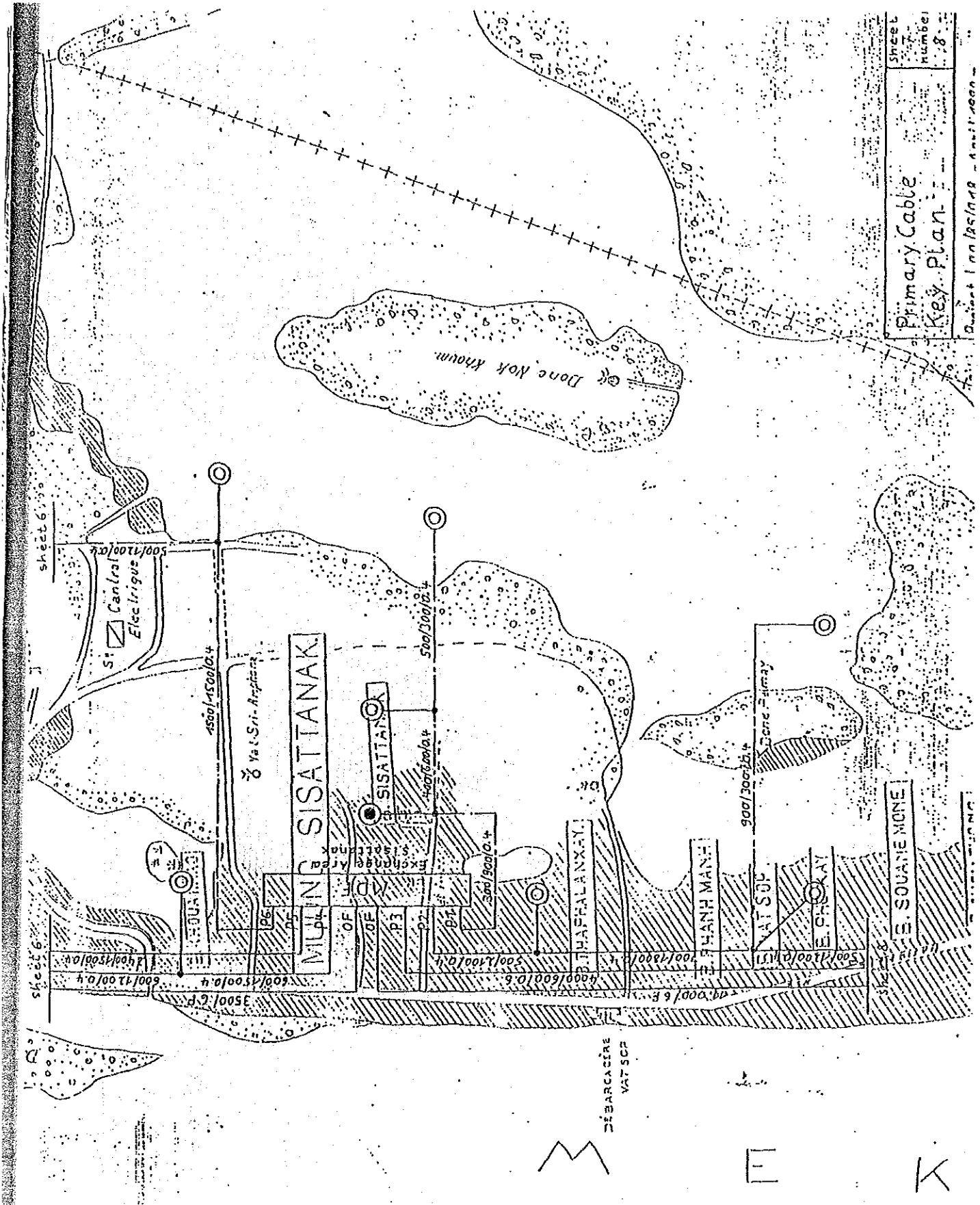

Figure-5 Local Cable Installation Program (7/16)

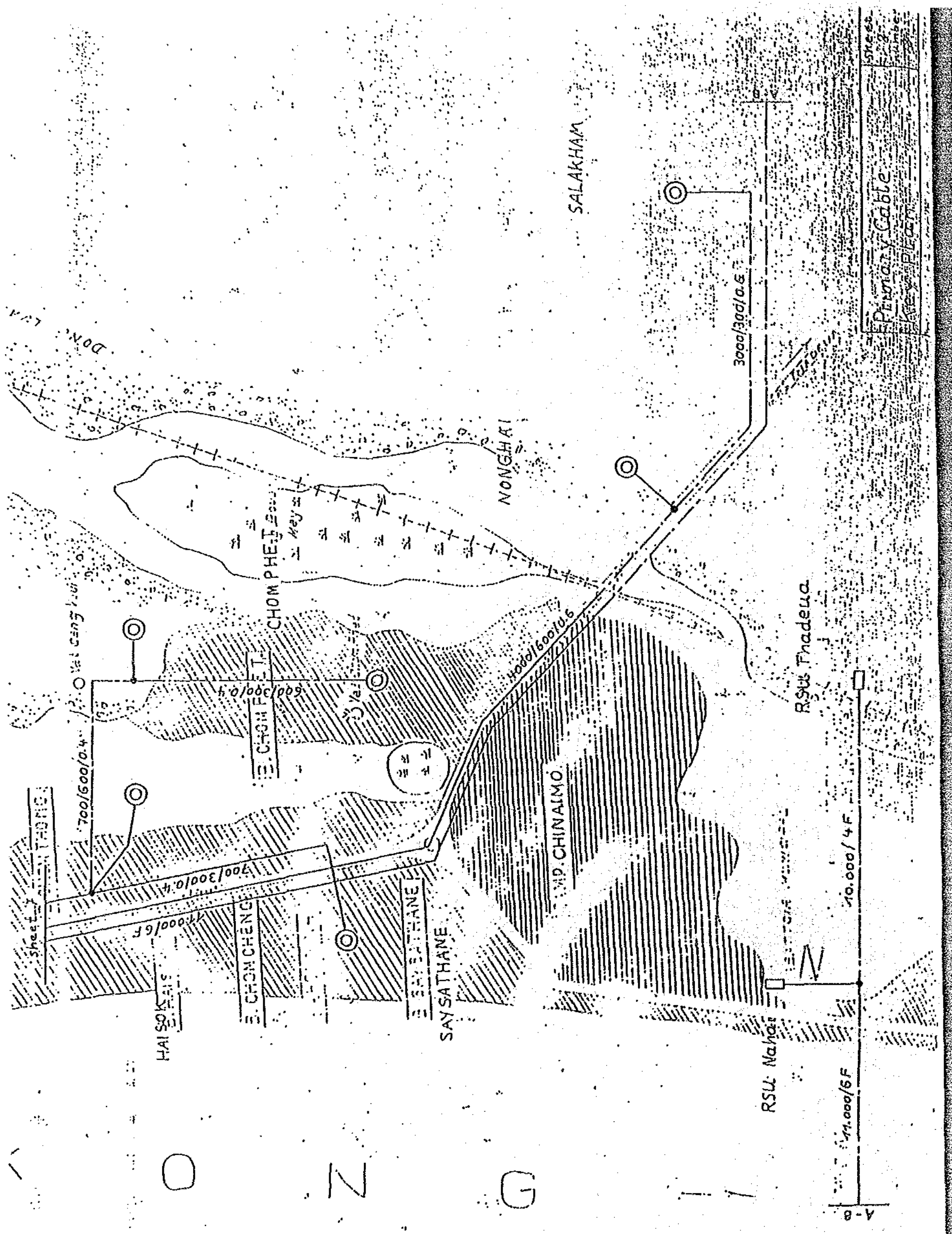

Figure-5 Local Cable Installation Program (8/16)

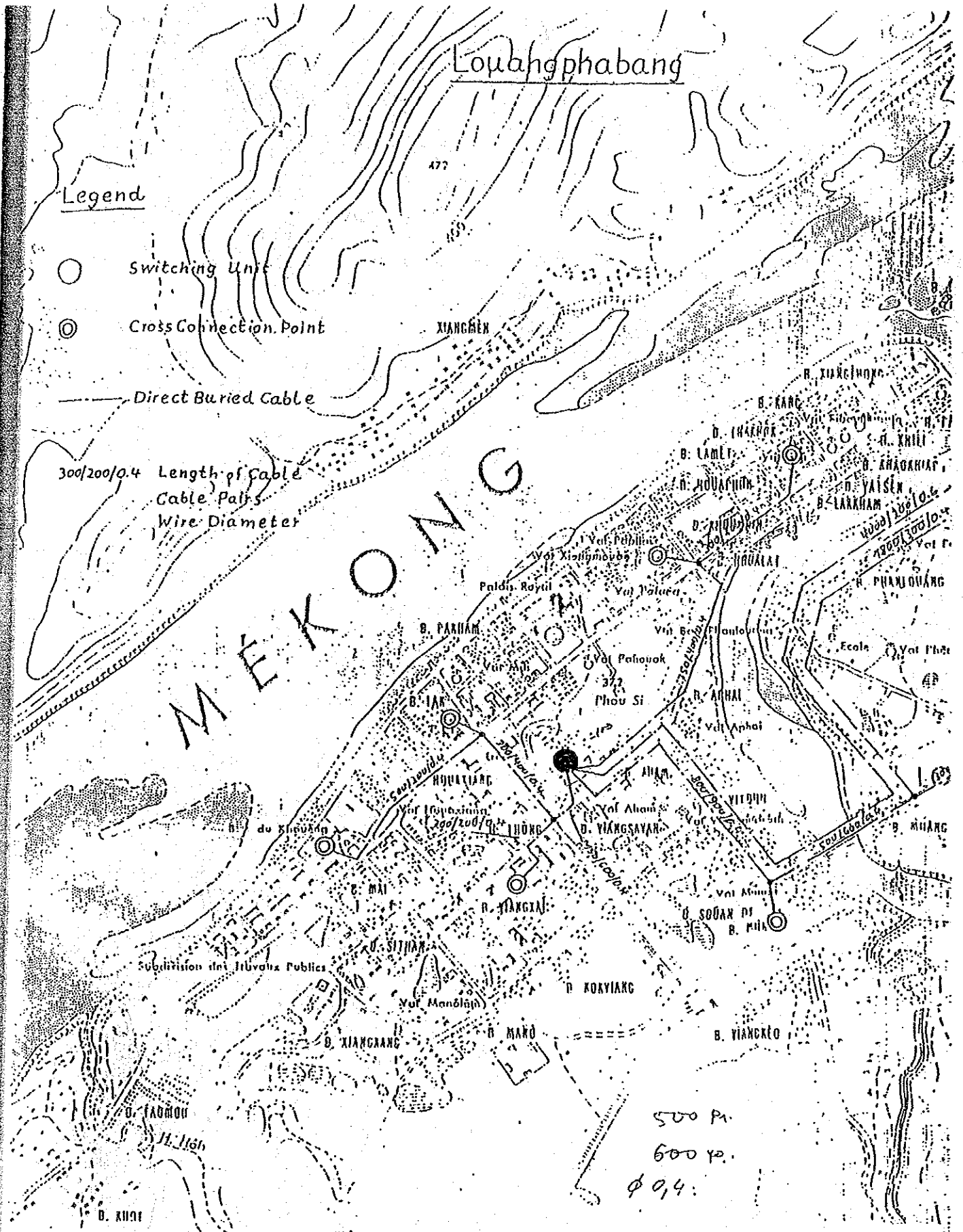

Figure-5 Local Cable Installation Program (9/16)

Primary Cable
Key Plan

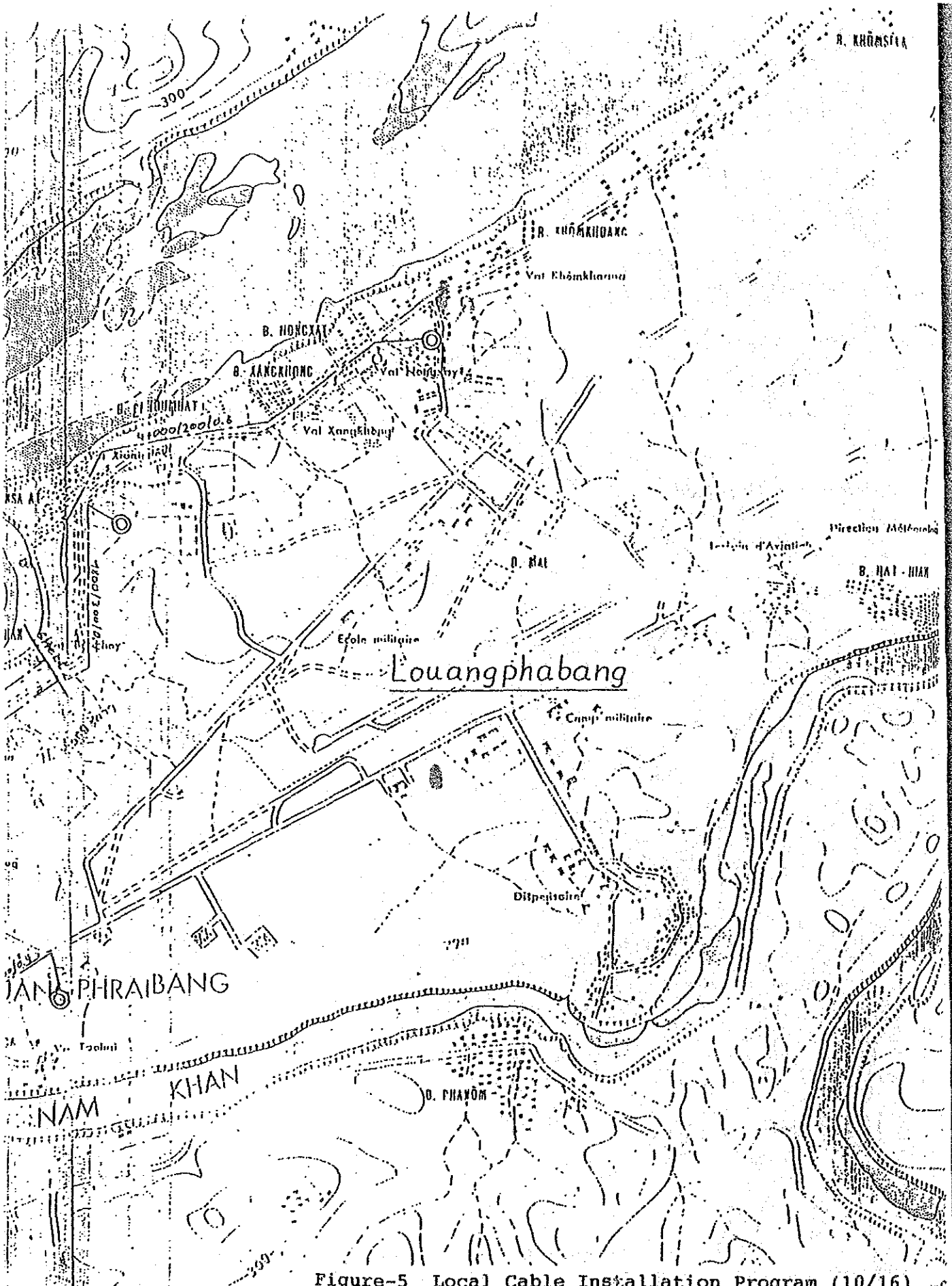

Figure-5 Local Cable Installation Program (10/16)

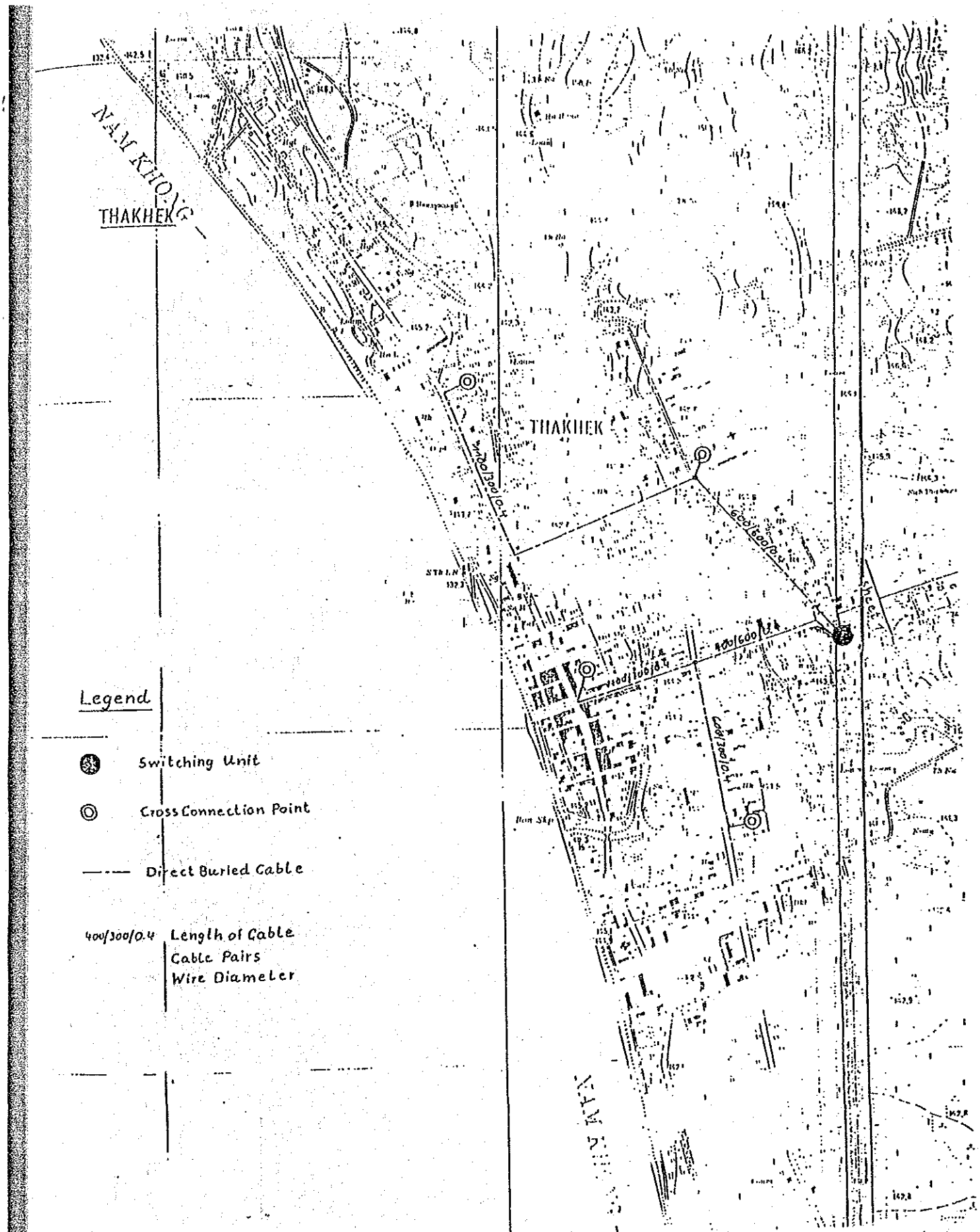

Figure-5 Local Cable Installation Program (11/16)

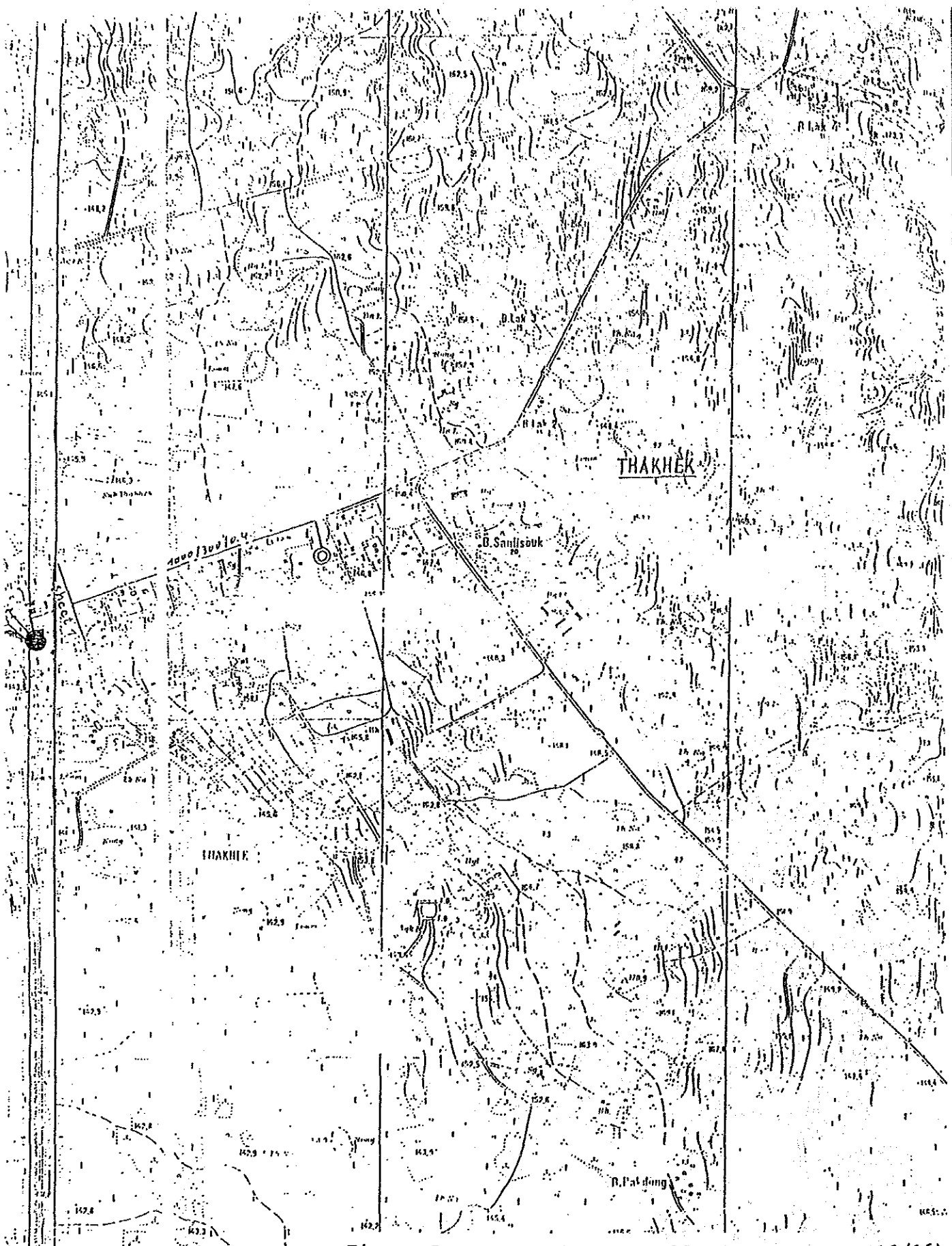

Figure-5 Local Cable Installation Program (12/16)

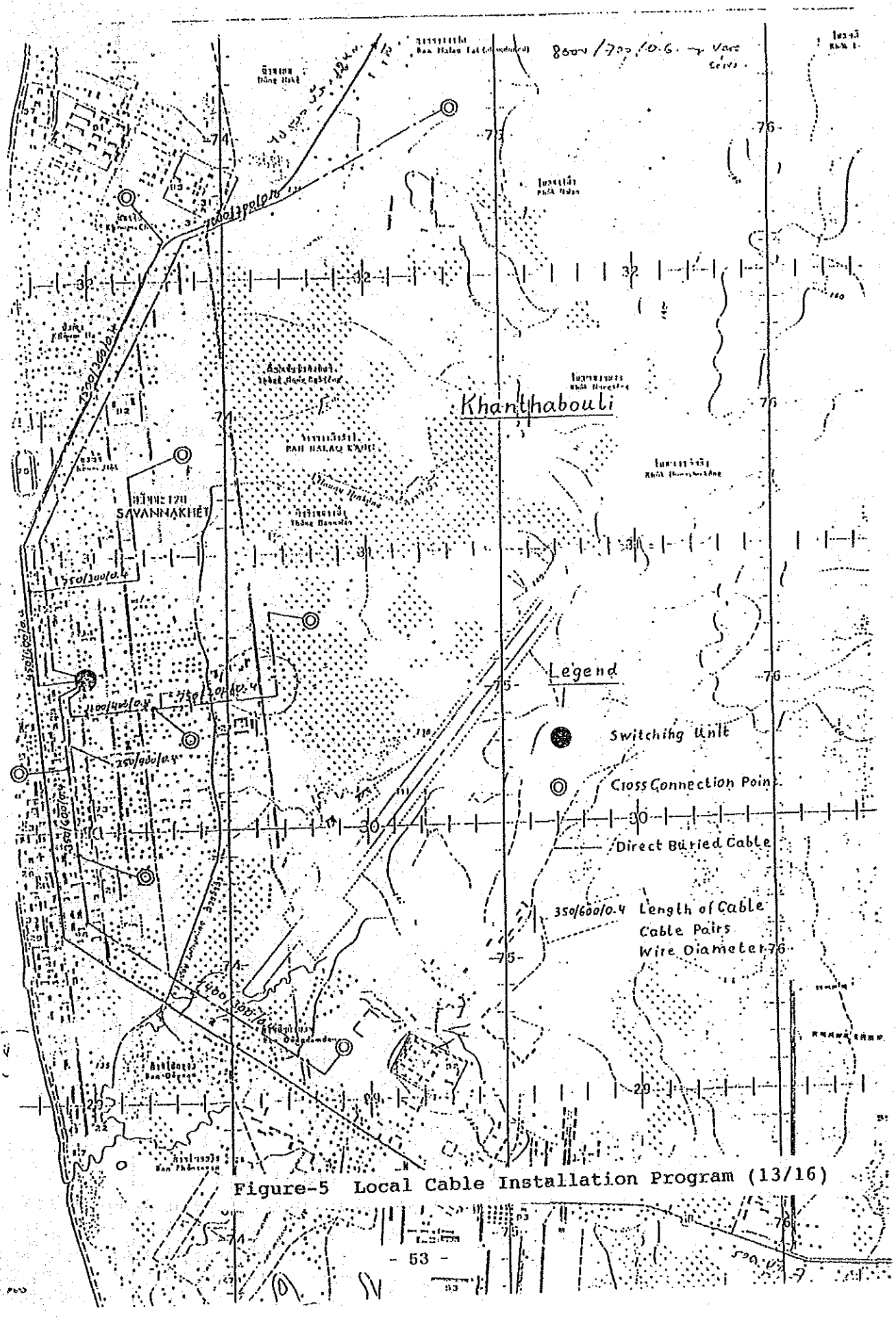

Figure-5 Local Cable Installation Program (13/16)

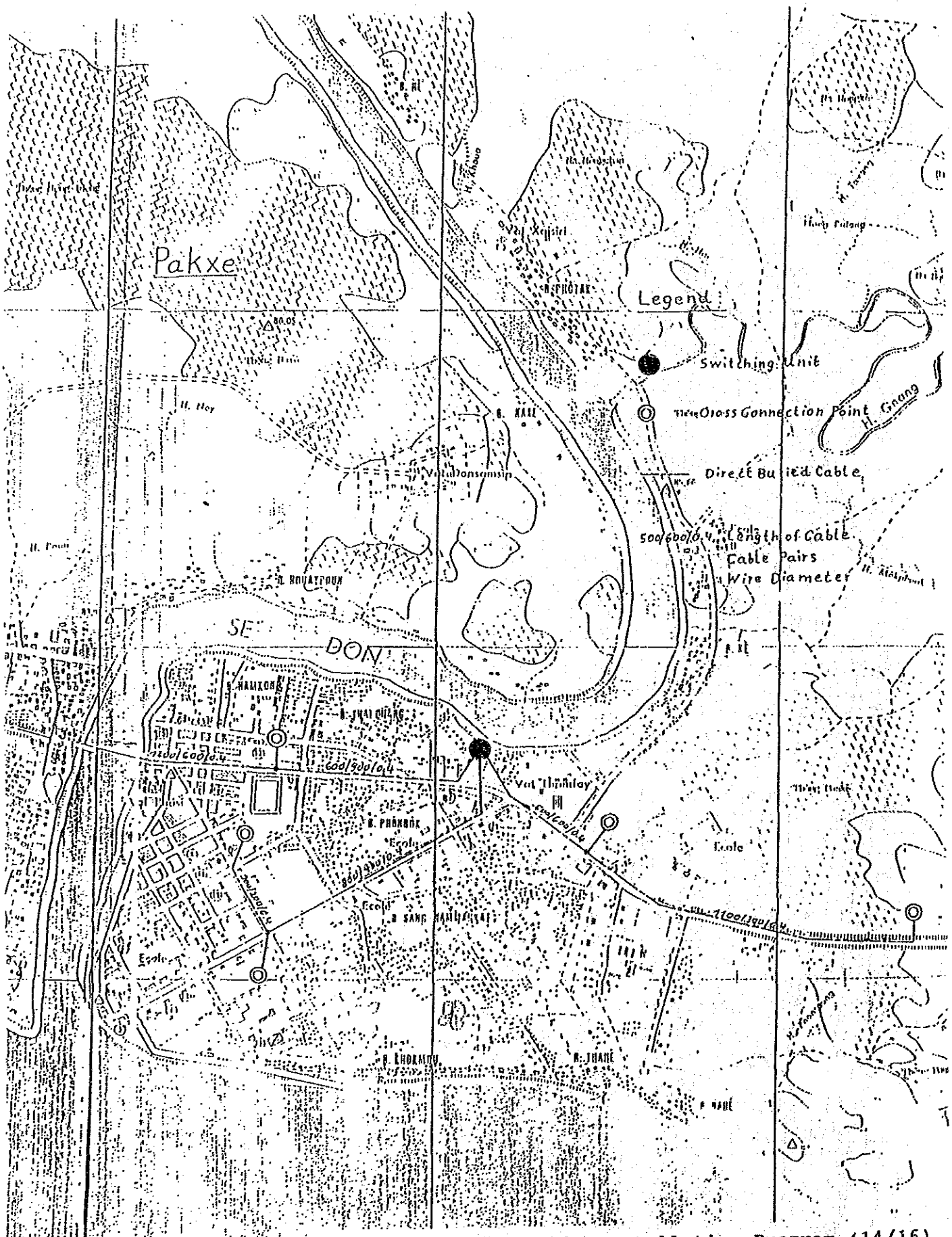

Figure-5 Local Cable Installation Program (14/16)

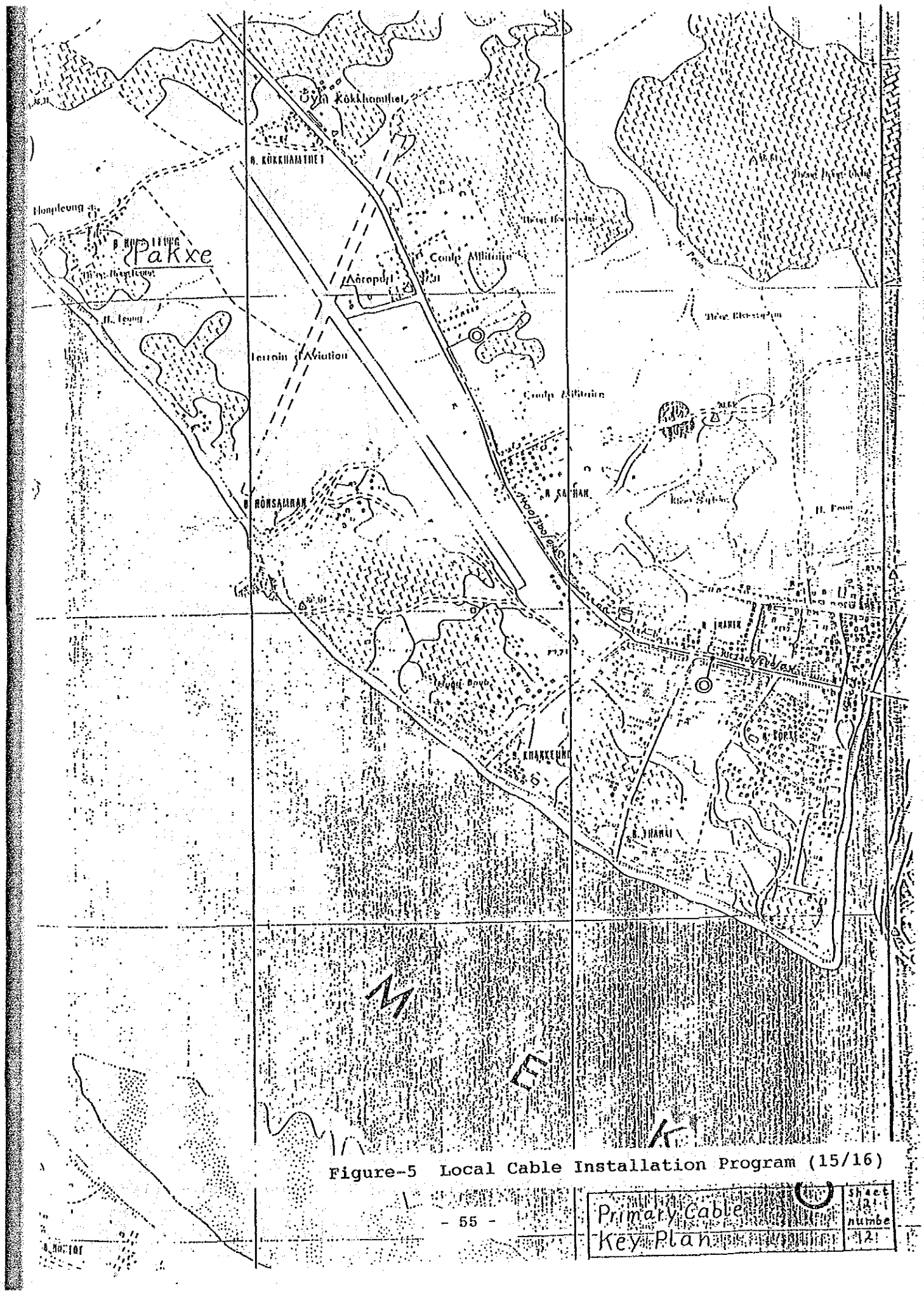

Figure-5 Local Cable Installation Program (15/16)

MUANG PAKXAN (PAKSANE)

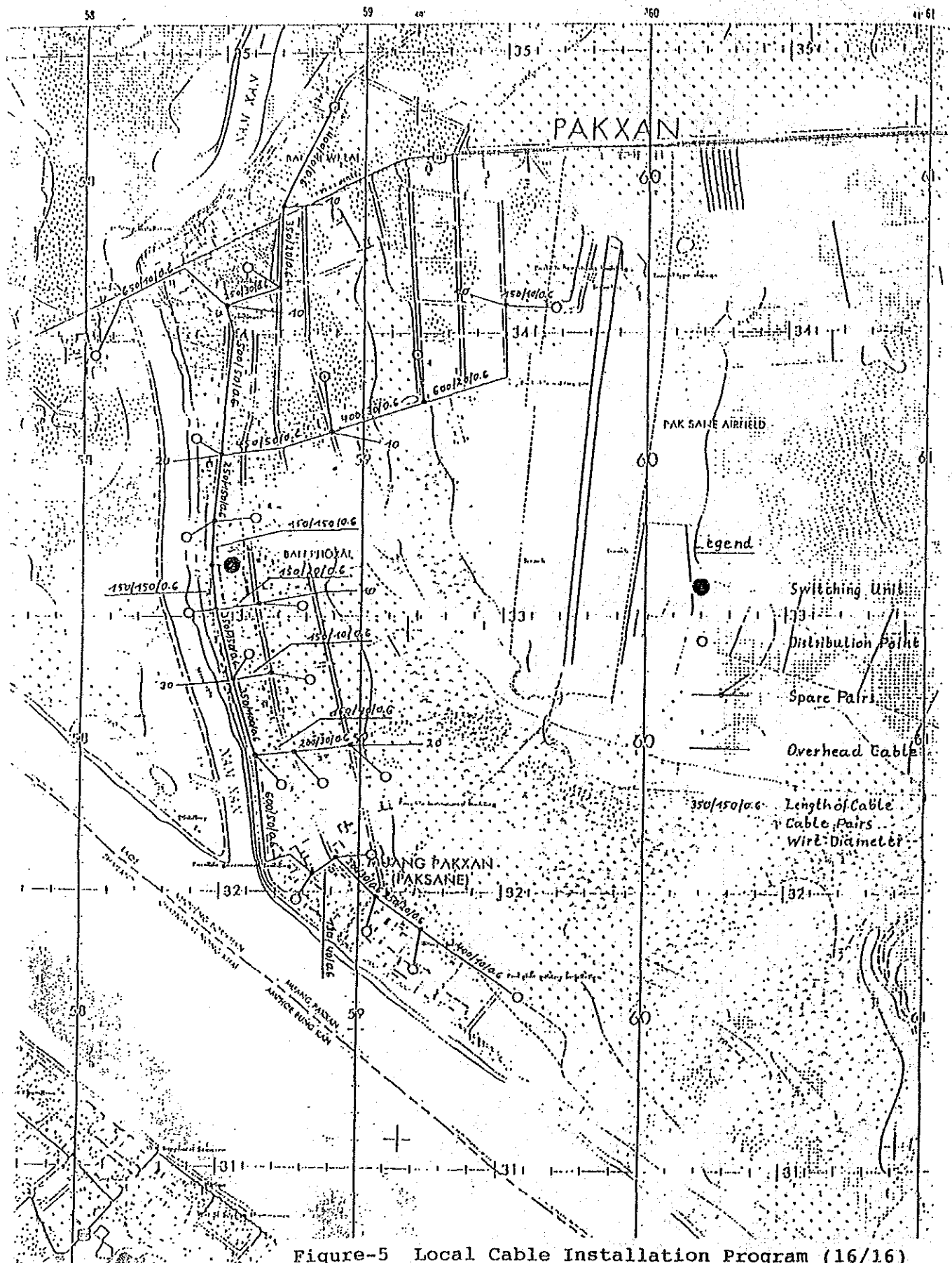

Figure-5 Local Cable Installation Program (16/16)

Distribution Cable Network (1/01) sheet number 1

Table-9 Implimentation Program for 2nd Telecommunications Project

(Sep., 1990)

Item		1990												1991												1992												1993												1994											
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1 Switching (JICA)	B								=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=																																										
	D																	*	=	=	=	=	=	=	=							*	=	=	=	=	=	=																								
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	A																																																														
2 Transmission (IDA)	D	=	=	=	=	=	=	=	=	=																																																							
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3 Local Cable (IDA)	D	=	=	=	=	=	=	=	=	=																																																					
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	I																									=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
4 Building (IDA)	D																																																												
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	C													=	=																																																	
	M																																																																
	I	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
5 Training (ITU)	E					=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
	F																									=	=	=	=	=	=	=	=	=	=	=	=																								

1. Switching project shall include power supply system and airconditioning equipment
2. Transmission project shall consist local junction network and toll transit network but power supply system for them are not included in this project, DC power shall supplied by the switching system
3. Local Cable project shall consist appropriate civil works
4. Training project indicate the ITU training program only
5. "J-D" means January-December
6. "B" means Basic Design works
   "D" means Detailed Design works
   "T" means Tendering works
   "C" means Contract negotiation and contract
   "M" means Manufacturing
   "I" means Installation works
   "A" means Total Performance Test
   "E" means training by Expart
   "F" means training by Foreign country
   "*" means Exchange of Notes
   "=" means work period during one month
7. Building project shall include the all necessary building installation works for the 2nd Telecommunications Project

3-3 Scope of the Project

3-3-1 Implementing Organization

EPTL is the implementing organization, with Project Department as its key body, for TELECOM II including this Project, with the assistance of an engineering consultant in Japan for this Project, and with the assistance of foreign consultants dispatched by IDA for other projects.

Project Department, responsible for the implementation of EPTL's development projects, is now subjected to institutional strengthening in accordance with the IDA's recommendation, which will be completed by the end of 1990.

In order to coordinate the matters correlated to projects under TELECOM II, it has been agreed to hold a coordination meeting among the engineering consultants for respective projects periodically, including the staff concerned of IDA, UNDP and ITU, as well as EPTL. Therefore, the Japanese engineering consultant for this Project should attend the meeting positively.

3-3-2 Project Procurement Plan

Items to be procured under TELECOM II are as follows:

(Unit: US$ million)

Project Items	ICB*	LIB*	LCB*	Total
Installation of Automatic Exchanges		11.7		11.7
Installation of Transmission System	11.8			11.8
Construction of Local Cable Network	7.5			7.5
Subscriber Connections	0.5			0.5
Supply of Subscriber Terminals	1.3	0.2		1.5
Miscellaneous Equipment	0.8	0.3		1.1
Construction of Buildings			0.6	0.6
Technical Assistance	3.1			3.1
Training	0.8			0.8
Total	25.8	12.2	0.6	38.6

Note (*): ICB: International Competitive Bidding
LIB: Limited International Bidding
LCB: Local Competitive Bidding

The total cost of 38.6 million dollars will be shared by IDA financing for 24.5 million dollars, by Japan's grant aid for 11.7 million dollars covering telephone exchange installation under this Project, by ITU for 1.2 million dollars for training and experts dispatch, and by the Government of the Lao PDR for the remaining 1.2 million dollars.

3-4 Effects and Benefits

3-4-1 Effects

The implementation of this Project, i.e., the completion of TELECOM II, means the establishment of the first nationwide advanced telecommunications network in the Lao PDR. Under this network, subscribers toll dialling is feasible among the objective major 6 cities and also the international subscriber dialling is realized. Since it facilitates rapid transmission of information, communication volume will remarkably increase and importance of telephone service will be magnified more than ever.

The direct effects of the expansion and improvement of telephone services on the social and economic activities are:

a. Rapid transmission of information permits frequent exchange of information and serves for reduction of stock, leading to effective and efficient management.

b. Expansion of information coverage area serves for stabilization of social life.

c. Increase in information transmission volume leads to promotion of social and economic activities.

The indirect effects are:

a. Increase in local and international investments and resultant promotion of economic activities and national development.

b. Impact on overall social and economic growth and conspicuous improvement in the morale through the above effect.

c. Increase in employment opportunities resulting from promoted social and economic activities and further development of societies and economies.

3-4-2 Benefits

The subscriber connections to be realized by TELECOM II including this Project will number 17,200 at the maximum. The number of people who will obtain benefits directly from TELECOM II will be 713,000, the total population of the objective 6 cities. That is approx. 17% of the total population of the country will obtain benefits from this Project.

The conceivable direct benefits are:

- Benefit of telephone service utilization
- Benefit of rapid information collection
- Benefit of rapid information transmission
- Benefit of overcoming time-wise difficulty
- Benefit of overcoming distance-wise difficulty

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4-1 Basic Design Principles

4-1-1 Outline of Basic Design Principles

Basic principles applied in the Basic Design Study of the digital telephone exchanges and the ancillary facilities, such as power system, air-conditioner, etc. to be introduced under the Project are as follows.

a. Equipments and facilities to be introduced are designed observing the Fundamental Technical Standard already prepared in the Lao PDR (Long Term Telecommunications Development Plan, Volume 2) and the relevant CCITT Recommendations to the maximum extent. In case technical and/or economical problems are involved, alternative and optimum methods will be recommended and adopted as the standard.

b. In view of the coordination with other projects included in TELECOM II, the telephone exchange installation works are to be divided into two stages: 1st stage for Vientiane City and 2nd stage for other cities. The installation schedule, however, is subject to modification, depending upon the technical requirements and economical advantages during the implementation.

c. The existing switching facilities are to be removed entirely and not used for the digital exchange network, except for the international link and the domestic HF microwave link.

d. For the HF microwave link not removed as mentioned above, the existing facilities will be used as they are without any rehabilitation or modification. Facilities not utilizable as they are will not be accommodated in the new digital exchange network.

e. Taking into account the investment costs for installing the exchanges and the operation/maintenance costs to be incurred after installation, it is so decided that the remote switching unit (RSU) be installed in an area where the demand for telephone subscription does not exceed 1,000 until the year 2000, and the independent telephone exchange be installed in an area where the demand exceeds 1,000 before the year 2000.

f. All the new telephone exchanges and ancillary facilities will be accommodated in telephone office buildings to be constructed anew, except for RSU exchanges in Vientiane City and Pakxan Exchange in Pakxan City. New buildings are to be constructed under the IDA Building Construction Project.

g. Thadua Exchange and Thangon Exchange (RSU exchanges) in Vientiane City and Pakxan Exchange will be accommodated in the existing buildings. Necessary building modification works are to be carried out under this Project.

h. In Vientiane, RSU Exchanges will be accommodated in containers, except for Thadua Exchange and Thangon Exchange. Necessary containers will be supplied by this Project.

i. Earthing works for the digital exchanges will be made by IDA Building Construction Project. In case the earth resistance of 5 ohm provided by IDA Project is not sufficient enough for the exchanges under this Project, additional installation is to be made by this Project. In case of the container-type exchange, all the earthing works are to be done under this Project.

The outline of switching system introducing this project shows Table-10.

4-1-2 Digital Telephone Exchanges

(1) Vientiane Numphou Exchange

a. The digital telephone switching system to be installed in Numphou Exchange is a combined exchange which is equipped with such multi-function as local, transit, long distance and international switching. A manual switchboard necessary for toll and international switching is also provided.

b. A billing computer be installed as an integral part of the digital exchange.

c. The centralized operation and maintenance facilities for Louang Phabang, Xaisettha and Sisattanak be provided to the minimum necessary extent.

d. The parent exchange function to control RSU in Houaxang, Nongteng, Airport and Pakxan be provided.

(2) Vientiane Xaisettha Exchange

a. The digital telephone switching system to be installed in Xaisettha Exchange is a local exchange.

b. The parent exchange function to control RSU in Donnoun and Thangon be provided.

(3) Vientiane Sisattanak Exchange

a. The digital telephone switching system to be installed in Sisattanak Exchange is a local exchange.

b. The parent exchange function to control RSU in Nahai and Thadua be provided.

(4) Other Exchanges in Vientiane Municipality

a. Houaxang, Nongteng, Airport, Thangon, Donnoun, Thadua and Nahai Exchanges are RSU exchanges. Houaxang, Nongteng and Airport Exchanges be controlled by Numphou Exchange, Thangon and Donnoun by Xaisettha Exchange, and Thadua and Nahai by Sisattanak Exchange.

(5) Khanta Bouli Exchange

a. The digital telephone switching system to be installed in Khanta Bouli Exchange is a combined exchange equipped with local and toll transit switching function.

b. A manual switchboard necessary for toll switching be provided.

c. The centralized operation and maintenance facilities for Thakhek and Pakxe be provided to the minimum necessary extent.

(6) Thakhek and Pakxe Exchanges

a. The digital telephone switching system to be installed in these Thakhek and Pakxe Exchanges are combined exchanges equipped with local and toll switching function.

b. A manual switchboard necessary for toll switching be installed in each exchange.

(7) Pakxan Exchange

a. The digital telephone switching facility to be installed in Pakxan Exchange is RSU, in accordance with the exchange introduction principle mentioned in Item e. of 4-1-1 Outline of Basic Design Principles. Vientiane Numphou Exchange is to control this Exchange.

b. All the necessary toll switching function be provided through Vientiane Numphou Exchange, and no facility for this function will be provided in Pakxan Exchange.

4-1-3 Ancillary Facilities

(1) Power Supply System

1) Vientiane Numphou Exchange

a. Commercial power be used as the primary power source, and the standby engine generator be installed as secondary power source for emergency use.

b. Power receiving facility must be sufficient enough in capacity to meet the following:

- Input capacity of rectifier.
- Input capacity of air-conditioner for telephone exchange.
- Input capacity of ventilators in power room, battery room, and engine generator room.
- Input capacity of lighting facilities and other power for the building.

c. Standby engine generator be equipped with auto-start and auto-stop function.

d. A low voltage distribution panel be provided between the loading device and power receiving facility, and standby engine generator.

e. Standby storage batteries be provided.

h. For D.C. power source, the booster system be adopted.

2) Vientiane Xaisettha, Vientiane Sisattanak, Louang Phabang, Thakhek, Khanta Bouli and Pakxe Exchanges

a. Commercial power be used as the primary power source, and standby engine generator be installed as the secondary power source for emergency use.

b. Power receiving facility be sufficient enough in capacity to meet the following:

- Input capacity of rectifier.
- Input capacity of air-conditioner for telephone exchange.
- Input capacity of ventilators in power room, battery room, and engine generator room.
- Input capacity of lighting facilities and other power for the building.

c. Standby engine generator be equipped with auto-start and auto-stop function.

d. A low tension distribution panel be provided between the loading device and power receiving facility, and standby engine generator.

e. Standby storage batteries be provided.

f. For D.C. power source, the dropper system be adopted.

3) Pakxan Exchange

a. Dual type engine generator be installed for primary power source.

b. A low tension distribution panel be provided between

the loading device and engine generator. A changeover switch be provided on the input side of this panel, to make it compatible with the power supply from portable generator.

c. Standby storage batteries be provided.

d. For direct power source, the dropper system be adopted.

4) RSU Exchanges

a. Main power source is the commercial power.

b. A low tension distribution panel be provided between the loading device and power receiving facility.

c. Standby storage batteries be provided.

d. For direct power source, the dropper system be adopted.

5) Others

The portable generator be provided in Vientiane Municipality to serve as the emergency use power source for RSU exchanges and Pakxan Exchange.

For reference, a power system diagram (draft) at each exchange is attached.

(2) Air-Conditioner

a. Dust-proof air-conditioner be adopted.

b. Humidity control function be provided.

c. The number of air-conditioners to be supplied be the necessary number for daily operation plus one standby (redundancy composition).

Table-10 Outline of New Switching System

Exchange Name	Avr.	Exchange Type	Line Capacity	System Capacity	Home Ex.	Remarks
1 Numphou	NMP	TLMS+INTS	5,400	6,200		*1
2 Houaxang	HXG	RSU	200		NMP	
3 Nongteng	NTG	RSU	200		NMP	
4 Air-Port	APT	RSU	200		NMP	
5 Xaisettha	XST	LS	2,900	3,300		
6 Thangon	TNG	RSU	200		XST	
7 Donnoun	DNN	RSU	200		XST	
8 Sisattanak	STN	LS	3,800	4,200		
9 Thadua	TDA	RSU	200		STN	
10 Nahai	NHI	RSU	200		STN	
11 Louang-Phabang	LPB	TLS	1,000	1,000		
12 Pakxan	PXN	TLS(RSU)	200		NMP	*1
13 Thakhek	THK	TLS	500	500		
14 Khanta-Bouli	KTB	TLS	1,000	1,000		
15 Pakxe	PKX	TLS	1,000	1,000		
TOTAL			17,200	17,200		

TLMS :Local/ Transit/ Toll Combined Switching System
INTS :International Switching System
TLS :Local/ Toll Combined Switching System
LS :Local Switching System
RSU :Remort Switching Unit

*1 :PXN Exchange was installed RSU(Home exchange is NMP in Vientiane) at initial stage.

4-2 Study of Preconditions for Basic Design

The basic external preconditions to be taken into account in making basic design of the digital telephone exchanges, such as traffic, domestic telephone network design conditions, etc. are studied.

4-2-1 Study of Traffic

(1) Originating Traffic per Subscriber

In the Long Term Telecommunications Development Plan prepared in September 1990, the originating traffic per subscriber in 1993 is estimated as follows:

(unit: Erlang)

Class of Subscribers	Estimated Orig. Traffic	Average Orig. Traffic
Residential Service	0.01 - 0.07	0.04
Business Service (single line)	0.05 - 0.15	
PBX Groups (per line)	0.10 - 0.60	0.19
Coin Boxes	0.10 - 0.30	

Before adopting these figures in this Study, they have been verified by the following methods:

a. The number of telephone subscribers of residential service and that of business service in each objective area are estimated.

b. Then, average originating traffic per subscriber is forecasted for each exchange.

c. The obtained value is increased by 20% to take into account the traffic at the time of overload, to be considered in designing the telephone exchange.

d. The data thus obtained are further studied in comparison with the data of the exchanges in Bangkok, Thailand, the neighboring country, during the period 1968-73(*).

Note (*): During the period 1968-73, local telephone demands in Bangkok increased so sharply, i.e., approx. 28 times the figure in 1968. This situation is considered comparable to the forthcoming condition in the Lao PDR where the telephone services are to be upgraded all at once from the next to "non" to the "full-automatic".

It is well known that the introduction of full automatic service usually leads to rapid increase in traffic per subscriber, but it is difficult to estimate the increase rate correctly. In addition, no past traffic data is

available in the Lao PDR and, therefore, no suitable forecast method is conceivable.

In estimating the average originating traffic per subscriber in this Basic Design Study, comparative study was made with the historical data in Thailand, the neighboring country, whose national traits are similar to those of the Lao PDR. In social, economic and cultural sectors, both countries are closely related with each other and considered to be similar also in behavior towards telephone service. The data obtained through the above study are adopted as the basic traffic data in this study.

Average originating traffic of exchanges in Bangkok is 0.206 Erl. per subscriber at the maximum, and 0.073 at the minimum. On the other hand, according to the Long Term Development Plan, average originating traffic at an exchange is 0.169 Erl. per subscriber, approx. 80% of the maximum value of Bangkok. These figures are an average in a busiest hour of a day and actual maximum and minimum values vary by ±20% - ±30%.

In view of the fact that the telephone service is automatized for the first time in the Lao PDR, adoption of the forecast by the Long Term Plan, i.e., 0.169, may probably cause the overload of the switching facility at the time of service commencement which further often leads to hardware trouble, especially in the case of the digital exchange.

In this study, therefore, the originating traffic per subscriber to be used as the basic data is decided to be the above value plus 20% to cover the overload traffic.

Table-11 presents the telephone demands forecast by subscriber classes and originating traffic forecast. Table-12 shows the transition of originating traffic volume per subscriber of each exchange in Bangkok.

(2) Distribution of Originating Traffic per Subscriber

On the basis of the originating traffic per subscriber estimated in above (1), distribution of originating traffic between subscribers of the same exchange, between exchanges in the same exchange area, toll transit, special number services (*), and international calls is estimated.

(*) Special number services include emergency services for police and fire station, information services on weather and time, etc., for which special telephone numbers are assigned.

The distribution estimate is based on the following:

a. For special service calls, 0.001 Erl. is adopted uniformly.
b. For international calls, 0.002 is adopted uniformly.
c. Originating toll traffic of the exchanges in Vientiane Municipality is estimated to be 10% of the total traffic, and that of the exchanges in Provincial capitals, 40% of the total.
d. As for the distribution of traffic between subscribers of the same exchange and between exchanges in the same exchange area is estimated based on the following formula recommended by CCITT as the standards method:

$$Aij = Ai \times \frac{Aj \times \exp(-aij \times Dij)}{\sum_{k=1}^{m} [Ak \times \exp(-aij \times Dij)}$$

Where Aij = Traffic between the originating exchange i and the terminating exchange j.
Ai = Total traffic in the originating exchange i
Aj = Total traffic in the terminating exchange j
Dij = Direct distance between the originating exchange i and the terminating exchange j
aij = Correlation between the originating exchange i and terminating exchange j.

Table-13 presents the estimated distribution of the originating traffic per subscriber.

(3) Traffic between Local Telephone Exchanges and between Toll Telephone Exchanges

Traffic between local telephone exchanges and traffic between exchanges in provincial capitals are estimated as shown in Table-14, on the basis of the formula recommended by CCITT.

4-2-2 *Long Distance Transmission Network Plan*

The hierarchy in the switching plan given in the Long Term Telecommunications Development Plan comprises three ranks, i.e., Secondary Center (SC), Primary Center (PC), and Local Exchange (LE): two ranks for toll switching and one for local switching.

With the recent advancement of switching technology, the capability of selecting transit route has been improved, and the less number of ranks are required in hierarchical arrangements in the digital switching network, as compared with the conventional analogue type electromagnetic exchange (crossbar, etc.) network.

In addition, it is a recent tendency to simplify the toll switching network configuration, because by accommodating a large number of channels in a toll transmission route, installation and

maintenance costs per toll channel are remarkably reduced and, therefore, a complicated configuration to obtain the above effect is not necessarily required in designing.

In view of the geographical condition (roughly rectangular in shape, and approx. 1,200 Km from south to north) and the administrative districts in the country, the hierarchy consisting two toll switching office ranks, with 7 SC and 21 PC, is considered most appropriate.

In Figure-6 is presented the basic plan of telephone switching network configuration, and in Figure-7, the Planning of Actual National Telephone Network.

4-2-3 Local Telephone Network Configuration

At present, the local telephone network exists in Vientiane Municipality only. The study, therefore, is limited to this municipality which is designed to be the multi-exchange area.

Three telephone exchanges, i.e., Numphou, Xaisettha and Sisattanak, are to be installed under this Project. In addition, remote switching units (RSU) will be installed at 7 locations in the suburbs in order to accommodate subscribers in remote areas. The local telephone switching network composed of the above facilities is shown in Figure-8.

Any two of the three exchanges, Numphou, Xaisettha and Sisattanak, are connected directly. For part of the traffic between Xaisettha and Sisattanak, however, alternative routing is made via Numphou, with a view to enhancing reliability.

All the toll traffic, special number service traffic, and international traffic are handled by Numphou Exchange.

4-2-4 Numbering Plan

Numbering plan is an overall arrangement of numbers each of which uniquely identifies each subscriber. The individual numbers once given constitute a kind of assets of respective subscribers. Telephone numbers should not be modified carelessly because it will cause unnecessary confusion in the telephone service (partial dial, mis-connection, etc.), in addition to cost-wise pressure on subscribers (necessitating publicity of new telephone numbers, reproduction of name cards and other documents, etc.) In general, the numbering plan once established is not to be modified for the period of 50 years.

Each telephone number usually consists of two parts: area code and local number. The latter is further divided into a local office number and a subscriber's number.

The telephone numbering capacity in the numbering scheme depends upon the number of digits adopted as follows:

With	2 digits	70
	3 digits	700
	4 digits	7,000
	5 digits	70,000
	6 digits	700,000
	7 digits	7,000,000

Accordingly, if the number of telephone subscribers as of the year 2040 is approx. 1,000,000 (5 times the number in the year 2010), the national numbering plan should be designed based on the 7-digit numbering.

In the Long Term Telecommunications Development Plan is employed the 7-digit system which, therefore, is considered appropriate. The numbering scheme prepared under the Long Term Development Plan is given in Table-15.

As can be seen from Table-15, 2-3 digits number is to be used as the area codes for PC and SC, which permits the discrimination of up to 70 - 700 areas. This arrangement will be reasonable when the 21 PCs, 8 SCs, plus future expansions are taken into consideration. As for the subscriber's number in local office area, Item 2 of the said Table presents the digits adopted, which also is reasonable.

In view of the above, the numbering plan of the Long Term Development Plan is to be adopted for this Study. Area codes for PCs under the national numbering plan are given in Figure-9.

In Figure-10 is shown a draft numbering plan for subscribers in PC areas in Vientiane.

4-2-5 Signalling System

Since all the telephone exchange networks to be constructed under the Project are the digital networks, CCITT Standard No. 7 Common Channel Signalling System is adopted in accordance with the CCITT Recommendation. For the existing international analogue circuits (7 circuits for Australia and 8 circuits for Thailand), the conventional signalling system will be used (For Australia, CCITT No. 5 signalling system, and for Thailand, CCITT No. 2 signalling system).

4-2-6 Charging System

(1) Local Calls

Metering system (message rate system) is adopted.

(2) Toll Calls

Periodic pulse metering system depending on communication time and distance is adopted. Night time discount system is also introduced.

Communication distance is classified into three categories: (1) within 150 Km, (2) 151 Km to 300 Km, and (3) beyond 301 Km.

Charges for calls handled by manual switchboard are calculated based on the records issued by the switchboard operator.

(3) International Calls

Message units by country is set up. Night time discount is introduced. Charges for calls handled by manual switchboard are calculated based on the records issued by the switchboard operator.

(4) Special Number Service

Charges for special number service, when necessary, are the same as the local call charges.

(5) Charging Record System and Arrangements to be Made

Charging data are recorded on the magnetic recording device to be installed in the switching facilities. Charges are calculated by the charge computer.

The existing charging system (started in January 1991) and tariffs for international calls are shown in Table-16 and Table-17.

4-2-7 Network Synchronization Plan

In the digital telephone exchange network, it is necessary to ensure the synchronization of all the digital signals to be transmitted and received. For this purpose, standard signal oscillator is to be provided in the exchange.

As for the method of network synchronization, CCITT recommends the following, considering that the international digital telephone network will be realized soon:

a. Standard signal oscillator for the domestic telephone network synchronization be installed in the international switching center (ISC).

b. Accuracy of the standard signal oscillator should be better than 1×10^{-11} (G811) of the Universal Time Clock (UTC).

The same is specified in the Long Term Development Plan, also.

Presently, no other signal oscillator than that using cesium can attain the above accuracy. This type of oscillator unit costs approx. 50 - 60 million yen as the standard price. In addition, in order keep the accuracy, a cesium oscillator itself must be replaced every 3 - 5 years. The cost of the oscillator accounts

for more than 50% of the total cost of the oscillator unit. That is, in order to keep the accuracy of the standard signal oscillator unit at the value specified by both CCITT and the Long Term Development Plan, maintenance costs will amount to approx. 10 million yen annually.

It should be noted here that the accuracy specified by CCITT is required only when the international telephone networks are digitalized and international switching centers are connected with digital signals. As far as the international switching centers are connected not by digital signals but by analogue signals, there will be no need to satisfy that accuracy. Moreover, even after the international network has been digitalized, such accuracy will not necessarily be required from the outset. (In this case, slave synchronization system is to be adopted, in which clock rates are corrected periodically based on the standard signals received from other country's ISC whose accuracy satisfies the CCITT recommendation.)

If the accuracy of approx. 1×10^{-10} is permissible for the standard signal oscillator, crystal oscillator can be adopted. It will cost only several million yen and moreover its service life is as long as 50 - 60 years. If the adjustment is made periodically, virtually no maintenance cost will be required.

Bearing the above in mind, as well as the telecommunications and financial conditions in the Lao PDR, it is recommended in our Basic Study to employ the crystal oscillator having the accuracy of approx. 1×10^{-10} as the standard signal oscillator for network synchronization.

4-2-8 Ancillary Facilities

(1) Power System

1) Emergency Engine Generator

a. Capacity

The capacity of the emergency engine generator should be enough to cover the telecommunications facilities to be supplied under this Project only, and not cover the building load and illumination equipment. However, it should be able to be increased up to the load of the year 2010 for rectifier equipment and exchange room air-conditioning.

b. Fuel Tank

Supposing that the commercial power failure time per month is four hours and the fuel replenishment is made semiannually, a 24-hour main fuel tank and a 2-hour service tank be provided.

c. Ambient Conditions

Engine output should be designed, taking into account the undermentioned ambient conditions:

Altitude	Louang Phabang	.....	304 m
	Vientiane	.....	170 m
	Khanta Bouli	.....	155 m
	Thakhek	.....	155 m
	Pakxe	.....	96 m
Temperature		.....	36°C
Humidity		.....	88 %

2) Engine Generator for Prime Power System

a. Capacity

Capacity of the engine generator for prime power system should be enough to satisfy the initial load of the telecommunications facilities, not including the load for the building and illumination equipment.

b. Fuel Tank

The fuel replenishment is made semimonthly, a 15-days main fuel tank and a 12-hour service tank be provided.

c. Ambient Conditions

Engine output should be designed, taking into account the following ambient conditions:

Altitude	.....	170 m
Temperature	.....	36°C
Humidity	.....	88 %

d. Maintenance-free Continuous Operation Hour

Engine generator be able to operate continuously for 1,500 hours without maintenance, requiring no replenishment and/or replacement of lubrication oil.

3) Mobile Engine Generator with Tractor

a. Capacity

The capacity should be the same with that of the engine generator for the prime power system in Pakxan Exchange.

b. Fuel Tank

A 50 liter tank be mounted.

c. Ambient Conditions

Engine output should be designed, taking into account the following conditions:

Altitude	.....	170 m
Temperature	.....	36°C
Humidity	.....	88%

4) Low Tension Distribution Panel

The capacity of each no-fuse circuit breaker should satisfy the load in the year 2010, except for RSU.

5) Rectifier Equipment

a. Capacity

Capacity of rectifier equipment of Pakxan Exchange and of RSUs in Vientiane should meet the power consumption of initial telecommunication facilities. As for the other exchanges, capacity of the control panel should correspond to the power consumption in the year 2010, and that of the FC type rectifier, initial power consumption, on condition that future increase of the power consumption can be covered by the additional installation of the rectifier having the same capacity.

Power consumption of equipments for the long distance transmission lines and junction lines in Vientiane to be installed under the IDA Projects should also be taken into account in calculating the capacity of the rectifier equipment under this Project.

b. FC Type Rectifier

FC type rectifier should be composed of N + 1.

c. Booster Converter

Similar to the rectifier equipment, the capacity of control panel should meet the requirements in the year 2010, and that of the converter unit, initial requirements, on condition that the future addition of the converter unit is feasible.

6) Storage Batteries

The capacity of storage batteries is calculated, taking into account the power consumption of the initial telecommunications facilities under this Project and the equipments of the long distance transmission lines and junction lines under the IDA Projects, on the following conditions:

a. Design Temperature

The lowest temperature at the battery room is 15°C.

b. Holding Time

- Exchanges where emergency engine generator is installed

  Holding time: 6 hours

  To cover the recovery time when the emergency engine generator fails to operate (because of its own trouble or being overhauled for inspection) at the time of commercial power breakdown, or rectifier fails, etc.

- Pakxan Exchange

  Holding time: 8 hours
  To cover the time to be required before a mobile engine generator is put to operation, when the working engine generator fails while the other is under overhaul.

- RSU

  Holding time: 8 hours

  To cover the time to be required before a mobile engine generator is put to operation when the commercial power supply fails.

c. Number of Battery Sets

Some 23 - 25 cells are connected in series in use and, therefore, if one of them fails, the whole battery becomes defective. In order to enhance reliability, necessary number of cells to meet the required capacity are divided into two to obtain two sets of batteries.

(2) Air-Conditioner

Preconditions for designing the air-conditioner are as follows:

Design temperature and humidity in the exchange room

Temperature	25°C±5°C
Humidity	50% - 65%

Outdoor Conditions

	Louang Phabang		Vientiane		Khanta Bouli		Pakxe	
	Ave. Temp.	Ave. Hum.	Ave. Temp.	Ave. Hum.	Ave. Temp.	Ave. Hum.	Ave. Temp.	Ave. Hum.
January	20.5	79	21.5	75	21.3	72	24.6	65
February	22.6	75	23.8	72	24.1	67	26.7	62
March	25.6	71	26.7	69	27.2	66	28.6	60
April	27.9	72	28.8	69	28.9	68	29.9	64
May	28.4	78	28.4	80	28.3	78	28.7	74
June	27.9	84	28.1	84	27.9	81	28.1	81
July	27.4	86	27.7	85	27.3	83	27.2	85
August	27.2	88	27.4	87	27.1	85	27.0	86
September	26.9	86	27.1	86	26.6	84	26.9	85
October	25.7	83	26.4	81	25.3	80	26.6	80
November	23.4	81	24.4	78	26.7	76	25.9	73
December	20.1	81	21.4	76	21.1	74	24.2	67

For Pakxan, data in Vientiane will apply, and for Thakhek, Khanta Bouli.

(Source: "Meteorological Data in Asia" published by Kokin Shoin)

Table-11 Estimated Number of Subscribers in each Service Category and Originating Calling Rate in each Exchange

Estimated Number of Subscribers in each Service Category (Unit:Lines)

	Excange Name	Avr.	1993			1995			2000			2005			2010		
			Lines	R	B	Lines	R	B	Lines	R	B	Lines	R	B	Lines	R	B
1	Numphou	NMP	5,400	810	4,590	6,140	1,228	4,912	7,960	2,388	5,572	10,800	4,320	6,480	17,200	10,320	6,880
2	Houaxang	HXG	200	30	170	220	44	176	280	84	196	400	160	240	600	360	240
3	Nongteng	NTG	200	30	170	220	44	176	280	84	196	400	160	240	600	360	240
4	Air-Port	APT	200	30	170	220	44	176	280	84	196	400	160	240	600	360	240
5	Xaisettha	XST	2,900	435	2,465	3,300	660	2,640	5,500	1,650	3,850	10,400	4,160	6,240	17,800	10,680	7,120
6	Thangon	TNG	200	30	170	220	44	176	280	84	196	400	160	240	600	360	240
7	Donnoun	DNN	200	30	170	220	44	176	280	84	196	400	160	240	600	360	240
8	Sisattanak	STN	3,800	570	3,230	4,100	820	3,280	7,000	2,100	4,900	10,000	4,000	6,000	15,800	9,480	6,320
9	Thadua	TDA	200	30	170	220	44	176	280	84	196	400	160	240	600	360	240
10	Nahai	NHI	200	30	170	220	44	176	280	84	196	400	160	240	600	360	240
11	Louang-Phabang	LPB	1,000	100	900	1,500	225	1,275	3,100	620	2,480	4,600	1,380	3,220	7,400	2,960	4,440
12	Pakxan	PXN	200	20	180	200	30	170	300	60	240	1,100	330	770	3,200	1,280	1,920
13	Thakhek	THK	500	50	450	900	135	765	2,000	400	1,600	3,500	1,050	2,450	5,700	2,280	3,420
14	Khanta-Bouli	KTB	1,000	100	900	1,500	225	1,275	2,800	560	2,240	5,000	1,500	3,500	10,000	4,000	6,000
15	Pakxe	PKX	1,000	100	900	1,000	150	850	2,100	420	1,680	4,200	1,260	2,940	6,400	2,560	3,840
	TOTAL		17,200	2,395	14,805	20,180	3,781	16,399	32,720	8,786	23,934	52,400	18,120	33,280	87,700	46,080	41,620

Estimated Calling Rate and Originating Traffic at each Exchange (Unit: Erlang)

	Excange Name	Avr.	1993			1995			2000			2005			2010		
			CR	R	B	CR	R	B	CR	R	B	CR	R	B	CR	R	B
1	Numphou	NMP	0.200	36	1,047	0.191	54	1,120	0.173	105	1,270	0.154	190	1,477	0.118	454	1,569
2	Houaxang	HXG	0.200	1	39	0.191	2	40	0.173	4	45	0.154	7	55	0.118	16	55
3	Nongteng	NTG	0.200	1	39	0.191	2	40	0.173	4	45	0.154	7	55	0.118	16	55
4	Air-Port	APT	0.200	1	39	0.191	2	40	0.173	4	45	0.154	7	55	0.118	16	55
5	Xaisettha	XST	0.200	19	562	0.191	29	602	0.173	73	878	0.154	183	1,423	0.118	470	1,623
6	Thangon	TNG	0.200	1	39	0.191	2	40	0.173	4	45	0.154	7	55	0.118	16	55
7	Donnoun	DNN	0.200	1	39	0.191	2	40	0.173	4	45	0.154	7	55	0.118	16	55
8	Sisattanak	STN	0.200	25	736	0.191	36	748	0.173	92	1,117	0.154	176	1,368	0.118	417	1,441
9	Thadua	TDA	0.200	1	39	0.191	2	40	0.173	4	45	0.154	7	55	0.118	16	55
10	Nahai	NHI	0.200	1	39	0.191	2	40	0.173	4	45	0.154	7	55	0.118	16	55
11	Louang-Phabang	LPB	0.210	4	205	0.200	10	291	0.191	27	565	0.173	61	734	0.154	130	1,012
12	Pakxan	PXN	0.210	1	41	0.200	1	39	0.191	3	55	0.173	15	176	0.154	56	438
13	Thakhek	THK	0.210	2	103	0.200	6	174	0.191	18	365	0.173	46	559	0.154	100	780
14	Khanta-Bouli	KTB	0.210	4	205	0.200	10	291	0.191	25	511	0.173	66	798	0.154	176	1,368
15	Pakxe	PKX	0.210	4	205	0.200	7	194	0.191	18	383	0.173	55	670	0.154	113	876
	AVERAGE/TOTAL		0.203	105	3,376	0.194	166	3,739	0.179	387	5,457	0.161	841	7,588	0.130	2,028	9,489

R :Residencal Subscriber
B :Business Subscriber
CR :Originating Calling Rate (including 20% over load traffic)

Table-12 Originating Calling Rate in Bangkok City

(Unit:Line/Erlang)

	BEFORE 1968		1968		1969		1970		1971		1972		1973	
EXCHANGE	CAPACITY	CALL/RATE	CAPACITY	CALL/RATE	CAPACITY	CALL/RATE	CAPACITY	CALL/RATE	CAPACITY	CALL/RATE	CAPACITY	CALL/RATE	CAPACITY	CALL/RATE
TK					1,500	0.127	2,000	0.127	3,000	0.130	3,000	0.130	3,000	0.094
BR														
SR1					10,000	0.164	10,000	0.164	10,000	0.168	10,000	0.168	10,000	0.166
SR2					10,000	0.164	10,000	0.164	10,000	0.168	10,000	0.168	10,000	0.166
SR3													10,000	0.156
SW1											10,000	0.206	10,000	0.197
SW2											10,000	0.192	10,000	0.187
SW3													10,000	0.179
PL1					10,000	0.154	10,000	0.154	10,000	0.156	10,000	0.156	10,000	0.162
PL2					3,000	0.154	4,000	0.154	10,000	0.155	10,000	0.155	10,000	0.162
TH1														
TH2			4,000	0.102	8,000	0.106	8,500	0.106	15,000	0.103	15,000	0.103	15,000	0.106
PY1											10,000	0.123	10,000	0.123
PY2	2,000	0.140	3,500	0.129	3,500	0.129	4,500	0.129	5,000	0.121	5,000	0.121	5,000	0.131
KK1														
KK2					10,000	0.152	10,000	0.152	10,000	0.153	10,000	0.153	10,000	0.158
CP1														
CP2					10,000	0.103	10,000	0.103	10,000	0.102	10,000	0.102	10,000	0.111
TM	4,000	0.140	9,000	0.146	9,000	0.129	9,000	0.129	10,000	0.122	10,000	0.122	10,000	0.121
SP							1,000	0.083	3,000	0.083	3,000	0.083	3,000	0.077
NWW	600	0.110	1,000	0.108	1,000	0.091	1,500	0.091	5,000	0.097	5,000	0.097	5,000	0.099
PD	600	0.110	1,000	0.108	1,000	0.082	1,500	0.092	3,000	0.097	3,000	0.097	3,000	0.088
DM					1,000	0.111	1,500	0.111	3,000	0.112	3,000	0.112	3,000	0.122
BN					4,000	0.085	4,500	0.095	7,000	0.098	7,000	0.098	7,000	0.078
BK					2,000	0.101	2,500	0.101	5,000	0.106	5,000	0.106	5,000	0.094
BC					2,000	0.085	2,500	0.095	5,000	0.100	5,000	0.100	5,000	0.076
DK					3,000	0.083	3,500	0.093	5,000	0.092	5,000	0.092	5,000	0.073
BS					3,000	0.107	3,500	0.107	7,000	0.111	7,000	0.111	7,000	0.102
BP											8,000	0.120	8,000	0.102
KC							3,000	0.080	5,000	0.083	5,000	0.083	5,000	0.079
IM					4,000	0.080	4,300	0.080	4,300	0.080	4,300	0.080	4,300	0.084
PS														
LS														
PKN														
SS														
NK														
RI														
PT														
TOTAL	7,200	0.125	18,500	0.119	96,000	0.118	107,300	0.115	145,300	0.116	183,300	0.123	203,300	0.122
MAX		0.140		0.146		0.164		0.164		0.168		0.206		0.197
MIN		0.110		0.102		0.080		0.080		0.080		0.080		0.073

Table-13 Estimated Calling Rate for each Type of Calls

(Unit:Erlang)

Exchange Name		C/R	I/O	Local	Toll	Special	INTS
Vientiane	NMP	0.200	0.098	0.079	0.020	0.001	0.002
	XST	0.200	0.058	0.119	0.020	0.001	0.002
	STN	0.200	0.076	0.101	0.020	0.001	0.002
	平均	0.200	0.077	0.100	0.020	0.001	0.002
Others	LPR	0.210	0.123		0.084	0.001	0.002
	THK	0.210	0.123		0.084	0.001	0.002
	KTB	0.210	0.123		0.084	0.001	0.002
	PKX	0.210	0.123		0.084	0.001	0.002

Table-14 Estimated Traffic Flow (Year of 1993)

a. Traffic Flow Matrix in Vientiane

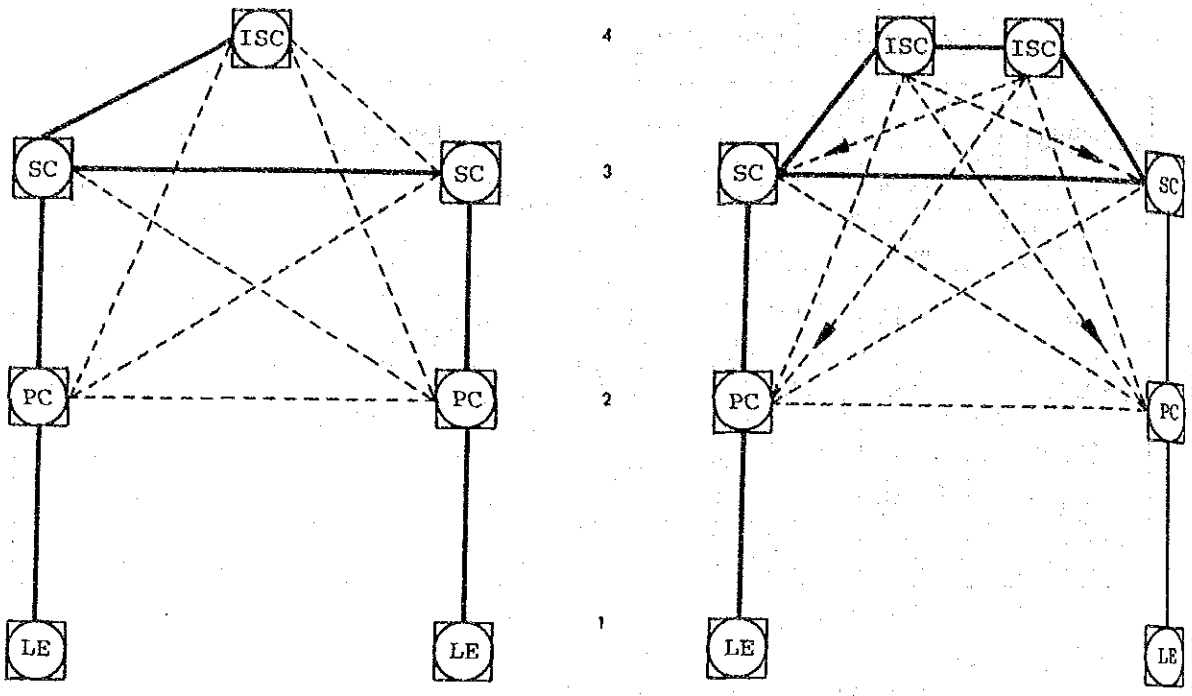
(Unit:Erlang)

Exchange	NMP	XST	STN	Toll	Special	INTS	Outgoing Total
NMP	607.8	239.2	250.5	124.0	6.0	12.4	1,240.0
XST	266.5	190.8	127.1	66.0	3.0	6.6	660.0
STN	290.3	132.5	320.8	84.0	4.0	8.4	840.0
Toll	76.3	40.6	51.7	-	-	-	168.6
Special	-	-	-	-	-	-	-
INTS	14.9	7.9	10.1	-	-	-	32.9
Terminating Total	1,255.9	611.0	760.2	274.0	13.0	27.4	2,941.5

B. Traffic Flow Matrix in Toll Network

(Unit:Erlang)

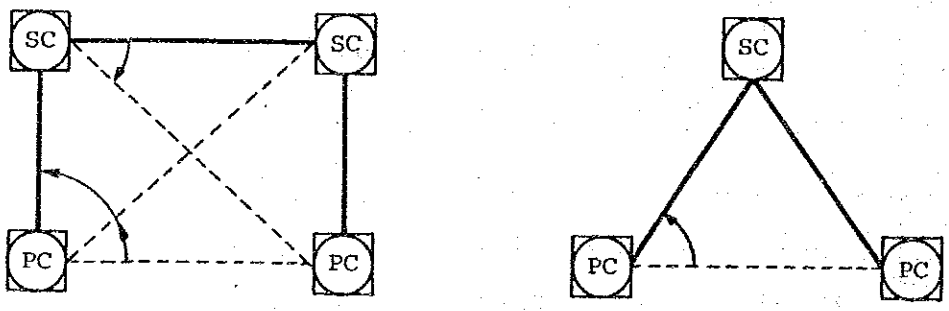
Exchange	LPR	VTN	THK	KTB	PKX	Special	INTS	Outgoing Total
LPR	123.0	62.4	5.7	9.3	6.6	1.0	2.0	210.0
VTN	100.9	2,425.6	45.4	74.8	52.9	13.0	27.4	2,740.0
THK	4.4	21.7	61.5	9.3	6.6	0.5	1.0	105.0
KTB	8.8	44.3	11.3	123.0	19.6	1.0	2.0	210.0
PKX	8.1	40.2	10.4	25.3	123.0	1.0	2.0	210.0
Special	-	-	-	-	-	-	-	-
INTS	2.4	32.9	1.2	2.4	2.4	-	-	41.3
Terminating Total	247.6	2,627.1	135.5	244.1	211.1	16.5	34.4	3,516.3



one ISC in the country two ISCs in the country

(routes without arrows are possible in both directions)

HIERARCHICAL NETWORK STRUCTURE



ROUTING PRINCIPLES

ISC: International Switching Center PC: Primary Center
SC: Secondary Center LE: Local Exchange

Figure-6 Basic Planning for National Telephone Network

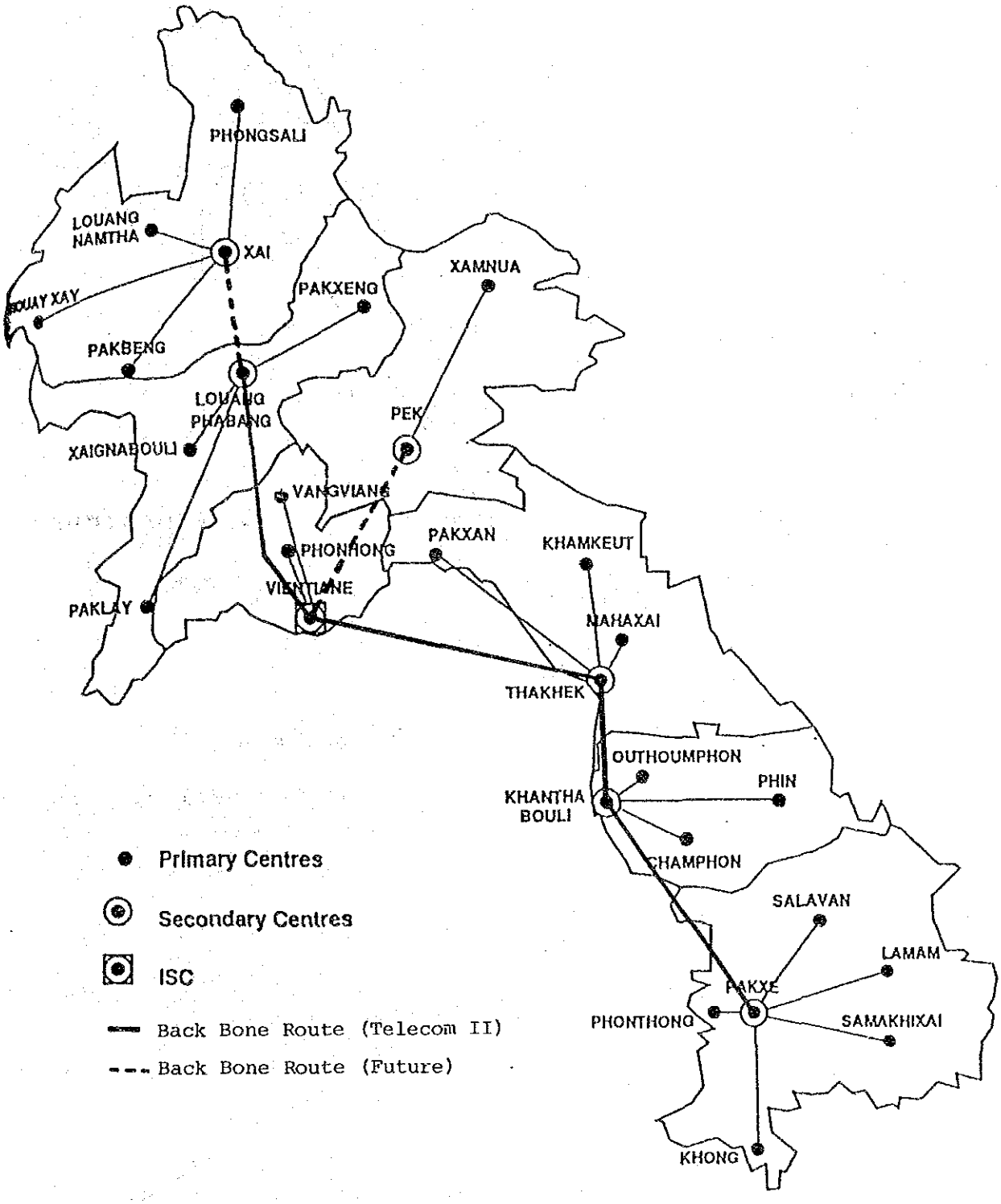


Figure-7 National Telephone Network in Lao PDR

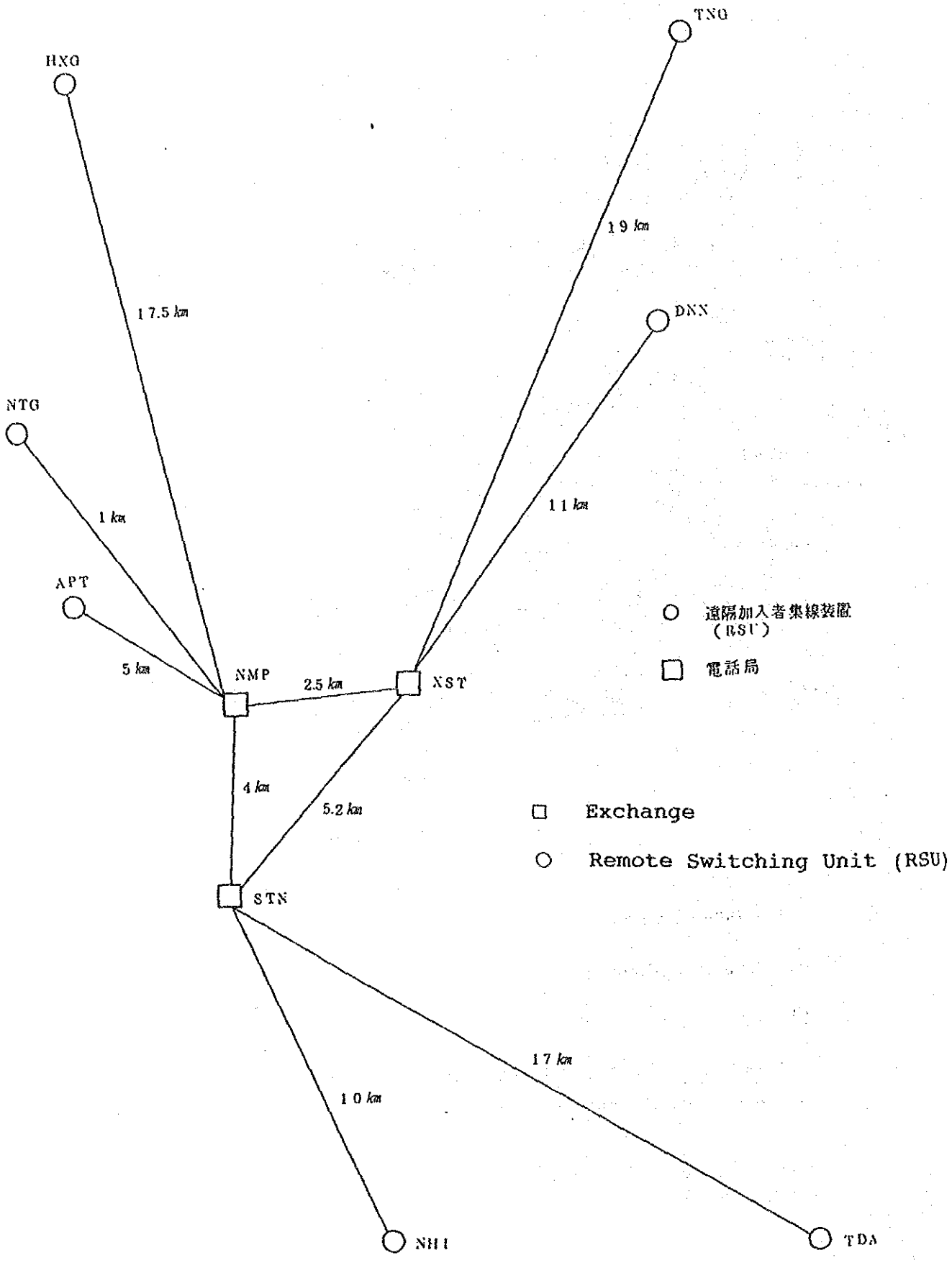
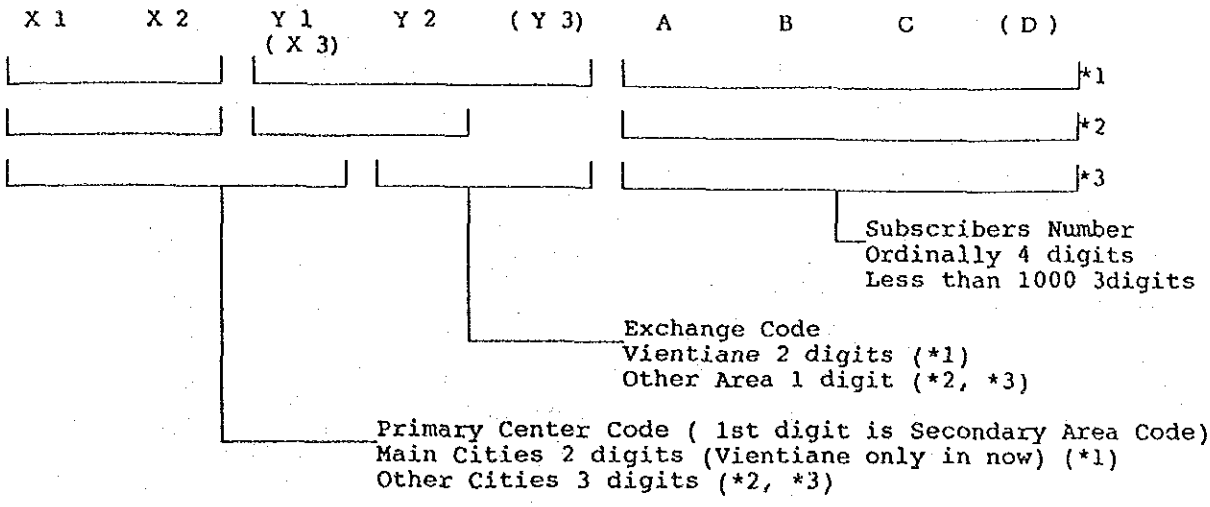


Figure-8 Local Junction Network in Vientiane Multi-Exchange Area

Table-15 National Numbering Plan

1. Numbering Configuration



2. Numbering Capacity

a. Vientiane	X1 X2 + Y1 Y2 + A B C D	700,000 subscribers
b. Other Cities (without Pakxan)	X1 X2 (X3) + Y1 (Y2) + A B C D	700,000 subscribers (Y1 only at initial stage in that case 70,000 subscribers)
c. Pakxan	X1 X2 X3 + Y2 + A B C	7,000 subscribers

3. Special Service Code

"13" Movile Telephone Service (Reserved)
"171" Toll Manual Boad
"175" Complain
"178" National Information
"179" International Information
"170" International Boad
"191" Police
"195" Ambulance
"190" Fire

4. Network Identification Code

"0" Toll Network
"00" International Network

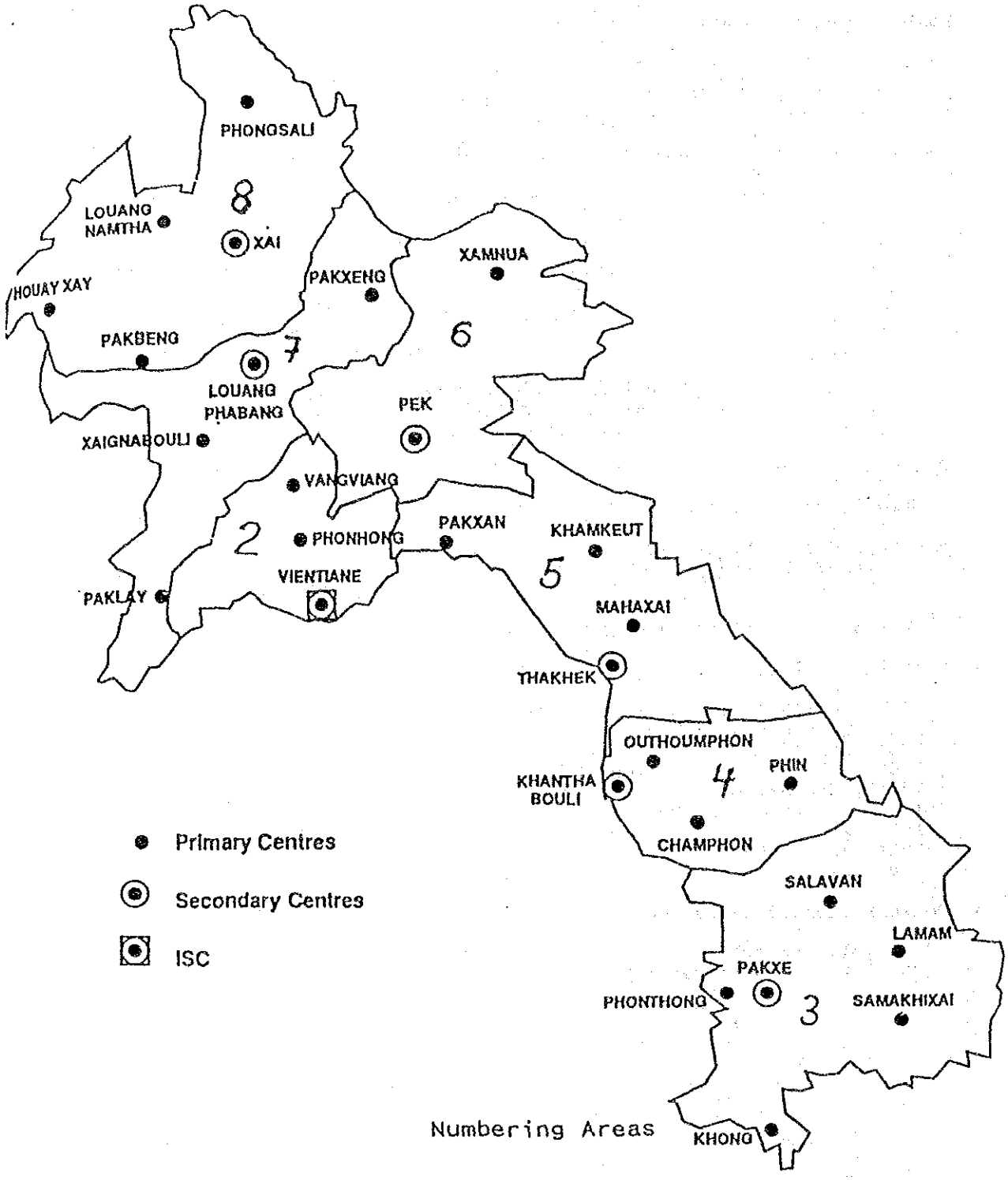
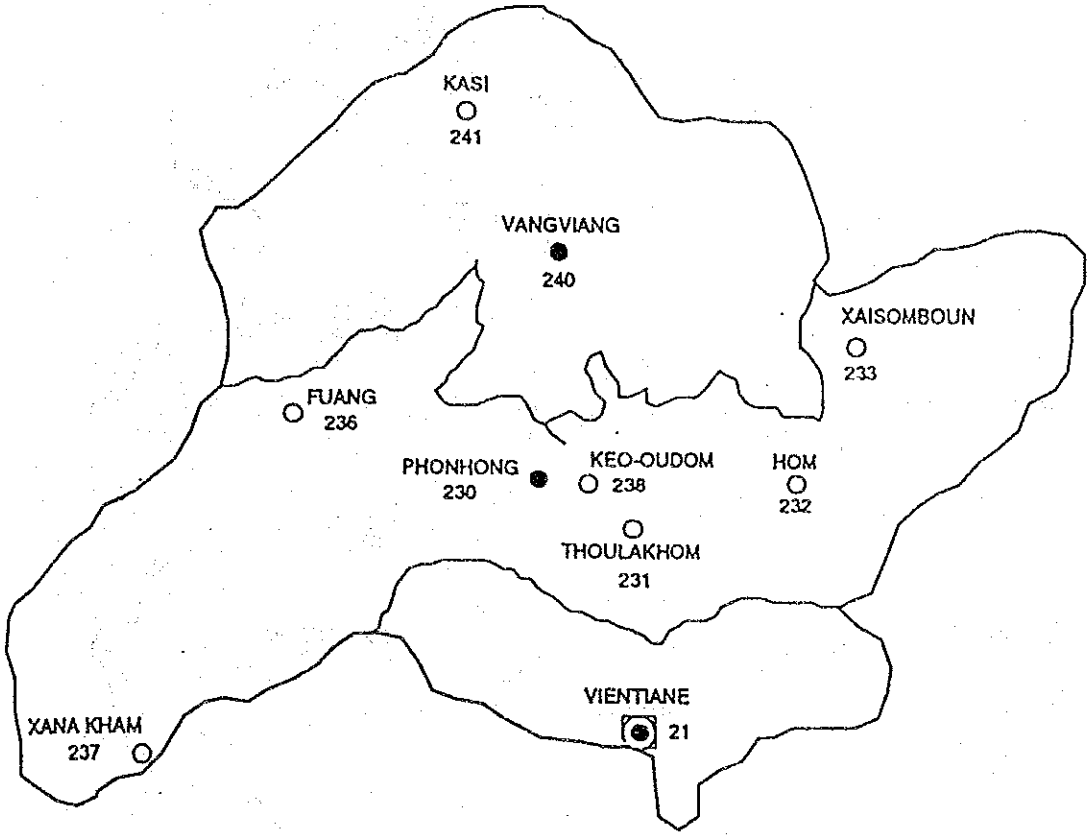
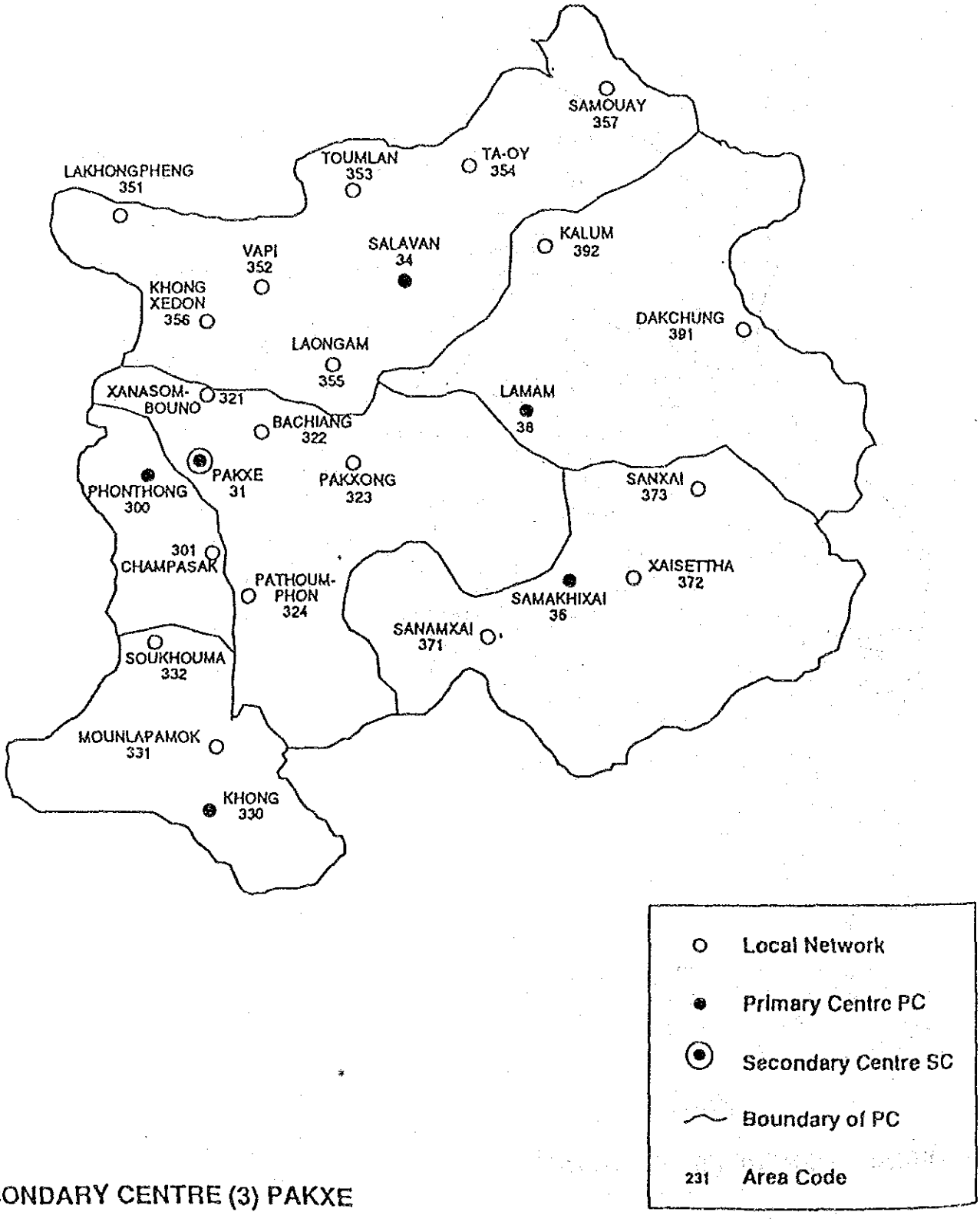


Figure-9 National Numbering Plan (1/10)



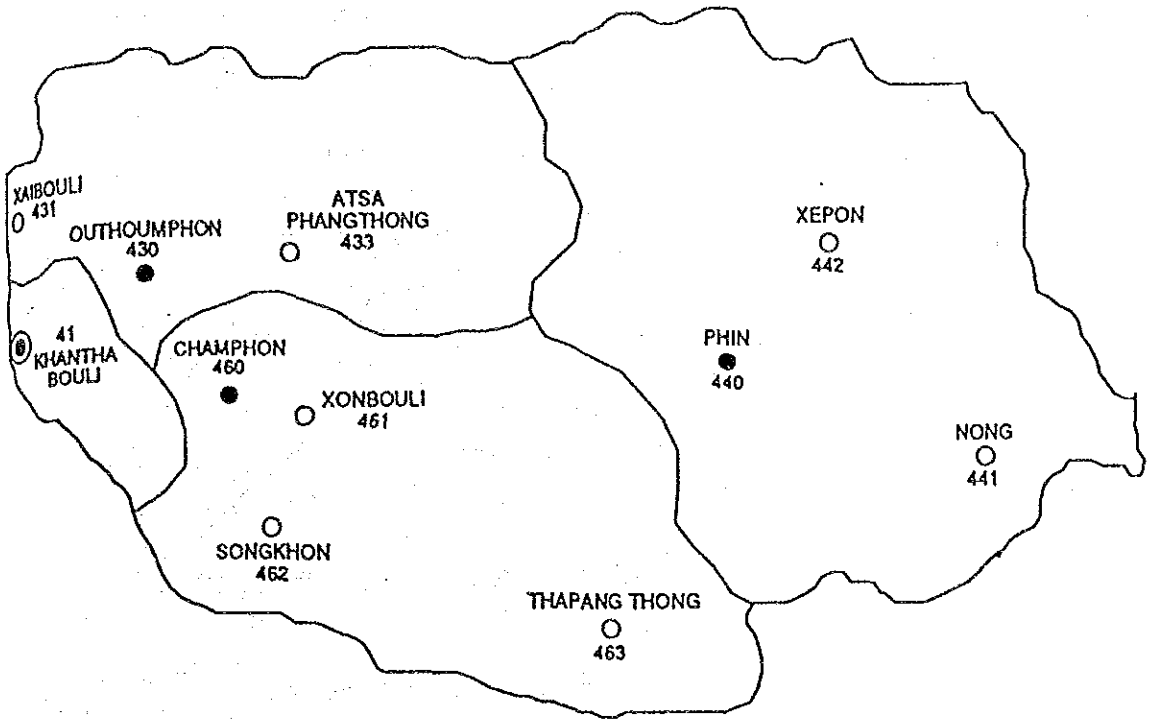
SECONDARY CENTRE (2) VIENTIANE

Figure-9 National Numbering Plan (2/10)



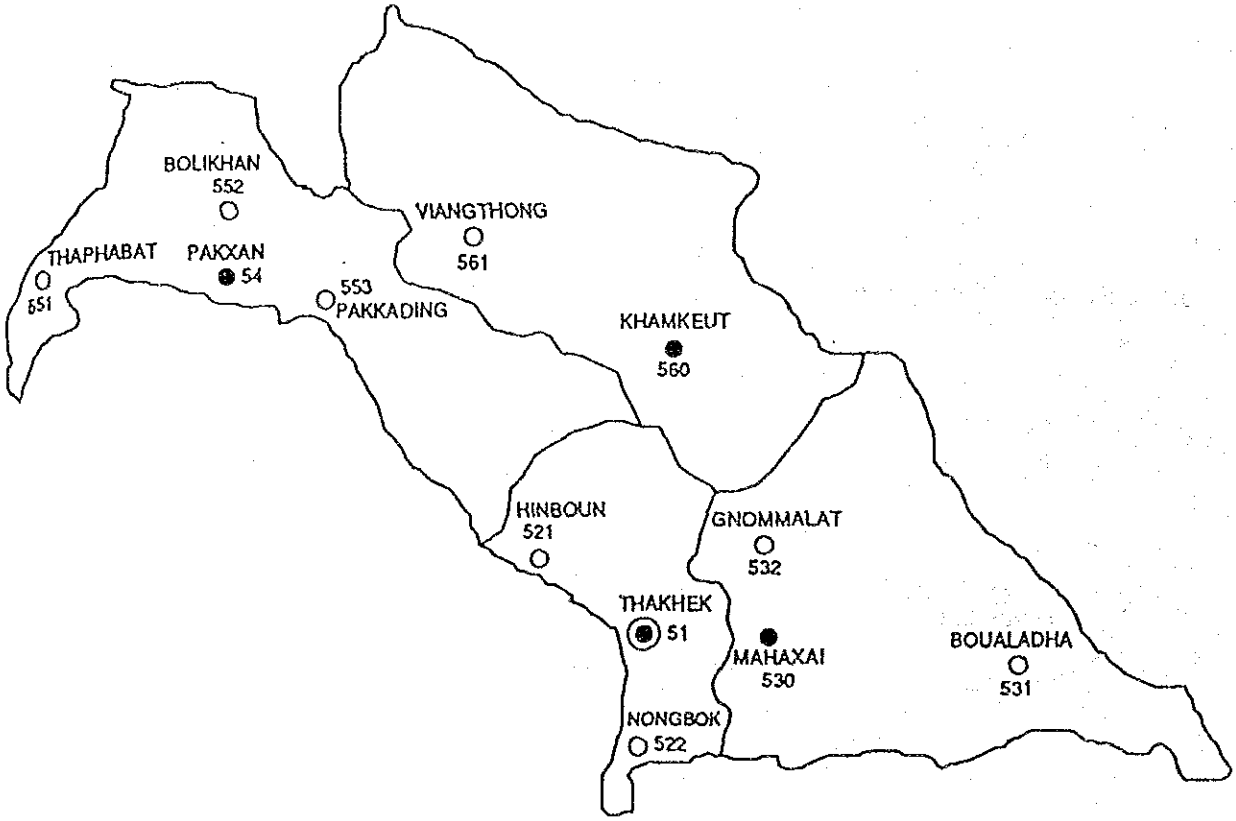
SECONDARY CENTRE (3) PAKXE

Figure-9 National Numbering Plan (3/10)



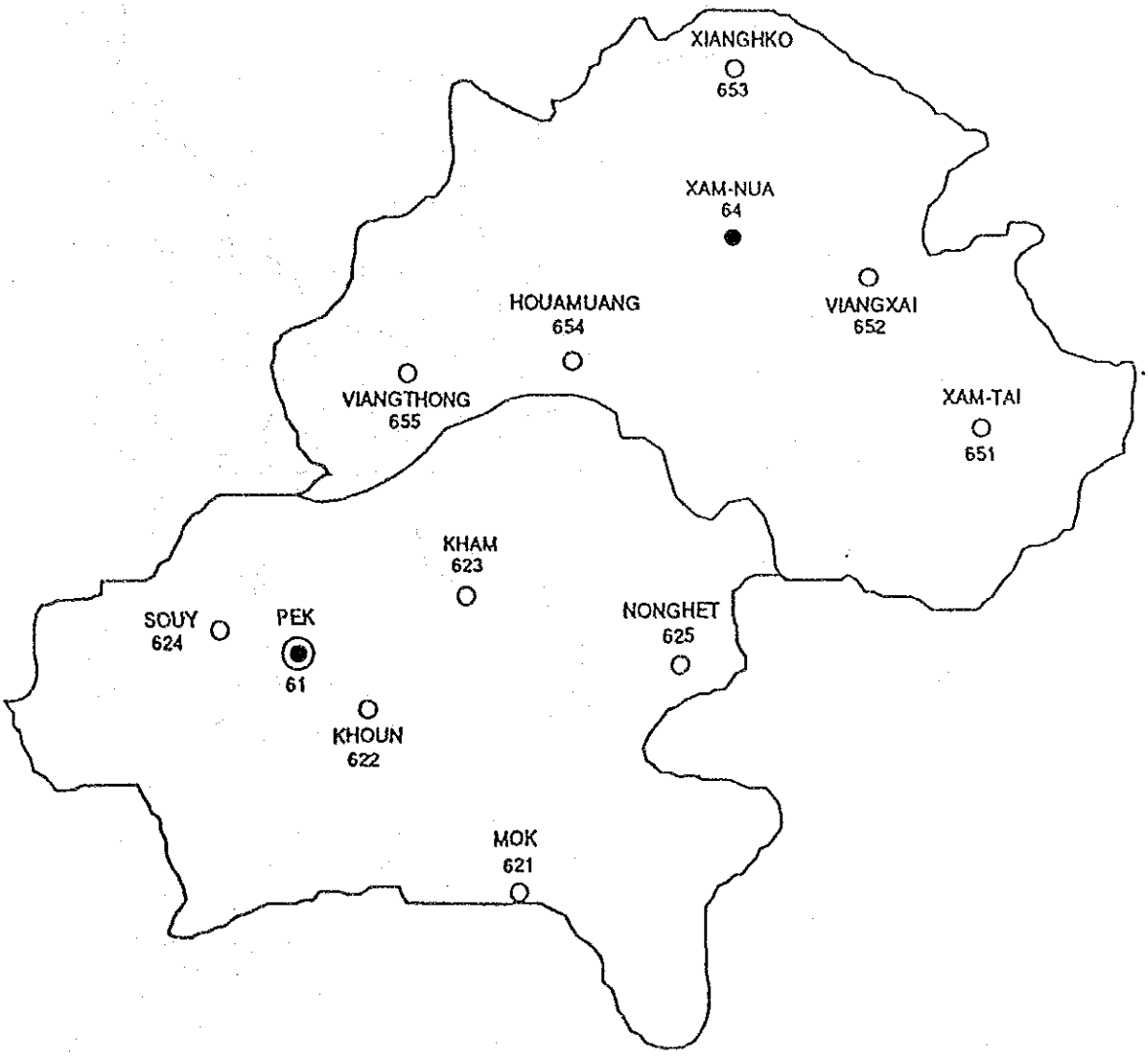
SECONDARY CENTRE (4) KHANTHABOULI

Figure-9 National Numbering Plan (4/10)



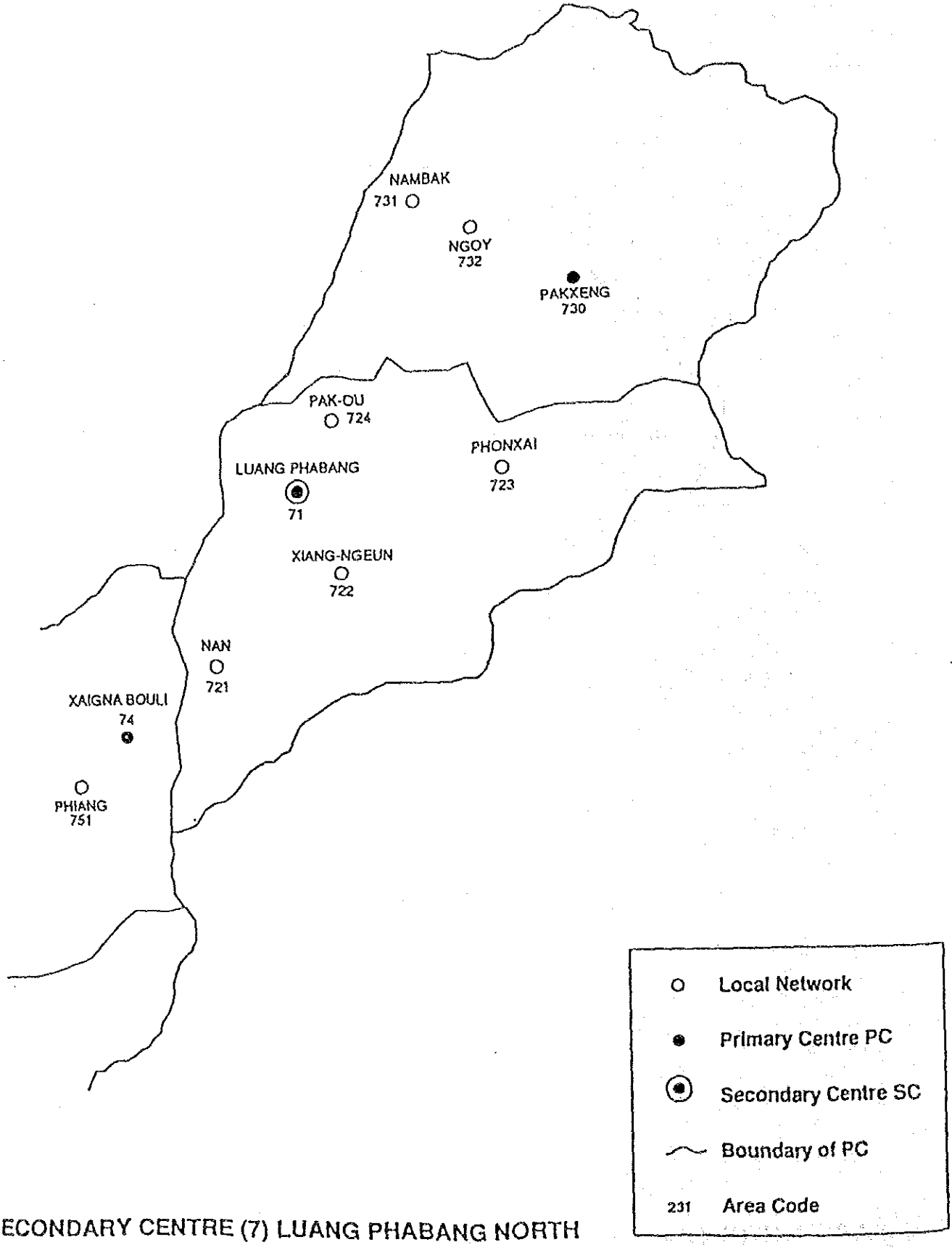
SECONDARY CENTRE (5) THAKHEK

Figure-9 National Numbering Plan (5/10)



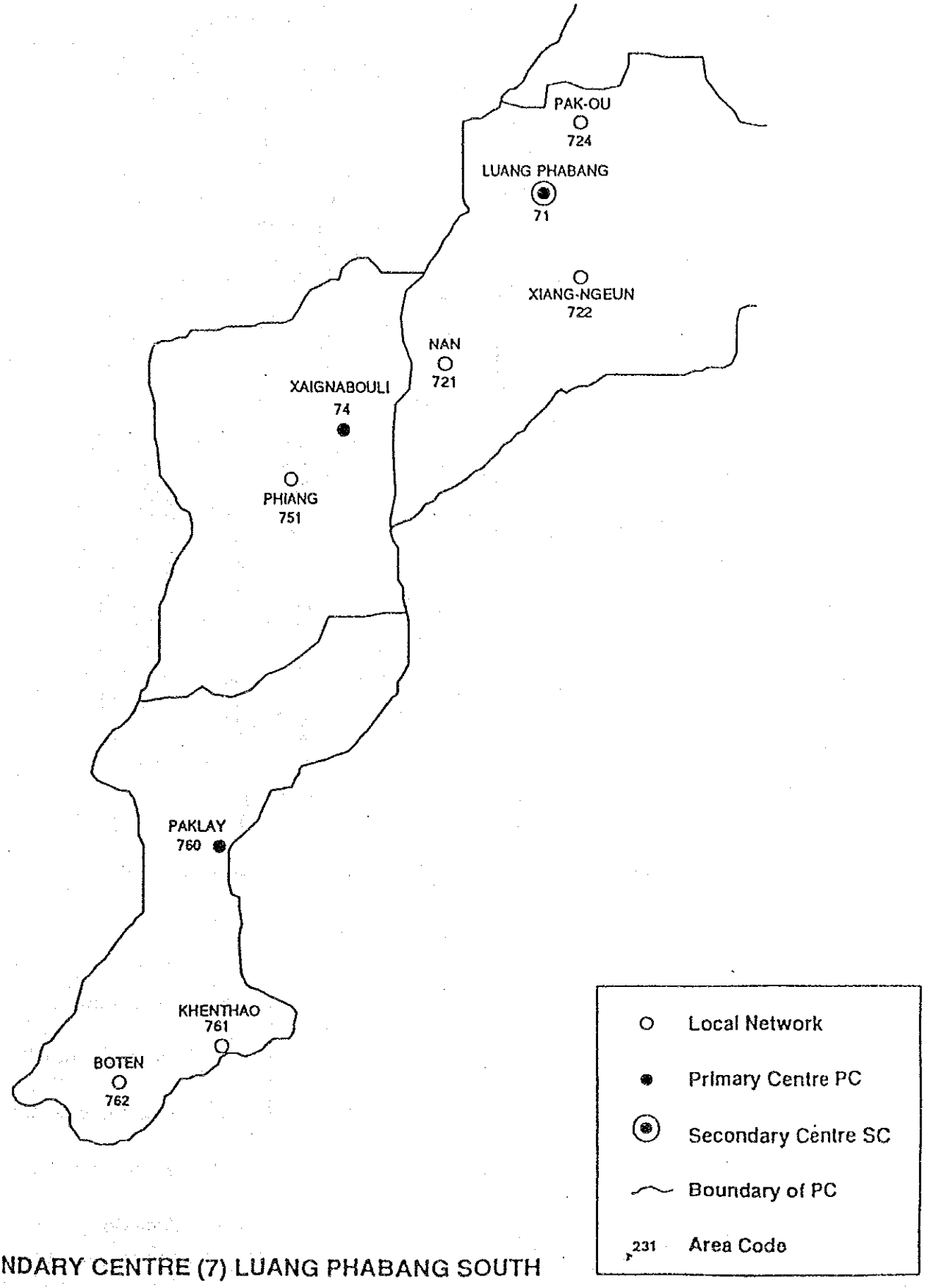
SECONDARY CENTRE (6) PEK

Figure-9 National Numbering Plan (6/10)



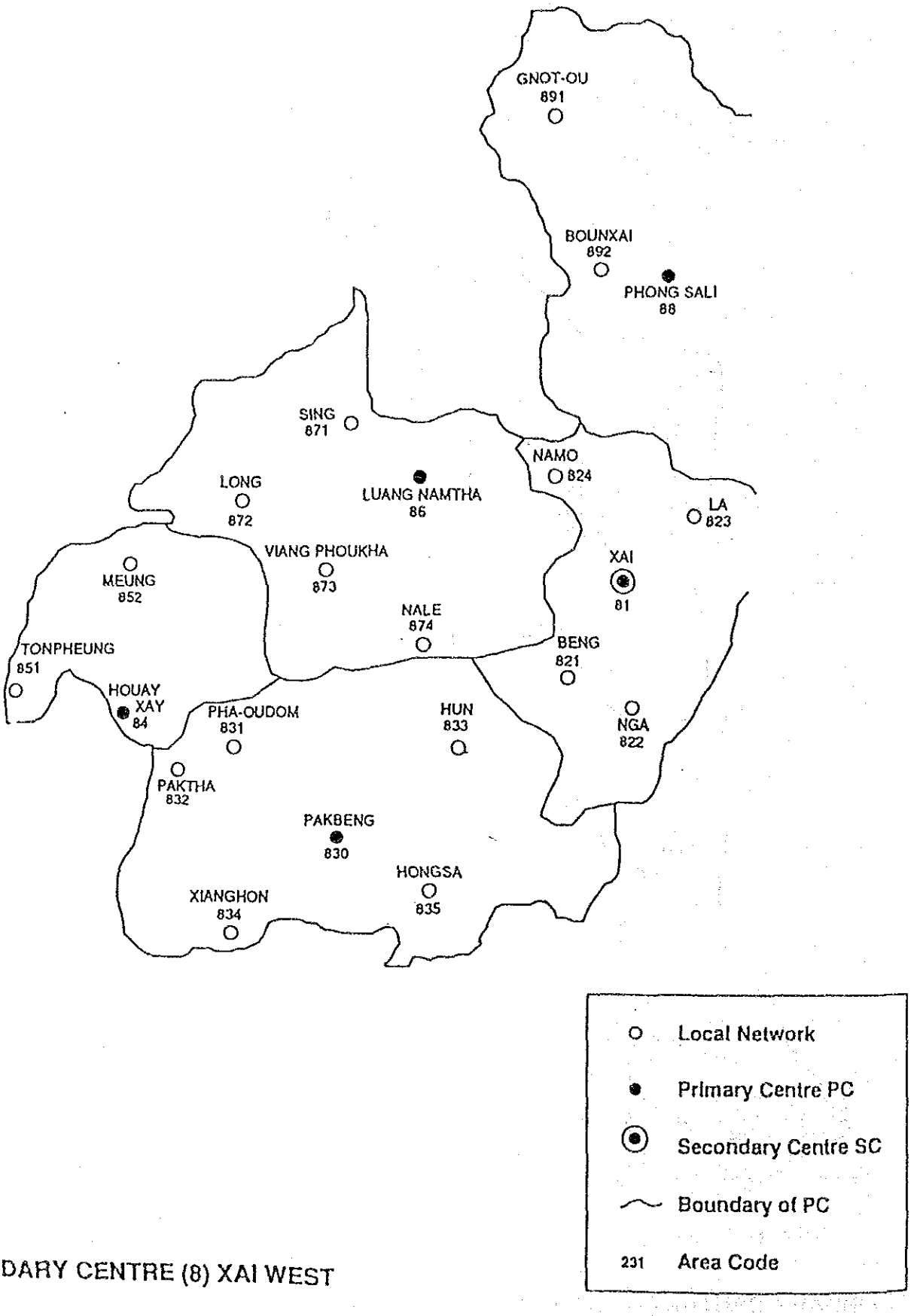
SECONDARY CENTRE (7) LUANG PHABANG NORTH

Figure-9 National Numbering Plan (7/10)



SECONDARY CENTRE (7) LUANG PHABANG SOUTH

Figure-9 National Numbering Plan (8/10)



SECONDARY CENTRE (8) XAI WEST

Figure-9 National Numbering Plan (9/10)

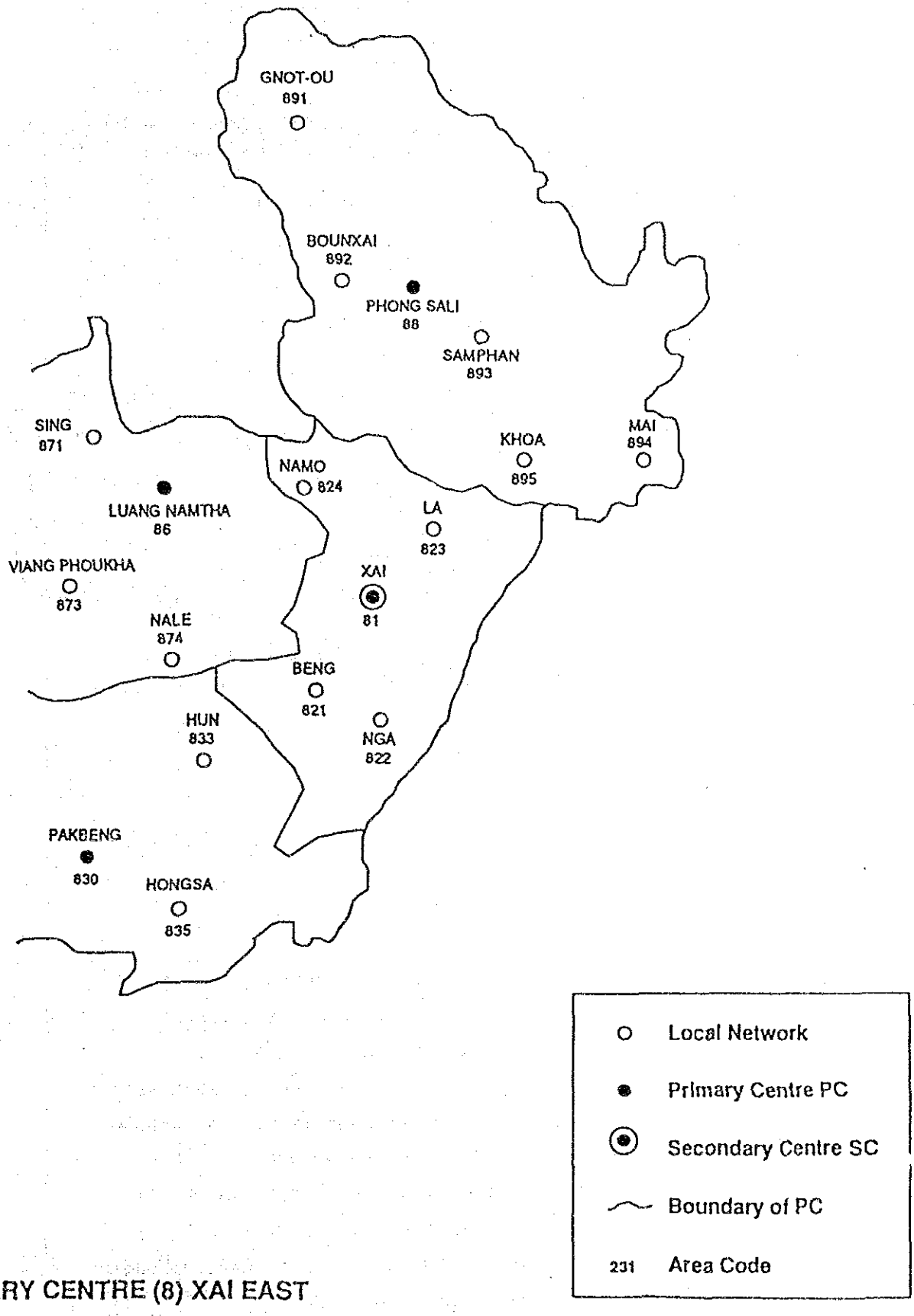
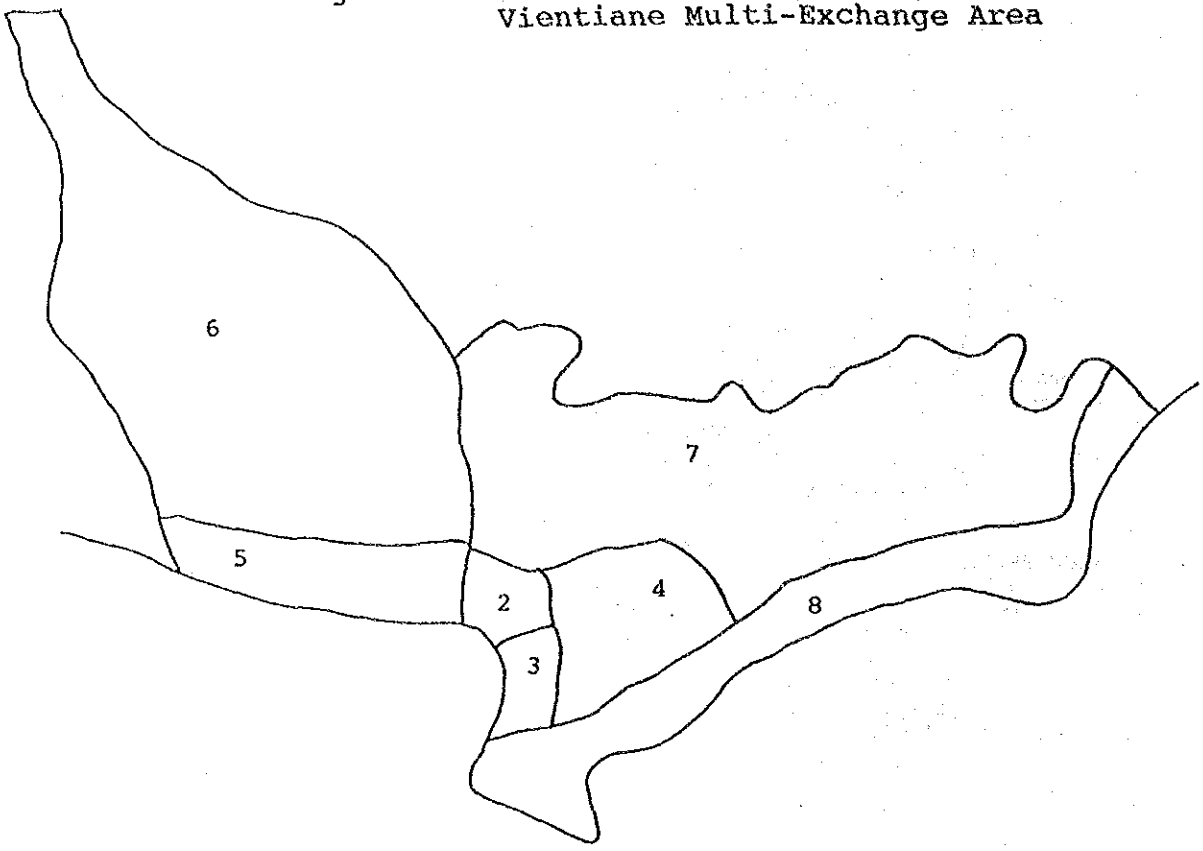


Figure-9 National Numbering Plan (10/10)

Figure-10 Recommendable Numbering Plan for Vientiane Multi-Exchange Area



National Area Code "21"

Local Area Code

"2X"	Numphou Exchange (Chanthabouli)
"3X"	Sisattanak Exchange (Sisattanak)
"4X"	Xisettha Exchange (Xisattha)
"5X"	Airport Exchange (RSU) (Sikhottabong)
"6X"	Houaxang Exchange (RSU) (Naxaythong)
	Nongteng Exchange (RSU) (")
"7X"	Thangon Exchange (RSU) (Xaithani)
	Donnoun Exchange (RSU) (")
"8X"	Thadua Exchange (RSU) (Hatsayphong)
	Nahai Exchange (RSU) (")

"X" is any figure from "1" to "0"

Table-16 Tariff System (After Jan. 1991)

Telephone Tariff

1. Basic Charge

a. Automatic Subscriber with Charge Meter

Area Scale	Res./Gov. (Kip)	Business (Kip)	Foreigner (US$)
～ 200	3,200	4,800	—
201～1,000	3,600	5,400	—
1,000～5,000	4,000	7,600	11.60
5,001～10,000	4,800	8,400	12.80
10,000以上	5,600	9,600	14.00

b. Automatic Subscriber without Charge Meter

Area Scale	Res./Gov. (Kip)	Business (Kip)	Foreigner (US$)
～ 50	2,000	4,200	6.00
51 ～ 100	3,200	4,800	6.70
101以上	3,600	5,400	7.50

c. Manual Subscriber

Area Scale	Res./Gov. (Kip)	Business (Kip)	Foreigner (US$)
～ 50	1,600	2,000	—
51 ～ 100	2,000	2,500	—
101以上	2,400	3,000	—

2. Installation Charge

Res./Gov.	70,000 Kip
Business	100,000 Kip
Foreigner	176.60 US$

3. Local Call Charge (over 30 calls)

Res./Gov.	40 Kip
Business	50 Kip
Foreigner	0.1 US$
Public Telephone	60 Kip

4. Toll Call Charge (Whole Country Single Rate by using HF link)

Subscriber Category	Initial 3 Minutes	Aditional 1 Minute	Handling Charge
Residence/Business	450Kip	150Kip	—
Government	600Kip	200Kip	—
Public Telephone	600Kip	200Kip	100Kip

Note: Special Handling Charge 300 Kip shall be corrected when subscriber calls over the official time (7:30-11:30, 14:00-17:30)

Table-17(1/3) Tariffs for Internaitonal Calls (US$)

Since 01.06.88

Country	3 minutes	Additional minutes
Thailand I	0.87	0.29
II	2.34	0.78
III	3.24	1.08
Via Hanoi		
Vietnam	8.13	2.71
Cambodia	8.13	2.71
Via Moscow		
Vietnam	10.86	3.62
Cambodia	10.86	3.62
U.S.S.R	10.86	3.62
North Korea	10.86	3.62
Cuba	12.21	4.07
Mongolia	9.51	3.17
German D.R.	9.51	3.17
Bulgaria	9.51	3.17
Hungary	9.51	3.17
Czechoslovakia	9.51	3.17
Romania	9.51	3.17
Poland	9.51	3.17
France	13.29	4.43
Germany, F.R.	13.29	4.43
Via Hongkong		
Asia		
Vietnam	12.21	4.07
U.S.S.R	21.81	7.27
Abu-Dhabi	13.29	4.43
Brunei	13.29	4.43
Bharein	17.73	5.91
Bangladesh	13.29	4.43
China	14.94	4.98
North Korea	12.21	4.07
South Korea	13.29	4.43
Hongkong	9.03	3.01
Kowloon	9.03	3.01
India	14.79	4.93
Indonesia	11.82	3.94

Table-17(2/3) Tariffs for Internaitonal Calls (US$)

Since 01.06.88

Country	3 minutes	Additional minutes
Japan	13.29	4.43
Macao	11.52	3.84
Malaysia	13.29	4.43
Maledives	13.29	4.43
Oman	18.45	6.15
Pakistan	9.45	3.15
Philippines	13.29	4.43
Singapore	13.29	4.43
Srilanka	14.79	4.93
Taiwan	11.07	3.69
Thailand	13.29	4.43
Qatar	13.29	4.43
Myanmar	9.99	3.33
Kuwait	17.73	5.91
Saudi-Arabia	22.17	7.39
Oceania		
Australia	13.29	4.43
Fiji	13.29	4.43
New-Zealand	10.35	3.45
New Hebrides	23.64	7.88
Netherlands Antilles	16.14	5.38
Tonga	17.73	5.91
Aruba	16.14	5.38
West-Samoa	13.29	4.43
Hawaii	15.00	5.00
Europe		
German D.R.	13.59	4.53
Bulgaria	16.29	5.43
Hungary	19.62	6.54
Romania	16.29	5.43
Poland	12.21	4.07
Austria	11.22	3.74
Great Britain	11.82	3.94
Germany, F.R.	13.29	4.43
Belgium	17.73	5.91
Denmark	13.29	4.43
Spain	13.29	4.43
France	13.29	4.43
Finland	13.29	4.43

Table-17(3/3) Tariffs for Internaitonal Calls (US$)

Since 01.06.88

Country	3 minutes	Additional minutes
Greece	13.29	4.43
Netherlands	13.29	4.43
Iceland	17.73	5.91
Italy	17.73	5.91
Luxembourg	17.73	5.91
Norway	17.73	5.91
Portugal	17.73	5.91
Sweden	13.29	4.43
Switzerland	17.73	5.91
Africa		
Uganda	17.73	5.91
Angola	17.73	5.91
Mosambik	17.73	5.91
Kap Verde	17.73	5.91
Guinea-Bissau	17.73	5.91
Sao Tome and Principe	17.73	5.91
Kenya	17.73	5.91
Tanzania	22.17	7.39
Algeria	17.73	5.91
Marocco	17.73	5.91
Egypte	22.62	7.54
America		
Alaska	18.75	6.25
Antigua	17.73	5.91
Brazil	17.73	5.91
Barbados	17.73	5.91
Canada	14.54	4.18
Cuba	12.21	4.07
Jamaika	17.73	5.91
U.S.A.	15.00	5.00
Mexico	17.73	5.91
Peru	11.82	3.94
Puerto Rico	18.75	6.25
British Virgin Islands	18.75	6.25

4-3 Basic Plan for Introduction of Exchange

4-3-1 Selection of Exchange Type

Telephone switching facilities to be introduced under this Project are full automatic telephone exchanges of stored program control system using digital technologies (digital telephone exchange). A block diagram to indicate the main equipments composing the exchange is given in Figure-11. In Figure-12 and Figure-13 are presented the construction of the billing computer and the equipment for centralized operation and maintenance, both being integral part of the exchange.

The introduction of digital exchanges (including ancillary facilities) is decided for the following reasons:

a. Full digitalization is the current tendency of telecommunications technology.

b. The installation cost of digital switching facilities is lower than that of analogue switching facilities.

c. A number of manufacturers already stop manufacturing of analogue switching facilities and, therefore, it will become difficult to obtain necessary maintenance/spare parts in the future.

d. The installation of digital switching facilities requires less space as compared with analogue switching facilities, leading to cost economization.

e. Digital switching facilities are superior to analogue switching facilities in stability and reliability.

Digital switching facilities to be installed in Numphou, Xaisettha, and Sisattanak in Vientiane Municipality are so designed that they require maintenance staff stationed therein. However, for Xaisettha and Sisattanak, maintenance staff will be stationed only during day time, from 7:00 to 17:00, and during night time, i.e., 17:00 - 7:00 next morning, no personnel will be stationed but remotely controlled and supervised from Numphou Exchange.

Digital exchanges in Louang Phabang, Thakhek, Khanta Bouli and Pakxe are also those to be maintained by personnel stationed in respective exchanges. However, exchanges other than Khanta Bouli will have maintenance personnel only during day time, with no person during night time. Remote control and supervision for Louang Phabang be made by Vientiane Numphou and for other exchanges, by Khanta Bouli Exchange.

The facilities to be installed should be capable of providing the standard services specified by CEPT.

4-3-2 Provision Year

Provision year of the telephone switching facilities under this Project (the number of fiscal years to be taken into account in calculating the capacity of the facilities to be provided by this Project) is set to be only one, i.e., the initial year 1993.

However, the functions of the facilities installed should be workable all through its service life (usually 15 years) with appropriate additional expansion works, and without particular modification on the basic facilities.

4-3-3 Provision Capacity

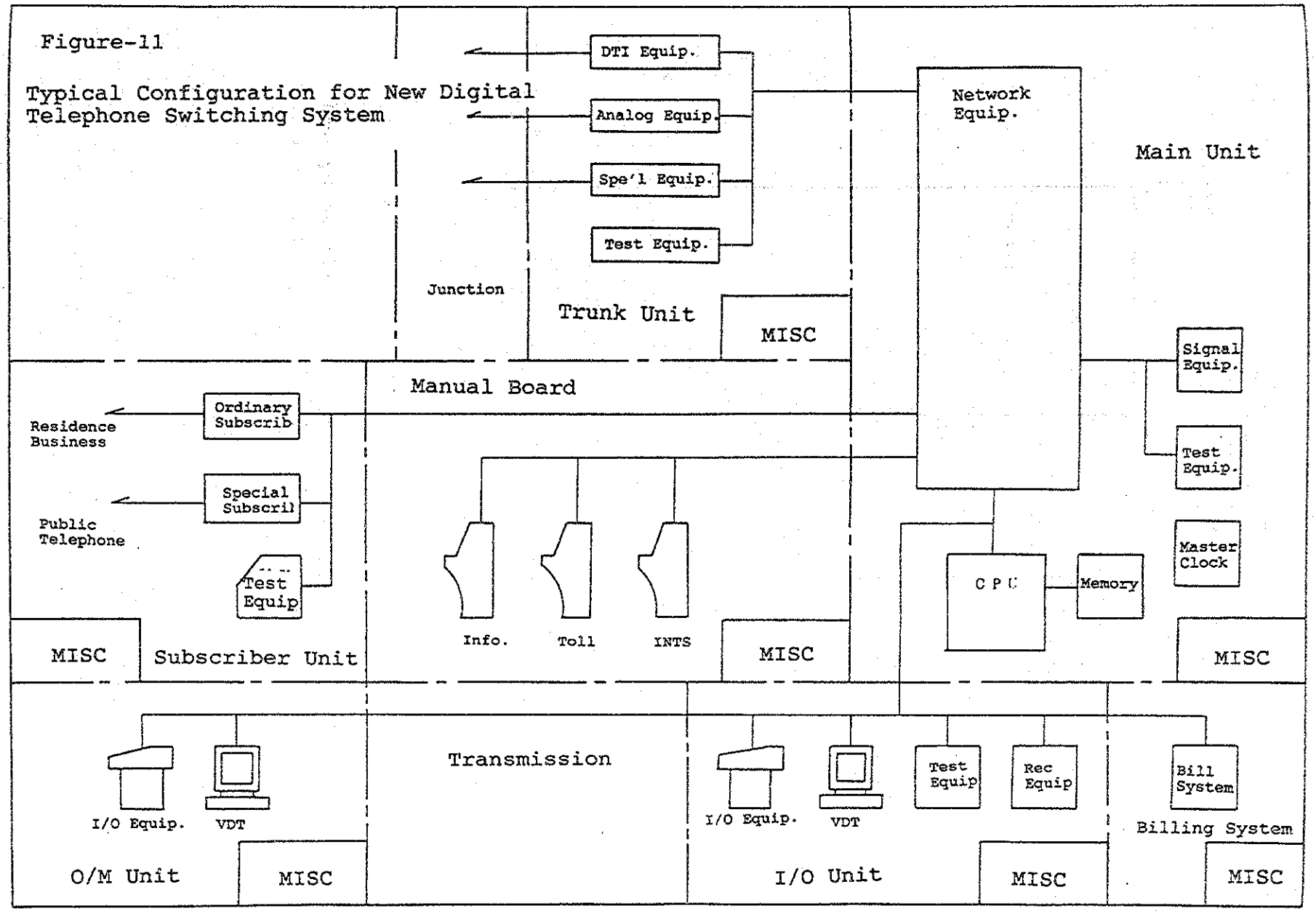
The capacity of the digital switching facilities to be provided by this Project should be such that can meet the requirements during the provision year mentioned above.

On the basis of descriptions in Section 1, Section 2 and the above Item 4-3-2 of this Chapter, capacities of the facilities are calculated as follows:

- Traffic volume of toll trunk network ... Figure-14
- Traffic volume of local switching network in Vientiane ... Figure-15
- Traffic and necessary circuits requirements of each exchange ... Figure-16

Figure-11

Typical Configuration for New Digital Telephone Switching System



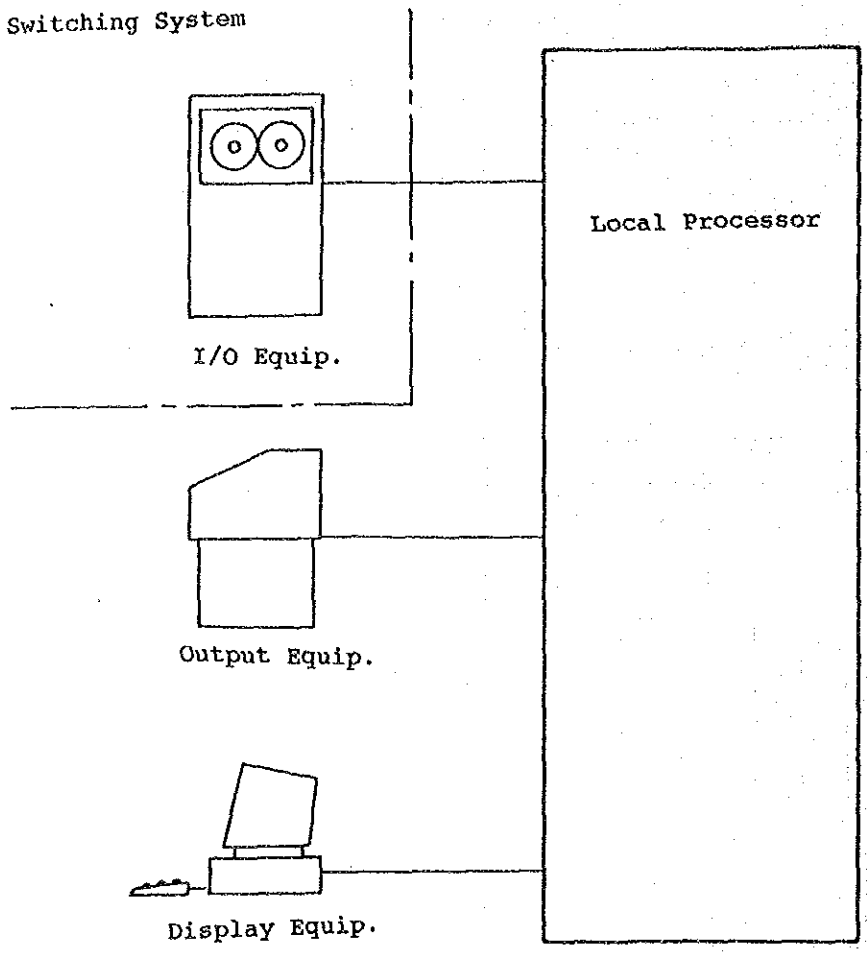


Figure-12 Typical Configuration for Billing System

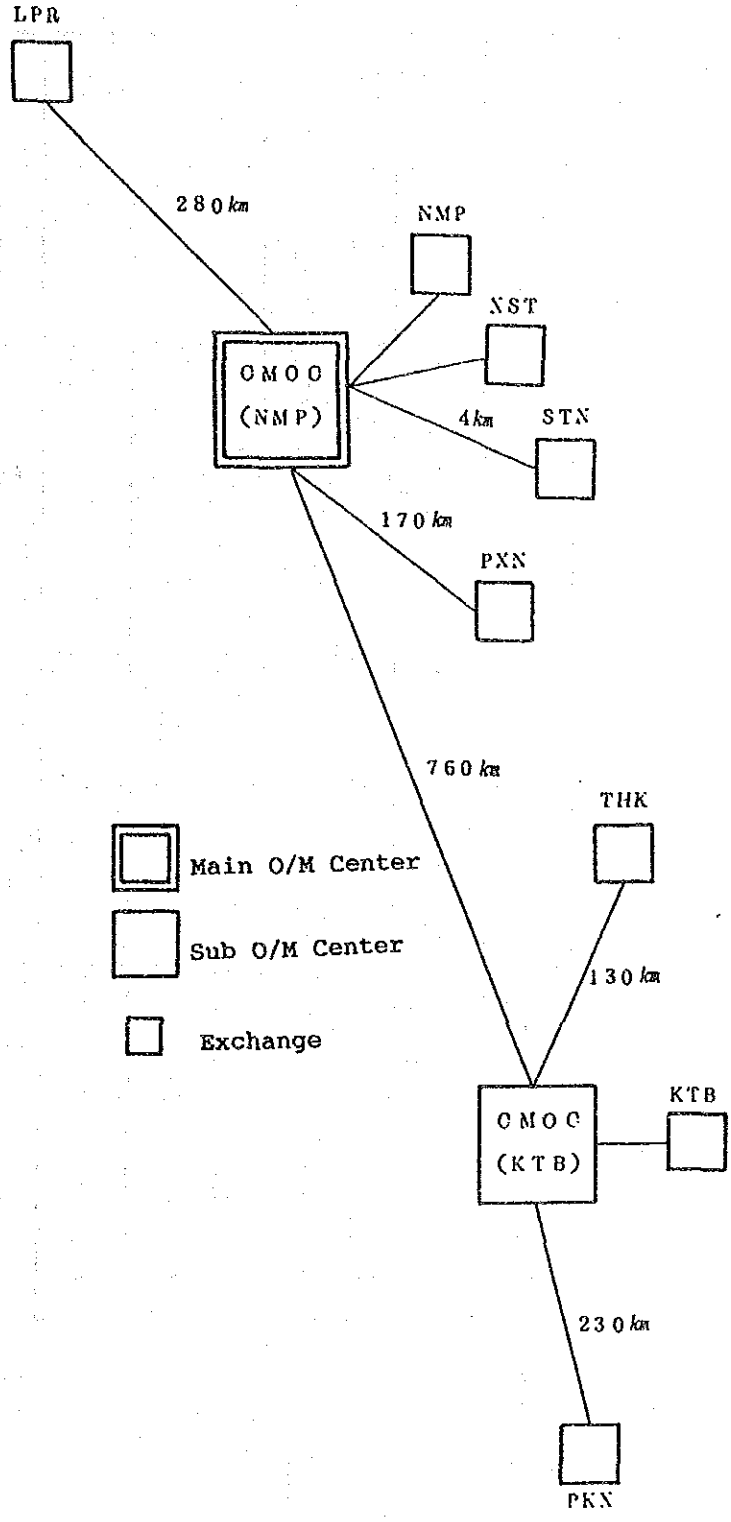
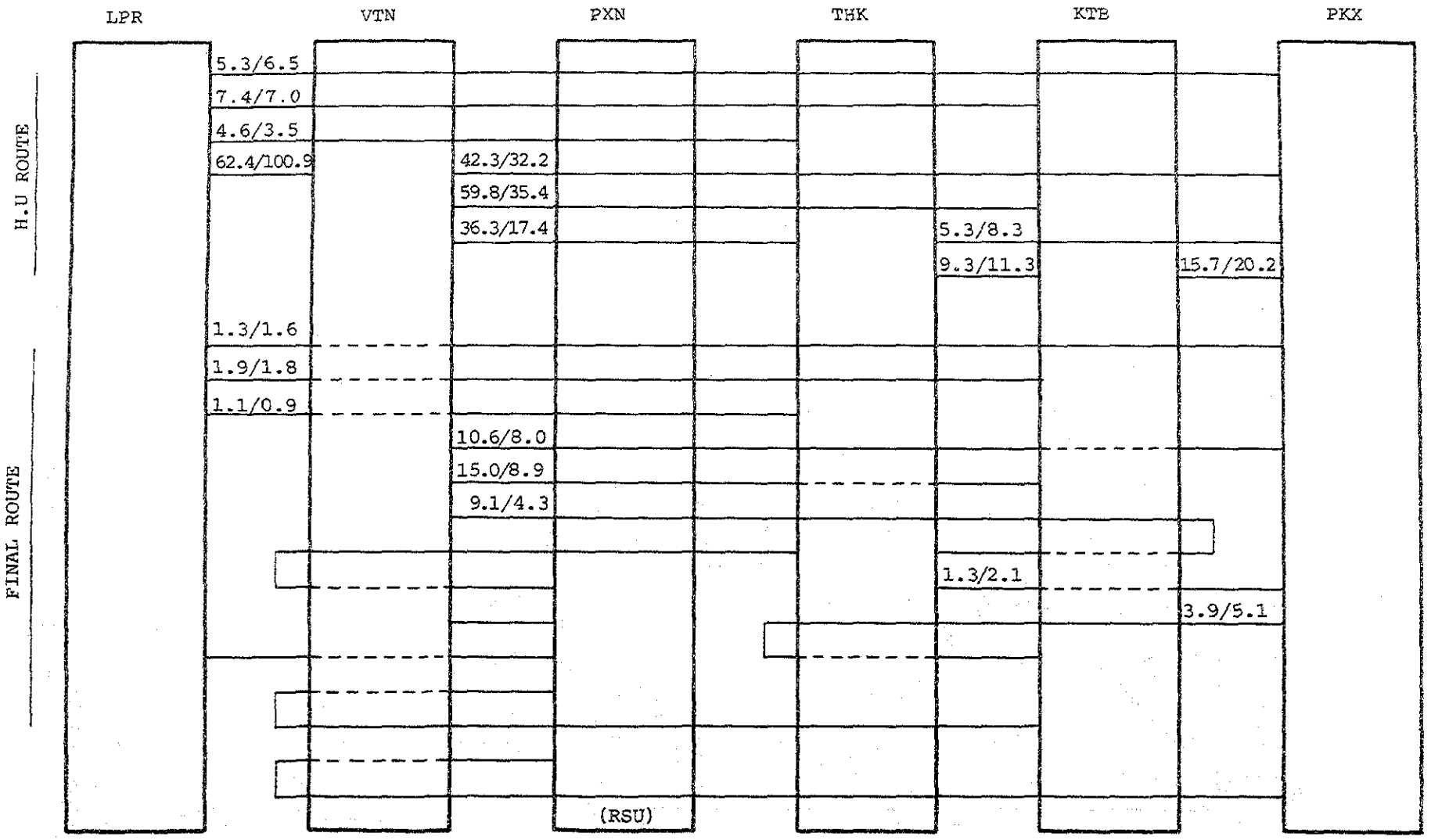


Figure-13 Typical Configuration for Centrallaized Operation & Maintenance System



——— DIRECT CONNECTION

----- CONNECTION VIA SWITCHING SYSTEM

5.3/6.5 TRAFFIC FLOW FROM LEFT TO RIGHT/TRAFFIC FLOW FROM RIGHT TO LEFT.
EACH TRAFFIC VOLUME IS NO INCLUDED THE INTERNATIONAL TRAFFICS.

Figure-14 Traffic Flow Condition on National Telephone Network

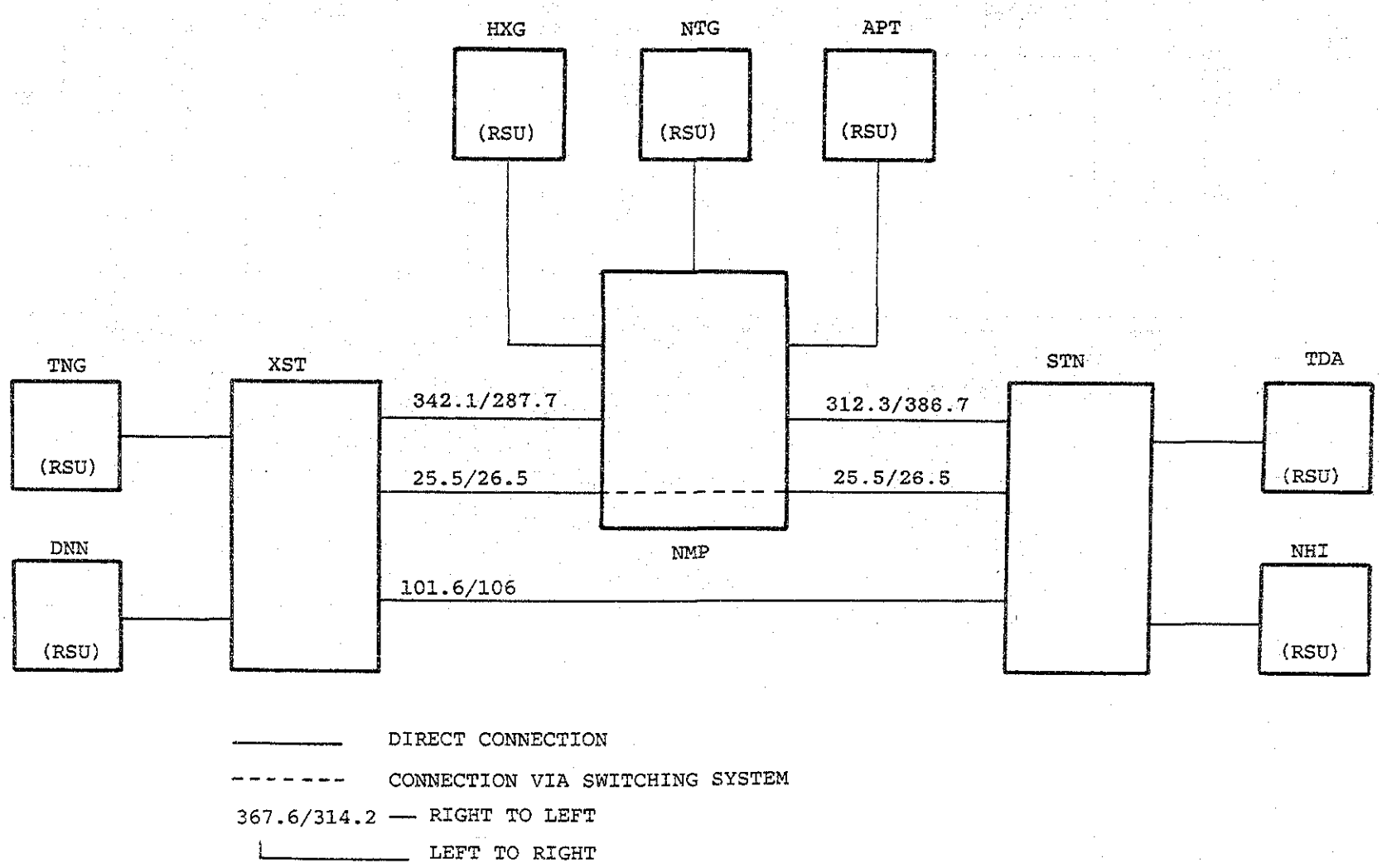


Figure-15 Traffic Flow Condition on Local Telephone Network in Vienti

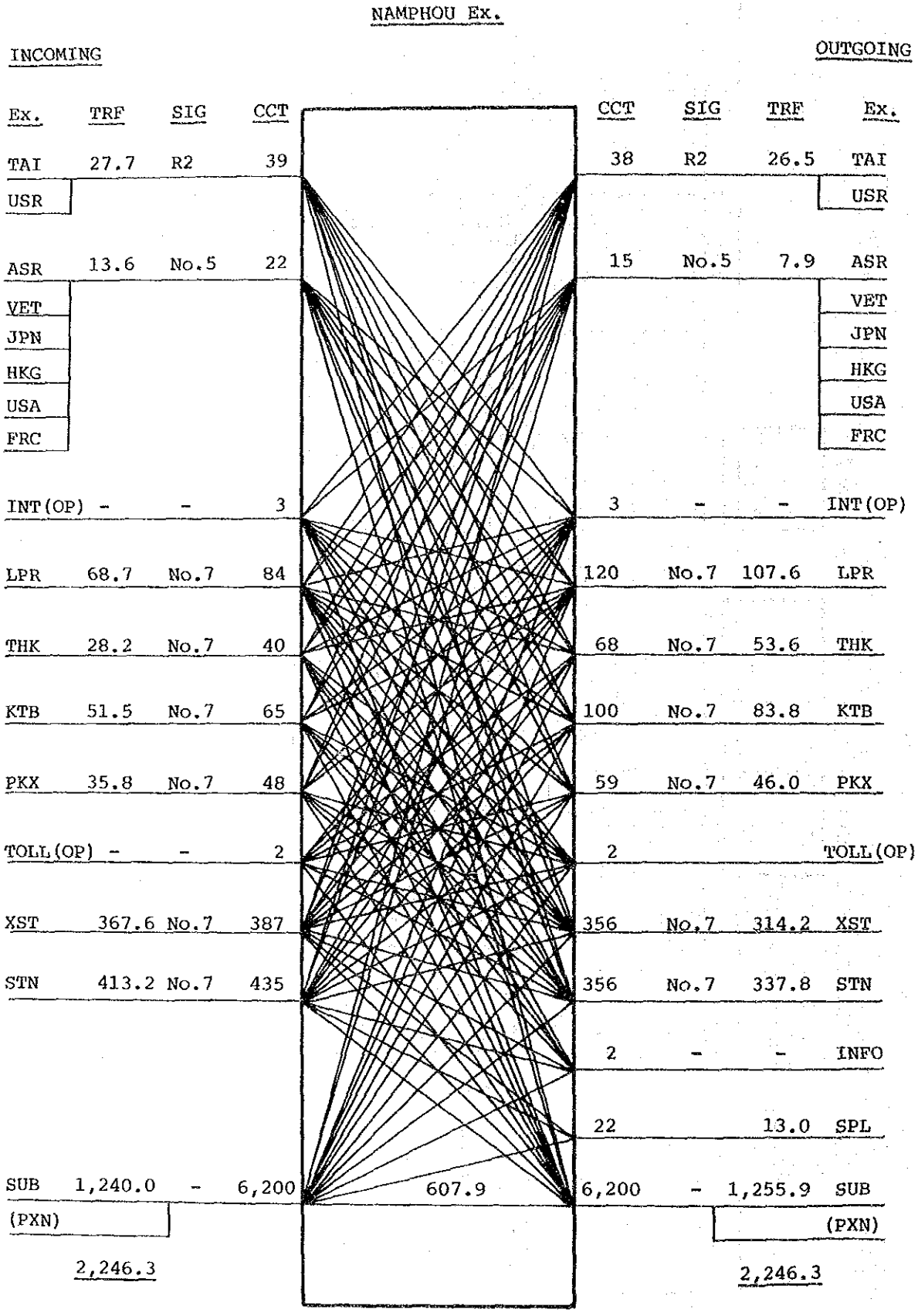


Figure-16(1/7) Traffic Flow Condition in Numphu Exchange

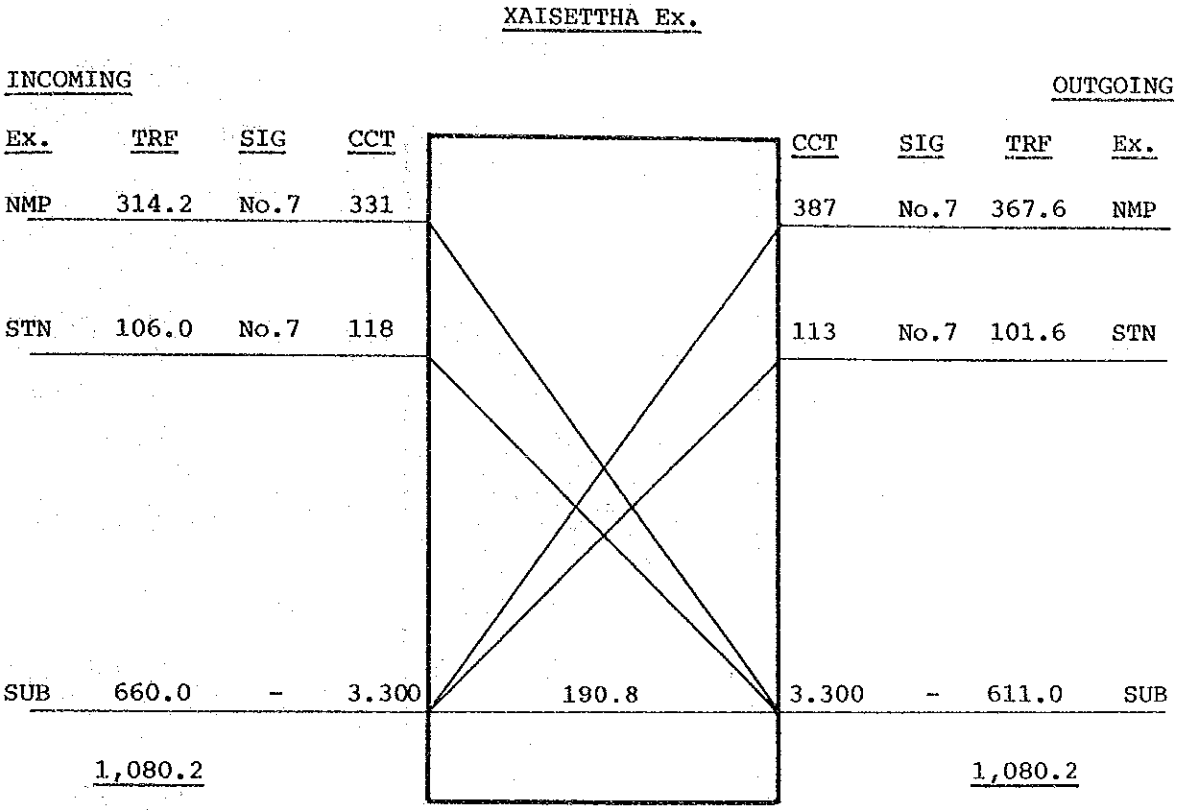


Figure-16(2/7) Traffic Flow Condition on Xisettha Exchange

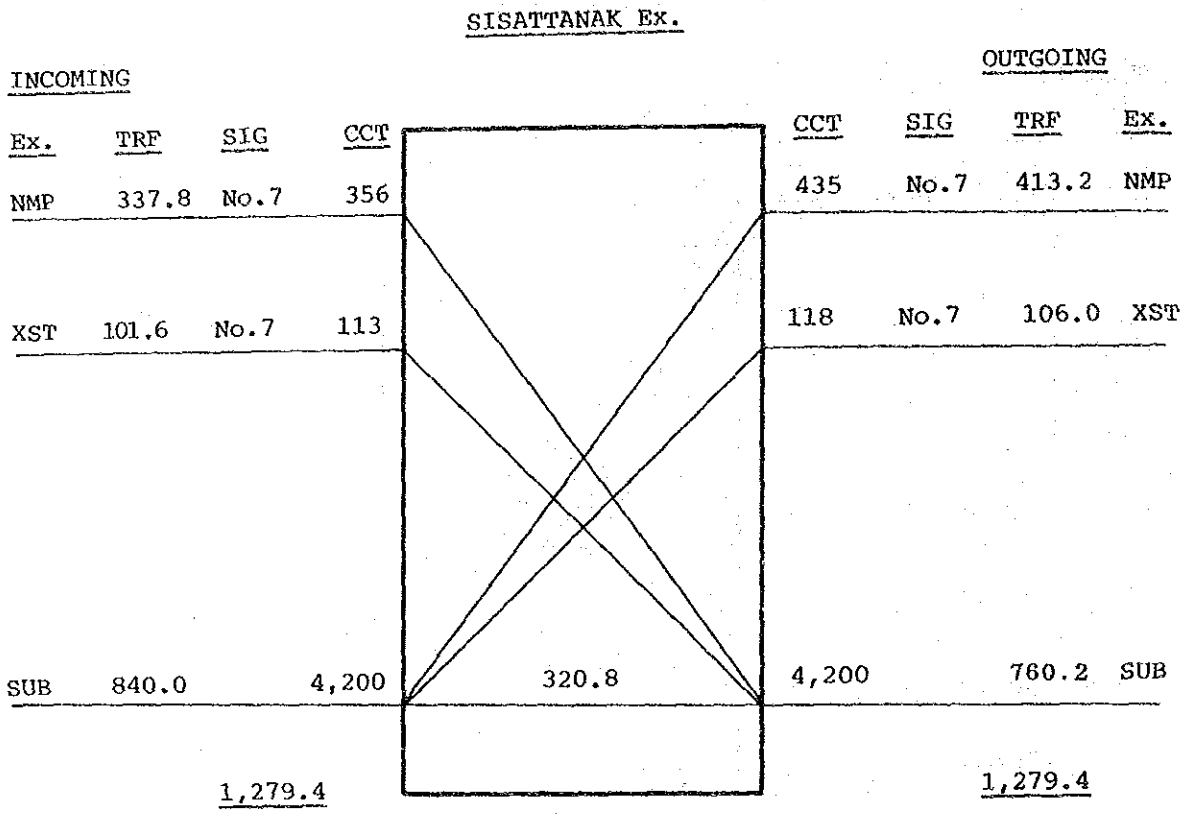


Figure-16(3/7) Traffic Flow Condition on Sisattanak Exchange

LOUANG PHABANG Ex.

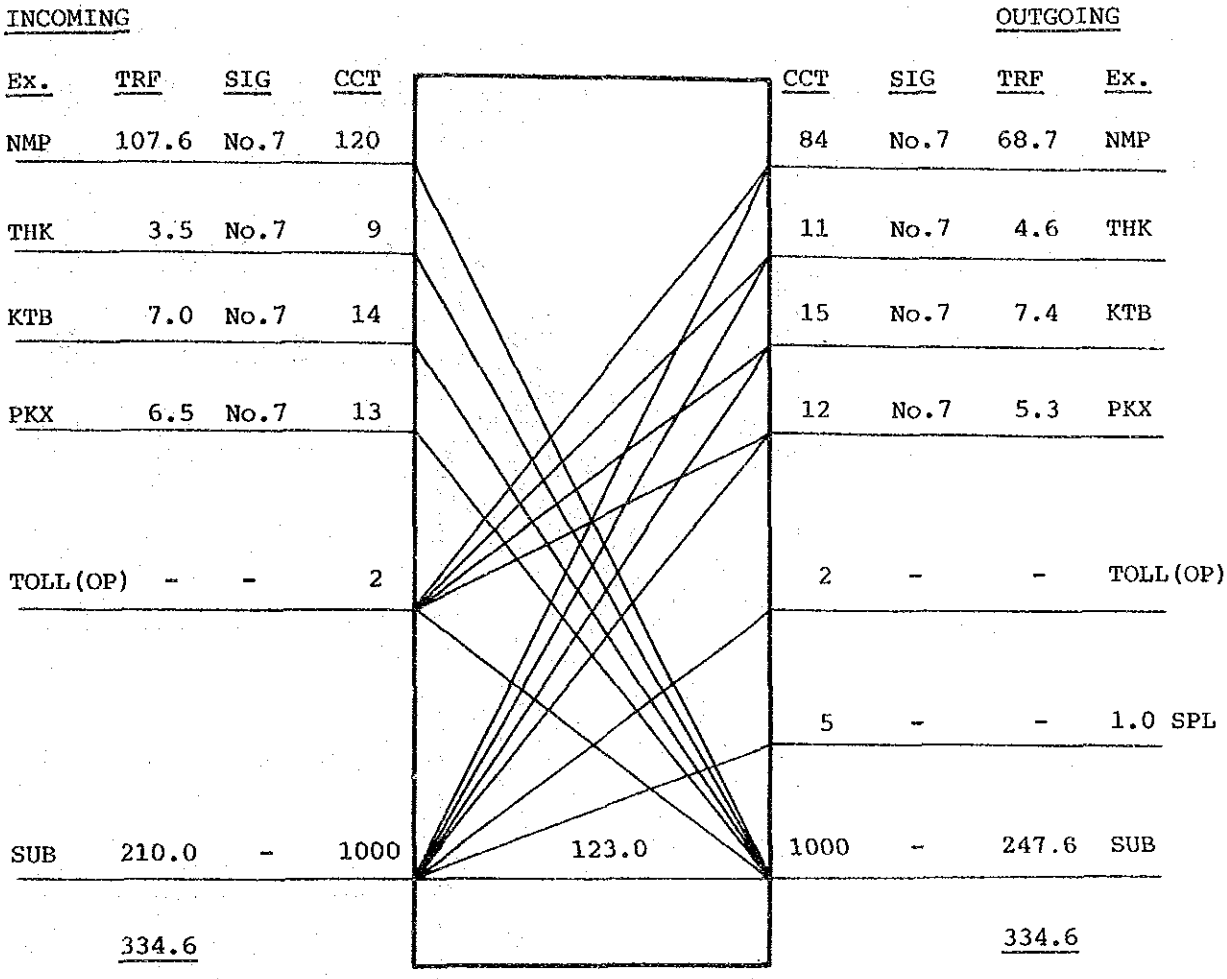


Figure-16(4/7) Traffic Flow Condition on Louang Phabang Exchange

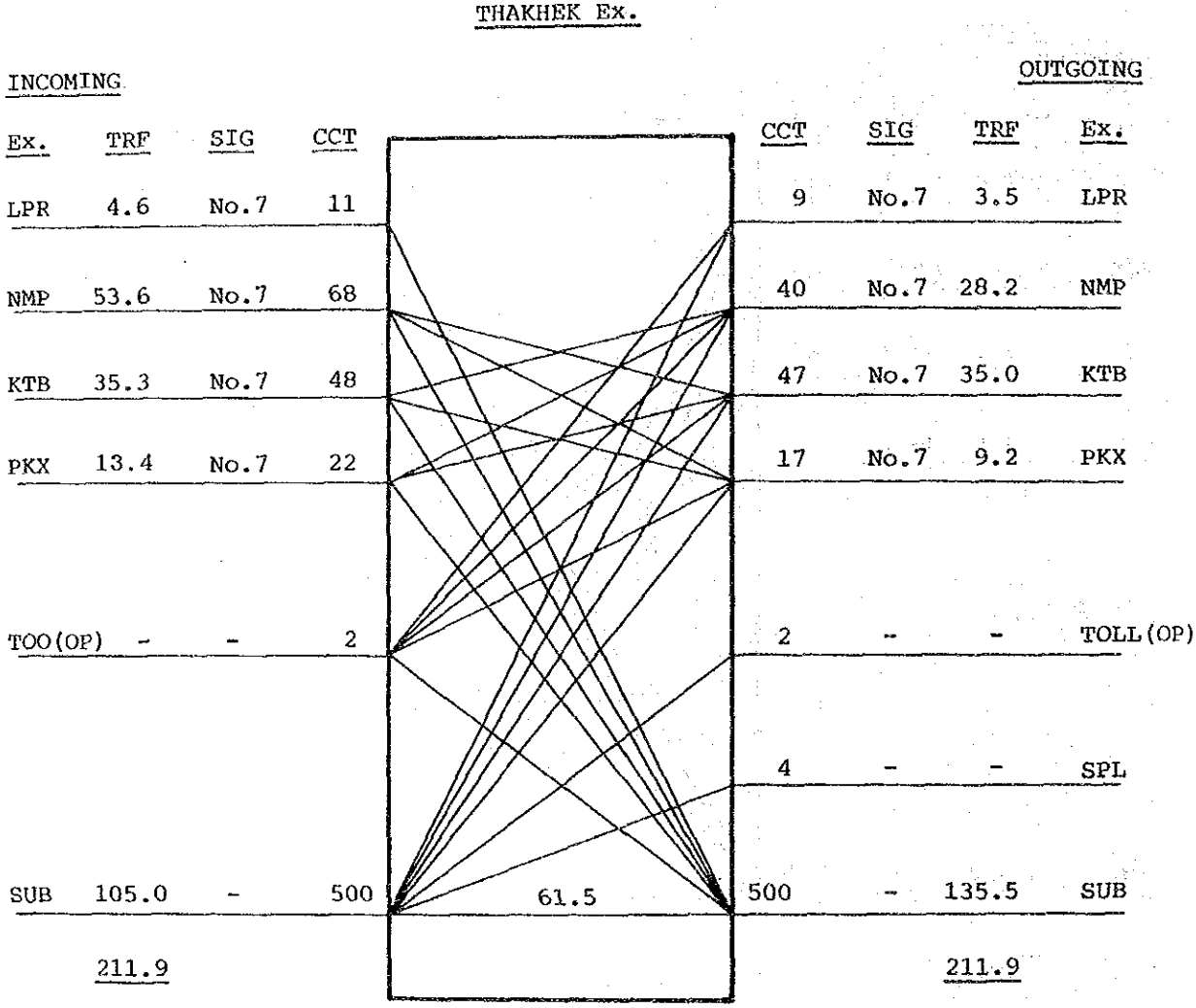


Figure-16(5/7) Traffic Flow Condition on Thakhek Exchange

KHANTA BOULI Ex.

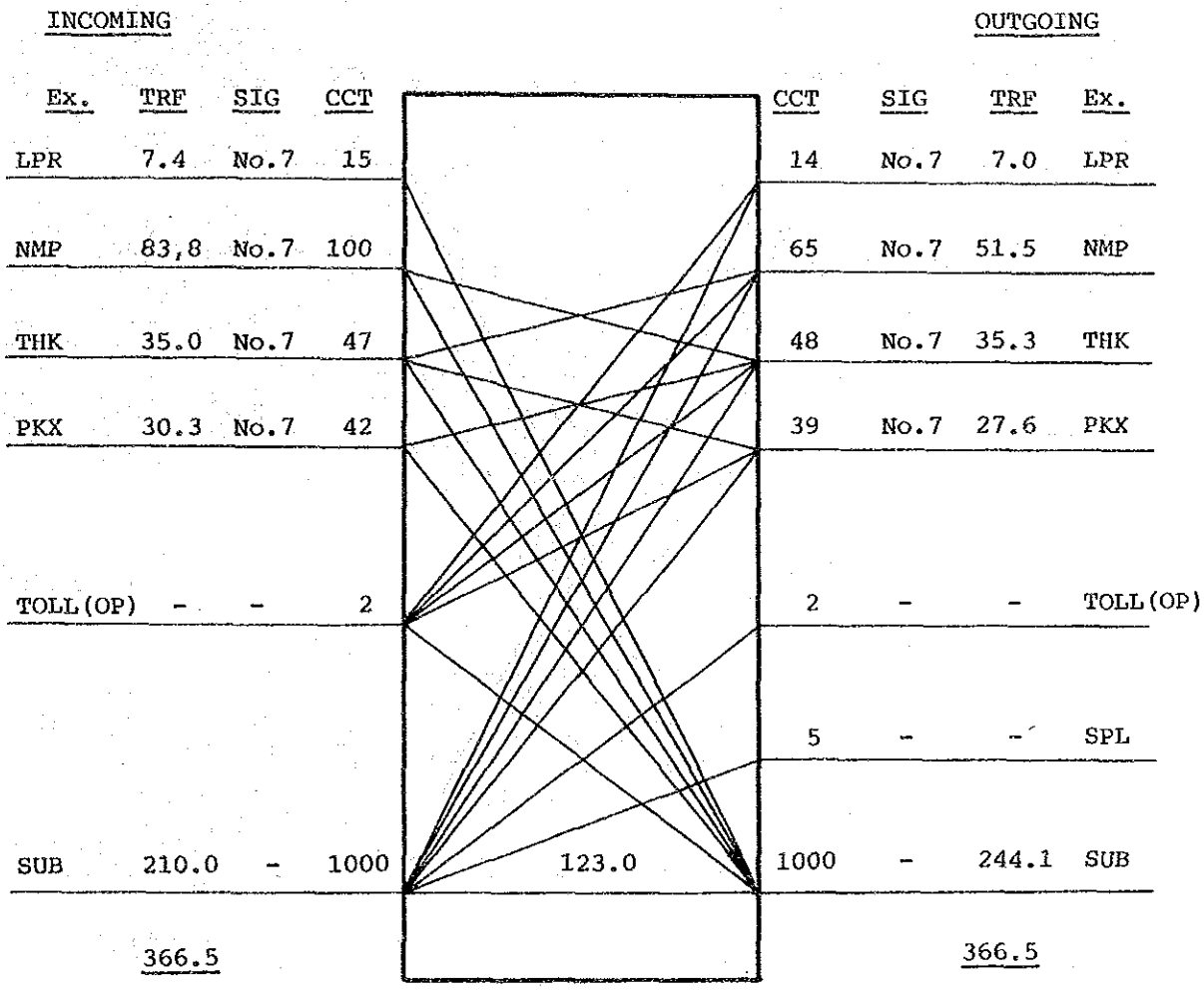


Figure-16(6/7) Traffic Flow Condition on Khantabouli Exchange

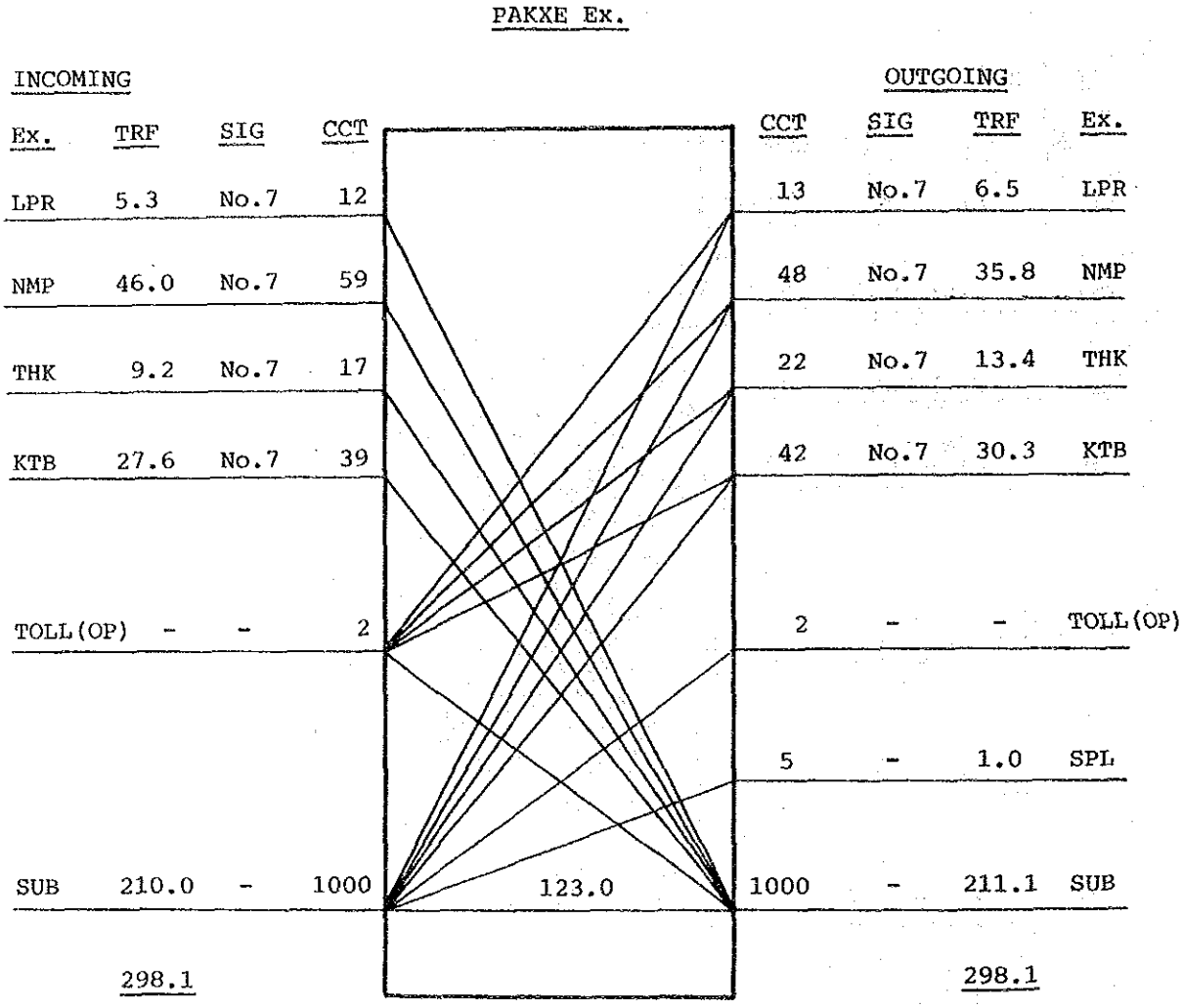


Figure-16(7/7) Traffic Flow Condition on Pakxe Exchange