3	1	x	x	x	x
Gral. Paz						2				
Gral. Paz						3				
Gral. Paz						4				
Gral. Paz						5				
Gral. Paz						6				
El Correo		6	1	2	4	1				
El Correo						2				
El Correo						3				
El Correo						4				
Villa Nueva		6	1	2	6	1				
Villa Nueva						2				
Villa Nueva						3				
Hipodromo		6	1	2	7	1				
Hipodromo						2				
Dorrego		6	1	3	2	1				
Dorrego						2				
Gody Cruz		6	1	3	4	1				
Gody Cruz						2				
Gody Cruz						3				
Gody Cruz						4				
Las Heras		6	1	3	6	1				
Las Heras						2				
Las Heras						3				
Loria		6	1	3	8	1				
Loria						2				

Table III - 3 - 4 Numbering plan in phase 3 (2/5)

Exchange	Area	Trunk code		Subscriber number						
		A	B	C	D	E	F	G	H	J
Rodeo de la Cruz		6	1	7	2	1	x	x	x	x
La Primavera				7	3	1				
Col. Segovia				7	3	2				
Puente de Hierro				7	3	2				
Lavalle				7	4	1				
El Pastal				7	5	1				
Fray Luis Beltran				7	6	1				
Rodeo del Medio				7	7	1				
Maipu		6	1	8	2	1				
Maipu				8	2	2				
Lujan de Cuyo		6	1	8	3	1				
Chacras de Coria				8	4	1				
B. Encalada				8	5	1				
Tunuyan	Tunuyan	6	2	2	2	2				
San Pablo					3	2				
Vista Flores					3	3				
La Consulta	San Carlos				4	2				
E. Bustos					5	2				
Chilecito					5	3				
Pareditas					5	4				
Tupungato	Tupungato				7	2				
San Jose					7	4				
El Zampal					7	5				
Zapata					7	6				
Potrerillos	Lujan de Cuyo				8	2				
Agrelo					8	3				

Table Ⅲ-3-4 Numbering plan in phase 3 (3/5)

Exchande	Area	Trunk code					Subscriber number			
		A	B	C	D	E	F	G	H	J
Ugarteche					8	4	x	x	x	x
El Carrizal					8	5				
Rural	Tunuyan	6	2	2	9	2				
Rural	Lujan de Cuyo	6	2	2	9	3				
San Martin	San Martin	6	2	3	2	2				
San Martin					2	3				
Ing. Giagnoni					3	2				
Alto Verde					3	3				
Rivadavia	Rivadavia	6	2	3	4	2				
Philipps					5	2				
La Central					5	3				
Los Campamentos					5	4				
Palmira	Palmira	6	2	3	6	2				
Tres Portenas					7	2				
Chapanay					7	3				
Junin	Junin	6	2	3	8	2				
Medrano					8	3				
Rodrigues Pena					8	4				
Reduccion					8	5				
Rural	San Martin	6	2	3	9	2				
Rural	Rivadavia	6	2	3	9	3				
Uspallata	Las Heras	6	2	4	2	2				
Las Cuevas					2	3				
Jocoli	Lavalle	6	2	4	4	2				
3 de Mayo					4	3				
Costa de Araujo					4	4				

Table III-3-4 Numbering plan in phase 3 (4/5)

Exchange	Area	Trunk code					Subscriber number			
		A	B	C	D	E	F	G	H	J
Gustavo Andre					4	5	x	x	x	x
Nueva California					4	6				
Santa Rosa	Santa Rosa	6	2	4	6	2				
Las Catitas					6	3				
La Dormida					6	4				
La Paz	La Paz	6	2	4	7	2				
Desaguadero					7	3				
Rural	Lavalle	6	2	4	9	2				
Rural	La Paz	6	2	4	9	3				
Gral. Alvear	Gral. Alvear	6	2	5	2	2				
Bowen					3	2				
Escandinava					3	3				
Carmensa					3	4				
Villa Atuel	San Rafael	6	2	5	7	2				
Real del Padre					7	3				
Jaime Prats					7	4				
Col. Andes					7	5				
La Materrina					8	2				
Las Aguaditas					8	3				
La Guevarina					8	4				
Rural	Gral. Alvear	5	2	5	9	2				
San Rafael	San Rafael	6	2	7	2	2				
San Rafael					2	3				
San Rafael					2	4				
25 de Mayo					4	2				
Cuadro Benegas					4	3				

Table III－3－4 Numbering plan in phase 3 (5/5)

Exchande	Area	Trunk code					Subscriber number			
		A	B	C	D	E	F	G	H	J
Rama Caida					4	4				
Canada Seca					5	2				
Goudge					5	3				
La Llave					5	4				
Monte Coman					5	5				
Las Malvinas					6	2				
El Nihuil					6	3				
Malargue	Malargue	6	2	7	7	2				
El Sosneado					8	2				
El Chacay					8	3				
Rural	San Rafael	6	2	7	9	2				
Rural	Malargue	6	2	7	9	3				

3.2 Network Configuration

3.2.1 Network configuration in Argentina

In Argentina, the toll network is established with a 4－level hierarchy at present and central offices are classified as follows.

A. National Switching Center (NSC) ···· Buenos Aires, Cordoba and other major cities

B. Tertiary Switching Center (TSC) ···· Major province capitals

C. Secondary Switching Center (SSC) ···· Cities

D. Local Exchange (LE) ···· Other areas

In principle, toll switchboards are installed in the central offices higher than SSC level.

The central offices for international traffic or international switching centers (ISC) are established in Buenos Aires and Cordoba, as the country is divided into two major service areas for the international traffic.

3.2.2 *Network configuration in the province of Mendoza*

The present network configuration in the province of Mendoza is as shown below.

(1) Toll network

1) Office ranks
The office ranks are as shown in Table III–3–5.

2) Toll switchboard
Toll switchboards are presently installed at the following three central offices: Mendoza (General Paz), San Rafael and General Alvear.

Table III –3–5 Office ranks in the province of Mendoza

TSC	SSC	LE
Mendoza	Mendoza	20 LEs
	San Martin	13 LEs
	San Rafael	10 LEs
	Gral. Alvear	6 LEs
	Tunuyan*	8 LEs

* Tunuyan presently has no SSC function.

3) Network configuration

Figure III－3－1 shows the toll network configuration in the province of Mendoza. International traffic from the province is wholly handled through Cordoba international switching center.

An international subscriber dialing service is not yet offered.

(2) Local junction network

Cran Mendoza only has a local multiple exchange area. The central area has a mesh network and the outskirts areas have a star network, and as a whole, the Gran Mendoza area has a composite network.

3.2.3 Study of future network plan

(1) Toll network

The configuration of toll network in the province of Mendoza will be changed remarkably because of the cost performance of recent transmission equipment as well as developed function of digital exchanges.

Owing to the recent progress in technology, the cost of transmission equipment has dropped and, in particular, introduction of large capacity transmission lines has been realized at low cost. This tendency may be further accelerated in the future.

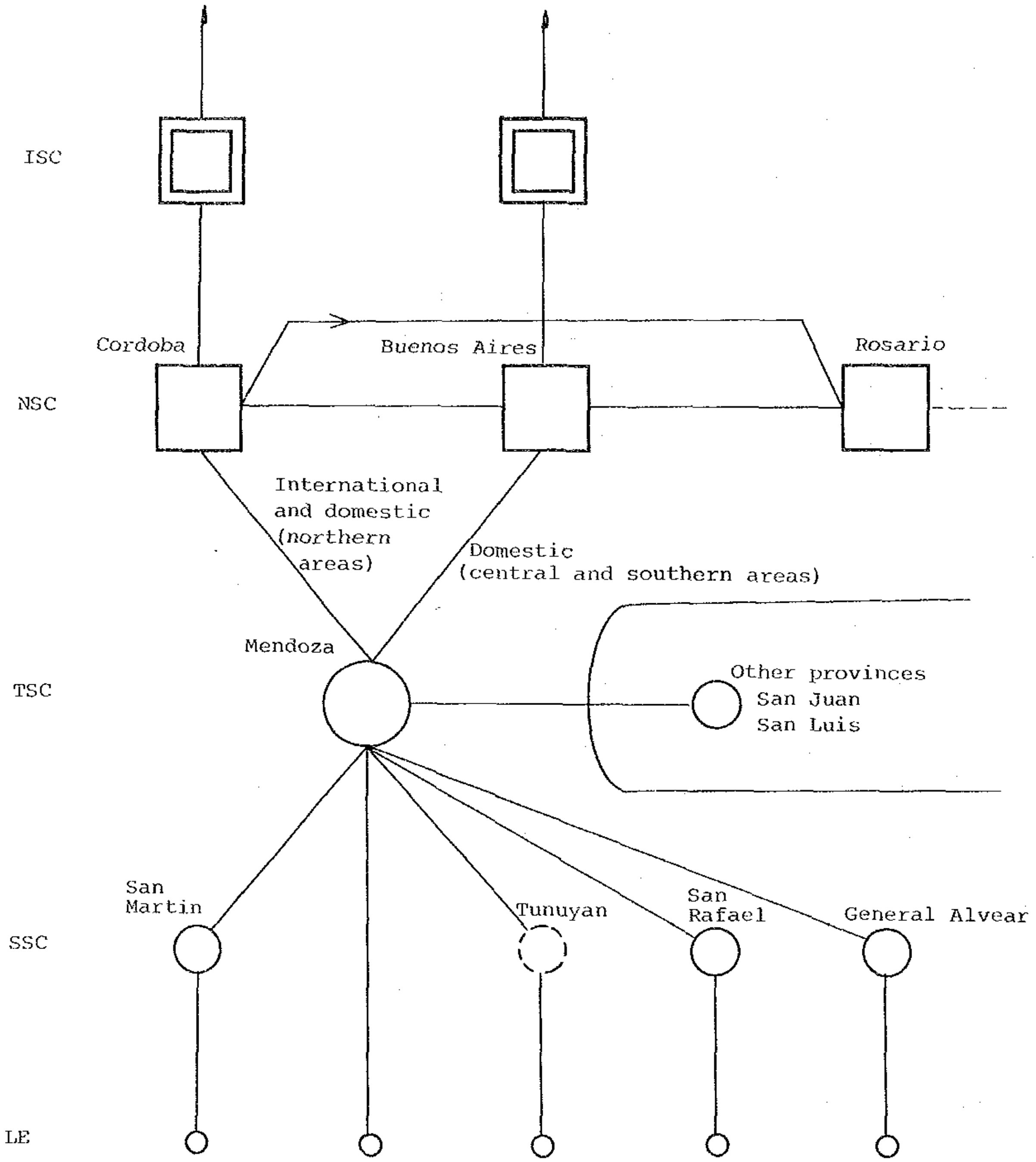


Fig. III－3－1 Network configuration in the province of Mendoza

While, the digital exchange, which has become the worldwide trend, is characterized with following points compared with the conventional analogue exchange.

1) Extremely large capacity.

2) That remote switching units (RSU) of digital exchange can be economically installed ranging from small capacity to comparatively large capacity with almost no limitation by distance.

The province is characterized with the facts that several cities with relatively big size are found having Gran Mendoza as their center, and a lot of small villages are dotted surrounding the cities. This brings about a typical configuration of star network linking the major cities to Gran Mendoza through large capacity backbone routes from which spur routes are extended further to reach villages.

In the circumstances, the large capacity digital transmission lines with high cost performance facilitate the construction of backbone routes between the major cities. Morever, the digital exchanges enable to provide not only the major cities with the telephone service but also those villages with all the same high quality service as that in the urban areas at relatively low cost by means of the RSU function.

For the end, the new technology will be most effective for the expansion of the telecommunications network in the province of Mendoza. In other words, the province has the advantage to make the best use of the new technology.

At present, the toll exchanges installed at San Martin, San Rafael and General Alvear, or the SSCs except Tunuyan, bundle and link toll traffic out of local exchanges in each area to the toll exchange in Mendoza.

However, the new technology necessarily brings about a great change to this system. When judged from the telephone demand in the year 2005, traffic in each SSC, except that in Gran Mendoza, can be dealt with one or two units of digital exchanges. Accordingly, there is no need to establish an independent toll exchange for the conventional purpose in those SSCs.

The analogue exchanges with small capacity installed at many villages are to be replaced with remote switching units which will be linked through digital PCM channels with the host exchange located in the center of the area, so the toll circuits in the conventional form will become unnecessary.

Figure III−3−2 shows the basic configuration of network at the completion of digitalization.

(2) Digitalization of telecommunications network

Basic concept of telecommunications network digitalization is as follows.

1) Merits of digitalization

Merits of digitalization are expected as follows.

Economy

- Affinity to new technology (LSI).
- Interfacing in bulk between transmission lines and exchange.
- Miniaturization.

Improvement of transmission quality

- Improving speech quality through digital one−link network.
- High speed and high quality data transmission.

Flexibility for new services

- *Introduction of non-telephone new services.*
- Transfer to the ISDN.

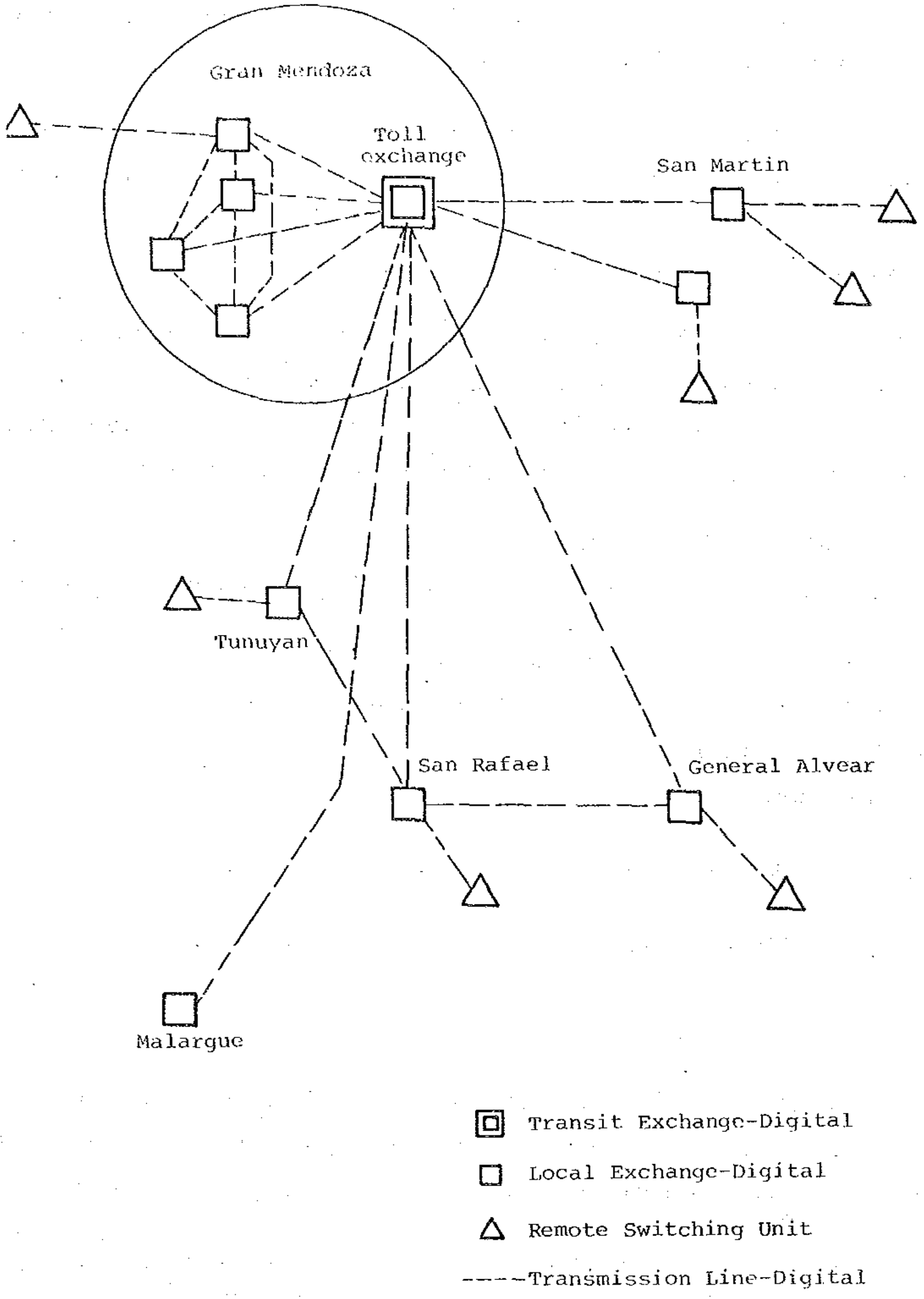


Fig. III-3-2 Telephone network configuration of final stage

2) Goal of telephone network digitalization

Telephone exchanges and circuits between them are to be completely digitalized by the end of the year 2005.

3) Principles of forwarding digitalization

Whenever feasible, telephone exchanges and related circuits are digitalized at the same time, to bring about economical project performance, thus saving use of CODECs and keeping speech quality.

The analogue telecommunications network will coexist with the digital until the digitalization is completed. The digital network are established overlaying the analogue as much as possible to avoid deterioration in transmission quality and to ease introduction of new services.

4) Opportunities of digitalization

Digitalization is worked out in principle taking the following opportunities.

- Shortage in capacity of existing facilities.
- Replacement of manual exchanges with the automatic.
- Replacement of old facilities.
- Introduction of new services.

(3) Development of the ISDN

Owing to diversified social activities, various kinds of services have been demanded. At the same time, progress of technology has made it possible to provide many new services.

As the expression "information–oriented society" implies, information has increased its value and the trend is still gathering momentum. Thus information needs more accurate and speedy transmission.

To cope with this situation, many countries are pushing ahead with studies aiming at high quality networks which can provide diverse services in an integrated form. The CCITT is also studying that kind of network, namely the Integrated Services Digital Network (ISDN), to work out concept and protocols.

The ISDN can be realized when information of all kinds of telecommunications is converted into a form of transparent signals or digital codes, before sending. Consequently, the key point is network digitalization.

The following steps are being considered for the development of the ISDN in the province of Mendoza. Figure III-3-3 shows the conception of network configuration when the ISDN is introduced.

The first step: Setting up foundations

1) Setting up foundations for the ISDN

- Establishing high speed digital transmission lines leading to Buenos Aires and Cordoba.
- Introducing a digital exchange into the Mendoza toll office.
- Introducing packet switching equipment.

2) Developing demand

- Deregulating terminal equipment connection.

The second step: Connection between various networks and network integration

- internetwork connection between telephone and packet switching networks.
- Merging telex and telegraph networks.

The third step: Substantial development of the ISDN

- Adopting ISDN function in digital exchanges.
- Digitalizing subscriber local networks.

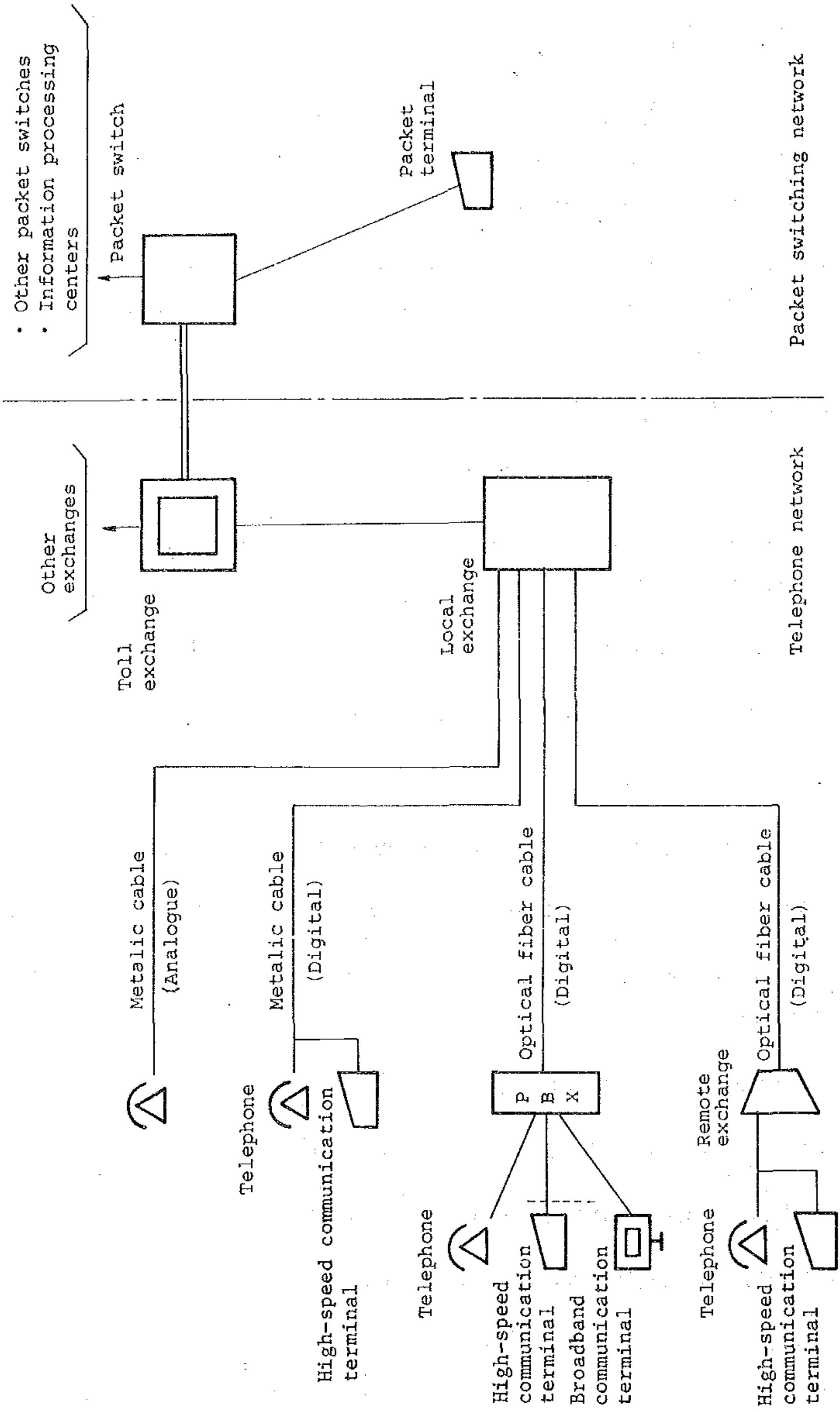


Fig. III - 3 - 3 Configuration of the network when the ISDN is introduced

In addition to the above, a signaling system called No. 7, which is a signaling system between digital exchanges, must be applied in order to realize the introduction of the ISDN. A recommendation on the protocol for the signaling system No. 7 for telephone service has been released from the CCITT, while a new version to be available for new services is still under study. The CCITT is supposed to recommend the new version in the near future (1988).

3.2.4 Charging system

(1) Existing rate system

1) Subscriber telephone

Local calls are charged by the message rate system irrespective of calling time. Toll calls are charged by distance according to Table III – 3 – 6.

However, a fixed monthly rate is charged irrespective of the number of calls up to a fixed number (for instance, 120 calls for a residential telephone in Mendoza), and beyond that extra is charged.

2) Public telephone

For calling by a public telephone, a token called a ficha is used. Two types of fichas are sold, i.e., for local calls and for toll calls.

Table III – 3 – 6 Tariff of long distance calls

Step No.	Distance	A pulse each	Pulses per minute
1	up to 30 km	20"	3
2	from 30 to 55 km	12"	5
3	from 55 to 110 km	8.57"	7
4	from 110 to 170 km	6"	10
5	from 170 to 240 km	4"	15
6	from 240 to 320 km	3.16"	19
7	from 320 to 440 km	2.61"	23
8	from 440 to 600 km		
9	from 600 to 840 km	1.67"	36
10	from 840 to 1,200 km		
11	from 1,200 to 1,680 km		
12	more than 1,680 km		

3) Revision of rates

Because of running inflation, a system to adjust a rate upwards with commodity prices in a sliding scale is adopted and the telephone rates have also been revised frequently. The unit rate was 0.017936 Austral a pulse as of October 1986.

4) Charging device

As there are many crossbar exchanges in use, a bulk charging system is adopted with the use of a charging meter.

(2) Study of charging system

For toll call charging, a periodic pulse metering method, a standard one in the world, is adopted at present.

However, local calls are charged by the number of calls but irrespective of calling time.

Introduction of local call timing method in the near future is recommended, because the utilization mode of telephone network will diversify from now on, such as the introduction of data communications services through the said network.

As for the charging system, a change from existing bulk system into detailed charging system is also recommended considering the introduction of new services and building up of the ISDN in the future.

3.2.5 Signaling system

(1) Present signaling system

There are three types of exchanges in the province of Mendoza, namely SXS, crossbar, and digital exchanges. Their signaling system is as shown below.

Table III - 3 - 7 Signaling system

From \ To	SXS	Crossbar	Digital
SXS	DP	DP	DP
Crossbar	DP	R2(A)	R2(A)
Digital	DP	R2(A)	R2(D)

Note: R2 (A) ··· R2 Analogue version.
R2 (D) ··· R2 Digital version.

(2) Study of future signaling system

For the signaling system between digital exchanges, the adoption of the No. 7 signaling system is desirable in consideration of future introduction of new services. However, the No.7 signaling system has many elements that must be determined freely according to the conditions of the country. Therefore, it is important to note that the contents of the signaling system differ for each manufacturer even.

Actual introduction of the system could wait for the recommendation for the ISDN version by the CCITT.

In Argentina, plural number of operating entities presently provides telephone service. Therefore, it is recommended to unify the signaling system at national level.

3.3 Network Synchronization Plan

3.3.1 Types of network synchronization

Network synchronization is the basis for providing the clock of the same frequency to digital switching equipment and transmission lines in the digital networks and carrying time slot conversion, circuit setting, multiplexing and separation economically and flexibly.

There are the following three network synchronization systems and Fig. III－3－4 shows the respective concepts :

Plesiochronous synchronization
Master－slave synchronization
Mutual synchronization

(1) Plesiochronous synchronization system

The plesiochronous synchronization system independently sets an oscillator of high precision at each station. This system allows for flexibility in increasing, modifying and abolishing networks, but it requires installation of a very accurate and expensive atomic oscillator at each station.

The plesiochronous synchronization system is suited to international digital links because of oscillator administration and independency from surrounding exchanges inside and outside the country. CCITT recommends not to make the delivery of the clock in an international digital link. It recommends, with characteristic specifications, the plesiochronous synchronization system that allows the frequency departure of not greater than 10^{-11} with its independent oscillator (CCITT Rec. G.811).

(2) Master-slave synchronization system

In the master-slave synchronization system, all clocks in the network are synchronized with a reference clock of the master station, which distributes its highly stable clock to slave stations through clock distributing paths. Each of the slave stations receives the clock and regenerates the clock for uniform synchronization with the master station frequency by the network synchronization equipment. If the master station oscillator or distributor should fail, the slave station runs under its own clock, and if necessary, the system can change its master station within a fixed allowable time. Required accuracy of frequency for master station is approximately 10^{-10}.

(3) Mutual synchronization system

The mutual synchronization system obtains a uniform frequency commonly used by each station within the network by mutually controlling a variable oscillator installed at each station with the clock of other stations.

This system does not require each station oscillator to have very high frequency accuracy (10^{-6} is sufficient), and unlike the master-slave synchronization system, it has no master-slave relationship between stations. However, the control system is more complicated than other systems and it has the problem that if one of the stations should fail, the whole network system is affected.

3.3.2 Network synchronization plan

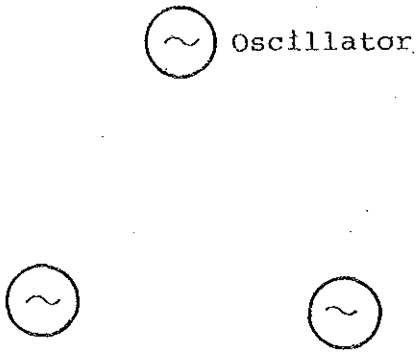
The network synchronization system for the digital link of the province of Mendoza shall be the master-slave synchronization system for the following reasons:

1) The plesiochronous synchronization system is economically disadvantageous as it requires expensive high accuracy atomic oscillators at each station.

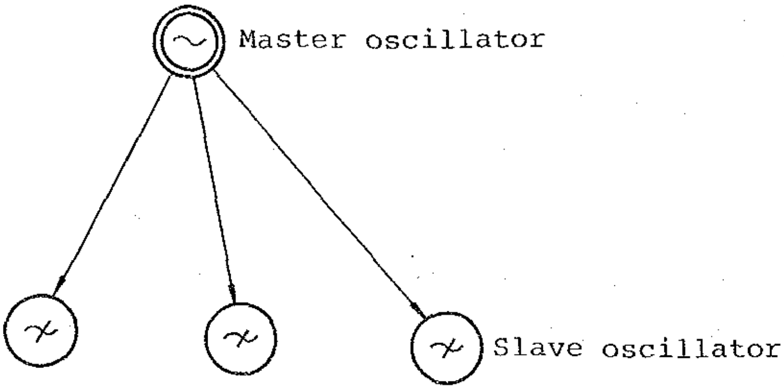
2) Since the mutual synchronization system uses loop-type clock distribution path, it is difficult to locate a faulty point. Furthermore, cost reduction by advanced high-stability oscillator technology has nearly eliminated the economical merits of the mutual synchronization method.

3) Since toll transmission lines in the province of Mendoza form a starshaped network, the mutual synchronization system that requires loop-type clock distribution paths is not adequate.

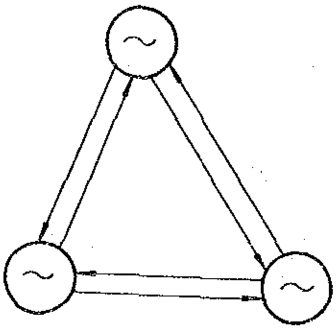
Fig. III−3−5 shows a plan based on the above-mentioned studies.



(a) Plesiochronous synchronization



(b) Master slave synchronization



(c) Mutual synchronization

Fig. III-3-4 Methods of synchronization

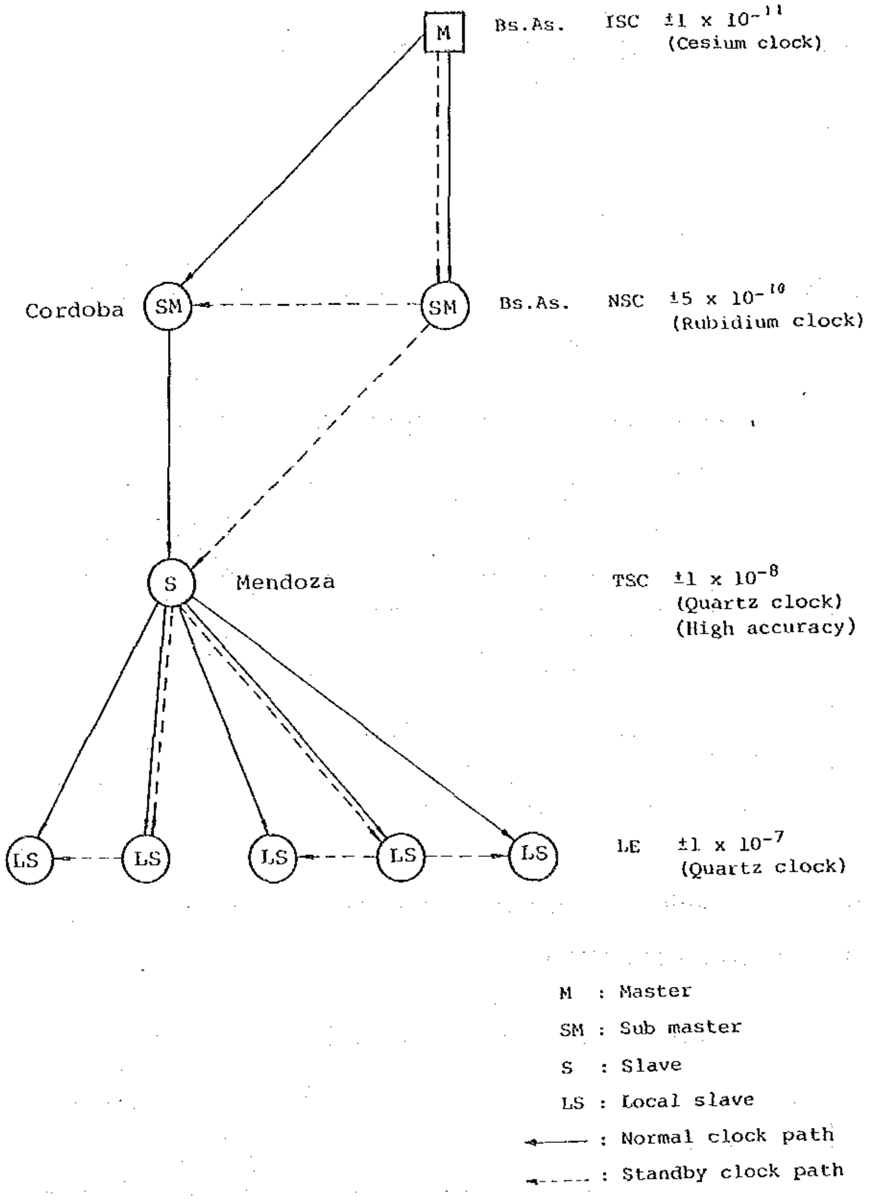


Fig. III-3-5 Network synchronization Plan

CHAPTER 4 ENGINEERING STANDARDS

4.1 Grade of Service

4.1.1 Loss probability

Loss provability of each section of circuits is assigned as follows on the basis of CCITT Recommendation E.520.

Table III - 4 - 1 Loss probability (circuits)

Section	Loss probability
Basic trunk groups (per link)	1%
High usage trunk groups (per link)	2%
Circuit groups between local exchanges in multiple exchange area	2%

Loss probability of each connection of exchange is assigned as follows on the basis of CCITT Recommendation Q.504.

Table III - 4 - 2 Loss probability (exchange)

Connection stage	Loss probability
Originating connection	0.1%
Transit connection	0.1%
Terminating connection	2%

4.1.2 Post dial delay

Post dial delay nominal values are assigned as follows on the basis of the values realized when digital exchanges and a common channel signaling system are used.

Table III -4-3 Post dial delay

Protocol	Measure	Nominal value
Audible tone	mean time	5 seconds
Non-audible tone	mean time	5 seconds

4.2 Transmission Engineering Standard

4.2.1 Introduction

As described in the telecommunications network basic plan of Chapter 3, all exchanges and transmission systems in the province of Mendoza will have been digitalized by the end of phase 3.

The main purpose of this standard is to adequately provide transmission quality distribution to the digitalized national telecommunications network, and to economically secure the quality of national and international calls.

4.2.2 Basic considerations on transmission qualities

The CCITT recommends both Corrected Reference Equivalent (CRE) and Loudness Rating (LR) as measures for loudness loss, the most important factor affecting transmission quality of telephone networks. As CRE is presently in use in the Argentine Republic, this standard shall use CRE as a measure for transmission quality in conformity with the existing quality measure for analogue networks.

Also, in view of possible future applications of Integrated Services Digital Network (ISDN) in telecommunications services, and in conformity with CCITT Recommendation G. 821, this standard shall use error performance as the measure for the transmission quality of bearer service whose terminals are connected with a wholly digitalized circuit.

4.2.3 Corrected reference equivalent

(1) Specifications of transmission quality

The existing transmission engineering standard specifies that the Overall Corrected Reference Equivalent (OCRE) between subscribers shall be 15 dB. This value meets the long term objective of OCRE = 13 to 16 dB as called for in CCITT Recommendations G.111 and G.121.

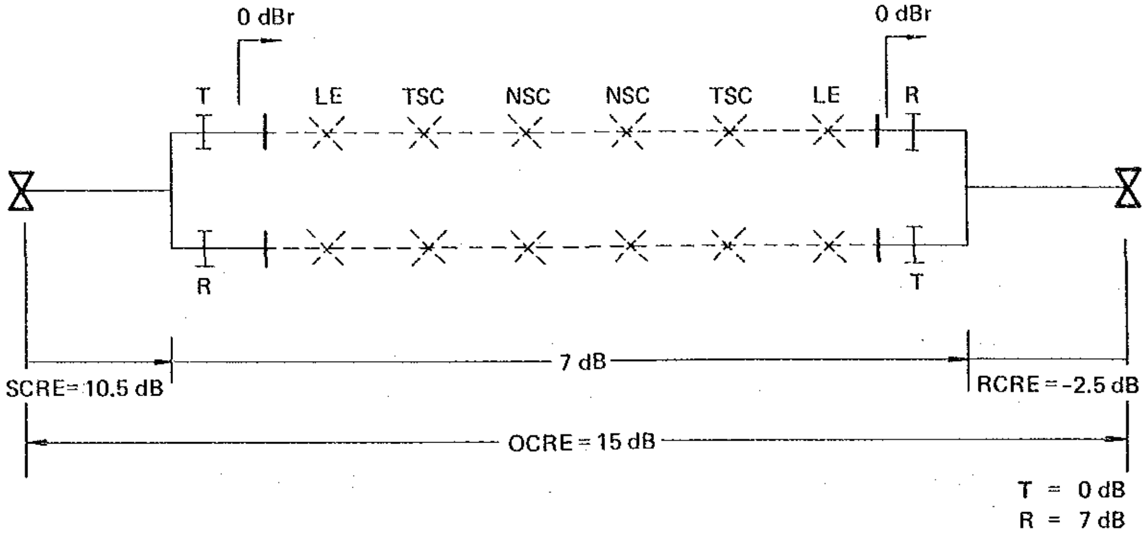
The new engineering standard also adopts this value without change.

CREs to be distributed to each section are as follows:

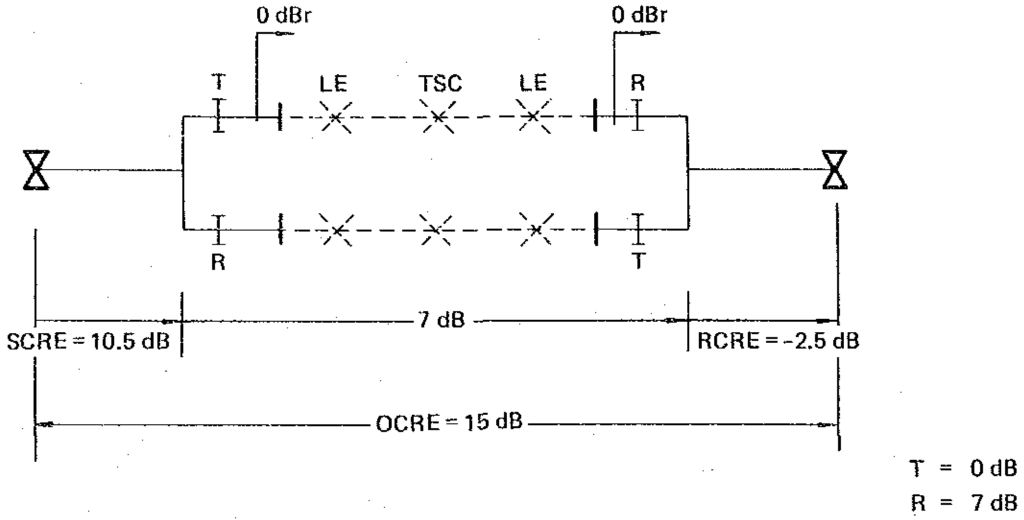
CRE of local sending system = 10.5 dB
CRE of transmission section = 7.0dB
CRE of local receiving system = −2.5 dB

where the CRE values of local sending and receiving systems are measured with maximum subscriber line loop resistance Rmax = 800 ohms. The CRE value of the transmission section is equivalent to the transmission loss measured at 800 Hz.

Fig. III−4−1 shows the CRE distribution for national and international connections.



(a) National connection



(b) Toll connection

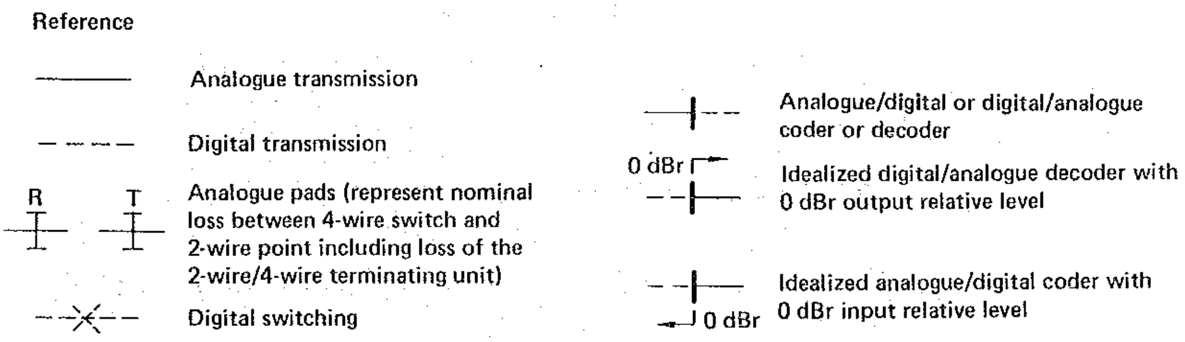
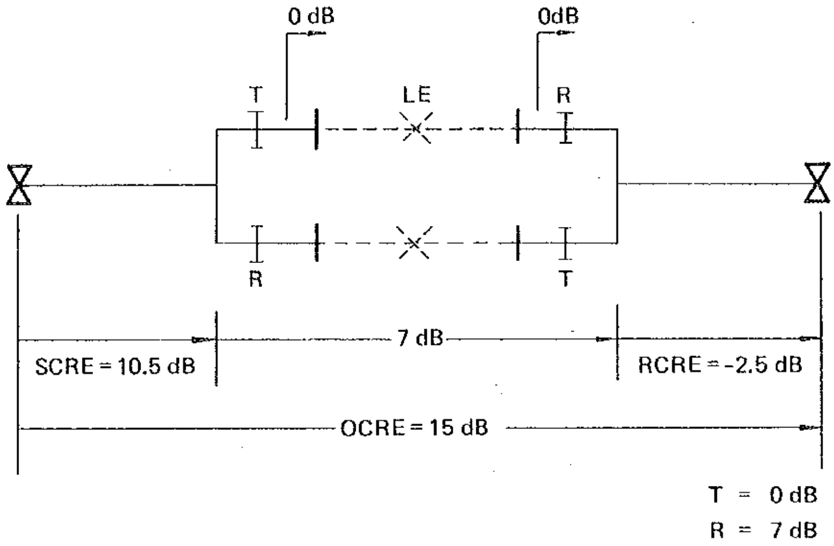
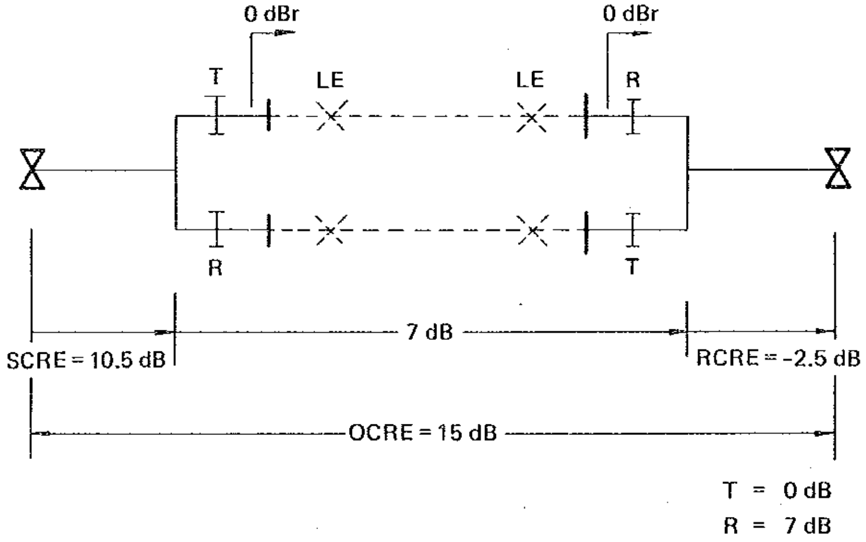


Fig. III – 4 – 1 Corrected reference equivalent distribtion (1/3)

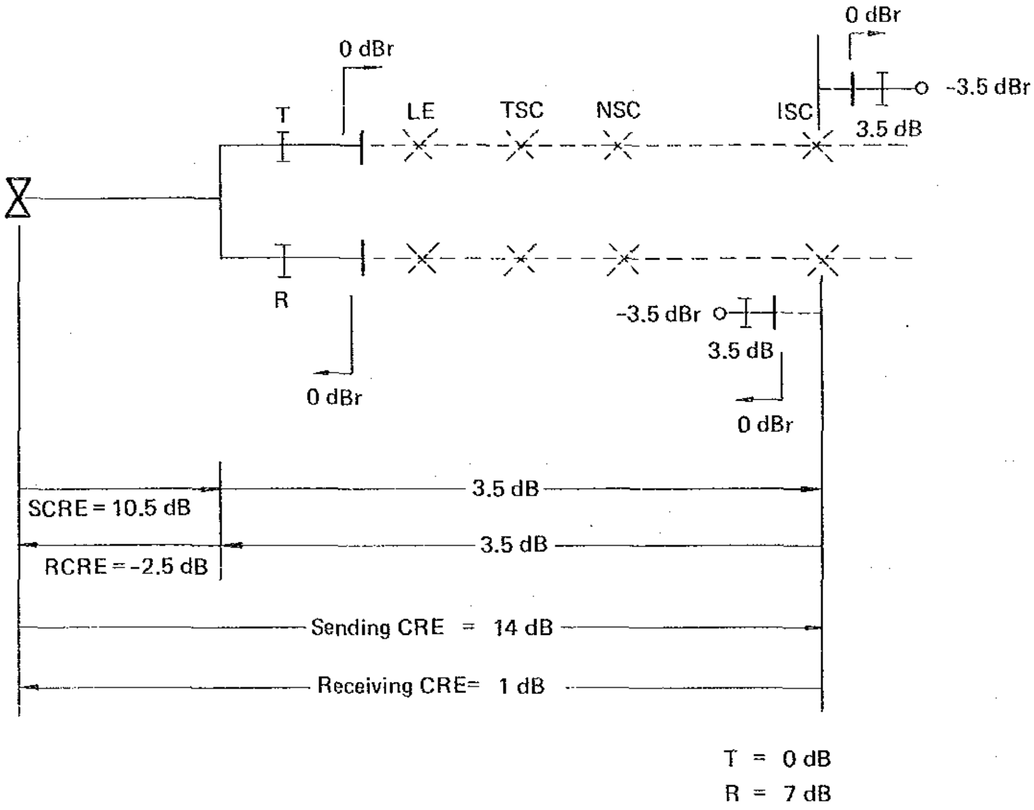


(c) **Local connection**



(d) **Local connection in multiple exchange area**

Fig. III - 4 - 1 Corrected reference equivalent distribtion (2/3)



(e) International connection

Fig. III – 4 – 1 Corrected reference equivalent distribtion (3/3)

(2) Factors contributing to transmission quality

In a telephone network, there are many factors contributing to degradation of transmission quality, such as loudness loss, echo, noise and attenuation distortion. Since echo, second to loudness loss, is the most important factor in specifying transmission quality, especially in digital telephone networks, echo should be specified as follows. If echo meets the required values, this shall be interpreted as meaning that there is no degradation of transmission quality as regulated with CRE.

a) Based on the CCITT Recommendation G.122, the mean value of echo loss (a−b) shown in Fig. III−4−2 should be maintained not less than (15+n) dB to minimize the influence of echo for an international connection, where n is the number of 4−wire circuits in the national chain.

In the case of digital one−link network (n=1), the necessary mean value of echo loss (a−b) comes to 16 dB.

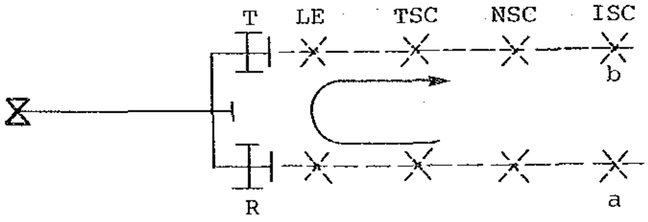


Fig. III −4−2 Echo loss (a-b)

b) Based on the CCITT Recommendation G.131, the probability of incurring the opinion "unsatisfactory" due to talker echo should be not more than 1%. An echo-control device should be used on connections which do not satisfy the specification.

Since the talker echo depends on the transmission line length and CRE, the following shows the relationship between them.

The corrected reference equivalent of the talker echo path (CRE_{echo}) is shown in Fig.III−4−3. It is given by

$$CRE_{echo} = SCRE + T_1 + R_2 + EBRL + T_2 + R_1 + RCRE$$

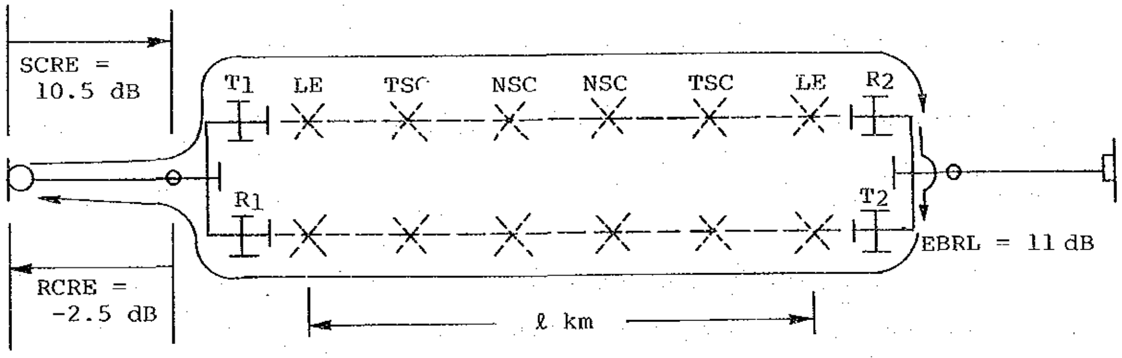


Fig. III − 4 − 3 Talker echo path

where SCRE is CRE of the local sending system, RCRE is CRE of the local receiving system, EBRL is echo balance loss, T_1, T_2, R_1 and R_2 are analogue pads which represent nominal loss between 4-wire switch and 2-wire point including loss of the 2-wire/4-wire terminating unit.

Assume the values of $T_1 + R_2$ and $T_2 + R_1$ are 7 dB respectively, and EBRL is 11 dB, supposing minimum average value in accordance with CCITT Recommendation G.122. Hence, the value of CRE_{echo} is

$$CRE_{echo} = 33dB$$

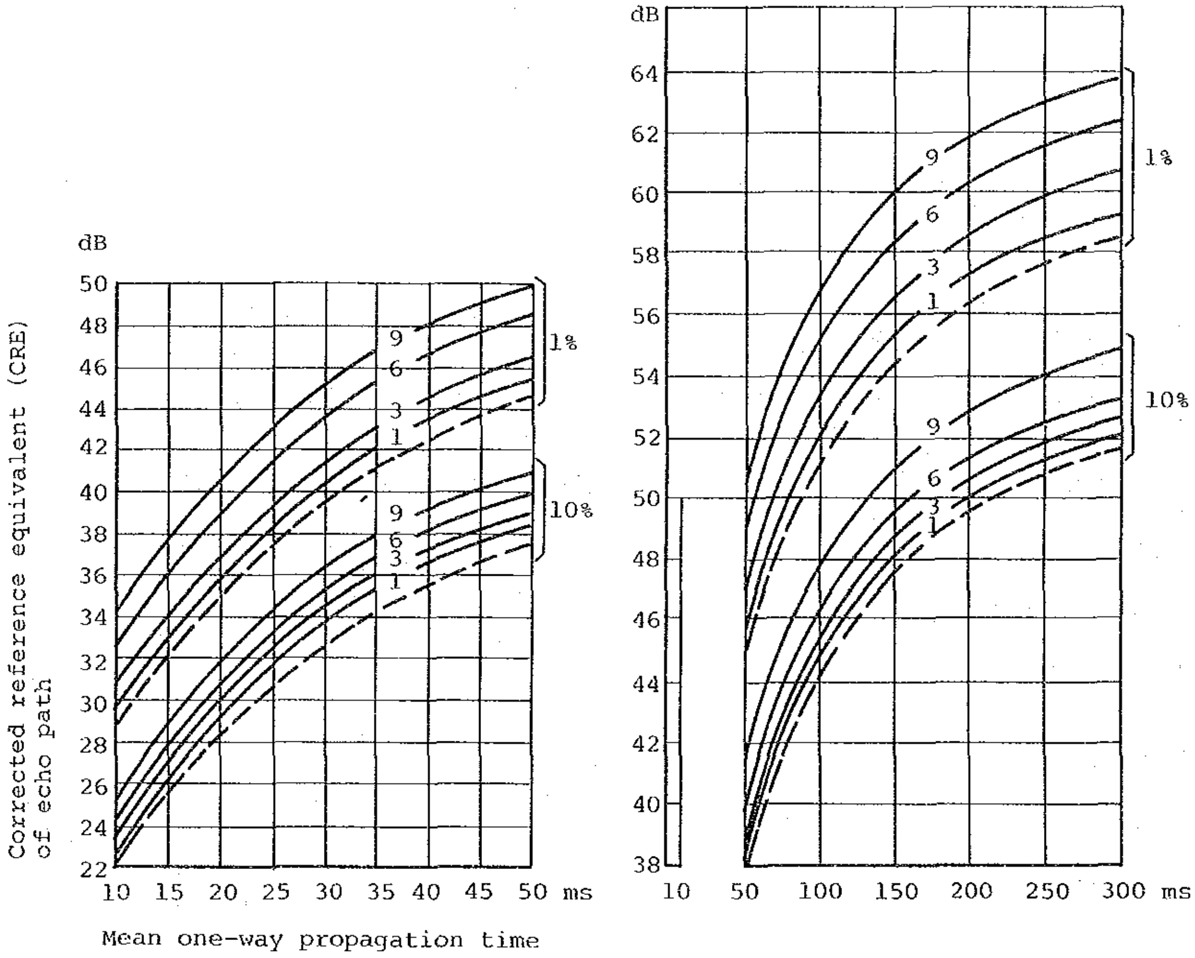
The relationship between CRE_{echo} and the mean one-way propagation time is given in CCITT Recommendation G.131. It is graphically presented in Fig. III−4−4. For the full digital connections, the mean one-way propagation time (τ) for $\text{CRE}_{\text{echo}} = 33$ dB with 1% probability of incurring the opinion "unsatisfactory" due to talker echo becomes approximately 16.5 msec.

Values of propagation time by the transmission medium are presented in CCITT Recommendation G.114. They are listed in Table III−4−4. For the circuit configuration shown in Fig. III−4−3, the mean one−way propagation time (τ) is as shown below.

Digital transmission system (Microwave system)	ℓkm	$\ell \times 0.004$ msec
Digital exchange	6 exchanges	2.7 msec
PCM coder/decoder	1 set	0.6 msec
Total		$\tau = \ell \times 0.004 + 3.3$ msec

For $\tau = 16.5$ msec, the transmission line length ℓ becomes approximately 3,300 km. In the case of Argentina with a vast expanse of territory, there exist connections exceeding 3,300 km. Therefore, if the probability of incurring the opinion "unsatisfactory" due to talker echo is 1%, an echo control device should be used on any connection exceeding approximately 3,300 km in order to secure the transmission quality of OCRE = 15 dB.

Echo control devices are installed at LEs in principle. In the case of Argentina, however, the land is vast and there are may LEs where the device should be installed, therefore it is recommended to study, at national level, an economical installation method including centralized installation at NSCs.



——— Analogue circuits, with indication of number of 4-wire circuits

----- Fully digital connections

Note 1: The percentages refer to the probability of encountering objectionable echo.

Note 2: The corrected reference equivalent of the echo path is here defined as the sum of:

- the corrected reference equivalents in the two directions of transmission of the local telephone system of the talking subscriber (assumed to have minimum values of CRE);
- the corrected reference equivalents in the two directions of transmission of the chain of circuits between the 2-wire end of the local telephone system of the talking subscriber and the 2-wire terminals of the 4W/2W terminating set at the listener's end;
- the mean value of the echo balance return loss at the listener's end.

Fig. III – 4 – 4 Echo tolerance curves

Table III - 4 - 4 Propagation time of transmission medium

Transmission medium	Contribution to one-way propagation time	Remarks
Terrestrial coaxial cable or radio relay system; FDM and digital transmission	4 µs/km	Allows for delay in repeaters and regenerators
Optical fibre cable system; digital transmission	5 µs/km	Allows for delay in repeaters and regenerators
Submarine coaxial cable system	6 µs/km	
Satellite system - 14,000 km altitude - 36,000 km altitude	110 ms 260 ms	Between earth stations only
FDM channel modulator or demodulator	0.75 ms a)	Half the sum of propagation times in both directions of transmission
FDM compandored channel modulator or demodulator	0.5 ms b)	
PCM coder or decoder	0.3 ms a)	
PCM/ADPCM/PCM transcoding	0.5 ms	
Transmultiplexer	1.5 ms c)	
Digital transit exchange, digital-digital	0.45 ms d)	
Digital local exchange, analogue-analogue	1.5 ms d)	
Echo cancellers	1 ms e)	

a) These values allow for group-delay distortion around frequencies of peak speech energy and for delay of intermediate higher order multiplex and through-connecting equipment.

b) This value refers to FDM equipments designed to be used with a compandor and special filters.

c) For satellite digital communications where the transmultiplexer is located at the earth station, this value may be increased to 3.3 ms.

d) These are mean values: depending on traffic loading, higher values can be encountered, e.g. 0.75 ms (1.925 ms) with 0.95 probability of not exceeding.

e) Echo cancellers, when placed in service, will add a one-way propagation time of up to 1 ms in the send path of each echo canceller. This delay excludes the delay through any codec in the echo canceller. No significant delay should be incurred in the receive path of the echo canceller.

4.2.4 Error performance objectives for digital connection

(1) Basic considerations

1) Scope

The performance objectives are stated for each direction of a 64kb/s circuit-switched connection used for voice traffic or as a "bearer channel" for data type services.

2) Error performance parameters

The performance objective is stated in terms of error performance parameters each of which is defined as follows:

The percentage of averaging periods each of time interval T_O during which the bit error ratio (BER) exceeds the threshold value. The percentage is assessed over a much longer time interval T_L.

It should be noted that total time (T_L) is split into two parts, namely, time for which the connection is deemed to be available and that time when it is unavailable.

(2) Performance objectives

The performance objectives for an international ISDN connection are shown in Table III−4−5. International ISDN connections should meet all of the requirements of Table III−4−5 concurrently.

Table III −4−5 Error performance objectives for international ISDN connections

Performance classification	Objective
(a) Degraded minutes	Fewer than 10% of one-minute intervals to have a bit error ratio worse than $1\cdot10^{-6}$
(b) Severely errored seconds	Fewer than 0.2% of one-second intervals to have a bit error ratio worse than $1\cdot10^{-3}$
(c) Errored seconds	Fewer than 8% of one-second intervals to have any errors (equivalent to 92% error-free seconds)

(3) Allocation of overall objectives

Since the objectives given in Table III-4-5 relate to an overall connection, it is necessary to subdivide this.

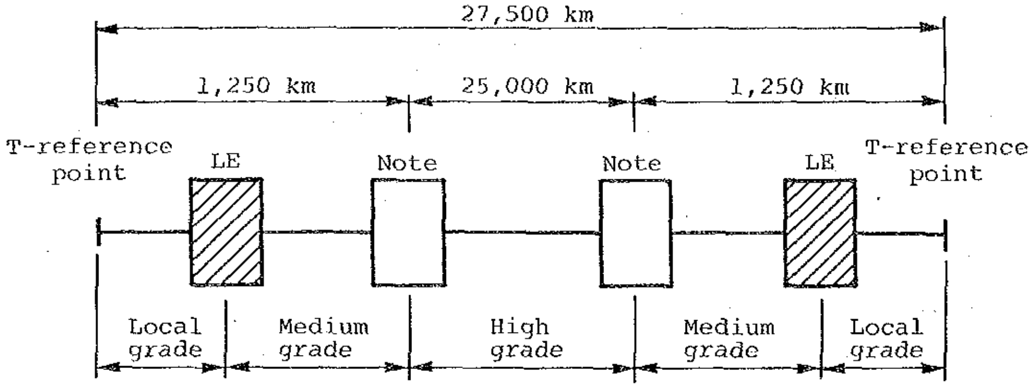
1) Basic apportionment principles

Three distinct quality classifications have been identified to represent practical digital transmission circuits and are independent of the transmission systems used. These classifications are termed local grade, medium grade and high grade and their usage generally tends to be dependent on their location within a network.

The circuit quality demarcation of longest HRX is shown in Fig. III-4-5.

2) Apportionment strategy for the degraded minutes and errored seconds requirements

The apportionment of the permitted degradation, i.e. 10% degraded minutes and 8% errored seconds, is given in Table III-4-6. The derived network performance objectives are given in Table III-4-7.



Note: It is not possible to provide a definition of the location of the boundary between the medium and high grade portions of the HRX.

In the case of the province of Mendoza, however, the local grade and medium grade portions cover up the circuits between the T-reference point and the Mendoza toll exchange while the medium grade or high grade portion covers the interprovincial circuits according to their length.

Fig. III-4-5 Circuit quality demarcation of longest HRX

Table III－4－6 Allocation of the degraded minutes and errored seconds objectives for the three circuit classifications

Circuit classification	Allocation of the degraded minutes and errored seconds objectives given in Table III-4-5.
Local grade (2 ends)	15% block allowance to each end
Medium grade (2 ends)	15% block allowance
High grade	40% (equivalent to conceptual quality of 0.0016% per km for 25,000 km)

Table III－4－7 Allocation of % degraded minute intervals and errord seconds objectives

Circuit classification	Network performance objectives at 64 kbit/s	
	% degraded minutes	% errored seconds
Local grade	1.5	1.2
Medium grade	1.5	1.2
High grade	4.0	3.2

3) Apportionment strategy for severely errored seconds
The total allocation of 0.2% severely errored seconds is subdivided into each circuit classification (i.e. local, medium, high grade) in the following manner:

a) 0.1% is divided between the three circuit classifications in the same proportions as adopted for the other two objectives. This results in the allocation as shown in Table III－4－8.

b) The remaining 0.1% is a block allowance to the medium and high grade classifications to accommodate the occurrence of adverse network conditions occasionally experienced (intednded to mean the worst month of the year) on transmission systems. Because of the statistical nature of the occurrence of worst month effects in a world-wide connection, it is considered that the following allowances are consistent with the total 0.1% figure:

- 0.05% to a 2500 km HRDP for radio relay systems which can be used in the high grade and the medium grade portion of the connection;
- 0.01% to a satellite HRDP.

Table III – 4 – 8 Allocation of severely errored seconds

Circuit classification	Allocation of severely errored seconds objectives
Local grade	0.015% block allowance to each end
Medium grade	0.015% block allowance to each end
High grade	0.04% (Note 1)

Note 1: For transmission systems covered by the high grade classification each 2,500 km portion may contribute not more than 0.004%.

CHAPTER 5 DEMAND FORECAST

5.1 Telephone Service

National macro telephone demand for the forecast year is calculated using an income elasticity model equation. Then, this demand is distributed to the province of Mendoza and to individual central offices. The following descriptions explain the method of forecasting telephone demand and the amount of demand obtained.

This method is adopted after comparing and examining national macro telephone demand with the estimated values given in ENTEL's Megatel Project, with the "Study on the Telecommunication Service Expansion Plan, 1985~2005", with the province macro demand figured out from data over time and with the estimation by CAT.

(1) Income elasticity model

Telephone demand depends on the performance of such factors as the economic strength of the country shown in GDP or GNP, level of telephone charges, service quality, customs, etc. as generally understood. The following equation is generally applied to obtain the long-term forecast for telephone demand:

$$Q = F(X, N, P, D)$$

Where Q : Number of telephone demand
X : Economic strength such as GDP or GNP
N : Population
P : Level of telephone charges
D : Demand growth factor

By dividing the above equation by population, the following equation is obtained:

$$q = f(x, p, d)$$

Where q : Number of main lines per unit persons (demand density)
x : GDP or GNP per capita
p : Charge index
d : Demand growth factor

From the above equation, demand density becomes a function of the GDP or GNP per capita, the charge index, and the demand growth factor. The demand growth factor is determined with the demand growth trend up to present stage. The demand growth is generally divided into three phases, that is, starting, rapid growth, and saturation phase. The province of Mendoza is presently in the rapid growth phase. Demand for telephone services for business and professional use will steadily grow. Furthermore, demand for household telephone services will grow rapidly as the convenience it gives to people's daily lives is conceived in depth. And the total demand for telephone services will increase rapidly.

During the rapid growth phase, it is known that there is a relationship between telephone demand density q and GNP per capita x as shown in the following equation:

$$\log q = a + b \times \log x$$

Where a and b are constants.

Using this income elasticity model equation (see footnote), the national macro telephone demand is forecasted.

Footnote

Income elasticity model equation is obtained as follows:

When income (GNP per capita) x increases a little volume dx, demand q increases by dq and if the ratio of increase is b, the following equation holds:

$$b = \frac{\frac{dq}{q}}{\frac{dx}{x}}$$

$$\frac{dq}{q} = b \times \frac{dx}{x}$$

$$\log q = a + b \times \log x$$

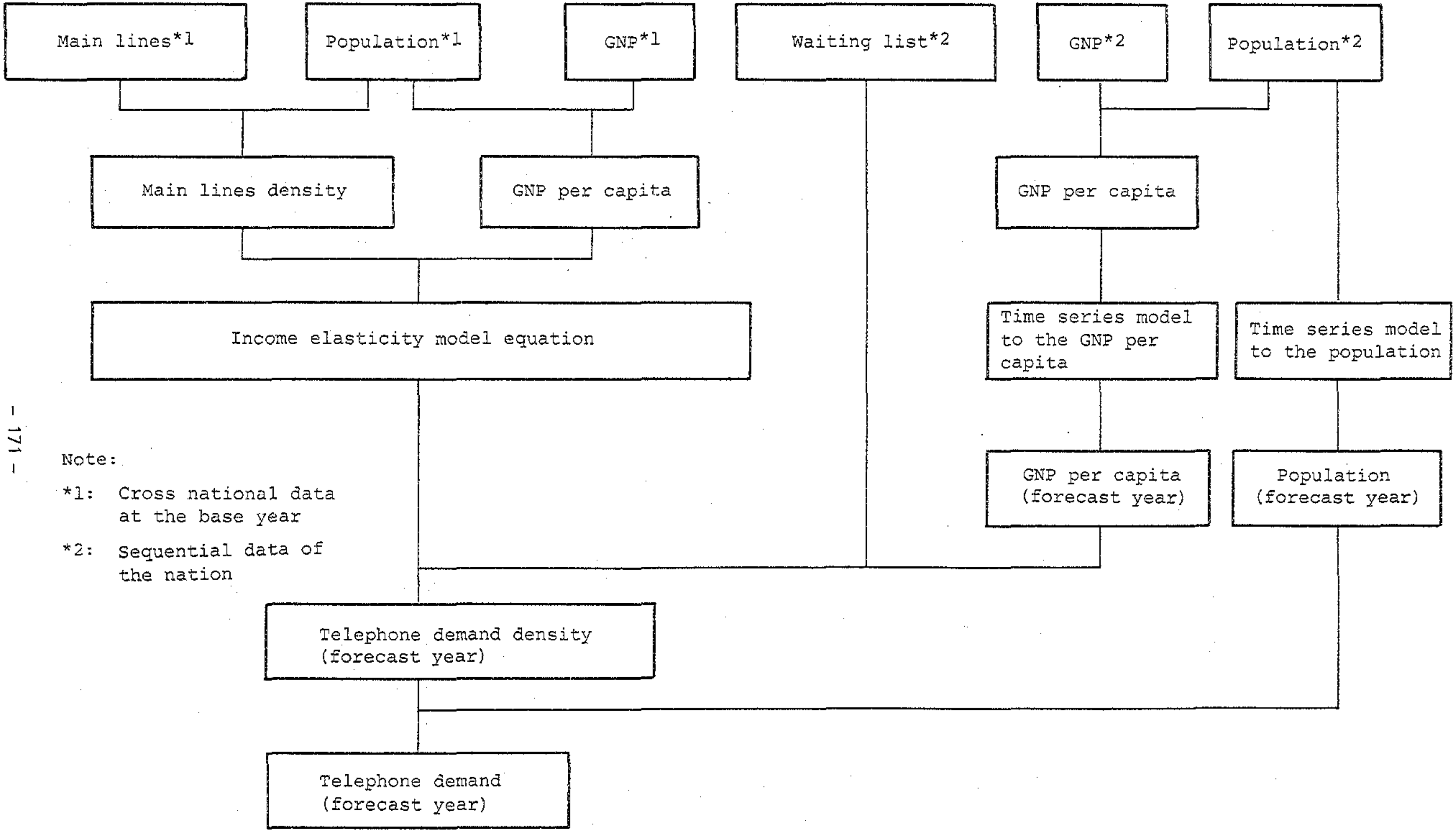
The above equation is called the "income elasticity model equation" since demand grows b times as much as income grows.

(2) National macro telephone demand

The national macro telephone demand has been forecast based on the income elasticity model equation. Fig. III-5-1 shows the procedures for the calculation of forecast. In order to make the income elasticity model equation, data on the number of main lines, population, and GNP in many countries are needed. For the model, countries in western Europe, South and North America, and Japan are selected, where political and economic systems are similar to those of Argentina. For the base year, 1983 is selected, as many of the sample countries have the aforementioned data for that year, and it is the latest year. Although GDP is preferrable to GNP for forecasting telephone demand, GNP is used as all reliable cross-national data are available. For GNP, the reliable World Bank Atlas' data are available.

Since no long-term forecast data on Argentina's GNP applicable to the development plan is available, a 4% growth rate as shown in the "Economic Development and Growth Project 1985~1989" is applied to calculate the GNP for the forecast year, by supposing that the growth rate would continue after the base year.

For population forecast, the Statistics Bureau's long-term forecast up to the 2025 is used.



Note:

*1: Cross national data at the base year

*2: Sequential data of the nation

Fig. III – 5 – 1 Flow of the macro telephone demand forecast

Table III－5－1 shows the telephone demand for the forecast year. Appendix 1 shows the related figures including the number of main lines, population growth, etc.

According to the forecast results, GNP per capita grows from US $ 2,510 for the base year to US $ 4,510 in the final forecast year. Consequently, telephone demand grows from 3,298,000 lines for the base year to 8,499,000 lines for the final forecast year.

In the event the telephone demand is fully met, the main lines density would be 21.6 lines per 100 persons at the final forecast year. The value is approximately equal to the level of Spain and Italy for the base year.

(3) Telephone demand for the province of Mendoza

The national macro telephone demand is distributed to the province of Mendoza using the distribution coefficients obtained from the GNP per capita ratio and the population ratio between the nation and the province. Table III－5－1 shows the result. Appendix 2 shows the basis for calculating the distribution coefficients.

As the table shows, the telephone demand in the province of Mendoza reaches 323,000 lines in the final forecast year.

(4) Telephone demand by central office

The province macro telephone demand is distributed to individual exchange using the distribution coefficients obtained from the present demand and the present service state. Table III－5－2 shows the result. Appendix 3 shows the basis for calculating distribution coefficients for individual central office.

(5) Others

The above telephone demand according to the income elasticity model equation has the following limitations:

Table III－5－1 Telephone demand on the nation and the province of Mendoza

Unit: Thousand lines

Year	1990	1995	2000	2005
Argentina	4,458	5,529	6,857	8,499
Mendoza	169	210	261	323

- the GNP per capita expressed in U.S. dollars is not always an accurate reflection of the national real standards of living,
- the difference in income distribution by country may distort comparisons.

In the future, upon implementing the development plan, there will be a call for improved accuracy of forecasts. In preparation for this, Appendix 4 contains as the figures for the telephone demand forecast using telephone demand over time and input—output tables, GDP values by industrial division and by province, and its figures over time, etc., population figures by urban and rural area, employment figures, their data, and forecasts, by area and over time.

5.2 Other Services

5.2.1 Mobile communications service

Moving bodies that can be the objects of mobile communications service are automobiles, trains, ships, aircraft and people. Since the province of Mendoza has no sea, it has very few ships, and trains and aircraft are operated by the nation as transportation services so they should be excluded from the list of objects for mobile communications service in the province of Mendoza.

Under this development plan, therefore, only mobile communications service for automobiles and people away from home, that is land mobile telephone service and radio paging service, are examined.

Table III-5-2 Telephone damand on the zone and the exchange area (1/2)

End of the year

Zone or exchange area	1990	1995	2000	2005
1. Gran Mendoza				
1.1 Multiple exchange area				
General Paz	26,300	32,700	40,600	50,200
El Correo	20,800	25,800	32,100	39,700
Dorrego	6,700	8,400	10,400	12,900
Godoy Cruz	17,000	21,100	26,200	32,500
Hipodromo	7,300	9,100	11,200	13,900
Las Heras	15,200	18,800	23,400	29,000
Loria	6,100	7,600	9,400	11,600
Villa Nueva	14,700	18,300	22,700	28,100
Subtotal	114,100	141,800	176,000	217,900
1.2 Gran Mendoza				
Chacras de Corea	1,700	2,100	2,600	3,200
Lujan de Cuyo	3,900	4,900	6,000	7,500
Agrelo	50	60	80	100
Blanco Encalada	50	60	80	100
El Carrizal	50	60	80	100
Ugarteche	50	60	80	100
Rodeo de la Cruz	1,500	1,900	2,300	2,900
Flay Luis Beltran	440	550	680	840
Maipu	5,700	7,100	8,800	10,900
Rodeo del Medio	540	670	840	1,000
Cruz de Piedra	240	290	370	450
El Pastal	50	60	80	100
La Primavera	50	60	80	100
Colonel Segovia	50	60	80	100
Puente de Hierro	50	60	80	100
Potrerillos	140	170	210	260
Uspallata	50	60	80	100
Las Cuevas	50	60	80	100
Subtotal	14,660	18,280	22,600	28,050
Gran Mendoza subtotal	128,760	160,080	198,600	245,950
2. Este				
Junin	810	1,000	1,300	1,600
Medrano	170	210	260	320
Rivadavia	2,600	3,300	4,000	5,000
Campamentos	50	60	80	100
Reduccion	30	40	50	60
San Martin	7,200	8,900	11,100	13,700
Palmira	2,000	2,500	3,100	3,800
Chapanay	30	40	50	60
Tres Portenas	150	190	230	290
La Central	50	60	80	100
Philipps	50	60	80	100
Alto Verde	50	60	80	100
Nueva California	50	60	80	100
Rodrigues Pena	50	60	80	100
Ing. Giagnoni	50	60	80	100
Subtotal	13,340	16,600	20,650	25,530

Table III-5-2 Telephone damand on the zone and the exchange area (2/2)

End of the year

Zone or exchange area	1990	1995	2000	2005
3. Noreste				
Lavalle	250	320	390	480
Costa de Araujo	70	80	100	130
Gustavo Andre	50	60	80	100
Jocoli	50	60	80	100
Tres de Mayo	50	60	80	100
Santa Rosa	170	210	260	320
La Dormida	240	290	370	450
Las Catitas	150	190	230	290
La Paz	640	800	990	1,200
Desaguadero	50	60	80	100
Subtotal	1,720	2,130	2,660	3,270
4. Centro Oeste				
Eugenio Bustos	390	480	600	740
Chilecito	70	80	100	130
La Consulta	1,200	1,400	1,800	2,200
Pareditas	80	110	130	160
Tunuyan	1,800	2,200	2,700	3,400
Campo los Andes	100	130	160	190
Vista Flores	240	290	370	450
San Pablo	50	60	80	100
Zapata	50	60	80	100
Tupungato	730	900	1,100	1,400
El Zampal	50	60	80	100
San Jose de Tupungato	50	60	80	100
Subtotal	4,810	5,830	7,280	9,070
5. Sur				
San Rafael	13,300	16,500	20,500	25,400
Canada Seca	100	130	160	190
25 de Mayo	50	60	80	100
El Nihuil	30	40	50	60
Gouge	20	20	30	30
La Llave	70	80	100	130
Las Malvinas	20	20	30	30
Monte Coman	190	230	290	360
Rama Caida	50	60	80	100
Cuadro Benegas	50	60	80	100
El Chapanay	50	60	80	100
El Sosneado	50	60	80	100
Villa Atuel	420	530	650	810
Real del Padre	240	290	370	450
General Alvear	3,200	4,000	4,900	6,100
Bowen	490	610	760	940
Carmensa	100	130	160	190
Jaime Prats	70	80	100	130
Andes	50	60	80	100
Escandinava	50	60	80	100
La Guevarina	50	60	80	100
La Materina	50	60	80	100
Las Aguaditas	50	60	80	100
Malargue	1,600	2,000	2,500	3,100
Subtotal	20,350	25,260	31,400	38,920
Total	168,980	209,900	260,590	322,740

As mobile communications service in the province of Mendoza, radio paging service is provided by Radio Aviso and Radio Llamada for approximately 1,000 subscribers. No land mobile telephone service has been started yet.

There is no established method for forecasting demand for mobile communications service. And in the case of the province of Mendoza, it is impossible to estimate from the trend of the number of subscribers from some point in past. Therefore, the demand forecast is made on the basis of related data collected during the field survey, and by referring to actual values in Japan which has ample experience in mobile communications service.

The object area for mobile communications service in the province of Mendoza is limited only to Gran Mendoza for the time being. This is because the area is the focus of social and economic activities with the concentration of several cities, and cities not included in this area are too small to be appropriate objects of mobile communications service.

Since the Gran Mendoza area consists of six cities each having a population of 150,000 to 200,000, the data used are on the actual situation of the mobile communications service in Japanese cities of the same size. Table Ⅲ−5−3 shows the values for each item.

According to the survey, the number of subscribers to radio paging service in the Gran Mendoza area amounts to about 1,000 and has shown almost no increase at all for the past two to three years. Unless some new demand factor is developed or there is a change in social and economic activities, there is little hope for any increase of demand in the future. Therefore, demand for radio paging service in 2005 is estimated by applying the same demand increase ratio as for the telephone service subscribers. Accordingly, supposing that the number of radio paging service subscribers is 2.69 times that for 1986, it is estimated that there would be a demand for 2,690 subscribers in 2005.

Table III - 5 - 3 Demand forecast for mobile communications service in the province of Mendoza

Item	The Province of Mendoza	Examples of Japanese cities
Population (1,000 persons: 1984)	1,272 (Total Province) 766 (G.M. area)	26 cities having a population of 150,000 to 200,000 were extracted.
Number of telephone subscribers (Notes 1 & 2)	120,000 (Total Province) 92,000 (G.M. area)	48.8 ∿ 92.1 x 10^3
Telephone density	12.0 subscribers/ 100 persons (G.M. area)	34.4 subscribers/100 persons
Telephone demand forecast (for 2005)	323,000 (Total Province) 245,950 (G.M. area)	
Number of radio paging service subscribers in 1986	1,000	256 ∿ 6,015
Radio paging service subscriber density	1.3 subscribers/ 1,000 persons	14.7 subscribers/ 1,000 persons
Radio paging service demand forecast (for 2005)	2,690 (Note 3)	
Number of registered automobiles in 1985	219,755 (Total Province) 149,965 (G.M. area)	
Automobile density (per 1,000 persons)	172.7 (Total Province) 195.8 (G.M. area)	284.3
Land mobile telephone service demand density	11.1 subscribers/ 100,000 persons (Notes 4 & 5)	46.2 subscribers/ 100,000 persons
Land mobile telephone service demand forecast (for 1986)	85 subscribers	
Land mobile telephone service demand forecast (for 2005)	229 subscribers (Note 3)	

Note 1: The number of telephone subscribers for the province of Mendoza includes waiting list.

Note 2: Gran Mendoza (G.M. area) consists of Capital, Las Heras, Guaymallen, Godoy Cruz, Lujan de Cuyo and Maipu.

Note 3: The telephone demand ratio between 1986 and 2005 was taken into consideration.

Note 4: The registered automobile density ratio (195.8/284.3) was taken into consideration.

Note 5: The telephone density ratio (12.0/34.4) was taken into consideration.

This means an increase of 1,690 subscribers over the 1986 total. Since the existing facilities have capacity for approximately 1,000 subscribers per system, the existing facilities of the two companies in operation are able to cover demand for another 1,000 subscribers. Furtheremore, it is quite likely that existing facilities will be updated and their capacities increased prior to 2005, fully meeting the estimated increase in demand.

Consequently, the area dose not need any new radio paging service company other than the two companies presently in operation. This plan, therefore, shall not consider facility for radio paging service.

The demand estimate for a land mobile telephone service for the Gran Mendoza area in 2005 is figured out by the same way as for the radio paging service. That is, the demand density of land mobile telephone service of Japanese cities of similar size and the registered automobile density and telephone density of the Gran Mendoza area are considered to estimate its potential demand for land mobile telephone service at present; this then becomes the basis for the 2005 estimate, Table III−5−3 shows the result of this estimation.

In the Japanese same size cities, the land mobile telephone service demand density is 46.2 subscribers per 100,000 persons. With this and from the registered automobile density and telephone density shown in Table III−5−3, the Gran Mendoza area is found to have a land mobile telephone service demand dencity of 11.1 subscribers per 100,000 persons. Since the area has a population of 766,000, the area is estimated to have a potential demand of 85 subscribers for 1985. By multiplying the figure by 2.69 of the telephone service demand increase ratio between 1986 and 2005, demand for the land mobile telephone service in 2005 is 229 subscribers.

5.2.2 Data communications, telegraph and telex service

Non–telephone new services are steadily being developed and introduced owing to the diffusion of computers which have seen rapid cost reductions. The services are categorized into bearer–services and tele–services.

Fundamentally a network provides means of transparent data transmission and its terminal is provided by the user for the bearer–service. Typical services are leased circuit, packet switching and circuit switching services. The leased circuit service has a long history, and features digitalization and high speed transmission. The packet switching service is being expanded in many countries because of its low price and convenience.

The tele–service, on the other hand, is a total service including both networks and terminals. Examples include teletex, facsimile and tele–conference. Although so many enterprises from so many counties have developed and introduced all kinds of services, virtually none has managed to find a firm business footing.

The demand for the bearer–service mainly depends on the tele–services and computer network services. Computer network services are considered to combine a host computer, terminal sets and a communications network such as the bearer–service. Most tele–services have only just started or are in the experimental stage, so there is no sequential data or long–and medium–range demand prospects yet. It is very difficult to forecast the diffusion for computer network services, because of increasingly intelligent, cheaper terminal sets and communications methods, and developing software technologies.

It is impossible to forecast the demands of the bearer–service which are mainly dependent on the tele–service and the computer network service. Further, the bearer–service itself will be changed by cost reductions in its transmission and exchange equipment through the introduction of optical fibers, sophisticated computer techonologies, etc.

Traffic of the telegraph service will not be increased owing to future improvement of the telephone service.

The telex service, which is in its expansion stage, will not grow further because it will be integrated into the packet switching service by the development plan.

CHAPTER 6 DEMAND FULFILMENT PLAN

6.1 Subscriber Telephone

Telephone demand as forecasted in the preceding Section 5.1, Chapter 5 is the number of main lines comprising subscriber telephones and public telephones.

Taking into account the public telephone fulfilment plan described in the next section, telephone demand is divided into subscriber telephone and public telephone services as Table III−6−1 shows.

Table III − 6 − 1 Distribution of telephone demand

Unit: Thousand lines

Year	1995	2000	2005
Subscriber telephone	208.5	258.1	318.6
Public telephone	1.5	2.9	4.4
Total	210.0	261.0	323.0

The telephone demand is also divided into the demand of areas accessible from central offices using ordinary subscriber lines (hereinafter referred to as cable service area) and the demand outside the cable service areas, where the rural telephone system is to be applied.

In this development plan, the telephone demand outside the cable service areas for 2005 is estimated as 3,000. The figure is approximately 3% of the telephone demand of 105,000 for areas other than the multiple exchange area, or 1% of the total demand of 323,000.

The fulfilment plan for the demand of subscriber telephone service is set out below.

(1) Telephone demand inside the cable service areas will be fulfilled by 2005.

(2) As for the telephone demand outside the cable service areas, the fulfilment plan is drawn so that the investment for the rural telephone service does not exceed 10% of total investment in the telecommunications division, as stated in (2) of Section 2.3.
In this case, the number of main lines to be installed by 2005 is 2,000 lines including 500 lines for public telephones stated in the next section.

Table III-6-2 shows the subscriber telephone fulfilment plan for each phase.

Telephone density for 2005 will reach 18.5 main lines per 100 persons including the public telephones.

Table III-6-2 Telephone demand fulfillment plan

Unit: Thousand lines

Phase	Phase 1	Phase 2	Phase 3
Subscriber telephone (Inside the cable service areas)	135.7	210.6	316.1
Subscriber telephone (Outside the cable service areas)	0.6	0.9	1.5
Public telephone (Inside the cable service areas)	1.3	2.6	3.9
Public telephone (Outside the cable service areas)	0.2	0.3	0.5
Total	137.8	214.4	322.0

6.2 Public Telephone

By referring to the density of public telephones in other countries, the density for the province of Mendoza in 2005 is set at 2.5 units per 1,000 persons. This density includes the public telephones to be installed inside and outside the cable service areas.

Table III-6-2 shows the number of public telephones installed at the end of each phase.

6.3 Other Services

6.3.1 Mobile communications service

The object area for land mobile telephone service is to be limited to the Gran Mendoza area, judging from the distribution of registered automobile density. And, because of the rather small demand forecasted to be 230 in the year 2005, the service is determined to be introduced in phase 3 aiming at fulfilling completely the demand at that time.

6.3.2 Data communications and telegraph

(1) Bearer–service

1) Leased circuit service

A leased circuit service is one which leases circuits to the user exclusively. Its frequency band is normally from 3.4 KHz (equivalent to one telephone channel), to 4 MHz (one TV channel), or its bit rate ranges from 50 b/s (one telex channel), to 6 Mb/s. Major users are speeding up the bit rate.

This service is useful for users who transmit large amounts of data at any time. There is no loss probability, and perfect transparency of data is assured.

These days, leased circuit services form the bulk of bearer–services and expansion is expected to continue.
In Argentina, the leased circuit service including digital circuits is predicted to develop further. Steps in introducing service are as follows:

Phase 1 : The digital leased circuit service to major cities in Argentina.

Phase 2 : The digital leased circuit service to major cities in the province of Mendoza.

Phase 3 : The digital leased circuit service to prominent cities in the province of Mendoza.

2) Packet switching service

In the packet switching service, data are packeted in fixed lengths, such as 128, 256 or 4,096 octets, and each packet has an address. Communications can be made between a variety of terminals as the conversion of protocol and transmission speed is done by the network. This service is very successful in many countries because of its low transmission cost.

This service can be used as a network for videotex and teletex. Integration of telex and telegraph network is also possible. As well, the packet switching network has been interconnected with telephone networks for convenience of simple and low speed terminals.

This service is one of the most rapid growing among the new services and available in many countries including Argentina. Expansions of the service must be made to business and industrial cities in the province of Mendoza.

Following the Gran Mendoza area where the service is already introduced, steps in introducing and expanding the service in the province are as follows:

Phase 1 : Extension of the packet switching service to San Rafael.

Phase 2 : Extension of the packet switching service to major cities in the province of Mendoza, and integration of the telex network and interconnection with the telephone network.

Phase 3 : Extension of the packet switching service to prominent cities in the province of Mendoza.

3) Circuit switching service

In principle, a circuit switching service is the same as telephone switching, but economically transmits and exchanges digital data transparently from terminal to terminal in high quality and high speed. Few countries, however, have introduced this service, and the rate of expansion in those countries (Japan, West Germany, etc.) is low compared with the growth of the packet switching service.

Introduction of this service in Argentina is not foreseen because of the situation in the developed countries. This service can be substituted by the leased circuit and packet switching services, and will be integrated into the ISDN network in future.

(2) Tele-service

1) Facsimile

In recent years, facsimile has progressed remarkably by redundancy reductions. At the same time, IC technology has enabled smaller and more economical terminal sets. Progress in MODEM has made it possible to transmit high speed digital signals through a telephone network. Especially in Japan with all those complicated Chinese characters the facsimile has been extraordinarily popular. In other developed countries, alphabetic telex terminals have already been diffused and facsimile is yet to take off.

As a result, telephone network facsimiles will be introduced in Argentina to some extent, but a sophisticated facsimile network will not be needed.

2) Videotex

Videotex is the system which retrieves pictures and characters upon user's request from a center through a telephone network, by means of a simple terminal set with a TV set or personal computer.

Up until a few years ago, videotex was the most highlighted service. As it turned out, success in Japan, the UK, Canada and the U.S. is not up to expectations. France is the one exception. The reasons are as follows:

- The high price of terminal sets.
- No menu attractive to the subscribers.
- The complicated method for providing programs by Information Providers (IP).

Reasons for the success in France are as follows:

- Distribution of terminal sets free of charge.
- Transferring telephone directory service into the videotex service.

Introduction of the videotex service should be put off for the time being. Moreover, as all potential IPs reside in Buenos Aires and it is possible to subscribe to videotex through the telephone network and the packet switching network, introducing a videotex center in Mendoza is not being considered.

3) Teletex

Teletex enables communication between word processors with communications facilities. Normally the packet switching network is used as a communications network.

4) Mailbox service

The mailbox service enables communicating between personal computers. Personal computers are normally in the off-line mode, so to communicate with each other a center computer stores messages from the originating personal computer and forwards these to the receiving computer on request. Ordinarily its communications network is the packet switching network.

5) TV conference

Despite long years of development, TV conference is still in the experimental stage because of its cost. Its introduction will be examined when dramatic reductions in transmission cost are realized.

6) High – speed facsimil

There is little demand in developing countries for high – speed facsimile which sends high quality pictures quickly. High – speed facsimile will be transmitted through the leased circuit network.

7) Other high – speed digital data transmissions

This category includes motion picture transmission, fine picture transmission and CAD (Computer Aided Design) data transmission. Demand for these is slight, so the leased circuit service will be used.

(3) Telegraph service

The telegraph service will be improved by distributing facsimiles to terminal offices (64 offices) where a direct dialing telephone service is available, except the Gran Mendoza area and towns where the existing automatic message transmission system is available.

CHAPTER 7 CENTRAL OFFICE ALLOCATION PLAN

7.1 Fundamentals

Central offices are allocated in areas with a certain amount of subscribers in accordance with the telephone demand fulfillment plan stated in Chapter 6. Other areas are not provided with the central office but the subscriber lines in the area are connected to the nearest central office by way of the rural telephone system.

7.2 Local Central Office Service Area

The service areas of existing local central offices are to be expanded up to about five kilometers of radius if necessary to cover new demand around the offices. The service areas are presently one to two kilometers in radius which can be technically expanded to around five kilometers. On the occasion of installation of a new digital exchange, the service area of a central office with a small manual exchange within the digital exchange service area is to be merged in principle.

An idea merging new demand areas into the service areas of existing central offices is adopted whenever possible. However, most of the new demand areas come to form new service areas as they are out of distant limitation from existing central offices. They are mostly the areas of the existing public telephone service stations (cabinas publicas).

A new central office is not planned in the multiple exchange area, because the present offices are able to cover new demand from the existing points by expanding the radius of the service area as outlined above. But Loria, the only central office with a remote switching unit in that area, is to be replaced with a host exchange as the capacity expansion is needed to meet demand increase.

7.3 Application of Host and Remote Office

A central office classified as LE in the network hierarchy forms either a host office or a remote office for realizing economical exchange of traffic.

The host office is equipped with an exchange having ordinary switching function and allocated in a city with a relatively large amount of traffic in the area.

While the remote office is not equipped with that function, but with such basic function as concentrating traffic. It is allocated to cover points with relatively small amounts of traffic dotted around the host office service area. It is equipped with a switching system called a remote switching unit (RSU). But in areas with a small number of main lines or less than 60 at the end of phase 3, a system called a subscriber line multiplexer, which is one of the rural telephone systems, is applied in place of the RSU, to connect main lines through digital transmission lines to the host exchange.

Consequently, the traffic of subscribers connected to the remote offices and line multiplexers are all dealt with through the host office, that is, a zone of traffic is formed by the host office and the remote offices.

In choosing between the remote switching unit and the subscriber line multiplexer to be applied for relatively small amounts of traffic, the following characteristics are taken into consideration.

The RSU doesn't need transmission line capacity more than that which corresponds with the amount of traffic for its function concentrating the traffic of main lines, but the function brings about a limitation in distance because it is put under the control of the exchange of the host office. While, the subscriber line multiplexer chosen here for examination is a system which is not designed to have such function but to connect main lines through transmission lines after multiplexing directly to the exchange in the host office. Consequently, it needs transmission lines corresponding to the number of the subscribers regardless the traffic amount.

In this connection, the former is advantageous when there are prospects for an increase in the number of subscribers in the near future and the latter is preferable when subscribers are few in number and the increase is not expected for a while.

A diverging point is determined as 60 main lines here as the transmission line capacity of the latter exceeds that of the former when the number of main lines is bigger than 60. And, if it is 80 km or more to the nearest host exchange, the former cannot be applied.

7.4 Toll Office

From the economic point of view as stated in Section 3.2.3, only General Paz is assigned as the toll central office.

A digital toll exchange is to be installed in parallel with the conventional analogue toll exchange in General Paz. Trunk circuits are to be transferred gradually from the analogue toll exchange to the digital, corresponding with the progress of replacement of the exchanges of local offices. The analogue toll exchange is to be removed when the circuits are all digitalized.

Toll exchanges are allocated at present in such central offices as San Martin, San Rafael and General Alvear, in addition to that in General Paz. However, traffic among neighboring offices is estimated at a few erlangs in those three areas even in phase 3. Moreover, the digital exchanges in those three host offices will have toll exchange function in substance handling not only traffic among their remote offices but also that to the toll exchange in General Paz. San Rafael and General Alvear will have direct trunk circuits between them. Accordingly, there is no need to allocate any toll exchange other than that in General Paz in the future.

Toll switchboards are to be concentrated in General Paz corresponding with the above-mentioned determination on the toll exchange allocation. Telephone directory service boards are not provided as they can be substituted by ordinary telephone sets.

7.5 Allocation of Central Office

Allocation of local central offices of each phase is shown in Figs. III−7−1 to III−7−3.

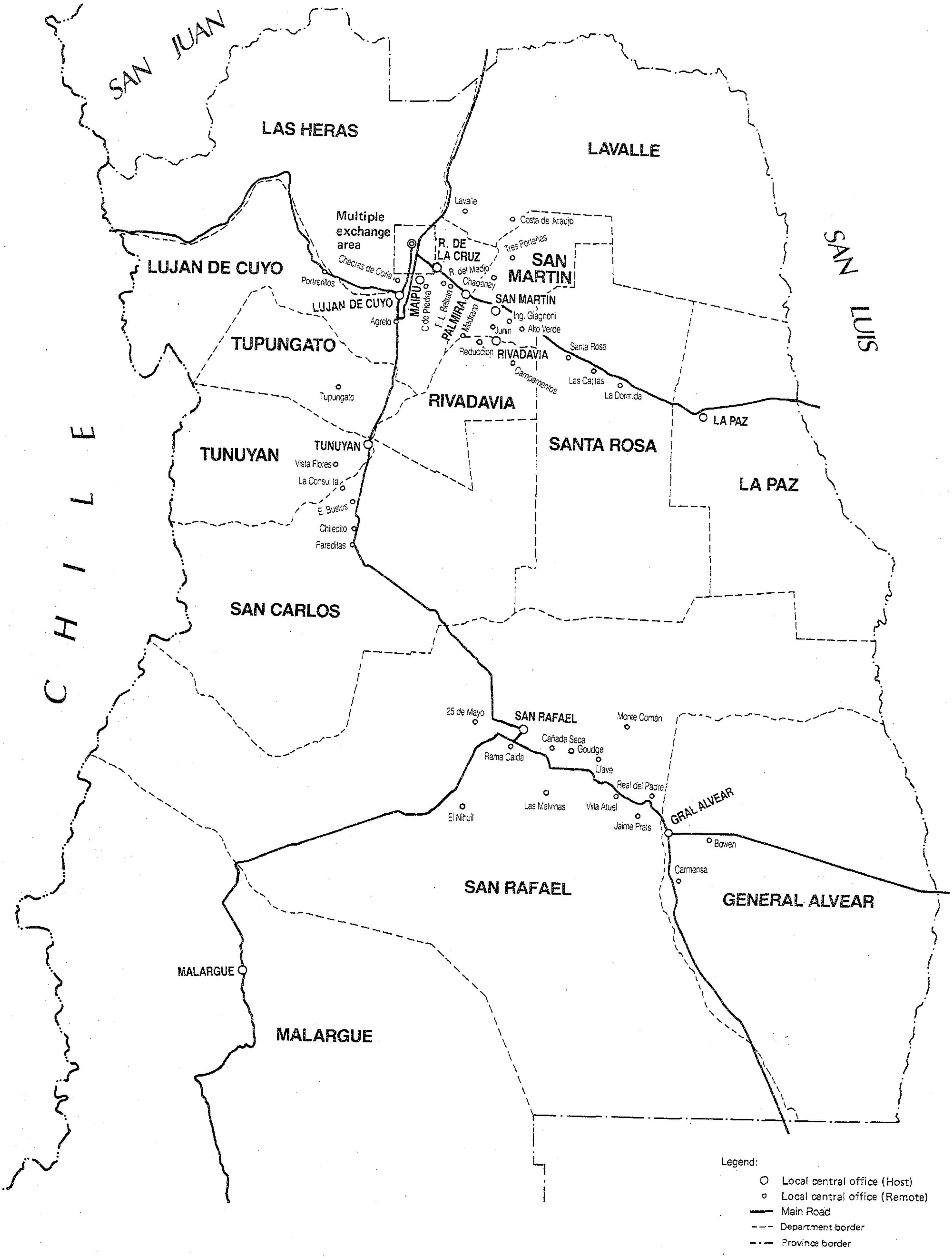


Fig. III-7-1 Central office allocation in phase 1 (1/2)

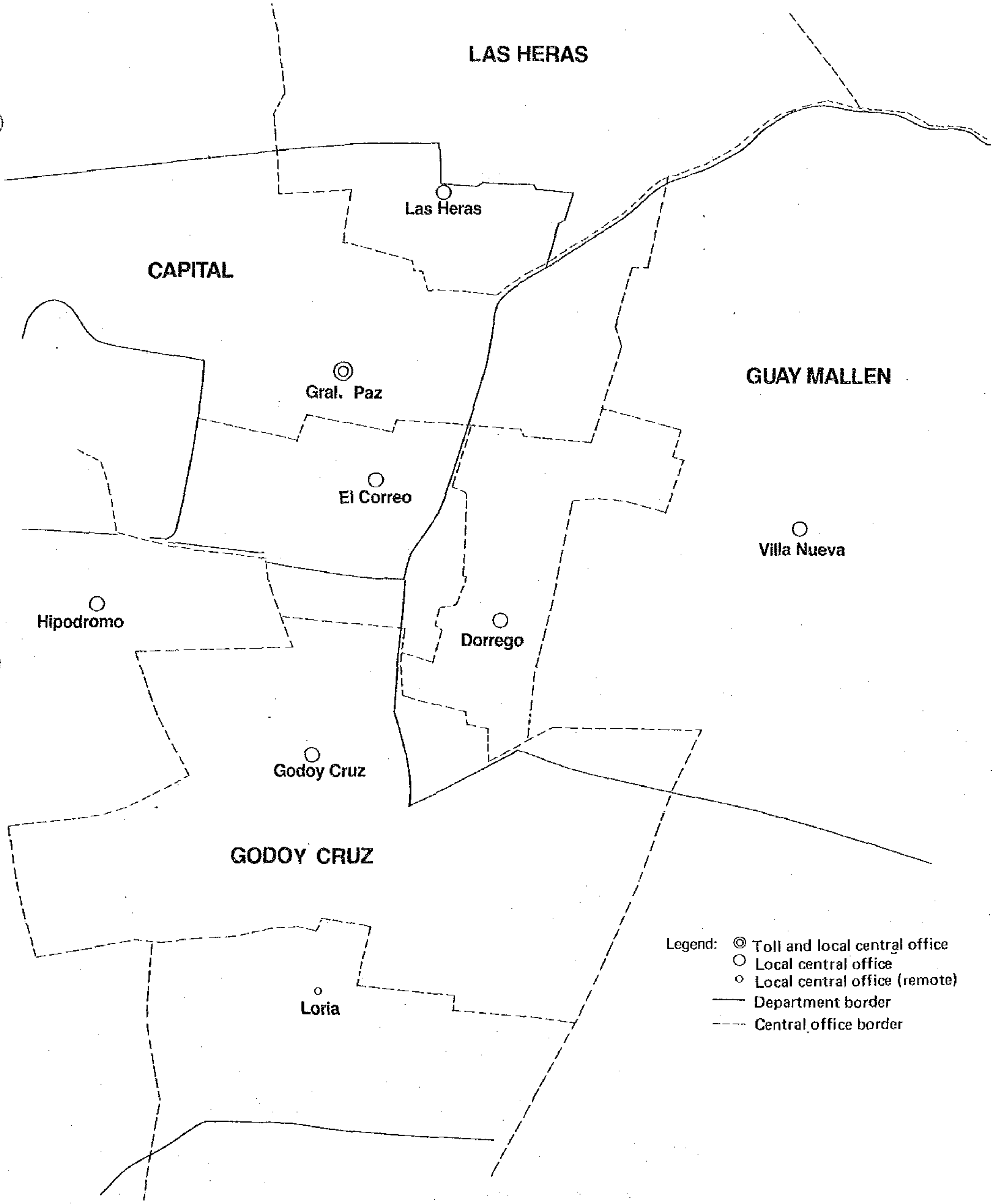


Fig. III-7-1 Central office allocation in phase 1 (2/2)
(Multiple exchange area)

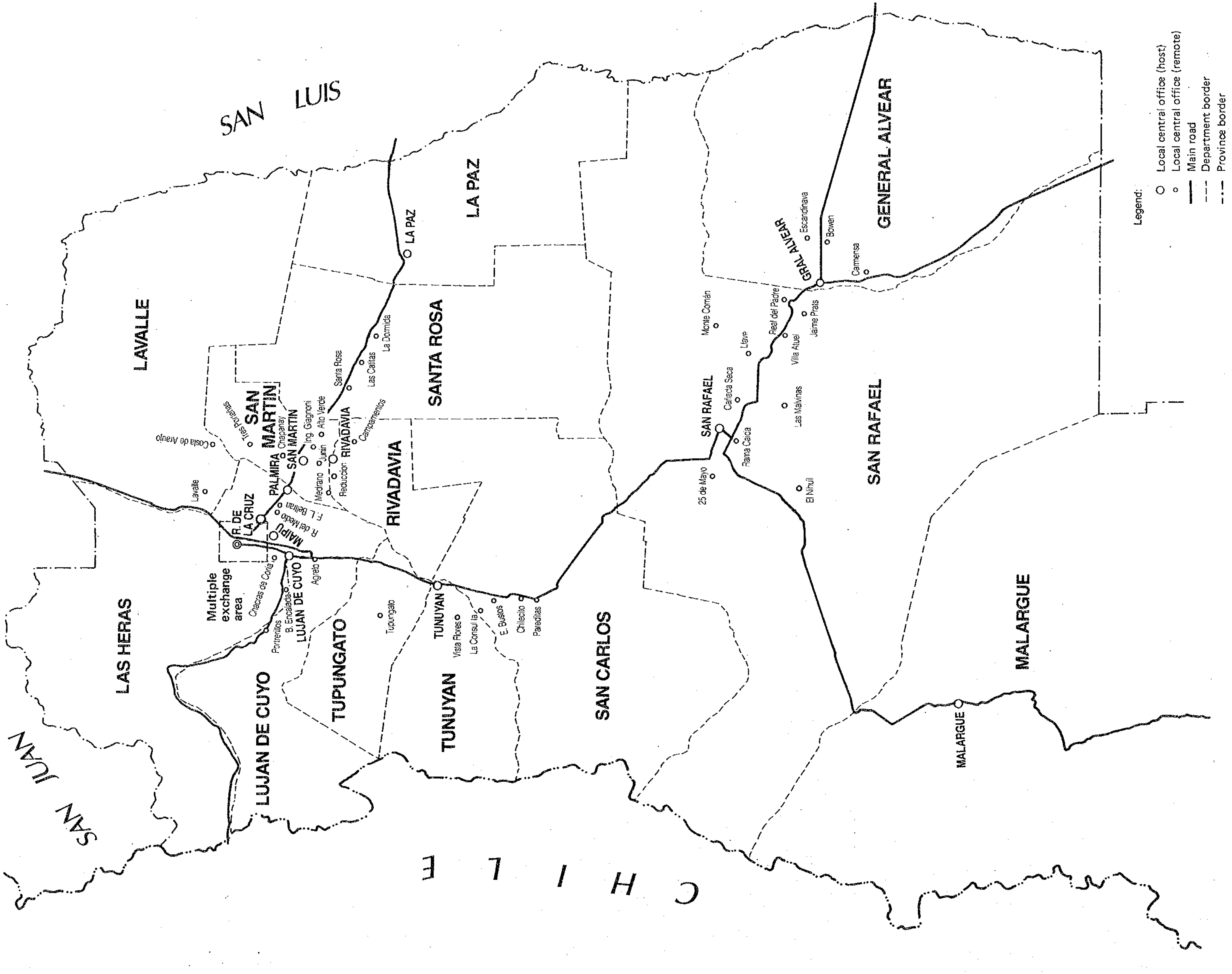


Fig. III－7－2 Central office allocation in phase 2 (1/2)

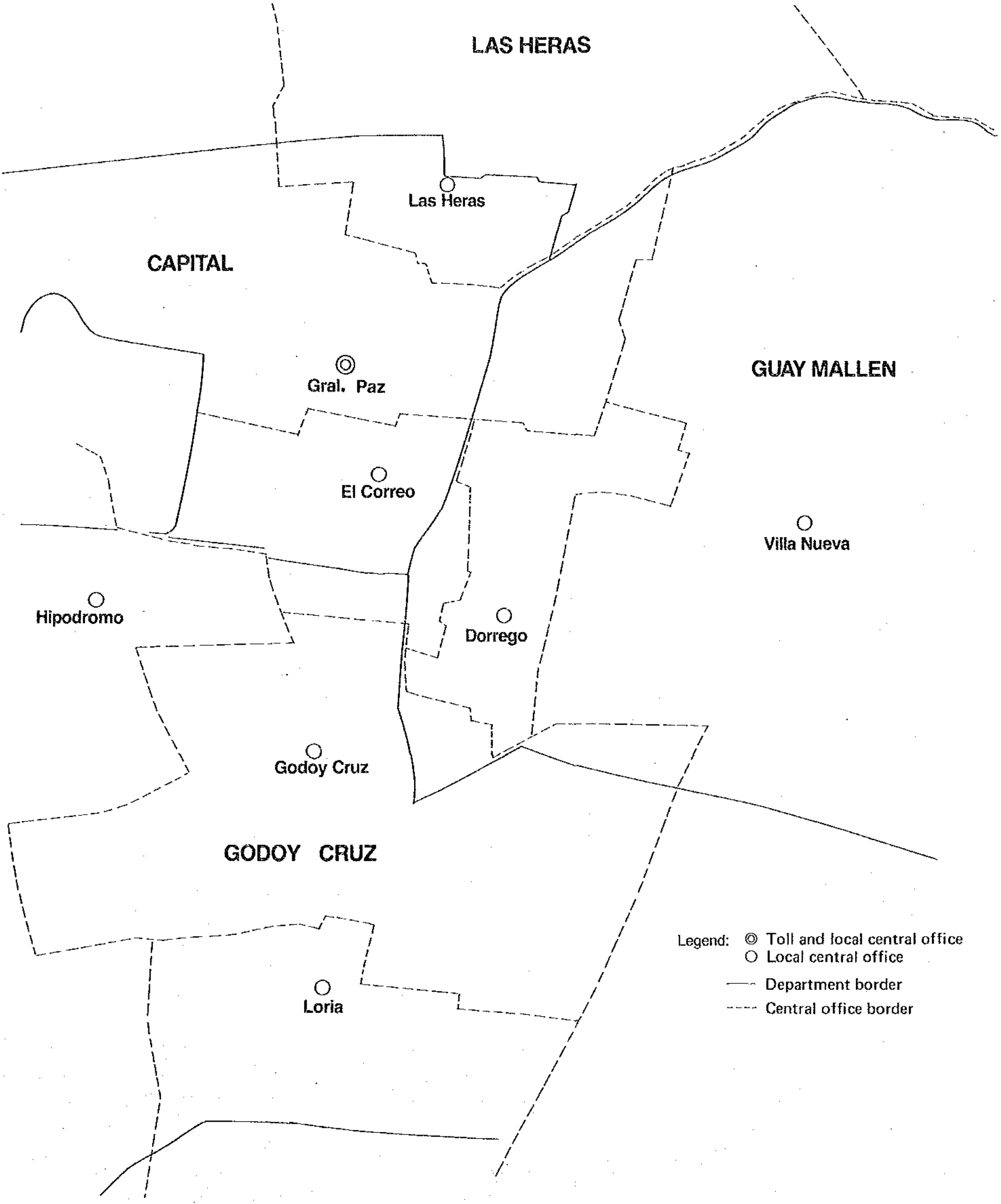


Fig. III-7-2 Central office allocation in phase 2 (2/2)

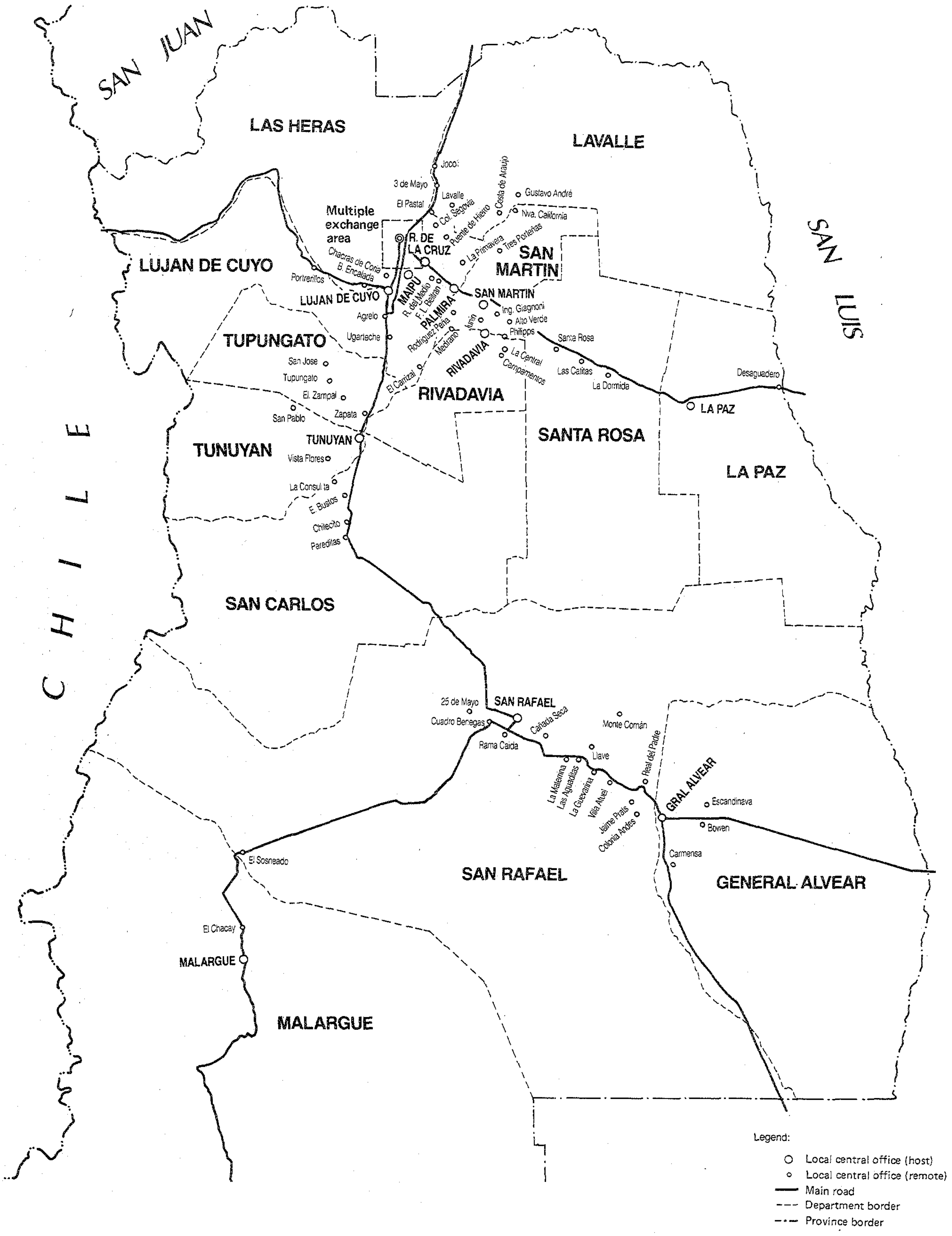


Fig. III – 7 – 3 Central office allocation in phase 3 (1/2)

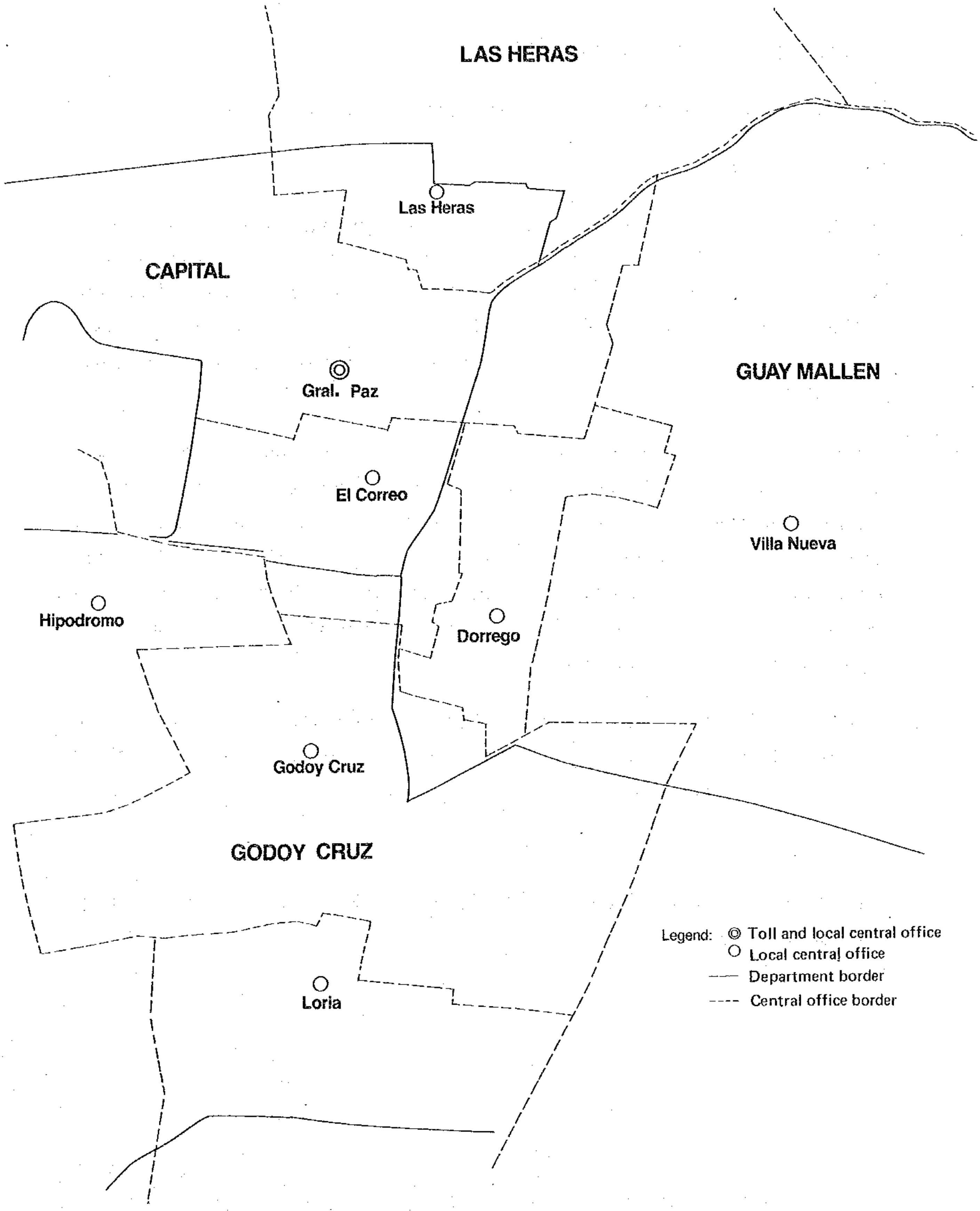


Fig. III - 7 - 3 Central office allocation in phase 3 (2/2)

CHAPTER 8 TRAFFIC FORECAST

8.1 Estimate of Calling Rate and Percentage of Traffic Categories

8.1.1 Introduction

Calling rate or total mean traffic per subscriber during the busiest one hour and percentage of traffic categories are dependent on various conditions such as the size and character of the town, the difference of the form of telephone use by the individual subscriber line, as well as the season and day of the week. Therefore, to accurately forecast them, statistical data covering these conditions are needed.

The result of a measurement conducted by CAT from January through July, 1986, on outgoing and incoming traffic of its toll exchanges in the province of Mendoza and that of local exchanges in the Mendoza multiple exchange area (hereinafter referred to as measurement result) is referred to for making the estimation in the development plan, although it dose not meet the above–mentioned conditions completely. The measurement result is shown in Tables III–8–1 through III–8–5.

As a principle, estimated values are applied throughout the period of the development plan, but some adjustment is given in the case that the result is judged to be unbalance on the basis of experience.

8.1.2 Calling rate

The calling rate is determined separately for the Mendoza multiple exchange area and other areas.

Table III – 8 – 1 Traffic matrix of multiple exchange area in 1986

(erl.)

To / From	Main lines	GRP			CRR			DOR	GDC	HPD	LAH	VLN	Special code	TAND	CMZ	Total
		2	3	Subtotal	1	2	Subtotal									
GRP 2	9,708	111	64	175	23	83	106	22	32	13	48	23	3	1	48	471
3	4,836	55	32	87	12	46	58	12	20	11	30	12	5	0	27	262
(Subtotal)	14,544	166	96	262	35	129	164	34	52	24	78	35	8	1	75	733
CRR 1	3,721	24	13	37	31	32	63	18	13	5	12	6	1		18	173
2	9,536	64	42	106	38	150	188	21	36	18	39	21	5		55	489
(Subtotal)	13,257	88	55	143	69	182	251	39	49	23	51	27	6	0	73	662
DOR	3,887	21	11	32	8	22	30	19	13	6	22	14	2		18	156
GDC	7,748	36	18	54	17	40	57	12	97	14	29	13	3	0	31	310
HPD	3,850	16	8	24	6	19	25	6	12	17	10	5	1	3	10	113
LAH	8,801	54	23	77	14	54	68	16	33	13	52	16	3		44	322
VLN	5,833	29	11	40	8	25	33	13	13	7	14	65	5	0	19	209
CMZ	-	45	24	69	17	51	68	15	24	8	46	22	6			258
Total	57,920	455	246	701	174	522	696	154	293	112	302	197	34	4	270	2,763

Table III-8-2 Traffic of Mendoza toll exchange in 1986

Exchange	Main lines	Traffic (erl.)			Circuit		
		I/C	O/G	Total	I/C	O/G	Total
Gral. Paz	14,553	75.12	69.56	144.68	90	85	175
El Correo	13,257	73.04	66.94	139.98	97	90	187
Dorrego	3,877	17.72	14.68	32.40	24	22	46
Godoy Cruz	7,748	30.61	24.16	54.77	44	30	74
Hipodromo	3,850	9.69	8.41	18.10	15	13	28
Las Heras	8,801	44.17	46.12	90.29	60	60	120
Villa Nueva	5,833	18.59	21.94	40.53	41	34	75
Special service			6.07	6.07		8	8
Rodeo de la Cruz	726	20.98	17.90	38.88	30	23	53
Fray L. Beltran	151	4.18	4.92	9.10	8	8	16
Lavalle	79	4.85	3.00	7.85	6	4	10
Rodeo del Medio	148	5.45	5.56	11.01	8	8	16
Maipu	1,932	22.37	47.06	69.43	36	62	98
Lujan de Cuyo	1,935	13.74	29.99	43.73	19	37	56
Chacras de Coria	945	19.90	21.68	41.58	24	31	55
Tunuyan	1,108	16.40	11.25	27.65	23	16	39
Tupungato	476	7.62	4.59	12.21	12	8	20
Eugenio Bustos	157	5.01	5.25	10.26	8	8	16
San Martin	3,395	41.66	36.42	78.08	49	43	92
Rivadavia	1,340	13.21	11.86	25.07	22	16	38
San Rafael	6,019	33.52	34.44	67.96	50	43	93
Malargue	679	6.50	3.51	10.01	9	4	13
General Alvear	2,027	25.78	14.56	40.34	30	25	55
Manual boards		27.48	5.02	32.50	40	20	60
Buenos Aires		86.15	87.84	173.99	99	98	197
Buenos Aires (Direct)			33.28	33.28		36	36
Cordoba		52.97	51.84	104.81	58	57	115
San Luis		25.76	12.06	37.82	30	24	54
San Juan		50.79	47.23	98.02	56	51	107
Total	79,036	753.26	747.14	1,500.40	988	964	1,952

Table III-8-3 Traffic of San Martin toll exchange in 1986

Exchange	Main lines	Traffic (erl.)			Circuit		
		I/C	O/G	Total	I/C	O/G	Total
Palmira	871	13.72	10.68	24.40	21	18	39
S. Martin AGF	3,395	42.46	36.73	79.19	50	44	94
Rivadavia	1,340	6.56	5.47	12.03	15	14	29
Total	5,606	62.74	52.88	115.62	86	76	162

Table III-8-4 Traffic of San Rafael toll exchange in 1986

Exchange	Main lines	Tfaffic (erl.)			Circuit		
		I/C	O/G	Total	I/C	O/G	Total
S. Rafael AGF	6,019	38.93	33.58	72.51	50	46	96
Malargue	679	9.22	4.65	13.87	13	10	23
Manual boards	-	4.99	.23	5.22	8	7	15
Total	6,698	53.14	38.46	91.60	71	63	134

Table III-8-5 Traffic between Tunuyan and Tupungato in 1986

From - to	Traffic (erl.)	Circuit
Tunuy. - Tupun.	1.75	6
Tupun. - Tunuy.	1.77	8
Total	3.52	14

(1) Mendoza multiple exchange area

According to the measurement result, the calling rates in Mendoza multiple exchange area are: 0.09 erlang on the average, 0.10 erlang or more for the central offices in the central parts (with 10,001 or more subscribers), and 0.07 erlang or more for the offices in peripheral parts (with 10,000 or fewer subscribers), as shown in Table III-8-6.

With 10% given for seasonal fluctuation, calling rates to be applied to the development plan are determined as 0.11 erlang for the offices in the central part, and 0.08 erlang for the others, as shown in Table III-8-7.

Table III-8-6 Calling rate of multiple exchange area in 1986

Central office	Main lines	Calling rate (erl.)
Gral. Paz	14,544	0.10
El correo	13,257	0.10
Dorrego	3,877	0.08
Godoy Cruz	7,748	0.08
Hipodromo	3,850	0.06
Las Heras	8,801	0.07
Villa Nuea	5,833	0.07
Total/Average	57,910	0.09

Table III-8-7 Calling rate of multiple exchange area for the development plan

(in erlangs)

Main lines	Mendoze multiple exchange area	
	Central parts	Others
1 - 10,000	-	0.08
10,001 or more	0.11	0.08

Table III – 8 – 8 Estimated traffic of automatic exchanges in areas other than multiple exchange area in 1986

(erl.)

Central office	Type of exchange	Main lines	Traffic (erl.)		Traffic category ratio (%)			Traffic by categories (erl.)			Measured toll traffic (erl.)
			C/R	Amount	Internal	Toll	Total	Internal	Toll	Total	
Lavalle	AEX-100	79	.09	7.11	.10	.90	1.00	.71	6.40	7.11	7.85
Rodeo del Medio	ARX-100	148	.08	11.84	.10	.90	1.00	1.18	10.66	11.84	11.01
Fray L. Beltran	ARX-100	151	.07	10.57	.15	.85	1.00	1.59	8.98	10.57	9.10
Eugenio Bustos	ARX-100	157	.07	10.99	.15	.85	1.00	1.65	9.34	10.99	10.26
Tupungato	ARF-102	476	.06	28.56	.40	.60	1.00	11.42	17.14	28.56	15.73
Malargue	ARF-102	679	.06	40.74	.40	.60	1.00	16.30	24.44	40.74	23.88
Rodeo de la Cruz	ARF-102	726	.07	50.82	.40	.65	1.05	20.33	33.03	53.36	38.88
Palmira	ARF-102	871	.06	52.26	.40	.60	1.00	20.90	31.36	52.26	24.40
Chacras de Coria	ARF-102	945	.06	56.70	.35	.65	1.00	19.85	36.86	56.70	41.58
Tunuyan	ARF-102	1,108	.06	66.48	.50	.50	1.00	33.24	33.24	66.48	31.17
Rivadavia	ARF-102	1,340	.06	80.40	.50	.50	1.00	40.20	40.20	80.40	37.10
Maipu	ARF-102	1,932	.06	115.92	.45	.55	1.00	52.16	63.76	115.92	69.42
Lujan de Cuyo	ARF-102	1,935	.07	135.45	.67	.33	1.00	90.75	44.70	135.45	43.73
General Alvear	SXS	2,027	.07	141.89	.72	.28	1.00	102.16	39.73	141.89	40.34
San Martin	AGF	3,395	.09	305.55	.75	.25	1.00	229.16	76.39	305.55	79.19
San Rafael	AGF	6,019	.10	601.90	.88	.12	1.00	529.67	72.23	601.90	72.51
Total/Average		21,988	.08	1,717.18	.69	.31	1.00	1,171.28	548.44	1,719.72	556.15

(2) Other areas

The calling rate is estimated through a simulation by means of the toll traffic data given in the measurement result as a sole clue, because the measurement result does not give data except that of the toll traffic. The simulation follows the tendency generally observed that where the number of main lines is between several hundreds to several thousands, the more lines the central office has, the higher the calling rate, and that the more lines the office has, the higher the percentage of intra–office traffic. In addition, the supposition that the calling rate does not exceed that of the Mendoza multiple exchange area is counted in. Table III–8–8 shows the calculation result.

Based on the estimation, the calling rate is determined as 0.06 erlang for offices with main lines up to 2,000, 0.08 erlang for those with the lines from 2,001 to 5,000 and 0.10 erlang for those with 5,001 or more lines, as shown in Table III–8–9 below.

Table III–8–9 Calling rate of areas other than multiple exchange area for the development plan (in erlangs)

Main lines	Other than Mendoza multiple exchange area
1 - 2,000	0.06
2,001 - 5,000	0.08
5,001 or more	0.10

8.1.3 Percentage of traffic categories

The percentage of traffic categories is determined separately for the Mendoza multiple exchange area and other areas.

(1) Mendoza multiple exchange area

A result obtained from the measurement result is directly applied for the traffic calculation. That is, according to the measurement result, percentages by categories are 32% for internal, 57% for local and 11% for toll traffic for the central offices in the central parts (with 10,001 or more main lines) of the Mendoza multiple exchange area. Those for the others are 23%, 65% and 12% respectively. Table III−8−10 shows the percentage of traffic categories of the multiple exchange area.

Table III−8−10 Percentage of traffic categories of multiple exchange area for the development plan

(in percent)

Main lines	Local call		Toll
	Internal	Others	
1 - 10,000	23	65	12
10,001 or more	32	57	11

(2) Other areas

According to the simulation result, the ratio between internal and toll traffic is 34% and 66% for central offices with 1,000 or fewer main lines; 65% and 35% for those with 1,001 to 5,000 lines; and 88% and 12% for those with 5,001 and more lines.

The toll traffic must be divided into two categories as a central office and remote offices under the control of the former form a traffic zone as stated in Section 7.3, that is, traffic which originates and terminates within the zone (hereinafter referred to as intrazonal traffic) and the other.

The percentages by categories are determined as shown below on the basis of the average values (22% for neighboring offices and 78% for the others) of Tupungato, Tunuyan, and Rivadavia offices which have high usage direct trunks with neighbouring offices.

However, the intrazonal traffic of the host office is not calculated by a rate but a certain amount of traffic is given corresponding to the concentrated traffic out of the remote exchanges. Table III–8–11 shows the percentage of traffic categories of areas other than the multiple exchange area.

Table III – 8 – 11 Percentage of traffic categories of areas other than multiple exchange area for the development plan

Main lines	Local	Toll	
	Internal	Intrazonal	Others
1 - 1,000	34	15	51
1,001 - 5,000	65	8	27
5,001 or more	88	3	9

8.2 Traffic Calculation

8.2.1 Local central office

Traffic on the side of subscribers of the exchange of local central offices is obtained as follows:

$$A_S = (C_{ORG} + C_{TER}) \times T$$

Where A_S : Subscriber total traffic.

C_{ORG} : Originating calling rate.

C_{TER} : Terminating calling rate; equal to C_{ORG} here.

T : Number of main lines.

On the other hand, traffic on the network side is obtained as follows:

$$A_N = A_S \times (P_L + P_T)$$

Where A_N : Traffic on network side
P_L : Rate of local traffic (excluding internal traffic.)
P_T : Rate of toll traffic.

Traffic between exchanges of local central offices is calculated on the basis of the affinity coefficients obtained from current traffic flow given in the measurement result. However, the traffic of Loria office is that which has been separated by affinity coefficients of a gravity model as it was not given in the measurement result. Table III−8−12 shows the result of the separation.

Table III−8−12 Estimated traffic matrix of multiple exchange area in 1986

(erl.)

To From	GRP	CRR	DOR	GDC	HPD	LAH	LRA	VLN	TOTAL (outgoing)
GRP	262	164	34	52	24	67	11	35	649
CRR	143	251	39	49	23	42	9	27	583
DOR	32	30	19	13	6	11	11	14	136
GDC	54	57	12	97	14	15	14	13	276
HPD	24	25	6	12	17	7	3	5	99
LAH	67	56	8	17	9	37	2	13	209
LRA	10	12	8	16	4	3	10	3	66
VLN	40	33	13	13	7	14	3	65	188
Total (incoming)	632	628	139	269	104	196	63	175	
(outgoing)	649	583	136	276	99	209	66	188	
Grand total	1,281	1,211	275	545	203	405	129	363	3,180

The affinity coefficient is expressed and applied as shown below.

Affinity coefficient

$$C(i,j) = \frac{1}{d^a(i,j)}$$

Where C (i, j) :Affinity coefficient between Exchange i and Exchange j.
d (i, j) :Distance between Exchange i and Exchange j.
a :Coefficient.

Inter-office traffic

$$f(i,j) = \frac{C(i,j) \times Di \times Dj}{\Sigma C(i,j) \times Dj}$$

Where f (i, j) :Traffic from Exchange i to Exchange j.
Di : Outgoing traffic from Exchange i.

Tables III-8-13 through III-8-15 show the traffic of individual exchanges in each phase estimated based on the aforementioned conditions and Tables III-8-16 through III-8-19 show the traffic in matrix.

Table III-8-13 Traffic in phase 1 (1/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local		Toll	Total
			Internal	Interzonal		
<MULTIPLE EXCHANGE AREA>						
General Paz	32,800	.11	721.6	884.0	198.4	1,804.0
El Correo	25,900	.11	569.8	698.0	156.7	1,424.5
Dorrego	3,891	.08	35.8	101.2	18.7	155.7
Godoy Cruz	13,800	.08	176.6	314.6	60.7	551.9
Hipodromo	3,800	.08	35.0	98.8	18.2	152.0
Las Heras	6,810	.08	62.7	177.1	32.7	272.5
Loria	1,946	.08	17.9	50.6	9.3	77.8
Villa Nueva	5,700	.08	52.4	148.2	27.4	228.0
Zonal total	94,647		1,671.8	2,472.5	522.1	4,666.4

Table III-8-13 Traffic in phase 1 (2/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local	Toll		Total
			Internal	Intrazonal	Others	
<USPALLATA>						
Uspallata	60	.06	0.6	0.0	1.2	1.8
Las Cuevas	0	.06	0.0	0.0	0.0	0.0
Zonal total	60		0.6	0.0	1.2	1.8
<LAVALLE>						
Lavalle	285	.06	2.9	1.3	4.4	8.6
Costa de Araujo	28	.06	0.3	0.1	0.4	0.8
Tres de Mayo	0	.06	0.0	0.0	0.0	0.0
Jocoli	0	.06	0.0	0.0	0.0	0.0
Nueva California	0	.06	0.0	0.0	0.0	0.0
Gustavo Andre	0	.06	0.0	0.0	0.0	0.0
El Pastal	0	.06	0.0	0.0	0.0	0.0
Zonal total	313		3.2	1.4	4.8	9.4
<RODEO DE LA CRUZ>						
Rodeo de la Cruz	760	.06	7.8	1.6	13.4	22.8
La Primavera	0	.06	0.0	0.0	0.0	0.0
Col. Segovia	0	.06	0.0	0.0	0.0	0.0
Peunde de Hierro	0	.06	0.0	0.0	0.0	0.0
Fray L. Beltran	190	.06	1.9	0.9	2.9	5.7
Rodeo del Medio	190	.06	1.9	0.9	2.9	5.7
Zonal total	1,140		11.6	3.4	19.2	34.2

Table III-8-13 Traffic in phase 1 (3/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local	Toll		Total
			Internal	Intrazonal	Others	
<MAIPU>						
Maipu	1,900	.06	37.0	0.5	19.5	57.0
Cruz de Piedra	104	.06	1.1	0.4	1.6	3.1
Zonal total	2,004		38.1	0.9	21.1	60.1
<LUJAN DE CUYO>						
Lujan de Cuyo	1,900	.06	37.1	4.5	15.4	57.0
Chacras de Coria	950	.06	9.6	4.4	14.6	28.5
Agrelo	28	.06	0.3	0.1	0.4	0.8
Potrerillos	28	.06	0.3	0.1	0.4	0.8
Ugarteche	0	.06	0.0	0.0	0.0	0.0
Blanco Encalada	0	.06	0.0	0.0	0.0	0.0
El Carrizal	0	.06	0.0	0.0	0.0	0.0
Zonal total	2,906		47.3	9.1	30.8	87.2
<TUNUYAN>						
Tunuyan	2,200	.08	57.2	9.9	20.9	88.0
Zapata	0	.06	0.0	0.0	0.0	0.0
San Pablo	0	.06	0.0	0.0	0.0	0.0
Eugenio B.	480	.06	4.9	2.2	7.3	14.4
La Consulta	1,500	.06	29.2	3.6	12.2	45.0
Campo L. Andes	(merged)					
Pareditas	28	.06	0.3	0.1	0.4	0.8
Chilecito	28	.06	0.3	0.1	0.4	0.8
Vista Flores	290	.06	3.0	1.3	4.4	8.7
Tupungato	570	.06	5.8	2.6	8.8	17.2
San Jose	0	.06	0.0	0.0	0.0	0.0
El Zampal	0	.06	0.0	0.0	0.0	0.0
Zonal total	5,096		100.7	19.8	54.4	174.9
<SAN MARTIN>						
San Martin	8,900	.10	391.7	9.1	44.3	445.1
Junin	1,000	.06	10.2	4.4	15.3	29.9
Medrano	210	.06	2.1	1.0	3.2	6.3
Reduccion	28	.06	0.3	0.1	0.4	0.8
Rodrigues P.	0	.06	0.0	0.0	0.0	0.0
La Dormida	290	.06	3.0	1.3	4.4	8.7
Santa Rosa	210	.06	2.1	1.0	3.2	6.3
Las Catitas	190	.06	1.9	0.9	2.9	5.7
Ing. Giagnoni	60	.06	0.6	0.3	0.9	1.8
Alto Verde	60	.06	0.6	0.3	0.9	1.8
Zonal total	10,948		412.5	18.4	75.5	506.4

Table III - 8 - 13 Traffic in phase 1 (4/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local	Toll		Total
			Internal	Intrazonal	Others	
<RIVADVIA>						
Rivadavia	1,330	.06	25.9	0.2	13.9	40.0
Philipps	0	.06	0.0	0.0	0.0	0.0
Campamentos	28	.06	0.3	0.1	0.4	0.8
La Central	0	.06	0.0	0.0	0.0	0.0
Zonal total	1,358		26.2	0.3	14.3	40.8
<PALMIRA>						
Palmira	950	.06	9.7	0.3	18.6	28.6
Chapanay	28	.06	0.3	0.1	0.4	0.8
Tres Portenas	28	.06	0.3	0.1	0.4	0.8
Zonal total	1,006		10.3	0.5	19.4	30.2
<LA PAZ>						
La Paz	800	.06	8.2	0.0	15.8	24.0
Desaguadero	0	.06	0.0	0.0	0.0	0.0
Zonal total	800		8.2	0.0	15.8	24.0
<SAN RAFAEL>						
San Rafael	11,000	.10	483.9	0.9	65.2	550.0
El Nihuil	9	.06	0.1	0.0	0.1	0.2
Goudge	9	.06	0.1	0.0	0.1	0.2
La Llave	38	.06	0.4	0.2	0.6	1.2
Las Malvinas	9	.06	0.1	0.0	0.1	0.2
Monte Coman	38	.06	0.4	0.2	0.6	1.2
Rama Caida	19	.06	0.2	0.1	0.3	0.6
Canada Seca	48	.06	0.5	0.3	0.7	1.5
25 de Mayo	28	.06	0.3	0.1	0.4	0.8
Cuadro Benegas	0	.06	0.0	0.0	0.0	0.0
Zonal total	11,198		486.0	1.8	68.1	555.9
<MALARGUE>						
Malargue	760	.06	7.8	0.0	15.1	22.9
El Sosneado	0	.06	0.0	0.0	0.0	0.0
El Chacay	0	.06	0.0	0.0	0.0	0.0
Zonal total	760		7.8	0.0	15.1	22.9

Table III-8-13 Traffic in phase 1 (5/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local	Toll		Total
			Internal	Intrazonal	Others	
<GENERAL ALVEAR>						
Gral. Alvear	4,000	.08	104.0	6.9	49.2	160.0
Bowen	610	.06	6.2	2.8	9.3	18.3
Carmenza	19	.06	0.2	0.1	0.3	0.6
Real del Padre	290	.06	3.0	1.3	4.4	8.7
Villa Atuael	530	.06	5.4	2.4	8.1	15.9
Jaime Prats	80	.06	0.8	0.4	1.2	2.4
Colonia Andes	0	.06	0.0	0.0	0.0	0.0
La Guevarina	0	.06	0.0	0.0	0.0	0.0
La Materrina	0	.06	0.0	0.0	0.0	0.0
Las Aguaditas	0	.06	0.0	0.0	0.0	0.0
Escandinava	0	.06	0.0	0.0	0.0	0.0
Zonal total	5,529		119.6	13.8	72.5	205.9

Table III-8-14 Traffic in phase 2 (1/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local		Toll	Total
			Internal	Intrazonal		
<MULTIPLE EXCHANGE AREA>						
General Paz	32,800	.11	576.3	1,029.3	198.4	1,804.0
El Correo	25,900	.11	455.9	811.9	156.7	1,424.5
Dorrego	10,000	.08	128.0	228.0	44.0	400.0
Godoy Cruz	25,000	.08	320.0	570.0	110.0	1,000.0
Hipodromo	11,000	.08	141.0	251.8	48.4	441.2
Las Heras	20,000	.08	256.0	454.0	88.0	798.7
Loria	9,000	.08	82.8	234.0	43.2	360.0
Villa Nueva	19,000	.08	243.2	433.2	83.6	760.0
Zonal total	152,700	256.7	2,203.9	4,012.2	772.3	6,988.4

Table III-8-14 Traffic in phase 2 (2/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local	Toll		Total
			Internal	Intrazonal	Others	
<USPALLATA>						
Uspallata	80	.06	0.8	0.0	1.6	2.4
Las Cuevas	0	.06	0.0	0.0	0.0	0.0
Zonal total	80		0.8	0.0	1.6	2.4
<LAVALLE>						
Lavalle	285	.06	2.9	1.3	4.4	8.6
Costa de Araujo	28	.06	0.3	0.1	0.4	0.8
Tres de Mayo	0	.06	0.0	0.0	0.0	0.0
Jocoli	0	.06	0.0	0.0	0.0	0.0
Nueva California	0	.06	0.0	0.0	0.0	0.0
Gustavo Andre	0	.06	0.0	0.0	0.0	0.0
El Pastal	0	.06	0.0	0.0	0.0	0.0
Zonal total	313		3.2	1.4	4.8	9.4
<RODEO DE LA CRUZ>						
Rodeo de la Cruz	760	.06	7.8	1.6	13.4	22.8
La Primavera	0	.06	0.0	0.0	0.0	0.0
Col. Segovia	0	.06	0.0	0.0	0.0	0.0
Peunde de Hierro	0	.06	0.0	0.0	0.0	0.0
Fray L. Beltran	190	.06	1.9	0.9	2.9	5.7
Rodeo del Medio	190	.06	1.9	0.9	2.9	5.7
Zonal total	1,140		11.6	3.4	19.2	34.2

Table III-8-14 Traffic in phase 2 (3/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local	Toll		Total
			Internal	Intrazonal	Others	
<MAIPU>						
Maipu	9,170	.06	403.5	0.0	55.0	458.5
Cruz de Piedra	(merged)					
Zonal total	9,170		403.5	0.0	55.0	458.5
<LUJAN DE CUYO>						
Lujan de Cuyo	6,000	.06	264.1	4.7	31.2	300.0
Chacras de Coria	950	.06	9.6	4.3	14.6	28.6
Agrelo	28	.06	0.3	0.1	0.4	0.8
Potrerillos	28	.06	0.3	0.1	0.4	0.8
Ugarteche	0	.06	0.0	0.0	0.0	0.0
Blanco Encalada	60	.06	0.6	0.3	0.9	1.8
El Carrizal	0	.06	0.0	0.0	0.0	0.0
Zonal total	7,066		274.9	9.6	47.5	332.0
<TUNUYAN>						
Tunuyan	2,200	.08	57.2	12.3	18.5	88.0
Zapata	0	.06	0.0	0.0	0.0	0.0
San Pablo	0	.06	0.0	0.0	0.0	0.0
Eugenio B.	480	.06	4.9	2.2	7.3	14.4
La Consulta	1,500	.06	29.2	3.6	12.2	45.0
Campo L. Andes	(merged)					
Pareditas	28	.06	0.3	0.1	0.4	0.8
Chilecito	28	.06	0.3	0.1	0.4	0.8
Vista Flores	290	.06	3.0	1.3	4.4	8.7
Tupungato	1,100	.06	11.2	4.9	17.0	33.1
San Jose	0	.06	0.0	0.0	0.0	0.0
El Zampal	0	.06	0.0	0.0	0.0	0.0
Zonal total	5,626		106.1	24.5	60.2	190.8
<SAN MARTIN>						
San Martin	8,900	.10	391.7	9.1	44.3	445.0
Junin	1,000	.06	10.2	4.4	15.3	29.9
Medrano	210	.06	2.1	1.0	3.2	6.3
Reduccion	28	.06	0.3	0.1	0.4	0.8
Rodrigues P.	0	.06	0.0	0.0	0.0	0.0
La Dormida	290	.06	3.0	1.3	4.4	8.7
Santa Rosa	210	.06	2.1	1.0	3.2	6.3
Las Catitas	190	.06	1.9	0.9	2.9	5.7
Ing. Giagnoni	60	.06	0.6	0.3	0.9	1.8
Alto Verde	60	.06	0.6	0.3	0.9	1.8
Zonal total	10,948		412.5	18.4	75.5	506.4

Table III – 8 – 14 Traffic in phase 2 (4/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local	Toll		Total
			Internal	Intrazonal	Others	
<RIVADVIA>						
Rivadavia	4,000	.06	104.0	0.2	55.9	160.1
Philipps	0	.06	0.0	0.0	0.0	0.0
Campamentos	28	.06	0.3	0.1	0.4	0.8
La Central	0	.06	0.0	0.0	0.0	0.0
Zonal total	4,028		104.3	0.3	56.3	160.9
<PALMIRA>						
Palmira	3,100	.08	80.5	1.2	42.3	124.0
Chapanay	28	.06	0.3	0.1	0.4	0.8
Tres Portenas	230	.06	2.4	1.0	3.5	6.9
Zonal total	3,358		83.2	2.3	46.2	131.7
<LA PAZ>						
La Paz	800	.06	8.2	0.0	15.8	24.0
Desaguadero	0	.06	0.0	0.0	0.0	0.0
Zonal total	800		8.2	0.0	15.8	24.0
<SAN RAFAEL>						
San Rafael	11,000	.10	483.9	2.5	63.6	550.0
El Nihuil	9	.06	0.1	0.0	0.1	0.2
Goudge	30	.06	0.3	0.1	0.5	0.9
La Llave	100	.06	1.1	0.4	1.5	3.0
Las Malvinas	9	.06	0.1	0.0	0.1	0.2
Monte Coman	200	.06	2.1	0.9	3.1	6.1
Rama Caida	19	.06	0.2	0.1	0.3	0.6
Canada Seca	150	.06	1.5	0.8	2.3	4.6
25 de Mayo	28	.06	0.3	0.1	0.4	0.8
Cuadro Benegas	0	.06	0.0	0.0	0.0	0.0
Zonal total	11,545		489.6	4.9	71.9	566.4
<MALARGUE>						
Malargue	2,000	.06	39.0	0.0	21.0	60.0
El Sosneado	0	.06	0.0	0.0	0.0	0.0
El Chacay	0	.06	0.0	0.0	0.0	0.0
Zonal total	2,000		39.0	0.0	21.0	60.0

Table III-8-14 Traffic in phase 2 (5/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local	Toll		Total
			Internal	Intrazonal	Others	
<GENERAL ALVEAR>						
Gral. Alvear	4,000	.08	104.0	7.3	48.7	160.0
Bowen	610	.06	6.2	2.8	9.3	18.3
Carmenza	19	.06	0.2	0.1	0.3	0.6
Real del Padre	290	.06	3.0	1.3	4.4	8.7
Villa Atuael	530	.06	5.4	2.4	8.1	15.9
Jaime Prats	100	.06	1.0	0.4	1.5	2.9
Colonia Andes	0	.06	0.0	0.0	0.0	0.0
La Guevarina	0	.06	0.0	0.0	0.0	0.0
La Materrina	0	.06	0.0	0.0	0.0	0.0
Las Aguaditas	0	.06	0.0	0.0	0.0	0.0
Escandinava	80	.06	0.8	0.4	1.3	2.5
Zonal total	5,629		120.6	14.7	73.6	208.8

Table III-8-15 Traffic in phase 3 (1/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local		Toll	Total
			Internal	Intrazonal		
<MULTIPLE EXCHANGE AREA>						
General Paz	50,200	.11	883.5	1,573.8	303.7	2,761.0
El Correo	39,700	.11	698.7	1,244.6	240.2	2,183.5
Dorrego	12,900	.08	165.1	294.1	56.8	516.0
Godoy Cruz	32,500	.08	416.0	741.0	143.0	1,300.0
Hipodromo	13,900	.08	177.9	316.9	61.2	556.0
Las Heras	29,000	.08	371.2	661.2	127.6	1,160.0
Loria	11,600	.08	148.5	264.5	51.0	464.0
Villa Nueva	28,100	.08	359.6	640.6	123.6	1,123.9
Zonal total	217,900		3,220.6	5,736.7	1,107.1	10,064.4

Table III-8-15 Traffic in phase 3 (2/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local	Toll		Total
			Internal	Intrazonal	Others	
<USPALLATA>						
Uspallata	100	.06	1.0	0.0	2.0	3.0
Las Cuevas	100	.06	1.0	0.0	2.0	3.0
Zonal total	200		2.0	0.0	4.0	6.0
<LAVALLE>						
Lavalle	480	.06	5.0	1.9	7.5	14.4
Costa de Araujo	130	.06	1.3	0.6	2.0	3.9
Tres de Mayo	100	.06	1.0	0.5	1.5	3.0
Jocoli	100	.06	1.0	0.5	1.5	3.0
Nueva California	100	.06	1.0	0.5	1.5	3.0
Gustavo Andre	100	.06	1.0	0.5	1.5	3.0
El Pastal	100	.06	1.0	0.5	1.5	3.0
Zonal total	1,110		11.3	5.0	17.0	33.3
<RODEO DE LA CRUZ>						
Rodeo de la Cruz	2,900	.08	75.4	9.6	31.0	116.0
La Primavera	100	.06	1.0	0.5	1.5	3.0
Col. Segovia	100	.06	1.0	0.5	1.5	3.0
Peunde de Hierro	100	.06	1.0	0.5	1.5	3.0
Fray L. Beltran	840	.06	8.6	3.7	12.9	25.2
Rodeo del Medio	1,000	.06	10.2	4.5	15.3	30.0
Zonal total	5,040		97.2	19.3	63.7	180.2

Table III-8-15 Traffic in phase 3 (3/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local	Toll		Total
			Internal	Intrazonal	Others	
<MAIPU>						
Maipu	11,350	.10	499.4	0.0	68.1	567.5
Cruz de Piedra	(merged)					
Zonal total	11,350		499.4	0.0	68.1	567.5
<LUJAN DE CUYO>						
Lujan de Cuyo	7,500	.10	330.0	13.7	31.3	375.0
Chacras de Coria	3,200	.08	83.2	10.0	34.3	127.5
Agrelo	100	.06	1.0	0.5	1.5	3.0
Potrerillos	260	.06	2.7	1.2	4.0	7.9
Ugarteche	100	.06	1.0	0.5	1.5	3.0
Blanco Encalada	100	.06	1.0	0.5	1.5	3.0
El Carrizal	100	.06	1.0	0.5	1.5	3.0
Zonal total	11,460		419.9	26.9	75.6	522.8
<TUNUYAN>						
Tunuyan	3,400	.08	88.5	19.3	28.2	136.0
Zapata	100	.06	1.0	0.5	1.5	3.0
San Pablo	100	.06	1.0	0.5	1.5	3.0
Eugenio B.	740	.06	7.5	3.3	11.3	22.1
La Consulta	2,390	.06	62.1	7.6	25.8	95.6
Campo L. Andes	(merged)					
Pareditas	160	.06	1.6	0.7	2.5	4.8
Chilecito	130	.06	1.3	0.6	2.0	3.9
Vista Flores	450	.06	4.6	2.0	6.9	13.5
Tupungato	1,400	.06	27.4	3.4	11.3	42.1
San Jose	100	.06	1.0	0.5	1.5	3.0
El Zampal	100	.06	1.0	0.5	1.5	3.0
Zonal total	9,070		197.0	38.9	94.1	330.0
<SAN MARTIN>						
San Martin	13,700	.10	602.8	11.6	70.6	685.0
Junin	1,600	.06	31.2	3.8	13.0	48.0
Medrano	320	.06	3.3	1.4	4.9	9.6
Reduccion	60	.06	0.6	0.3	0.9	1.8
Rodrigues P.	100	.06	1.0	0.5	1.5	3.0
La Dormida	450	.06	4.6	2.0	6.9	13.5
Santa Rosa	320	.06	3.3	1.4	4.9	9.6
Las Catitas	290	.06	3.0	1.3	4.4	8.7
Ing. Giagnoni	100	.06	1.0	0.5	1.5	3.0
Alto Verde	100	.06	1.0	0.5	1.5	3.0
Zonal total	17,040		651.8	23.3	110.1	785.2

Table III-8-15 Traffic in phase 3 (4/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local	Toll		Total
			Internal	Intrazonal	Others	
<RIVADVIA>						
Rivadavia	5,000	.08	130.1	1.2	68.7	200.0
Philipps	100	.06	1.0	0.5	1.5	3.0
Campamentos	100	.06	1.0	0.5	1.5	3.0
La Central	100	.06	1.0	0.5	1.5	3.0
Zonal total	5,300		133.1	2.7	73.2	209.0
<PALMIRA>						
Palmira	3,800	.08	98.8	1.6	51.7	152.1
Chapanay	60	.06	0.6	0.3	0.9	1.8
Tres Portenas	290	.06	3.0	1.3	4.4	8.7
Zonal total	4,150		102.4	3.2	57.0	162.6
<LA PAZ>						
La Paz	1,200	.06	23.4	0.4	12.2	36.0
Desaguadero	100	.06	1.0	0.5	1.5	3.0
Zonal total	1,300		24.4	0.9	13.7	39.0
<SAN RAFAEL>						
San Rafael	25,400	.10	1,117.7	4.9	147.5	1,270.1
El Nihuil	60	.06	0.6	0.3	0.9	1.8
Goudge	30	.06	0.3	0.1	0.5	0.9
La Llave	130	.06	1.3	0.6	2.0	3.9
Las Malvinas	30	.06	0.3	0.1	0.5	0.9
Monte Coman	360	.06	3.7	1.5	5.5	10.7
Rama Caida	100	.06	1.0	0.5	1.5	3.0
Canada Seca	190	.06	1.9	0.9	2.9	5.7
25 de Mayo	100	.06	1.0	0.5	1.5	3.0
Cuadro Benegas	100	.06	1.0	0.5	1.5	3.0
Zonal total	26,500		1,128.8	9.9	164.3	1,303.0
<MALARGUE>						
Malargue	3,100	.08	80.6	0.8	42.6	124.0
El Sosneado	100	.06	1.0	0.5	1.5	3.0
El Chacay	100	.06	1.0	0.5	1.5	3.0
Zonal total	3,300		82.6	1.8	45.6	130.0

Table III-8-15 Traffic in phase 3 (5/5)

<ZONE> Central office	Main lines	Calling rate (erl.)	Traffic (origination, in erl.)			
			Local	Toll		Total
			Internal	Intrazonal	Others	
<GENERAL ALVEAR>						
Gral. Alvear	6,100	.08	268.4	13.6	23.0	305.0
Bowen	940	.06	9.7	4.1	14.4	28.2
Carmenza	190	.06	1.9	0.9	2.9	5.7
Real del Padre	450	.06	4.6	2.0	6.9	13.5
Villa Atuael	810	.06	8.3	3.5	12.5	24.3
Jaime Prats	130	.06	1.3	0.6	2.0	3.9
Colonia Andes	100	.06	1.0	0.5	1.5	3.0
La Guevarina	100	.06	1.0	0.5	1.5	3.0
La Materrina	100	.06	1.0	0.5	1.5	3.0
Las Aguaditas	100	.06	1.0	0.5	1.5	3.0
Escandinava	100	.06	1.0	0.5	1.5	3.0
Zonal total	9,120		299.2	27.2	69.2	395.6

Table III - 8 - 16 Traffic matrix of multiple exchange area in phase 1

(erl.)

To From	GRP2	GRP3	GRP4	CRR2	CRR3	DOR	GDC1	GDC2	HPD	LAH	VLN1	CMZ	Total
GRP 2	68.5	33.2	119.4	58.7	93.3	11.9	32.6	10.9	11.9	34.9	20.4	63.1	558.8
3	33.2	16.6	59.6	28.4	45.2	5.8	15.8	5.2	5.8	16.8	9.9	30.6	272.9
4	119.4	59.6	212.5	102.2	162.5	20.7	56.4	18.8	20.7	60.7	35.6	110.0	979.1
CRR 2	58.7	28.4	102.2	86.7	135.5	10.8	24.5	8.1	9.2	18.3	12.5	61.1	556.0
3	93.3	45.2	162.5	135.5	212.0	17.0	38.2	12.7	14.4	28.5	19.6	95.6	874.5
DOR	11.9	5.8	20.7	10.8	17.0	35.8	10.0	3.3	3.7	7.9	10.2	18.7	155.8
GDC 1	32.6	15.8	56.4	24.5	38.2	10.0	99.4	33.1	14.9	27.8	16.0	45.5	414.2
2	10.9	5.2	18.8	8.1	12.7	3.3	33.1	11.0	4.9	9.2	5.3	15.2	137.7
HDP	11.9	5.8	20.7	9.2	14.4	3.7	14.9	4.9	35.0	8.2	5.4	18.2	152.3
LAH	34.9	16.8	60.7	18.3	28.5	7.9	27.8	9.2	8.2	83.4	13.7	42.0	351.4
VLN 1	20.4	9.9	35.6	12.5	19.6	10.2	16.0	5.3	5.4	13.7	52.4	27.4	228.4
CMZ	63.1	30.6	110.0	61.1	95.6	18.7	45.5	15.2	18.2	42.0	27.4		527.4
Total	558.8	272.9	979.1	556.0	874.5	155.8	414.2	137.7	152.3	351.4	228.4	527.4	5,208.5

Table III - 8 - 17 Traffic matrix of multiple exchange area in phase 2

(erl.)

To From	GRP2	GRP3	GRP4	CRR2	CRR3	DOR	GDC1	GDC2	HPD1	HPD2	LAH	LRA	VLN1	VLN2	CMZ	Total
GRP 2	51.9	25.2	96.7	36.7	63.3	18.1	19.8	30.8	7.0	13.8	58.6	16.9	12.9	30.1	61.0	542.8
3	25.2	12.2	46.9	17.8	30.7	8.8	9.6	14.9	3.5	6.7	28.4	8.2	6.3	14.6	29.5	263.3
4	96.7	46.9	180.0	68.3	117.8	33.7	36.9	57.3	13.6	25.7	109.0	31.4	24.0	56.1	113.5	1,010.9
CRR 2	36.7	17.8	68.3	61.4	105.9	20.9	18.7	29.1	7.1	13.5	37.0	13.7	9.9	23.2	57.6	520.8
3	63.3	30.7	117.8	105.9	182.7	36.0	32.3	50.2	12.3	23.2	63.9	23.6	17.1	39.9	99.4	898.3
DOR	18.1	8.8	33.7	20.9	36.0	128.0	10.9	17.0	4.1	8.0	21.4	10.8	11.5	26.9	44.0	400.1
GDC 1	19.8	9.6	36.9	18.7	32.3	10.9	49.1	76.2	6.4	12.3	19.9	32.0	7.2	16.8	43.1	391.2
2	30.8	14.9	57.3	29.1	50.2	17.0	76.2	118.4	10.2	19.2	30.9	49.8	11.2	26.2	66.9	608.3
HPD 1	7.0	3.5	13.6	7.1	12.3	4.1	6.4	10.2	16.8	31.9	8.1	5.9	2.4	5.7	16.6	151.6
2	13.8	6.7	25.7	13.5	23.2	8.0	12.3	19.2	31.9	60.4	15.4	11.3	4.6	10.8	31.4	288.2
LAH	58.6	28.4	109.0	37.0	63.9	21.4	19.9	30.9	8.1	15.4	256.0	10.3	16.0	37.5	88.0	800.4
LRA	16.9	8.2	31.4	13.7	23.6	10.8	32.0	49.8	5.9	11.3	10.3	83.0	6.5	15.2	43.0	361.6
VLN 1	12.9	6.3	24.0	9.9	17.1	11.5	7.2	11.2	2.4	4.6	16.0	6.5	21.9	51.0	25.2	227.7
2	30.1	14.6	56.1	23.2	39.9	26.9	16.8	26.2	5.7	10.8	37.5	15.2	51.0	119.0	58.8	531.8
CMZ	61.0	29.5	113.5	57.6	99.4	44.0	43.1	66.9	16.6	31.4	88.0	43.0	25.2	58.8		778.0
Total	542.8	263.3	1,010.9	520.8	898.3	400.1	391.2	608.3	151.6	288.2	800.4	361.6	227.7	531.8	778.0	7,775.0

Table III - 8 - 18 Traffic matrix of multiple exchange area in phase 3

(erl.)

To From	GRP4	GRP5	CRR3	DOR	GDC2	HPD2	LAH	LRA	VLN2	CMZ	Total
GRP 4	186.0	213.1	251.9	37.1	106.6	43.0	133.4	30.5	103.0	143.2	1,247.8
5	231.1	264.8	313.4	46.0	132.5	53.4	165.6	37.8	127.9	177.8	1,550.3
CRR 3	251.9	313.4	700.0	77.7	182.9	75.9	152.7	45.8	144.1	241.0	2,185.4
DOR	37.1	46.0	77.7	165.0	32.1	13.2	26.2	10.9	50.1	57.0	515.3
GDC 2	106.6	132.5	182.9	32.1	416.0	54.9	64.7	84.8	82.4	143.0	1,299.9
HPD 2	43.0	53.4	75.9	13.2	54.9	178.0	28.9	17.2	30.5	61.0	556.0
LAH	133.4	165.6	152.7	26.2	64.7	28.9	371.0	11.5	77.6	128.0	1,159.6
LRA	30.5	37.8	45.8	10.9	84.8	17.2	11.5	148.0	25.4	51.0	462.9
VLN 2	103.0	127.9	144.1	50.1	82.4	30.5	77.6	25.4	360.0	124.0	1,125.0
CMZ	143.2	177.8	241.0	57.0	143.0	61.0	128.0	51.0	124.0		1,126.0
Total	1,265.8	1,532.3	2,185.4	515.3	1,299.9	556.0	1,159.6	462.9	1,125.0	1,126.0	11,228.2

Table III-8-19 Traffic matrix of local exchanges in areas other than multiple exchange area

(erl.)

From \ To	Phase	USP	RDC	MAP	LDC	TUN	SMR	RIV	PAL	LPZ	SRA	MAL	GRA	CMZ	Total
USP	1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	1.2	1.2
	2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	1.6	1.6
	3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	2.0	2.0
RDC	1	.0	.0	.6	.8	.7	1.5	.1	.5	.2	.3	.1	.3	14.1	19.2
	2	.0	.0	1.1	.8	.5	.6	.4	1.0	.1	.2	.1	.2	14.2	19.2
	3	.0	.0	2.8	3.1	1.6	2.4	1.1	2.8	.2	2.0	.4	.3	47.0	63.7
MAP	1	.0	.6	.0	1.3	.8	1.6	.1	.2	.2	.3	.1	.4	15.5	21.1
	2	.0	1.1	.0	3.9	1.9	2.3	1.5	1.4	.4	.9	.3	.9	40.4	55.0
	3	.0	2.8	.0	4.7	1.9	2.6	1.4	1.1	.2	2.3	.5	.4	50.2	68.1
LDC	1	.0	.8	1.3	.0	1.7	2.1	.2	.3	.3	.7	.2	.7	22.5	30.8
	2	.0	.8	3.9	.0	2.1	1.4	1.2	1.0	.3	.8	.3	.8	34.9	47.5
	3	.0	3.1	4.7	.0	3.0	2.4	1.6	1.2	.3	3.1	.7	.5	56.9	77.5
TUN	1	.0	.7	.8	1.7	.0	3.2	.3	.3	.7	3.2	.6	2.9	40.0	54.4
	2	.0	.5	1.9	2.1	.0	1.8	1.4	.8	.6	3.3	.9	2.7	44.2	60.2
	3	.0	1.6	1.9	3.0	.0	2.5	1.7	.8	.5	10.0	1.8	1.4	68.9	94.1
SMR	1	.0	1.5	1.6	2.0	3.2	.0	2.3	3.2	1.6	1.8	.5	2.1	55.7	75.5
	2	.0	.6	2.3	1.4	1.8	.0	5.8	4.8	.8	1.1	.4	1.1	55.4	75.5
	3	.0	2.4	2.6	2.4	2.5	.0	7.7	5.6	.7	3.8	.9	.6	80.9	110.1
RIV	1	.0	.1	.1	.2	.3	2.3	.0	.2	.2	.2	.0	.2	10.5	14.3
	2	.0	.4	1.5	1.2	1.4	5.8	.0	2.0	.6	.9	.3	.9	41.3	56.3
	3	.0	1.1	1.4	1.6	1.7	7.7	.0	1.9	.5	2.5	.6	.4	53.8	73.2
PAL	1	.0	.5	.2	.3	.3	3.2	.2	.0	.1	.1	.0	.2	14.3	19.4
	2	.0	1.0	1.4	1.0	.8	4.8	1.9	.0	.3	.4	.1	.4	34.1	46.2
	3	.0	2.8	1.1	1.2	.8	5.6	1.9	.0	.2	1.1	.2	.2	41.9	57.0
LPZ	1	.0	.2	.2	.3	.7	1.6	.2	.1	.0	.4	.2	.5	11.4	15.8
	2	.0	.1	.4	.3	.6	.8	.6	.3	.0	.3	.2	.4	11.8	15.8
	3	.0	.2	.2	.3	.5	.7	.5	.2	.0	.6	.3	.1	10.1	13.7
SRA	1	.0	.3	.4	.7	3.2	1.9	.2	.2	.4	.0	.7	10.4	49.7	68.1
	2	.0	.1	.4	.3	.6	.8	.6	.3	.0	.3	1.0	10.1	57.4	71.9
	3	.0	2.0	2.3	3.1	9.9	3.8	2.5	1.1	.6	.0	4.9	12.7	121.4	164.3
MAL	1	.0	.1	.1	.2	.6	.5	.0	.0	.2	.7	.0	1.6	11.1	15.1
	2	.0	.1	.3	.3	.9	.4	.3	.2	.3	1.0	.0	2.0	15.2	21.0
	3	.0	.4	.5	.7	1.8	.9	.6	.3	.3	5.0	.0	1.7	33.4	45.6
GRA	1	.0	.3	.4	.7	3.0	2.1	.2	.2	.5	10.4	1.6	.0	53.1	72.5
	2	.0	.2	.9	.8	2.7	1.1	.9	.4	.4	10.1	2.0	.0	54.1	73.6
	3	.0	.3	.4	.5	1.4	.7	.4	.2	.1	13.2	1.8	.0	50.2	69.2
CMZ	1	1.9	14.1	15.5	22.5	40.0	55.7	10.5	14.3	11.4	49.7	11.1	53.1		
	2	1.9	14.2	40.4	34.9	44.2	55.4	41.3	34.1	11.8	57.4	15.2	54.1		
	3	2.0	47.0	50.2	56.9	68.9	80.9	53.8	41.9	10.1	121.4	33.4	50.2		
Total	1	1.2	19.2	21.2	30.7	54.5	75.7	14.3	19.5	15.8	67.6	15.1	72.4	299.1	407.4
	2	1.6	19.1	54.5	47.0	57.5	75.2	55.9	46.3	15.6	76.7	20.8	73.6	404.5	543.7
	3	2.0	63.7	68.1	77.5	94.0	110.2	73.2	57.1	13.7	165.0	45.5	68.5	616.6	838.4

8.2.2 Toll central office

Traffic of an exchange of toll central office A_T is obtained as follows:

$$A_T = (A_S \times P_T) + T_T$$

Where T_T :Interprovincial traffic.

Interprovincial traffic is estimated by means of percentages of traffic of the toll exchange in General Paz in 1986 on the supposition that the traffic would increase at approximately the same rate as the intraprovincial traffic. It is calculated, for each phase, by multiplying the total traffic amount of the toll exchange by the percentages of the interprovincial traffic in 1986, while the total traffic is calculated by dividing the total of intraprovincial traffic of each phase by its percentages in 1986. The percentages for 1986 read 32% for the interprovincial and 68% for the intraprovincial.

Table III−8−20 shows the result of the forecast on the traffic of the toll exchange.

Table III-8-20 Traffic of Mendoza toll exchange (1/2)

(erl.)

Destination	Phase	A/D	Traffic
Local exchanges in MEA	1	A	493
		D	562
	2	A	466
		D	1,090
	3	A	0
		D	2,252
Local exchanges in areas other than MEA	1	A	307
		D	510
	2	A	99
		D	989
	3	A	0
		D	1,677
Other provinces	1	A	375
		D	504
	2	A	266
		D	978
	3	A	0
		D	1,849
Total	1	A	1,175
		D	1,576
	2	A	831
		D	3,057
	3	A	0
		D	5,778

Remarks:
A: Analogue
D: Digital
MEA: Multiple exchange area

Table III-8-20 Traffic of Mendoza toll exchange (2/2)

(erl.)

Section	Phase	Traffic
Analogue - Digital	1	121
	2	60
	3	0

8.3 Circuit Calculation

Based on the estimated traffic, the circuit calculation is conducted using Erlang's B formula with the loss probability described in Section 4.1.1. Direct toll trunks between digital exchanges are calculated according to the following empirical criteria. It is essential to find the diverging point based on cost comparison of each section on the occasion of implementation.

<Criteria for setting>

$y < 8$ erl. : No direct circuits.

8 erl. $< y < 50$ erl. : High usage direct circuits.

50 erl. $< y$: Final circuits.

Where y is the traffic of one way of the route.

Calculation result for Mendoza multiple exchange area is shown in Tables III−8−21 through III−8−23, that for areas other than Mendoza multiple exchange area is shown in Table III−8−24, and that for the toll exchange is shown Table III−8−25.

Table III - 8 - 21　Junction and trunk circuits of multiple exchange area in phase 1

(outgoing + incoming)

To / From	GRP2	GRP3	GRP4	CRR2	CRR3	DOR	GDC1	GDC2	HPD	LAH	VLN	CMZ
GRP 2		86	266	140	212	38	82	36	38	90	58	156
3			142	76	112	22	48	22	22	50	34	84
4				230	341	52	136	48	58	135	90	242
CRR 2					298	36	66	28	32	52	40	152
3						44	96	34	44	68	56	212
DOR							34	12	18	24	34	50
GDC 1								86	44	74	48	118
2									20	27	22	42
HPD										28	22	52
LAH											42	98
VLN 1												74
CMZ												

Table III - 8 - 22 Junction and trunk circuits of multiple exchange area in phase 2

(outgoing + incoming)

To / From	GRP2	GRP3	CRP4	CRR2	CRR3	DOR	GDC1	GDC2	HPD1	HPD2	LAH	LRA	VLN1	VLN2	CMZ
GRP 2		68	220	94	150	52	56	80	26	42	140	50	40	80	152
3			116	52	80	30	32	46	16	26	76	28	24	44	82
4				160	250	79	94	128	42	62	233	74	66	125	249
CRR 2					238	58	54	76	26	42	94	42	34	64	138
3						84	86	113	38	57	141	58	50	92	220
DOR							34	44	18	23	53	30	38	65	105
GDC 1								184	24	38	56	84	26	50	108
2									17	48	77	117	36	66	153
HPD 1										82	28	24	14	22	52
2											40	31	20	30	74
LAH												29	48	87	197
LRA													24	40	56
VLN 1														124	72
2															136
CMZ															

Table III-8-23 Junction and trunk circuits of multiple exchgnage area in phase 3

(outgoing + incoming)

To From	GRP4	GRP5	CRR3	DOR	GDC2	HPD2	LAH	LRA	VLN2	CNZ
GRP 4		443	521	86	228	57	282	72	221	310
5			635	105	280	120	346	88	271	382
CRR 3				169	382	166	321	104	304	512
DOR					76	35	63	30	113	127
GDC 2						123	143	184	179	310
HPD 2							69	44	72	140
LAH								32	169	279
LRA									62	119
VLN 2										271
CMZ										

Table III-8-24 Trunk circuits (other than multiple exchange area) (1/13)

ZONE: Uspallata

<HOST> Central office	Phase	Main lines	Sys.	Trunk circuits from/to (O/G + I/C)	
				<Host>	<CMZ>
<General Paz>					
Uspallata	1	60	M		10
	2	80	M		12
	3	100	S	100	
Las Cuevas	1	0	-		
	2	0	-		
	3	100	S	100	
Zonal total	1	60			10
	2	80			12
	3	200		200	

Table III-8-24 Trunk circuits (other than multiple exchange area) (2/13)

ZONE: Lavalle

<HOST> Central office	Phase	Main lines	Sys.	Trunk circuits from/to (O/G + I/C)	
				<Host>	<CMZ>
<General Paz>					
Lavalle	1	285	A		24
	2	285	A		24
	3	480	D	40	
Costa d. Araujo	1	28	M	8	
	2	28	M	8	
	3	130	R	15	
Tres de Mayo	1	0	-		
	2	0	-		
	3	100	R	13	
Jocoli	1	0	-		
	2	0	-		
	3	100	R	13	
Nueva Califor.	1	0	-		
	2	0	-		
	3	100	R	13	
Gustavo Andre	1	0	-		
	2	0	-		
	3	100	R	13	
El Pastal	1	0	-		
	2	0	-		
	3	100	R	13	
Zonal total	1	313		8	24
	2	313		8	24
	3	1,110		120	

Table III-8-24 Trunk circuits (other than multiple exchange area) (3/13)

ZONE: Rodeo de la Cruz

<HOST> Central office	Phase	Main lines	Sys.	Trunk circuits from/to (O/G + I/C)	
				<Host>	<CMZ>
<RODEO DE LA CRUZ>					
Rodeo d. Cruz	1	760	A		48
	2	760	A		48
	3	2,900	D		146
La Primavera	1	0	-		
	2	0	-		
	3	100	R	13	
Col. Segovia	1	0	-		
	2	0	-		
	3	100	R	13	
Puente d. Hierr	1	0	-		
	2	0	-		
	3	100	R	13	
Fray L. Beltran	1	190	A		20
	2	190	A		20
	3	840	R	64	
Rodeo d. Medio	1	190	A		20
	2	190	A		20
	3	1,000	R	75	
Zonal total	1	1,140			88
	2	1,140			88
	3	5,040		178	146

Table III-8-24 Trunk circuits (other than multiple exchange area) (4/13)

ZONE: Maipu

<HOST> Central office	Phase	Main lines	Sys.	Trunk circuits from/to (O/G + I/C)	
				<Host>	<CMZ>
<MAIPU>					
Maipu	1	1,900	A		63
	2	9,170	D		127
	3	11,350	D		155
Cruz d. Piedra	1	104	M	14	
	2	0	-		
	3	0	-		
Zonal total	1	2,004		14	63
	2	9,170			127
	3	11,350			155

Table III-8-24 Trunk circuits (other than multiple exchange area) (5/13)

ZONE: Lujan de Cuyo

<HOST> Central office	Phase	Main lines	Sys.	Trunk circuits from/to (O/G + I/C)	
				<Host>	<CMZ>
<LUJAN DE CUYO>					
Lujan d. Cuyo	1	1,900	A		84
	2	6,000	D		112
	3	7,500	D		172
Chacras d. Cor	1	950	A		58
	2	950	A		58
	3	3,200	R	382	
Agrelo	1	28	M	8	
	2	28	M	8	
	3	100	R	13	
Potrerillos	1	28	M	8	
	2	28	M	8	
	3	260	R	13	
Ugarteche	1	0	-		
	2	0	-		
	3	100	R	13	
Blanco Encal.	1	0	-		
	2	60	R	9	
	3	100	R	13	
El Carrizal	1	0	-		
	2	0	-		
	3	100	R	13	
Zonal total	1	2,906		16	142
	2	7,066		25	170
	3	11,360		447	172

Table III-8-24 Trunk circuits (other than multiple exchange area) (6/13)

ZONE: Tunuyan

<HOST> Central office	Phase	Main lines	Sys.	Trunk circuits from/to (O/G + I/C)		
				<Host>	<CMZ>	<SRA>
<TUNYAN>						
Tunuyan	1	2,200	D		56	
	2	2,200	D		136	
	3	3,400	D		209	20
Zapata	1	0	-			
	2	0	-			
	3	100	R	13		
San Pablo	1	0	-			
	2	0	-			
	3	100	R	13		
Eugenio Bustos	1	480	R	40		
	2	480	R	40		
	3	740	R	58		
La Consulta	1	1,500	R	107		
	2	1,500	R	107		
	3	2,390	R	212		
Campo L.Andes	1	0	-			
	2	0	-			
	3	0	-			
Pareditas	1	28	M	8		
	2	28	M	8		
	3	160	R	17		
Chilecito	1	28	M	8		
	2	28	M	8		
	3	130	R	15		
Vista Flores	1	290	R	27		
	2	290	R	27		
	3	450	R	38		
Tupungato	1	570	A		40	
	2	1,100	R	81		
	3	1,400	R	100		
San Jose	1	0	-			
	2	0	-			
	3	100	R	13		
El Zampal	1	0	-			
	2	0	-			
	3	100	R	13		
Zonal total	1	5,096		190	96	
	2	5,626		271	136	
	3	9,070		492	209	20

Table III-8-24 Trunk circuits (other than multiple exchange area) (7/13)

ZONE: San Martin

<HOST> Central office	Phase	Main lines	Sys.	Trunk circuits from/to (O/G + I/C)	
				<Host>	<CMZ>
<SAN MARTIN>					
San Martin	1	8,900	D		171
	2	8,900	D		171
	3	13,700	D		240
Junin	1	1,000	R	75	
	2	1,000	R	75	
	3	1,600	R	113	
Medrano	1	210	R	13	
	2	210	R	13	
	3	320	R	29	
Reduccion	1	28	M	8	
	2	28	M	8	
	3	60	S	60	
Rodrigues Pena	1	0	-		
	2	0	-		
	3	100	R	13	
La Dormida	1	290	R	27	
	2	290	R	27	
	3	450	R	38	
Santa Rosa	1	210	R	21	
	2	210	R	21	
	3	320	R	29	
Las Catitas	1	190	R	20	
	2	190	R	20	
	3	290	R	27	
Ing. Giagnoni	1	60	R	9	
	2	60	R	9	
	3	100	R	13	
Alto Verde	1	60	R	9	
	2	60	R	9	
	3	100	R	13	
Zonal total	1	10,948		182	171
	2	10,948		182	171
	3	17,040		335	240

Table III-8-24 Trunk circuits (other than multiple exchange area) (8/13)

ZONE: Rivadavia

<HOST> Central office	Phase	Main lines	Sys.	Trunk circuits from/to (O/G + I/C)	
				<Host>	<CMZ>
<RIVADAVIA>					
Rivadavia	1	1,330	A		46
	2	4,000	D		130
	3	5,000	D		166
Philipps	1	0	-		
	2	0	-		
	3	100	R	13	
Campamentos	1	28	M	8	
	2	28	M	8	
	3	100	R	13	
La Central	1	0	-		
	2	0	-		
	3	100	R	13	
Zonal total	1	1,358		8	46
	2	4,028		8	130
	3	5,300		39	166

Table III-8-24 Trunk circuits (other than multiple exchange area) (9/13)

ZONE: Palmira

<HOST> Central office	Phase	Main lines	Sys.	Trunk circuits from/to (O/G + I/C)	
				<Host>	<CMZ>
<PALMIRA>					
Palmira	1	950	A		58
	2	3,100	D		109
	3	3,800	D		132
Chapanay	1	28	M	8	
	2	28	M	8	
	3	60	S	60	
Tres Portenas	1	28	R	8	
	2	230	R	23	
	3	290	R	27	
Zonal total	1	1,006		16	58
	2	3,358		31	109
	3	4,150		87	132

Table III - 8 - 24 Trunk circuits (other than multiple exchange area) (10/13)

ZONE: La Paz

<HOST> Central office	Phase	Main. lines	Sys.	Trunk circuits from/to (O/G + I/C)	
				<Host>	<CMZ>
<LA PAZ>					
La paz	1	800	D		43
	2	800	D		43
	3	1,200	D		39
Desaguadero	1	0	-		
	2	0	-		
	3	100	R	13	
Zonal total	1	800			43
	2	800			43
	3	1,300		13	39

Table III - 8 - 24 Trunk circuits (other than multiple exchange area) (11/13)

ZONE: San Rafael

<HOST> Central office	Phase	Main lines	Sys.	Trunk circuits from/to (O/G + I/C)			
				<Host>	<CMZ>	<GRA>	<TUN>
<SAN RAFAEL> San Rafael	1	11,000	D		146	21	
	2	11,000	D		160	21	
	3	25,400	D		355	27	20
El Nihuil	1	9	A	8			
	2	9	A	8			
	3	60	S	60			
Goudge	1	9	A	8			
	2	30	S	30			
	3	30	S	30			
La Llave	1	38	A	14			
	2	100	R	13			
	3	130	R	15			
Las Malvinas	1	9	A	8			
	2	9	A	8			
	3	30	S	30			
Monte Coman	1	38	A	14			
	2	200	R	21			
	3	360	R	32			
Rama Caida	1	19	A	10			
	2	19	A	10			
	3	100	R	13			
Canada Seca	1	48	A	10			
	2	150	R	17			
	3	190	R	20			
25 de Mayo	1	28	M	8			
	2	28	M	8			
	3	100	R	13			
Cuadro Benegas	1	0	-				
	2	0	-				
	3	100	R	13			
Zonal total	1	11,198		80	146	21	
	2	11,545		115	160	21	
	3	26,500		226	355	27	20

Table III-8-24 Trunk circuits (other than multiple exchange area) (12/13)

ZONE: Malargue

<HOST> Central office	Phase	Main lines	Sys.	Trunk circuits from/to (O/G + I/C)	
				<Host>	<CMZ>
<MALARGUE>					
Malargue	1	760	A		48
	2	2,000	D		55
	3	3,100	D		108
El Sosneado	1	0	-		
	2	0	-		
	3	100	R	13	
El Cachay	1	0	-		
	2	0	-		
	3	100	R	13	
Zonal total	1	760			48
	2	2,000			55
	3	3,300		26	108

Table III-8-24 Trunk circuits (other than multiple exchange area) (13/13)

ZONE: General Alvear

<HOST> Central office	Phase	Main lines	Sys.	Trunk circuits from/to (O/G + I/C)		
				<Host>	<CMZ>	<SRA>
<GENERAL ALVEAR>						
Gral. Alvear	1	4,000	D		156	21
	2	4,000	D		156	21
	3	6,100	D		142	27
Bowen	1	610	R	49		
	2	610	R	49		
	3	940	R	71		
Carmenza	1	19	M	6		
	2	19	M	6		
	3	190	R	20		
Real d. Padre	1	290	R	27		
	2	290	R	27		
	3	450	R	38		
Villa Atuel	1	530	R	44		
	2	530	R	44		
	3	810	R	62		
Jaime Prats	1	80	M	12		
	2	100	R	13		
	3	130	R	15		
Col. Andes	1	0	-			
	2	0	-			
	3	100	R	13		
La Guevarina	1	0	-			
	2	0	-			
	3	100	R	13		
La Materrina	1	0	-			
	2	0	-			
	3	100	R	13		
Las Aguaditas	1	0	-			
	2	0	-			
	3	100	R	13		
Escandinava	1	0	-			
	2	80	R	11		
	3	100	R	13		
Zonal total	1	5,529		138	156	21
	2	5,629		150	156	21
	3	9,120		271	142	27

Note: A : Automatic analogue exchange.
D : Automatic digital exchange.
M: Manual exchange.
R : Automatic remote digital exchange.
S : Remote line multiplexer.

Table III-8-25 Trunk circuits of Mendoza toll exchange (1/2)

Destination	Phase	A/D	Circuit
Local exchanges in MEA	1	A	636
		D	644
	2	A	604
		D	1,190
	3	A	
		D	2,450
Local exchanges in areas other than MEA	1	A	520
		D	572
	2	A	182
		D	1,199
	3	A	
		D	1,885
Other provinces	1	A	496
		D	586
	2	A	362
		D	1,081
	3	A	
		D	1,994
Total	1	A	1,636
		D	1,792
	2	A	1,444
		D	3,457
	3	A	
		D	6,301

Remarks: A : Analogue.
D : Digital.
MEA: Multiple exchange area

Table III-8-25 Trunk circuits of Mendoza toll exchang (2/2)

Section	Phase	Circuits
Analoge - digital	1	152
	2	82
	3	0

CHAPTER 9 TRANSMISSION ROUTING AND CIRCUIT GROUPING

In the transmission planning, the routes and capacities of transmission systems to be installed should be decided. To calculate the capacity of each transmission section, the circuits are assigned to a corresponding route and bundled into an appropriate hierarchy. These procedures should be conducted according to the following directions:

(1) Technical conditions, cost, reliability, environmental conditions and existing transmission facilities should be taken into account.

(2) The circuits between central offices described in Section 8.4 are concentrated in units of 2 Mb/s as the interface rate with the digital switching equipment. However, to accommodate traffic fluctuation and the demand for data communications, additional circuits equivalent to 10% of the estimated values will be added in the unit of 2 Mb/s for the following transmission lines.

- Transmission lines between the Mendoza toll office and such host central offices as Rodeo de la Cruz, Palmira, San Martin, Rivadavia, La Paz, Maipu, Lujan de Cuyo, Tunuyan, San Rafael, General Alvear, and Malargue
- Transmission lines within the multiple exchange area
- Interprovincial transmission lines

The results of the transmission routing and the circuit grouping based on the above mentioned directions are indicated in Fig. III−9−1 for the toll transmission lines and interprovincial lines and in Fig. III−9−2 for the Mendoza multiple exchange area.

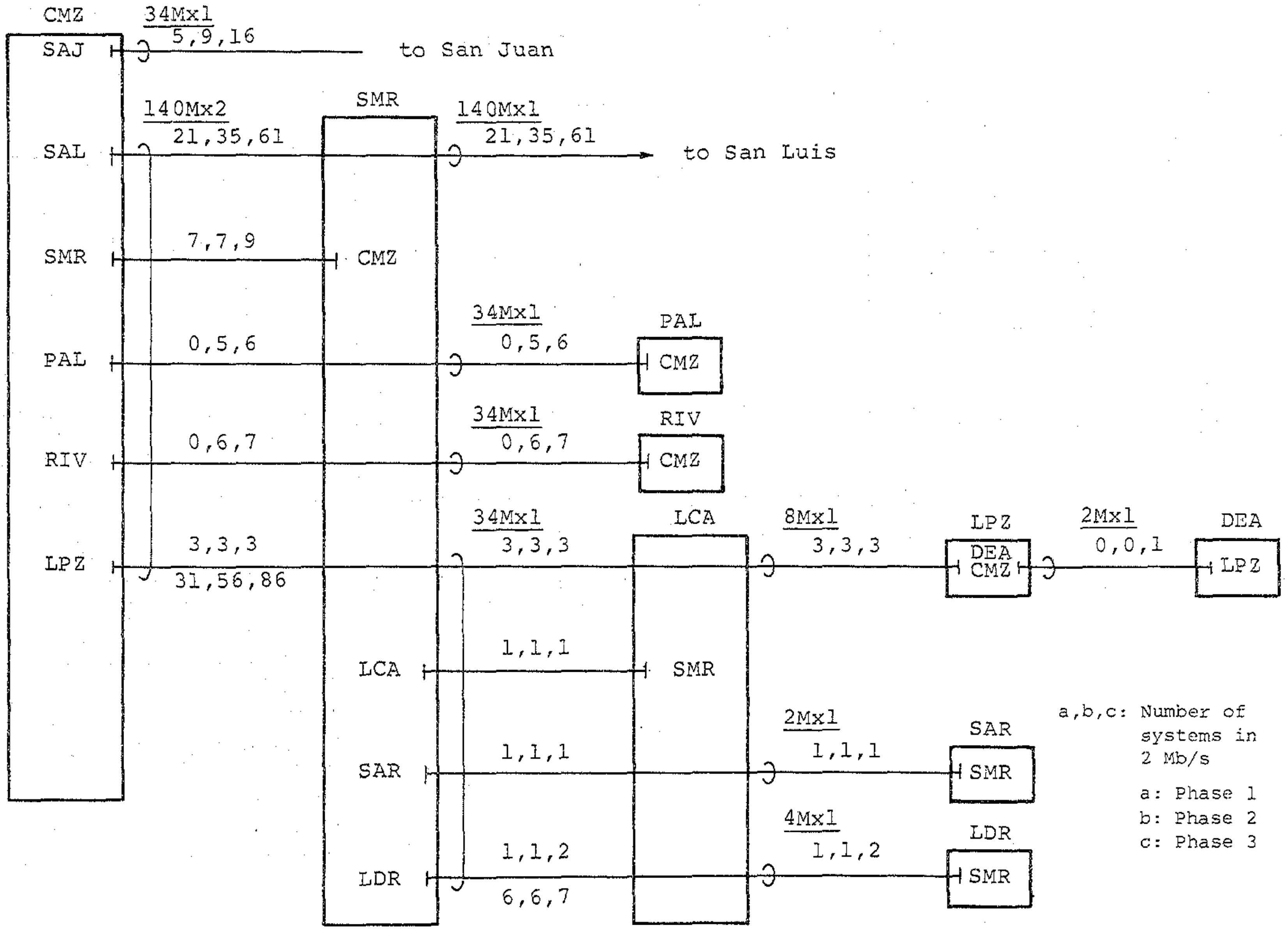


Fig. III – 9 – 1 Circuit grouping diagram (1/9)

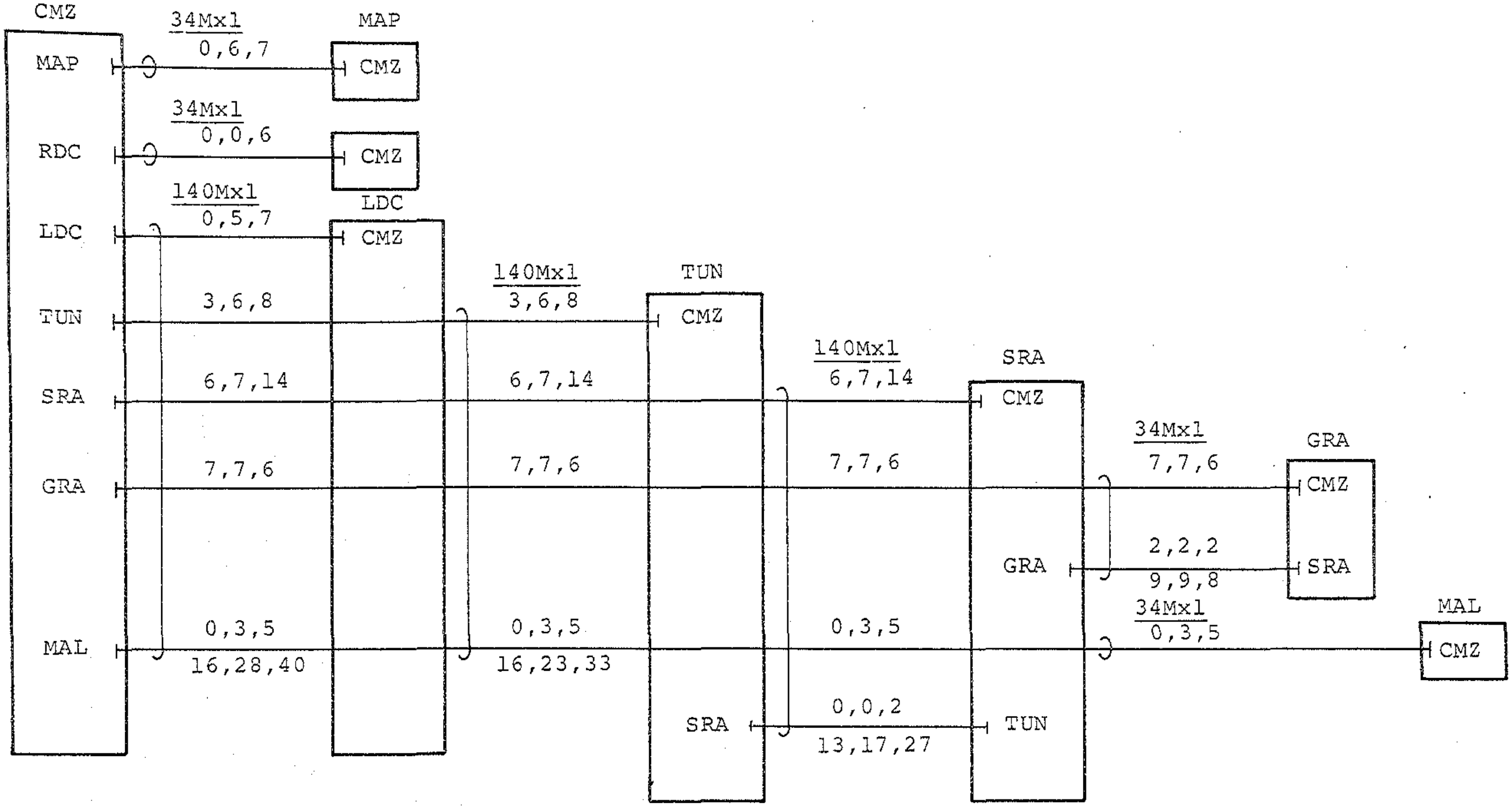


Fig. III – 9 – 1 Circuit grouping diagram (2/9)

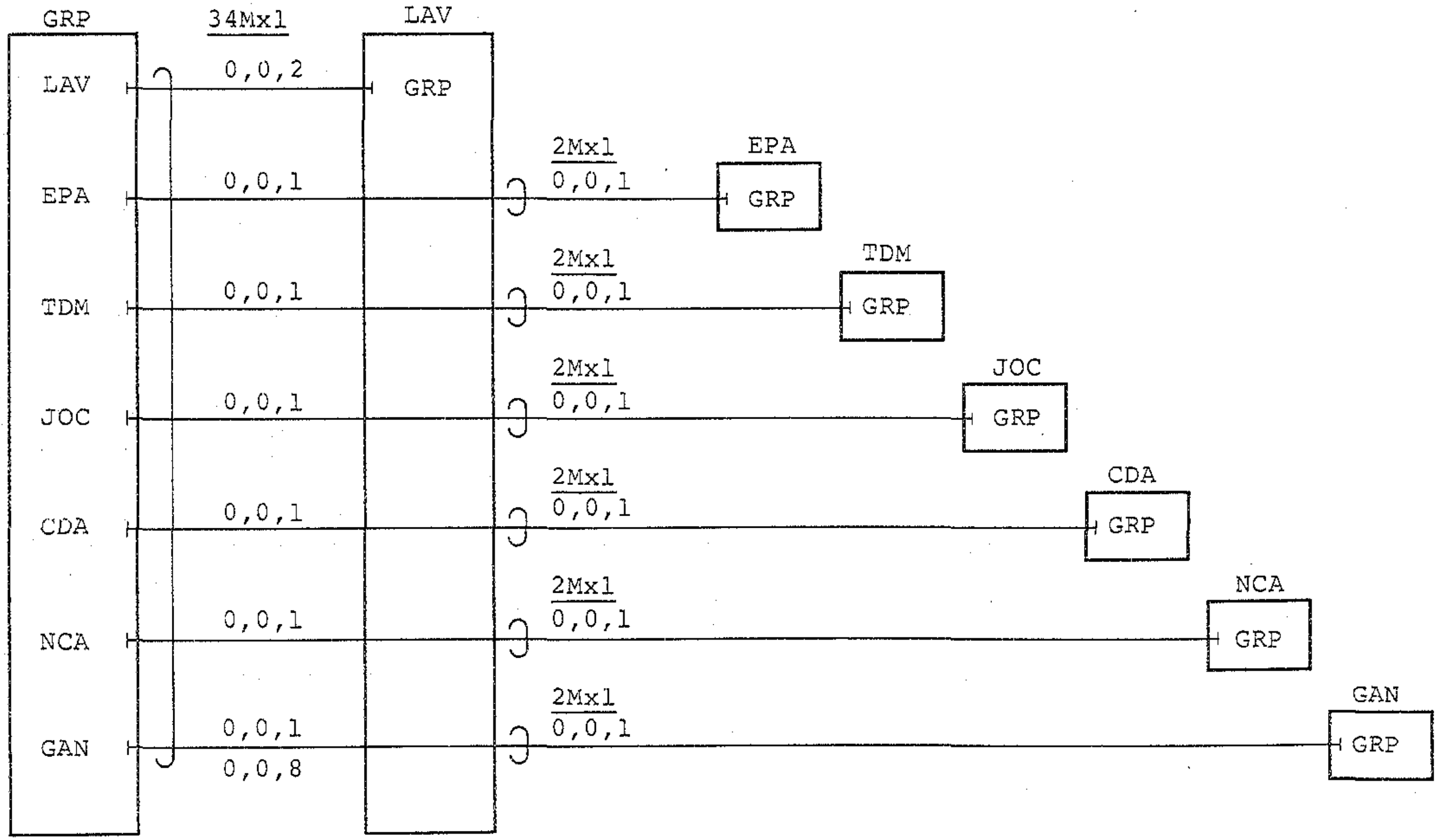


Fig. III – 9 – 1 Circuit grouping diagram (3/9)

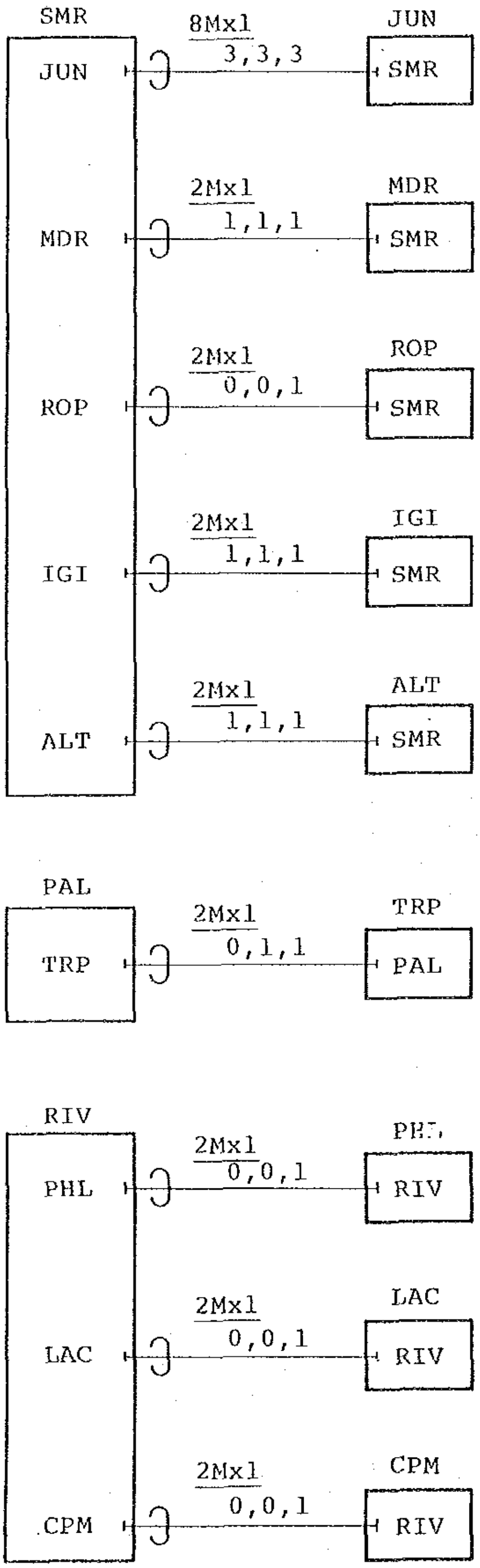


Fig. III – 9 – 1 Circuit grouping diagram (4/9)

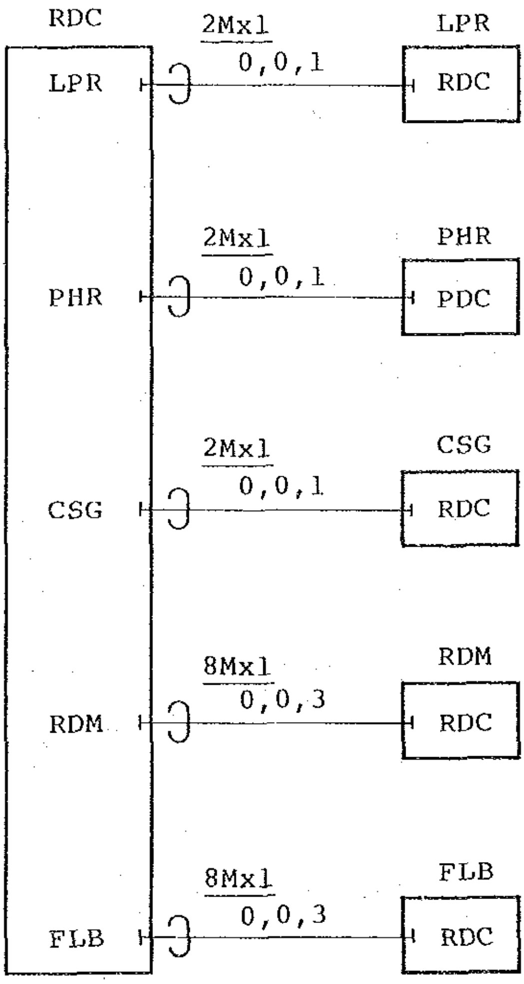


Fig. III-9-1 Circuit grouping diagram (5/9)

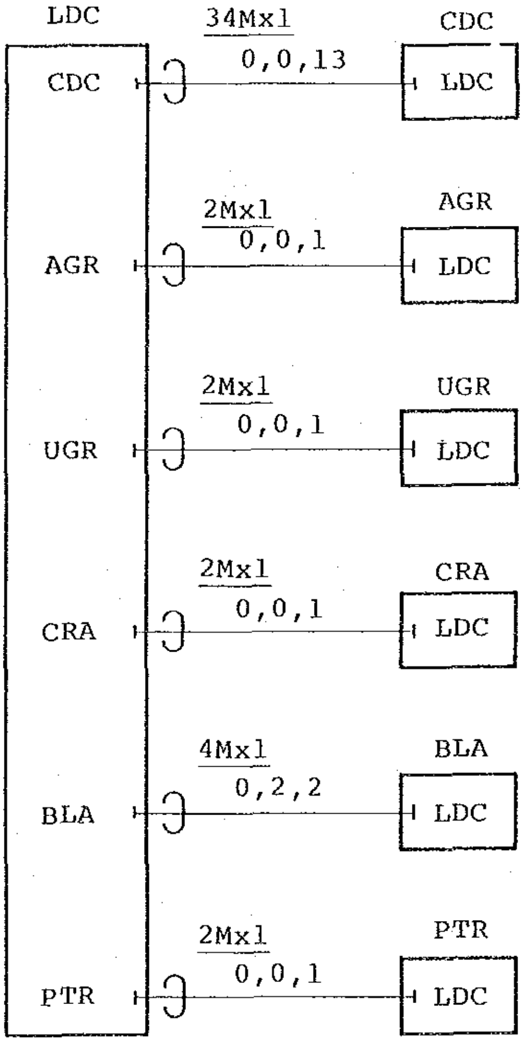


Fig. III – 9 – 1 Circuit grouping diagram (6/9)

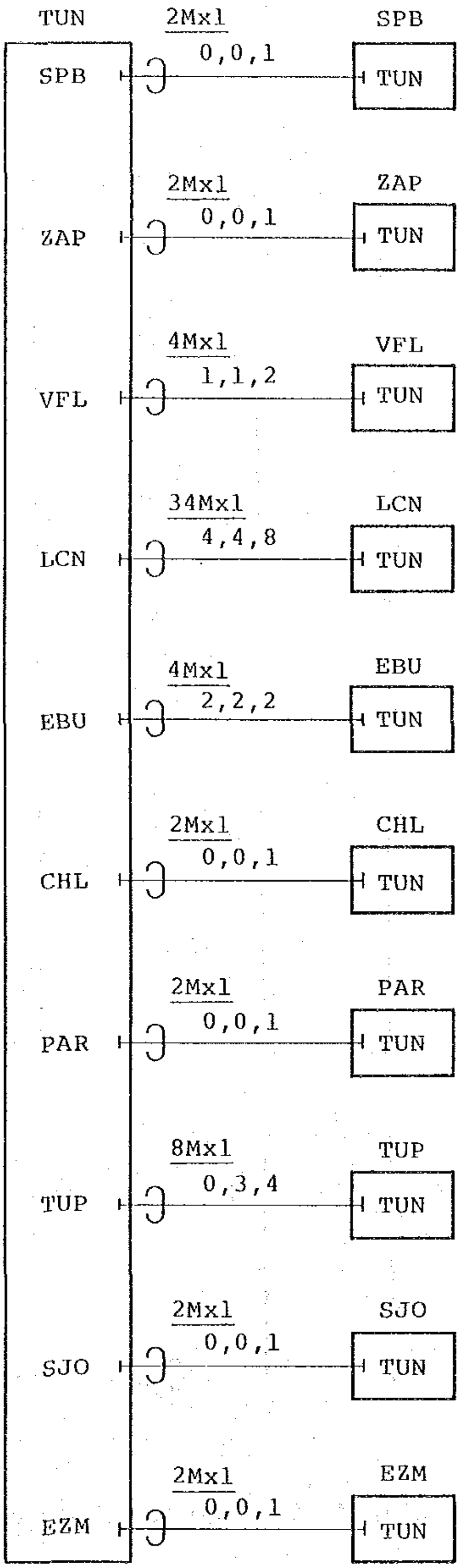


Fig. III – 9 – 1 Circuit grouping diagram (7/9)

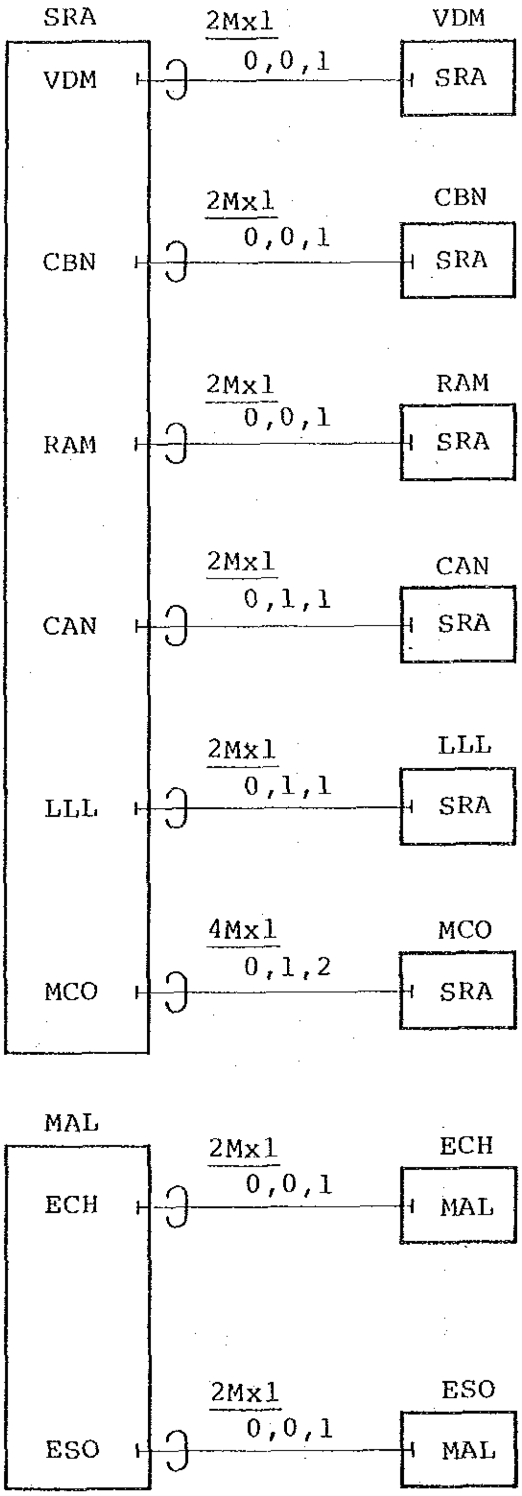


Fig. III – 9 – 1 Circuit grouping diagram (8/9)

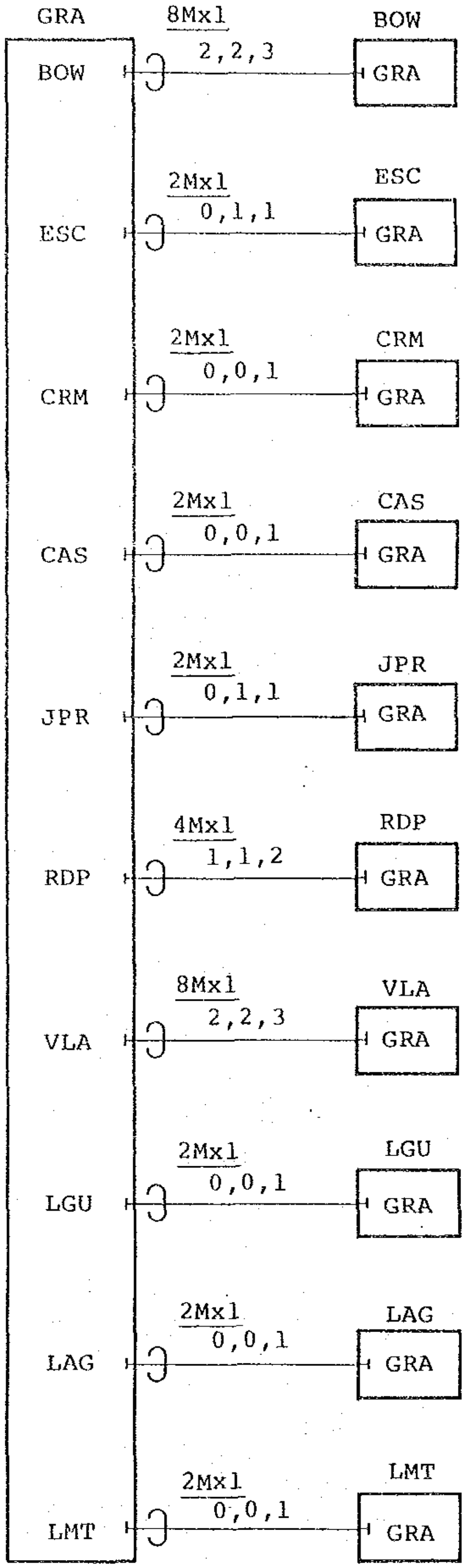


Fig. III – 9 – 1 Circuit grouping diagram (9/9)

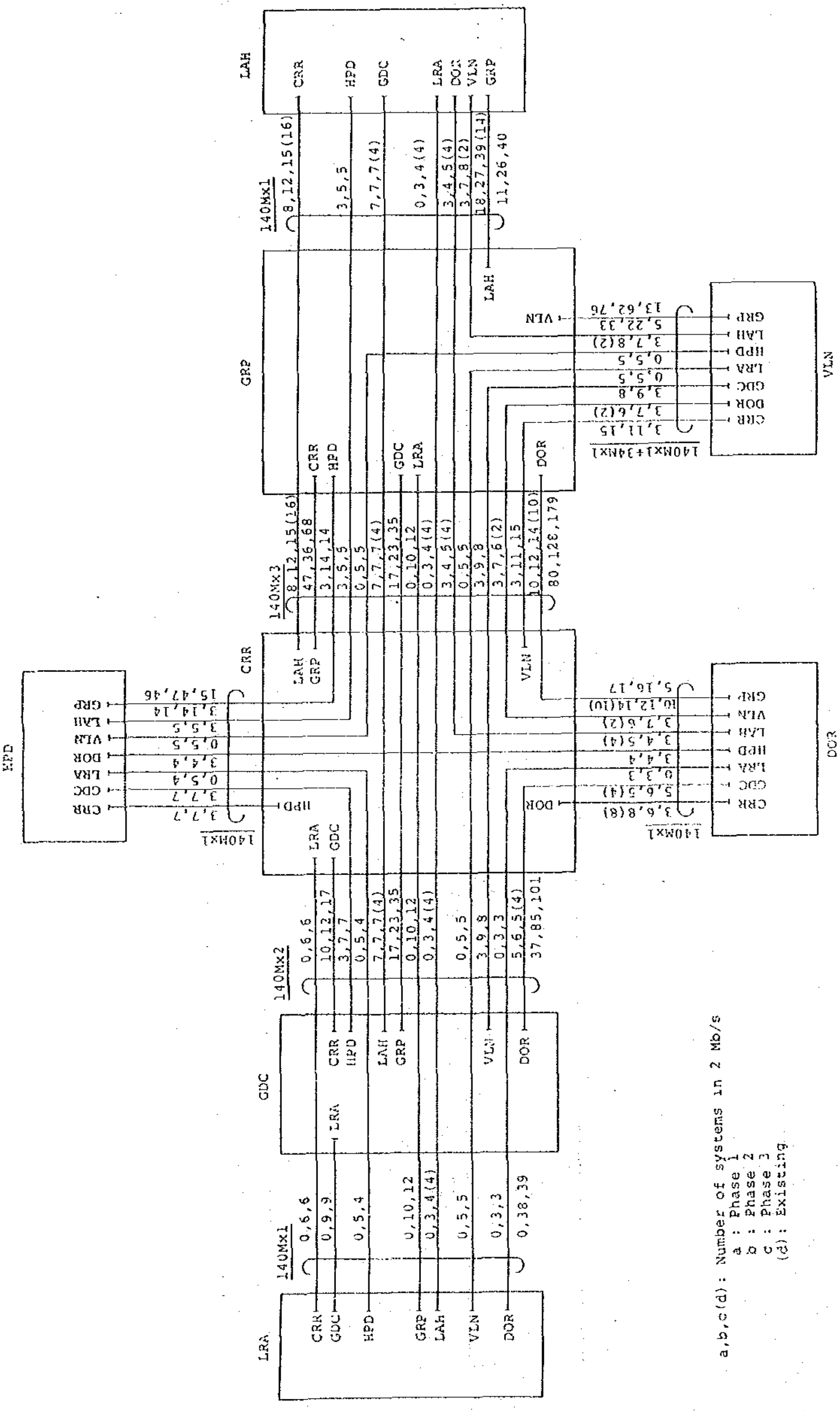


Fig. III – 9 – 2 Circuit grouping diagram (Multiple exchange area)

CHAPTER 10 INSTALLATION PLAN

10.1 Fundamentals for Installation Plan

10.1.1 Public telephone

(1) All public telephone sets should be of the type allowing toll dialling.

(2) All existing public telephone sets (881 sets as of 1986) should be replaced within the development plan period.

(3) In view of use in the nighttime, they are planned on assumption of outdoor installation. In actual installation, however, installation form should be selected in view of the circumstances of the location and use patterns.

10.1.2 Rural telephone

The object area for rural telephone service is outside the service area of central offices by subscriber cable, namely the areas more than 5km away from any central offices.

It is assumed that the demand for the rural telephone is not included in the demand of the multiple exchange area, and it is equally distributed in that of central offices of other areas.

Introduction of rural telephone service is timed so as to follow the period of telephone service automatization in urban areas. The service is expanded to keep abreast of the demand increase in the future.

With regard to Centro de Poblacion at 63 places as indicated by the Communications Director's Office of the province of Mendoza, the rural telephone service is actively provided to every place indicated.

10.1.3 Telephone exchange

(1) Exchanges are expanded corresponding with the foregoing telephone demand fulfillment plan.

(2) The exchanges to be purchased hereafter are to be digital, for the future introduction of new services. All the exchanges are planned to be digital by the end of this development plan.

(3) The exchange is designed in principle to be of a size that completely satisfies the demand at the end of the phase of introduction on the occasion of the replacement or inauguration. Power equipment capacity is determined to correspond with the capacity of the exchange.

(4) The order of exchange replacement is determined on the basis of economy and subscriber service improvement.

The main steps during phase 1 are ;

1)Fulfilling demand in the central part of the multiple exchange area of Gran Mendoza.

2)Fulfilling demand as well as replacing step-by-step and analogue crossbar exchange in major cities.

3)Fulfilling demand as well as replacing relatively large size manual exchanges.

The main steps during phase 2 are ;

1)Fulfilling demand in the rest of the multiple exchange area of Gran Mendoza.

2)Fulfilling demand as well as replacing analogue crossbar exchange in remaining major cities.

3)Fulfilling demand as well as replacing medium size manual exchanges.

The main steps during phase 3 are exchange expansion, replacement and inauguration to completely meet the plan to fulfill demand. Regarding service areas of existing public telephone service stations (cabinas publicas), most of them will be provided with automatic telephone service by introduction of remote exchanges or remote line multiplexers during this phase. As a result, all such areas will be provided with automatic service by the end of phase 3.

(5) Crossbar exchanges removed during phase 1 are to be partially used again, i.e., 200 terminals of Eugenio Bustos are to be transferred to Lavalle and 1,400 terminals of Tunuyan to Godoy Cruz.

10.1.4 Subscriber line

For subscriber lines exceeding 1,000, the flexible network is used for cable distribution, and the rigid network for subscriber lines less than 1,000.

In the flexible network, the capacity of the main cable linking the cabinet to the MDF is 1.1 times the target fulfilment value. The capacity of the distribution cable linking the cabinet to the subscriber's lead–in point is 1.3 times the main cable at the cabinet. The main cable is accommodated into the cable conduit. The distribution cable is generally laid with the aerial cable system, and for business and shopping districts where large demand is expected, the underground conduit system is adopted. Length of the provision period for both the main and distribution cables is five years.

In the rigid network, cable distribution is made directly from the central office with the distribution cable. Length of the provision period is five years, the same as for the flexible network.

In anticipation of the future increase of digital signal transmission over the subscriber line, jelly filled foamed plastic insulated cable is used for the main cable because of its high frequency characteristics with minimal crosstalk, transmission loss and failures. Cable conductor joints is made with wire connectors. Plastic insulated cable is used for the distribution cable, to match characteristics with the main cable.

To prevent the failure from increasing, improve the service and enhance labor–saving in maintenance work, cables over 30 years old are wholly replaced.

10.1.5 Junction circuit

(1) For the junction circuit to be constructed in the future, an optical fiber transmission system will be introduced to cope economically with network digitalization and large demand for the circuit.

(2) In phases 1 and 2, analogue and digital switching equipments coexist. If one switching equipment is digitalized, the analogue switching equipment on the other side carries out A/D conversion for connection to the digital switching equipment through the digital transmission line.

(3) Existing analogue circuits will remain as they are, without increasing the capacity.

(4) Existing 2M b/s and 8 Mb/s PCM transmission lines will remain in service until phase 3 in order to establish a 2–route system with the newly built transmission line.

(5) In principle, the number of optical fiber cable cores will match the number of systems of transmission facilities (including spare transmission line).
However, the design period should not be shorter than five years.

(6) Cables are wholly accommodated into the existing cable conduit lines.

10.2 Subscriber Telephone

This section deals with the installation plan of subscriber stations inside and outside the cable service areas.

The number of subscriber stations to be installed according to the fulfilment plan is as shown in Table III–10–1.

Table III-10-1 Subscriber telephone installation plan

Unit: Thousand lines

	Phase 1	Phase 2	Phase 3	Total
Subscriber telephone inside the cable service areas	54.2	74.9	105.5	234.6
Subscriber telephone outside the cable service areas	0.6	0.3	0.6	1.5
Total	54.8	75.2	106.1	236.1

10.3 Public Telephone

This section deals with the installation plan of public telephones inside and outside the cable service areas.

The number of public telephones to be installed according to the fulfilment plan is as shown in Table III-10-2.

Table III-10-2 Public telephone installation plan

Unit: Thousand lines

	Phase 1	Phase 2	Phase 3	Total
Public telephone inside the cable service areas	1.3	1.3	1.3	3.9
Public telephone outside the cable service areas	0.2	0.1	0.2	0.5
Total	1.5	1.4	1.5	4.4

10.4 Rural Telephone

While central offices are to be built according to the telephone exchange allocation plan, the object areas for the rural telephone service are outside the cable service area of the central offices, namely the areas more than 5km away from the central offices. Since subscriber's cable alone dose not warrant sufficient service quality due to the long distance from the central office, facilities using cable carrier or radio technology would be required.

The rural telephone service is provided with subscriber line multiplex system and/or multiple access subscriber radio system (MAS). The former system is advantageously applied when subscribers are comparatively concentrated and form groups, while the latter system is effective when subscribers are scattered over a wide area.

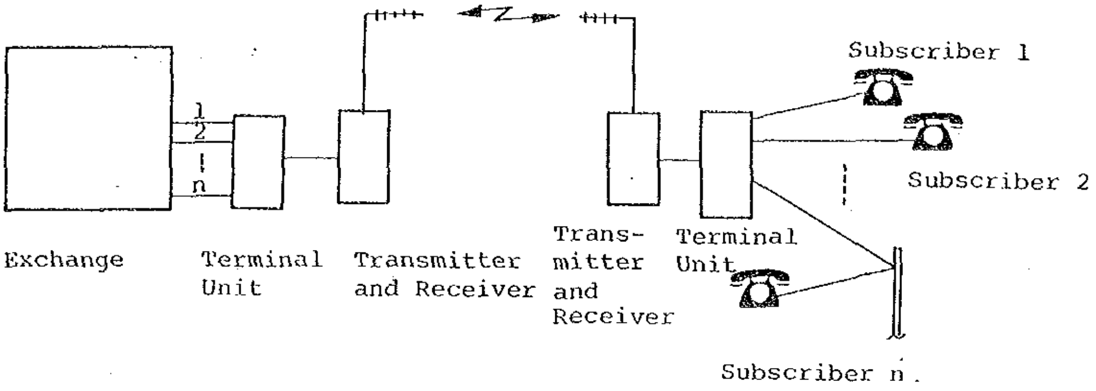
As in the case of the exchanges installation plan, every facility to be newly constructed uses digital technology. This also applies to the rural telephone service facilities, which are newly constructed during this plan period, with an eye to the future technological trends and interface with the exchanges.

The MAS system must depend on radio technology. While the subscriber line multiplex system applies radio or cable carrier technology. As the subscriber line multiplex system is designed for a small capacity service accommodating only some scores of subscribers and the cable carrier system requires to install new cable lines, from the economical point of view, the radio system is more advantageous to cover distances over 5km. Therefore, the subscriber line multiplex system utilizes the radio system throughout.

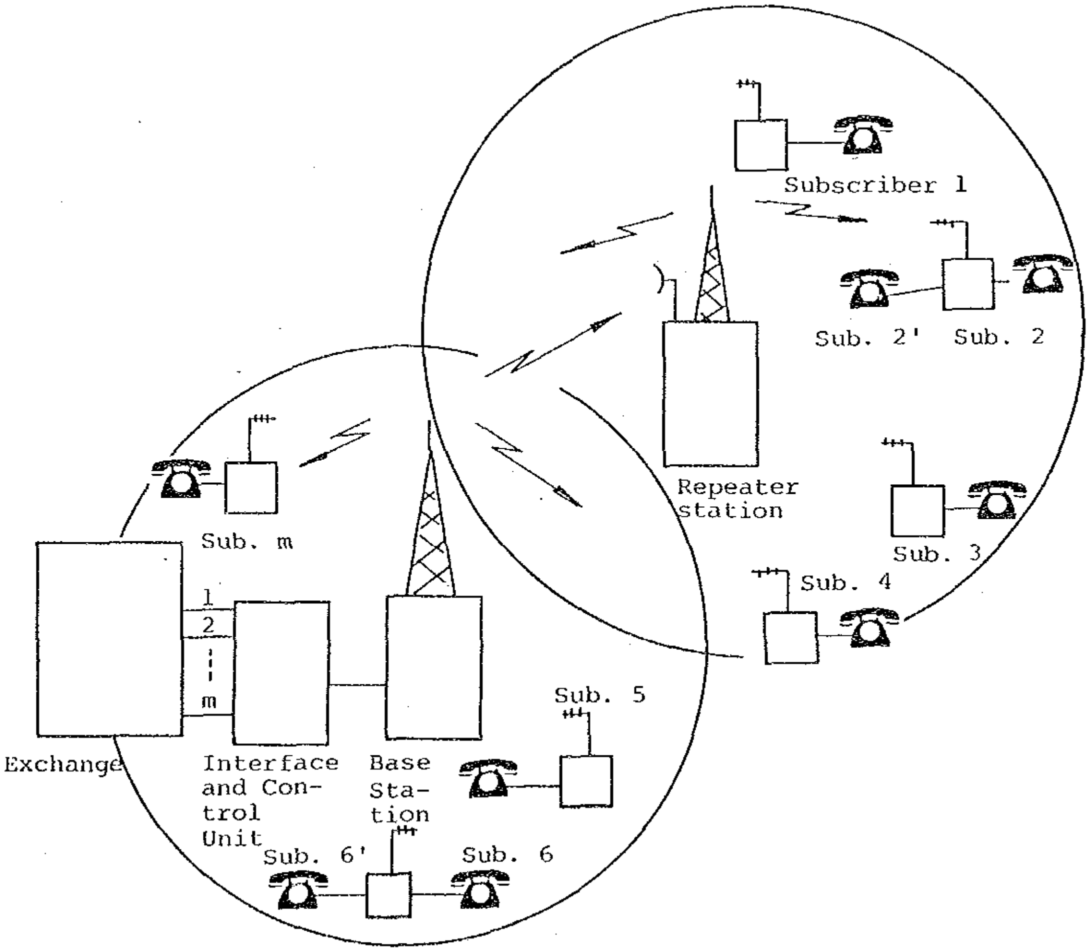
Fig. III-10-1 shows the basic configuration of the two rural telephone systems.

With regard to the accommodation ratio for the subscriber line multiplex system and the MAS system, although it is difficult to accurately grasp demand distribution in the rural telephone service object areas, some cities with comparatively large exchanges, such as Lujan de Cuyo, Maipu, San Martin and San Rafael, include comparatively densely populated areas in the rural telephone service object areas. For those cities having cocentrated demand for rural telephone service, the accommodation ratio for the subscriber line multiplex system is estimated at 50%, and for other cities, at 25%.

Under the condition that investment in the rural telephone service remain 10% of the total amount of investment in the telecommunications division, the construction of 2,000 new rural telephone lines is the limit, and these are constructed following the automatization of the exchanges.



(a) Subscriber line multiplex system



(b) MAS system

Fig. III-10-1 Rural telephone systems

Thus, for the whole province, approximately 800 subscribers are accommodated in the subscriber line multiplex system, and approximately 1,200 subscribers in the MAS system.

Since commercial power is available in most rural areas, the solar battery system is considered for merely 10% of the subscribers accommodated in the MAS system.

Fig. III–10–2 shows the location of base stations and repeater stations of the MAS system and the outline of the size of area covered by the respective stations, and Table III–10–3 shows the installation plan.

With regard to Centro de Poblacion at 63 places as designated by the Communications Director's Office of the province of Mendoza, the rural telephone service is actively provided to all the designated places. Of the 63 places, 38 are located within the area projected for coverage with the aforementioned MAS system, and those places are able to receive the telephone service accordingly. For the remaining 25 places, appliying the MAS system would pose economic problems, so some other economical system must be mapped out. Since those 25 places are located along the province border areas, 200 to 400km from Mendoza, there may be no alternative but to resort to the radio system using HF band. Consequently, the existing HF band radio facilities are to be updated so that a two–way radio telephone service can be put into practices.

Fig. III–10–3 shows a conceptual diagram of the radio telephone system by HF band.

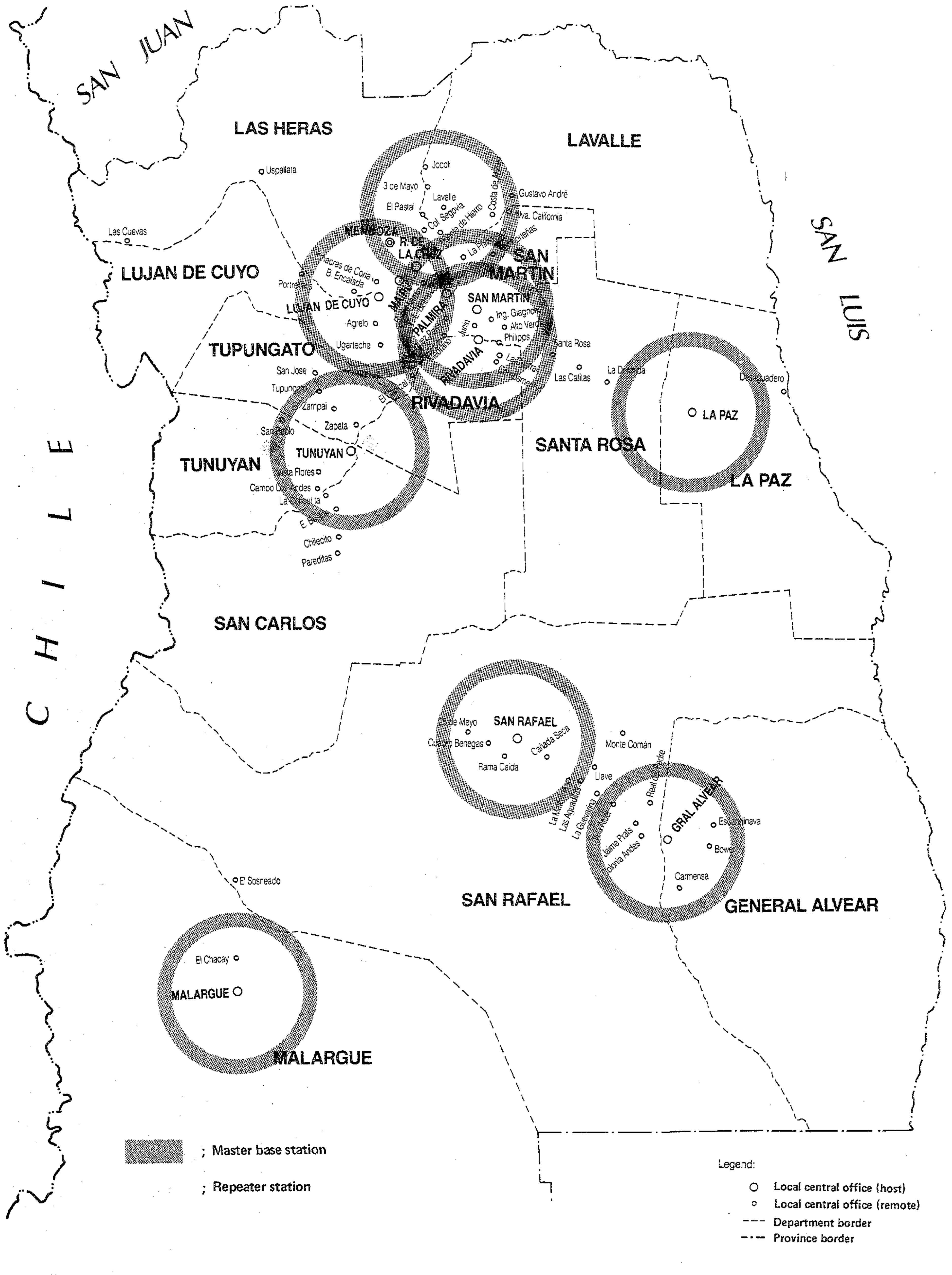
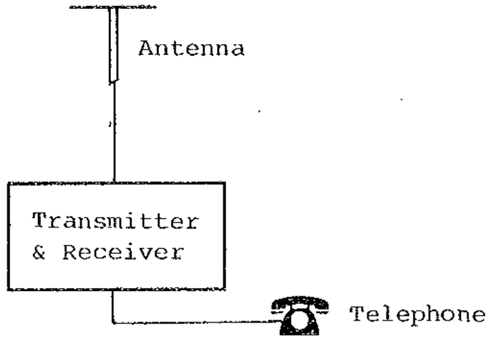


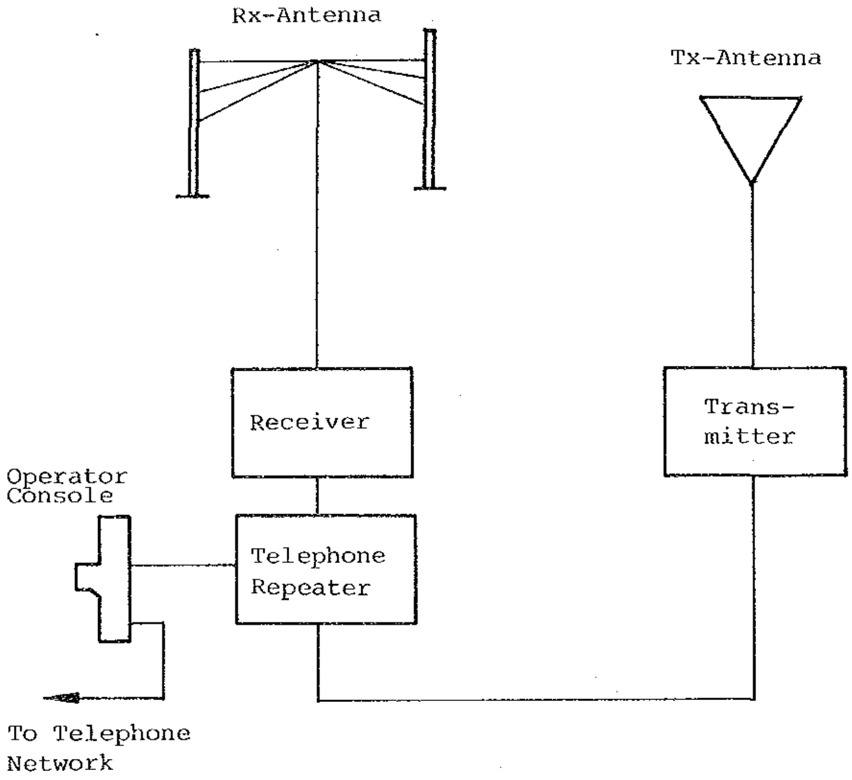
Fig. III – 10 – 2 Rural telephone system (MAS)

Table III-10-3 Installation plan of the rural telephone

Rural system	Equipment	Number of equipment		
		Phase 1	Phase 2	Phase 3
MAS radio system	Base station	4	1	4
	Repeater station	1		3
	Subscriber unit	500	200	500
Subscriber line multiplex system	System	13	8	13
	Subscriber unit	300	200	300
HF band radio telephone system	Main station		1	
	Remote station		13	12



Remote station



Main station

Fig. III-10-3 HF band radio telephone system