BASIC DESIGN STUDY REPORT
ON
THE 2ND TELECOMMUNICATIONS PROJECT
OF
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

MARCH 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to a request from the Government of the Lao People's Democratic Republic, the Government of Japan has decided to conduct a Basic Design Study on the Second Telecommunications Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Lao P.D.R. a survey team headed by Mr. Toru Kizuka, Special Advisor for International Cooperation, International Cooperation Division, Ministry of Posts and Telecommunictions, from September 5 to Octover 5, 1990.

The team exchanged views with the officials concerned of the Government of the Lao P.D.R. and conducted a field survey. After the team returned to Japan, further studies were made. Then, a mission was sent to the Lao P.D.R. in order to discuss the draft report and the present report was prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

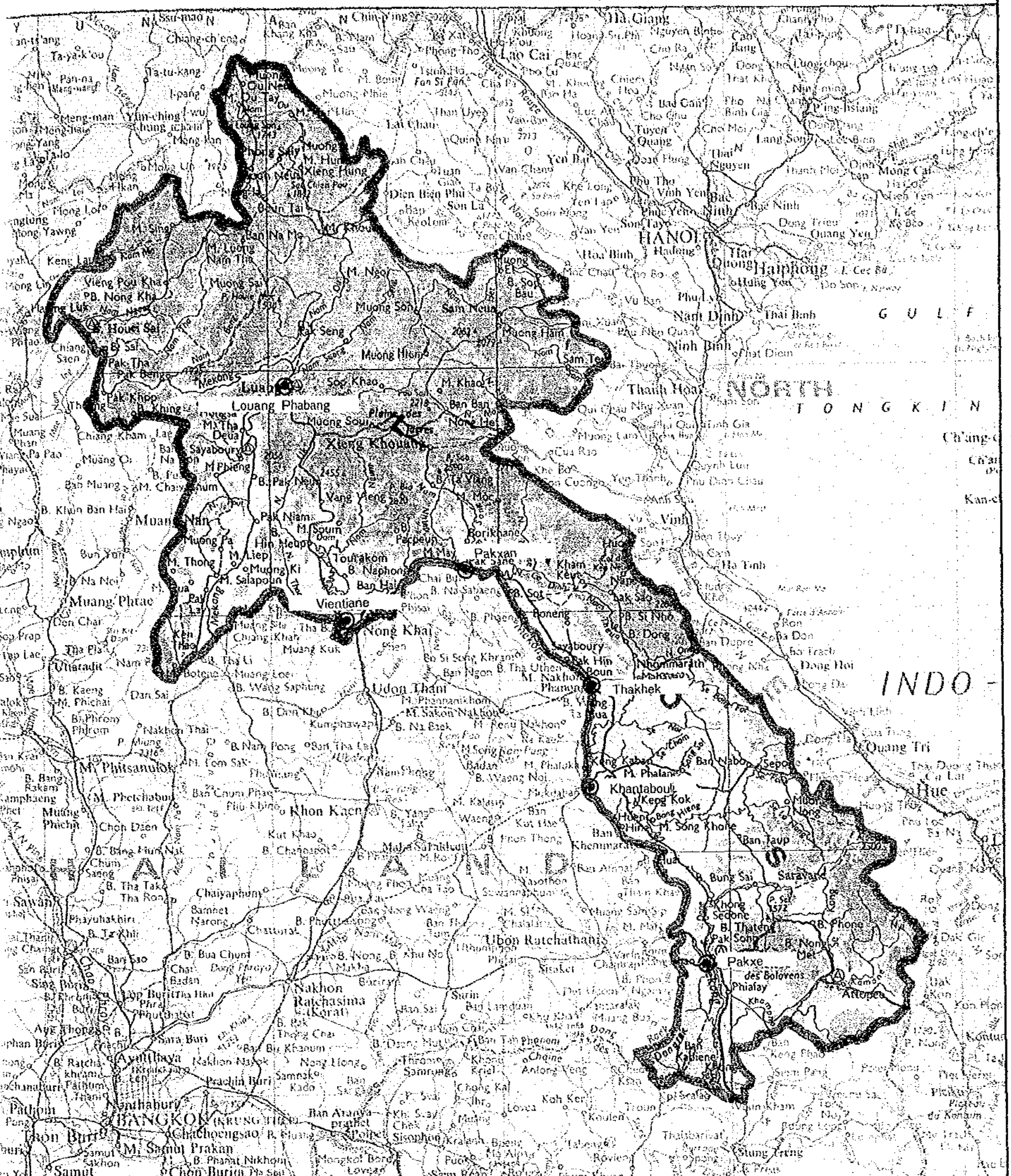
I wish to express my sincere appreciation to the officials concerned of the Government of the Lao People's Democratic Republic for their close cooperation extended to the teams.

March, 1991

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International cooperation Agency

LAO PEOPLE'S DEMOCRATIC REPUBLIC



SUMMARY

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The Government of the Lao People's Democratic Republic (Lao PDR) is now vigorously promoting the reconstruction of the national economy under the New System of Economic Management (NSEM), introduced in the Lao PDR in 1986 for liberalization of the national economy. The Government recognized the important role of telecommunications infrastructure in promoting this strategy and accorded the top priority to the improvement of the poor telecommunications services. In 1986, the Government proceeded to the implementation of the Telecommunications Rehabilitation and Technical Assistance Project (TELECOM I) to rehabilitate and improve the deteriorated facilities. This Project, however, failed to upgrade the services on account of the extremely deteriorated facilities and the lack of necessary spare parts and accessories.

The Government then planned the comprehensive replacement of the obsolete facilities to realize substantial service improvement and for this end, formulated the Second Telecommunications Project (TELECOM II), including the installation of the new digital switching system. To materialize TELECOM II, the Government requested the Japan's grant aid for the digital switching system installation, which constitutes an integral and most important part of TELECOM II.

In response to this request, the Japanese Government decided to carry out the Basic Design Study for the introduction of the digital switching system in the Lao PDR and entrusted the study to the Japan International Cooperation Agency (JICA). JICA dispatched the Preliminary Study Team to the Lao PDR in June 1990, and then the Basic Design Study Team, from September 5 to October 5, 1990. The Basic Design Study Team headed by Mr. Toru Kizuka, Special Advisor for International Cooperation, Ministry of Posts and Telecommunications, carried out the field survey, based on the findings of the Preliminary Study Team.

Discussions and negotiations were made with the persons concerned of the Ministry of Communications, Transport, Post and Construction and the Entreprise d'Etat des Postes et Telecommunications Lao, as well as the investigation of the status quo of telecommunications, social and economic conditions, etc. in the Lao PDR. After returning to Japan, the Basic Design Study Team studied and analyzed the requested items, on the basis of the data and information obtained through the field works, to define an outline of the project, basic design principles, implementation plan, etc. This report presents the study results, as summarized in the following:

(1) Outline of the Project

1) Size of the Facilities to be Installed

Telephone subscription capacity	17,200 lines
Combined exchange (international/ toll/local tandem/local)	1
Combined exchange (toll/local)	4

Local exchange	2
Remote switching unit	8
Billing system	1 system
Centralized operation and maintenance system	1 system

2) Objective Areas and Exchanges

Vientiane Municipality	13,500 lines
Namphou Exchange	5,400
Xaisettha Exchange	2,900
Sisattanak Exchange	3,800
Houaxang Exchange	200
Nongteng Exchange	200
Airport Exchange	200
Thangon Exchange	200
Donnoun Exchange	200
Thadua Exchange	200
Nahai Exchange	200
Louang Phabang City	1,000 lines
Louang Phabang Exchange	1,000
Pakxan City	200
Pakxan Exchange (RSU)	200
Thakhek City	500
Thakhek Exchange	500
Khanta Bouli City	1,000
Khanta Bouli Exchange	1,000
Pakxe City	1,000
Pakxe Exchange	1,000

(2) Basic Design Principles

1) Type of the Switching Equipment to be Supplied

The equipment to be supplied by this Project is the stored program type electronic telephone switching equipment employing the digital technologies. Spare parts and accessories necessary for repair and maintenance be obtainable all through the service life period of the equipment supplied.

2) Functions of the Equipment to be Supplied

The functions to be provided in the equipment are the basic public communication service functions, with no special addition, that is, limited to the minimum necessity. More than necessary functions and accuracy

are eliminated to achieve economy in operation and maintenance.

3) Operation and Maintenance

Easy operation/maintenance and high reliability are the key points in designing the system.

(3) Implementation Schedule

In consideration of the coordination with other correlated projects, this Project is to be implemented in two phases, Phase-I and Phase-II. The required period for completion of Phase-I Work is 21 months after the signing of the Exchange of Notes for Phase-I, and the following 22 months for Phase-II work, in total 43 months. Actually, however, the last 10 months of Phase-I and the initial 10 months of Phase-II are to be overlapped. By this arrangement, the whole project can be completed in 33 months after the signing of Exchange of Notes for Phase-I.

(4) Effect of Project Implementation

1) Effect of Project Implementation (Internal Effect)

With the construction of new digital telephone switching facilities, the up-to-date telephone service system can be realized in the Lao PDR for the first time, enabling the subscribers to make direct dialling not only domestically but also internationally.

2) Pervasive Effect (External Effect)

With the realization of high quality telephone services, rapid and accurate transmission and exchange of information become feasible, and social and economic activities gain momentum. In consequence, foreign investments are encouraged, leading to increase of employment opportunities, improvement of living standard, etc. In other words, completion of this Project will greatly contribute to the promotion of social and economic development of the country.

As described in the foregoing, the modernization of the telecommunications, including this Project, is requisite to achieve the reconstruction of the national economy now being proceeded with by the Government of the Lao PDR under the New System of Economic Management. In other words, the implementation of this Project, which means the realization of TELECOM II, can be a powerful support for the national economic development of the Lao PDR. That is, it can be said that this Project is the most significant and suitable for the Japan's grant aid.

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CHAPTER 1 GENERAL

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The Government of the Lao People's Democratic Republic (Lao PDR) is now vigorously promoting the economic development under the New System of Economic Management (NSEM). The Government recognized the importance of telecommunications as the infrastructure indispensable for the social and economic development and accorded the top priority to the improvement of telecommunications in the national development plan. In 1986, the Government implemented the Telecommunications Rehabilitation and Technical Assistance Project (TELECOM I), with the financial assistance from IDA, to rehabilitate the telecommunications facilities and thereby improve and expand the services.

TELECOM I, however, could not bring about noticeable fruits, due to the obsolete facilities and difficulty in procuring necessary spares and tools. Then the Government prepared the Telecommunications Investment Program 1990-95 (the Program) with the intention to replace the existing facilities comprehensively to realize substantial improvement of the services and, as the first step of this Program, proceeded to the Second Telecommunications Project (TELECOM II) in early 1990. In making a start of TELECOM II, the Government, acknowledging the availability of advanced telecommunications technologies in Japan, requested the Japanese Government to extend the grant aid for the introduction of new digital telephone exchanges (including the ancillary facilities), the key objective of TELECOM II.

The contents of the Lao PDR's request were the assistance for the installation of new telephone switching facilities in the capital city, Vientiane, and 5 provincial capitals, namely, Louang Phabang, Pakxan, Thakek, Khanta Bouli and Pakxe, with the installation of telephone exchanges, 17,200 lines in total capacity, and the provision of such associated functions as toll switching, international switching, billing, and centralized operation and maintenance.

More precisely, the facilities to be installed under the Japan's grant aid project (the Project) are the automatic digital telephone exchanges, as the main item, and the concomitant systems, such as charging (billing) system, centralized operation and maintenance system, and other ancillary facilities, i.e., power system, air-conditioning unit, etc.

This report presents the results of the Basic Design Study carried out for the materialization of this Project under the Japan's grant aid, as follows:

Chapter 2 "Background of the Project" describes the economic and social conditions and status quo of telecommunications in the Lao PDR, including the background of the request.

In Chapter 3 "Scope of the Project" is studied the justification of the Project, including the benefits from the Project.

Chapter 4 "Basic Design" presents the design philosophy and the study of technical requirements.

Chapter 5 "Outline of the Implementation Plan" covers the construction period, scope of works, critical points in installation, material procurement plan, etc.

Chapter 6 "Operation and Maintenance" outlines the operation and maintenance system, staffing plan, operation and maintenance cost plan, etc.

In Chapter 7 "Evaluation of the Project" is discussed the significance of the Project, based on the above study results.

In Chapter 8 "Conclusion and Recommendation" are given the final conclusion of this Basic Design Study Report and the recommendations on the matters involved in materialization of the Project.

CHAPTER 2 BACKGROUND OF THE PROJECT

CHAPTER 2 BACKGROUND OF THE PROJECT

2-1 General Information on Lao PDR

(1) Geographic Situation and Population

The Lao PDR is a landlocked country lying in the north eastern part of Indochina. It covers an area of about 240,000 square kilometers, approx. 1,500 km long from south to north, and roughly rectangular in shape. It is bordered on the west by Thailand across the River Mekong, on the east by Vietnam with Annam Mountains standing on the boundary, and on the south by Cambodia with Attopeu highlands dividing the two countries. Along the northern border with China and Myanmar, a mountain range extends.

The population in 1990 is approx. 4,050,000, with the density of 17 persons per 1 square kilometer, approx. one twentieth of that of Japan. Annual population growth rate is estimated to be 2.6%.

(2) Economy and Society

The gross national products (GNP) of the Lao PDR in 1989 was approx. 676 million dollars, and that per capita was 156.

After the political change in Vietnam and Cambodia which took place in April 1975, the Kingdom in this country also gave way to the Republic and the Lao People's Democratic Republic (Lao PDR) was established on December 2, 1975.

Then efforts have been made to organize a socialistic state, and politically the nation was stabilized shortly. Economically, however, results were not so successful: the planned economy was stagnant under the centralized management.

To improve the above situation, it was decided at the 4th Party Convention in November 1986, to open and liberalize the economy under the slogans "New Idea" and "Reform". Since then all the endeavours have been concentrated on the reconstruction of national economy.

In spite of such new policy, however, the economy of the Lao PDR has remained stagnant up to the present, with no prominent effects of the foreign investments in the domestic market. Such stagnancy is considered to have resulted from the lack of adequate telecommunications infrastructure to stimulate the economic growth, though the weakness of the domestic industries themselves should also be taken into account.

(3) Politics

Presently the Lao PDR is ruled by the Lao People's Revolutionary Party under the leadership of Mr. Kaysone Phomvihane, Secretary General and concurrently the Chairman of the Cabinet Council (Prime Minister). The Government is controlled by the Cabinet Council consisting of Chairman (Prime Minister), Deputy Chairman (Deputy Prime Minister), Ministers and Deputy Ministers of respective Ministries.

The Supreme People's Congress, the legislative of the Lao PDR, conducted the first general election to the Congress in March 1989, and 79 members were elected. At present, draft constitution is being referred to discussion, aiming at its enforcement in December 1990. 16 laws have been approved by the Supreme People's Congress and deliberated for the internal use in the country.

2-2 Status Quo of Telecommunications in the Lao PDR

2-2-1 Existing Telecommunications Facilities

The current telecommunication services in the Lao PDR is extremely poor. Even in major cities, telephone services are far from satisfactory. Only 9 out of 17 major cities (provincial capitals) are provided with the automatic telephone exchanges. The remaining 8 cities are served by the manual switchboards of more than 50 years old, and the rural areas have no access to telephone service at all.

Approx. 84% of the automatic telephone exchanges are installed in the capital city, Vientiane and, even when the manual switchboards are taken into account, 65% of the total telephone switching facilities are concentrated in Vientiane. However, the telephone density (the number of connected telephone lines per 100 inhabitants) in Vientiane is 1.25, considerably low even as compared with the rural cities in the neighboring countries.

A long distance transmission network connecting major cities in the country is established by HF radio link which, however, can hardly be called the public telephone line because the communication is made by utilizing the transceiver for single side band (SSB) on one way talking system, necessitating an assistance of an operator to change over transmitting and receiving each time by confirming the conversation.

Status quo of the existing telecommunications facilities is outlined below:

(1) Switching Facilities

The capacity of the existing automatic exchanges for the public telephone service in the Lao PDR is about 6,500 lines in terms of the telephone lines connected to subscribers. Besides the above, private automatic telephone exchanges with the capacity of 1,108 lines are in operation in Vientiane. They consist of exchanges for the government use (1,000 lines), those for the Dongdok University use (54 lines), and for EPTL use (54 lines). Table-1 presents the telephone exchanges now in operation for the public telephone services, and Figure-1 shows the existing telephone network in Vientiane, which is the only one public telephone network in the Lao PDR.

Some of these automatic telephone exchanges, however, are not suitable for the modern public telephone service system, because they are not equipped with the billing function. Such type of exchanges are called private automatic branch exchanges, PABX for short. PABX accommodated in the public telephone network amount to 486 lines in capacity (7.5% of the whole exchanges) and those in Vientiane, 162 lines. Introduction of the advanced billing system is very difficult with these exchanges.

The automatic telephone exchanges now employed for the public telephone service are conventional electromechanical exchanges called crossbar type, with some exceptions where AXE-104 (1,032 line), Ericsson Australia make, are employed. All the crossbar type exchanges, now 17 to 30 years old, are no longer manufactured, and their spare parts can hardly be obtained.

These existing old switching facilities, however, are maintained in good condition. Even the oldest facilities aged 30 years in Vientiane Namphou are good enough for their age.

Deterioration by age is observed not in the visible main parts, such as switches, etc., but in invisible electronic parts, such as wires, terminals, resistors, etc., which are likely to be broken with not so hard one touch. Redeployment of such facilities having no spare parts is impracticable.

(2) Local Outside Plant

The existing local outside plant consists of the underground conduit cable system and the aerial cable system.

Status of the existing facilities is not so good as problems are observed as follows:

<Underground Conduit System>

- Conduits are in short supply, and cable installation for new subscriber connection is difficult.
- Concrete pipes used have loose joints which permit intrusion of foreign objects, such as sand, etc., that is, the conduits are easy to be packed with foreign objects.
- A lot of handholes are not usable, as being broken or full of foreign objects.
- Conductors at the cable splice portion are not covered well and left to be easy to corrode, in some sections.

<Aerial Cable System>

- Aerial cables are installed on power poles jointly with power lines and such accidents as short circuit, electric shock to maintenance personnel due to contact with the power line, etc. are often caused.
- Noise troubles are easy to take place.

Local outside plant facilities are scheduled to be improved comprehensively with the IDA loan, under the Government's Investment Program 1990-95.

(3) Transmission Facilities

As mentioned previously, there is virtually no long distance telephone network in the Lao PDR. The long distance service is scarcely provided by the low quality HF link. It may safely be said that there is no long distance transmission system for the public telephone service at present.

The long distance transmission links to connect the objective cities of the Japan's grant aid Project and to constitute a nationwide backbone network in the Lao PDR, are to be constructed over the digital microwave system and/or the optical fibers by the end of 1993, with the same IDA loan as that for the outside plant expansion.

(4) Power System

1) Vientiane

Even at Numphou Exchange which is a toll center located in the central Vientiane, the power system is not available because the batteries to compose a d.c. power source for the exchange are too old to operate. In consequence, at the time of commercial power failure, the service is interrupted until the spare diesel engine generator is activated manually.

Two sets of spare diesel engine generators, 40 KVA each, are installed. They, however, seem to be more than 20 years old, judging from their worn-out name plates with which identification of their manufacturer is difficult. Their reutilization is not practicable.

Small capacity exchanges in the suburbs of Vientiane, i.e., Thangon and Thadua, are not equipped with the batteries nor spare diesel engine generator. In consequence, the telephone service is suspended at the time of commercial power failure.

2) Louang Phabang

Commercial power is available for 24 hours a day during the rainy season, and 6 hours during the dry season. Power source for telecommunications is in very poor condition. Battery system is not available as deteriorated by age. As for the diesel engine generator, there were three sets of aged generators, 5 KVA each. Two of them have been taken into pieces so as to obtain spare parts, and now one set of generator repaired with the parts thus obtained is scarcely in operation.

3) Pakxan

Commercial power is not available at Pakxan Exchange. For self-power feeding, two sets of diesel engine generator, 5

KVA each, is in operation.

4) Thakhek

Thakhek Exchange is receiving the power of single phase, 220V. During the peak hours, voltage fluctuation reaches -14%. If 3-phase power receiving is realized, stable power of ±5% will be obtained.

Availability of power source for telecommunications is similar to other exchanges. Battery system is too old and telephone service is interrupted at the time of commercial power failure, until the diesel engine generator is put to operation manually.

One set of diesel engine generator, 5 KVA, is installed.

5) Khanta Bouli

As is the case with other exchanges, battery system is not available. Condenser is provided for emergency use.

One set of spare diesel engine generator, single phase, 220V, 28 KVA (manufactured in 1977) is installed.

6) Pakxe

Commercial power is available for only 12 hours a day, and the battery system is too obsolete to be used as the power source for telecommunications. Only one set of spare diesel engine generator, 5 KVA, is in use to cope with the above situation.

(5) Air-conditioning Facilities

At the exchange room in Numphou Exchange, a split type, air-cooling system conditioner is provided. In other exchanges, exchange rooms are air-conditioned by window-cooler. All of these conditioners are deteriorated and not usable for a long time from now on.

2-2-2 Telecommunications Administration

Telecommunications services in the Lao PDR are, along with the postal services, controlled and supervised by the Ministere de Communications, Transports, Postes, et Construction (MCTPC), while Entreprise d'Etat des Postes et Telecommunications Lao (EPTL) is held responsible for the management and operation of the services, both domestic and international. The organization chart of MCTPC and EPTL is given in Figure-2 and Figure-3.

Although general telecommunications services are under the charge of EPTL, such entities as the national power company, air transportation related enterprises and defense agency, etc. are operating their own private radio links, under the license from MCTPC. Radio and TV broadcasting services are provided by the National Committee of Press, Radio Broadcasting and Television.

General Director and Department Directors of EPTL are appointed by the Minister of MCTPC, while the Operational Unit Chiefs are appointed by the Department Directors, subject to the approval of the General Director.

The current organization of EPTL is adequate for the operation and management of the present telecommunications services. However, in order to proceed with the Investment Program 1990-95, aiming at the drastic improvement of the telecommunications services (three times the current capacity in terms of the connected telephone subscribers), the introduction of new technologies, especially digital telecommunication technology, is requisite and, therefore, support of the expatriate technical specialists is necessary.

2-2-3 Communication Business and Its Management

EPTL is now operating 66 telephone exchanges (13 automatic and 53 manual), 113 telegram offices, and 121 post offices in the Lao PDR, with the revenue from these facilities amounting to approx. 1,200,000 dollars (as of fiscal 1988). This proves the good performance of EPTL, ranking top among a number of national companies. Annual records during the past 4 years are given in Table-2.

On the other hand, the number of EPTL staff amounts to 1,257 in total. About half of them are engaged in telecommunications business, and telephone subscribers per staff number less than 10.

This factor indicates the inefficiency of the EPTL's business. It corresponds to one fourth or fifth of that of the neighboring countries. Main reasons for this inefficiency lies in the inadequate training of staff, especially in the basic technology, in addition to the fact that the organization is still young and not yet integrated systematically. In Table-3 is presented the EPTL staff chart as of the end of 1989.

Table-1 Existing Telephone Switching System in Lao PDR

(Sep., 1990)

	Exchange Name	Type Auto/Manua	System	No. of Sys	No. of Lines	No. of Sub.
1	Attopeu	Manual		3	130	43
2	Houei Sai (bokeo)	Manual		3	130	46
3	Pakxan (Bolikhamsai)	Manual		1	30	23
		Auto	ATSK	1	108	49
4	Pakxe (Chapassack)	Manual		5	170	84
		Auto	PENTA	1	216	200
5	Thakhek (Khammouame)	Manual		5	70	45
		Auto	PENTA	1	74	74
6	San Neua (Houaphan)	Manual		5	130	89
		Auto	PENTA	1	108	81
7	Louang Namtha	Manual		3	160	43
8	Louang Phabang	Manual		7	146	80
		Auto	PENTA	1	216	216
9	Muong Sai (Oudom Sai)	Manual		6	160	57
		Auto	ATSK	1	54	48
10	Phong Saly	Manual		6	140	84
11	Saravane	Manual		5	170	57
		Auto	ATSK	1	54	47
12	Khanta Bouli (Savannakhet)	Manual		7	180	88
		Auto	PENTA	1	217	216
13	Sayaboury	Manual		2	150	48
14	Phone (Sekong)	Manual		1	20	19
15	Xiang Houang	Manual		5	170	77
16	Namphou (Vientiane)	Auto	PENTA	1	4,160	4,000
			AXE104	1	1,024	10
17	Thadua (Vientiane)	Auto	ATSK	1	54	40
18	Thangon (Vientiane)	Auto	ATSK	1	54	35
19	Naxay Tong (Vientiane)	Auto	ATSK	1	54	26
20	Phonhong (Vientiane)	Auto	ATSK	1	108	74
21	Vientiane Province	Manual		3	130	34
	Total	Auto	14	14	6,501	5,116
		Manual		67	2,086	917
		Total		81	8,587	6,033

A T S K : Crossber Type Switching System (PABX use)
Made By USSR (Now No Product)

P E N T A : Crossber Type Switching System
Made By France ITT (Now No Manufacturer)

A X E 1 0 4 : Digital Telephone Switching System (Rural use)
Made By Australian Ericsson

LAO PDR
Enterprise D'Etat Des Poste Et Telecommunications LAO (EPTL)
Second Telecommunications Project

Historical Income Statement in Dollars
Telecommunications & Posts

	1985			1986			1987			1988		
Exchange Rate: US$1 =		340			410			395			420	
	Local (000 US$)	Foreign (000 US$)	Total (000 US$)	Local (000 US$)	Foreign (000 US$)	Total (000 US$)	Local (000 US$)	Foreign (000 US$)	Total (000 US$)	Local (000 US$)	Foreign (000 US$)	Total (000 US$)
REVENUES												
Telecom. Revenues	115	438	553	288	577	865	317	677	994	524	707	1,231
Add: Quote Part Received	0	319	319	0	339	339	0	408	408	0	377	377
Less: Quote Part Paid	0	225	225	0	298	298	0	368	368	0	345	345
Net Telecom. Rev	115	532	647	288	618	906	317	717	1,034	524	739	1,263
Postal Service Rev	*114*	*95*	*209*	*220*	*174*	*395*	*259*	*159*	*417*	*347*	*266*	*613*
Add: Quote Part Received	0	65	65	0	54	54	0	220	220	0	275	275
Less: Quote Part Paid	0	44	44	15	11	26	15	64	79	27	275	302
Net Postal Rev	114	116	230	205	217	422	245	314	558	321	266	587
TOTAL REVENUES	229	648	877	493	835	1,328	561	1,031	1,592	845	1,005	1,850
OPERATING EXPENSES												
Materials	17	23	41	27	85	113	44	50	94	58	39	97
Repair & Maintenance	0	0	0	6	0	6	4	0	4	2	0	2
Electricity	14	0	14	44	0	44	46	0	46	43	0	43
Carburant	5	0	5	25	0	25	28	0	28	34	0	34
Transport	11	0	11	25	23	49	28	25	52	36	60	96
Salary	22	0	22	117	0	117	151	27	173	365	0	265
Labour Insurance	17	0	17	38	0	38	55	6	61	82	0	82
Subtotal	87	23	110	283	108	391	355	108	463	520	99	619
NET OPERATING PROFIT	142	625	757	210	727	937	207	923	1,130	365	804	1,231
Depreciation	18	272	290	21	248	269	28	318	347	34	354	438
Interest	0	0	0	0	0	0	0	24	24	0	28	38
Administration	24	0	24	67	3	69	87	24	110	92	3	35
R & D Expenses	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous	0	0	0	26	0	26	3	0	3	1	0	1
Subtotal	41	272	314	113	251	364	118	366	484	127	385	512
PROFIT BEFORE TAXES	101	352	453	97	476	573	89	557	646	198	521	719
Tax	11	27	38	25	38	63	29	42	71	44	49	92
NET PROFIT/(LOSS)	89	326	415	72	438	510	60	515	575	154	473	627

Source: EPTL: August 1989

Table-2 Financial Condition of Enterprices of Posts and Telecommunications Lao (EPTL)

Head Office and Vientiane City

Item	T	Telecommunication				Post				Planning				Administration		Service				S
		E	TC	ATC	W	E	TC	ATC	W	E	TC	ATC	W	E	TC	E	TC	ATC	W	
Telephone	69	6	47	13	3															
Telegraph	69		40	16	7		1	2				3								
Satellite	46	15	25	2													1			3
Work Shop	34	11	20															2	1	
Post	84					1	43	40												
News Papar	17		1				2	2	10								2			
Collection	40		3	5			8				5	9	10							
Vehicle	38		3	1			2				3		4		2	2	5		16	
Administration	40		5	2								5			3		6	4	9	6
Economy	20	1	3	1						1	11	3								
Telecom. Operation	5	1	3	1																
Posts Operation	5					2	3													
Vehicle Operation	8	7		1																
Building	5	2				1				1				1						
Total	480	43	150	42	10	4	59	44	10	2	19	20	14	1	5	2	14	6	26	9

(Note) T :Total
E :Engineer
TC :Technician
ATC :Assistant Technician
W :Worker
S :Special Task

Table-3(1/2) Number of Staff of EPTL (Vientiane)

Other Cities

Item	T	Telecommunication				Post				Planning				Administration		Service				S
		E	TC	ATC	W	E	TC	ATC	W	E	TC	ATC	W	E	TC	E	TC	ATC	W	
Special Service	61	4	24	12	2		2			2	2	3	2	2	2				4	
Phong Saly	36		6	5	6		6	6	5				2							
Houa Phanh	34	1	7	12	2		1	5	1		1				2				2	
Oudom Xay	44		10	12			7	14											1	
Bokeo	18		1	5	2		4	3	2		1									
Xieng Khouang	31		8	8			3	7	1		1	1			1				1	
Luang Namtha	41		4	16	8		1	7	2				1						2	
Luang Phabang	65		10	17	1		6	16	8		1	4							2	
Sayabury	39		4	11	1		5	9	4				2		1				2	
Vientiane	45		12	8			5	5	11		2	2								
Borihkomxay	33		3	8	7		2	5	6				2							
Khammouane	45		9	8	2		4	9	7		2	2			1				1	
Savanakhet	106		22	24	6		9	14	16		3	5	1		2		1		3	
Saravane	47		4	7	7		3	10	11		1		2						2	
Champassak	75	1	15	16	4		17	8	10			2							2	
Attopeu	30	1	5	4	6		3	5	2	1		3								
Sekong	28	1	5	6	8			2	6											
Total	778	8	149	179	62	0	78	125	92	3	14	22	12	2	9	0	1	0	22	0

(Note) T :Total
E :Engineer
TC :Technician
ATC :Assistant Technician
W :Worker
S :Special Task

Table-3(2/2) Number of Staff of EPTL (Other Cities)

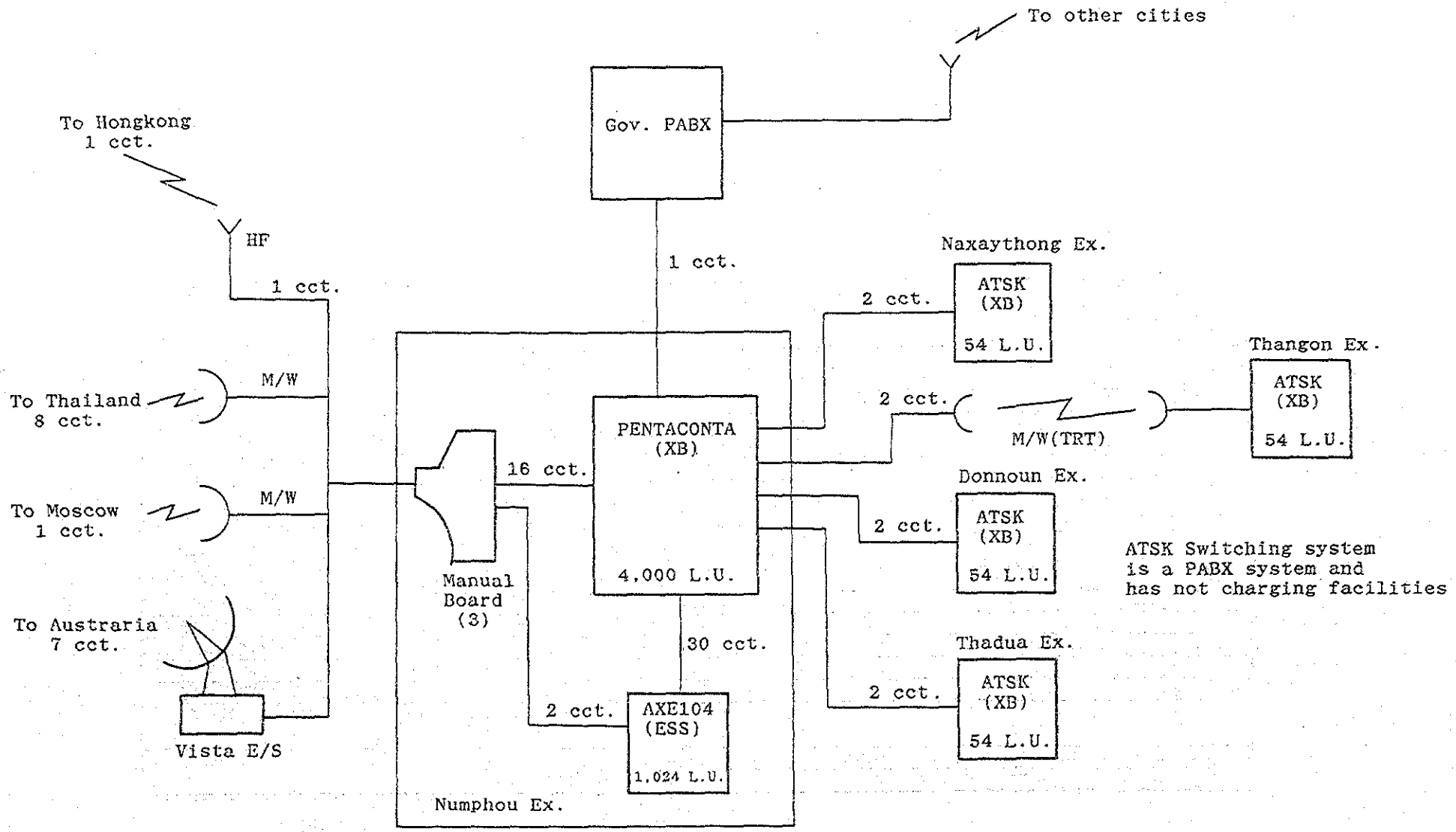

Figure-1 Existing Telephone Network in Vientiane City

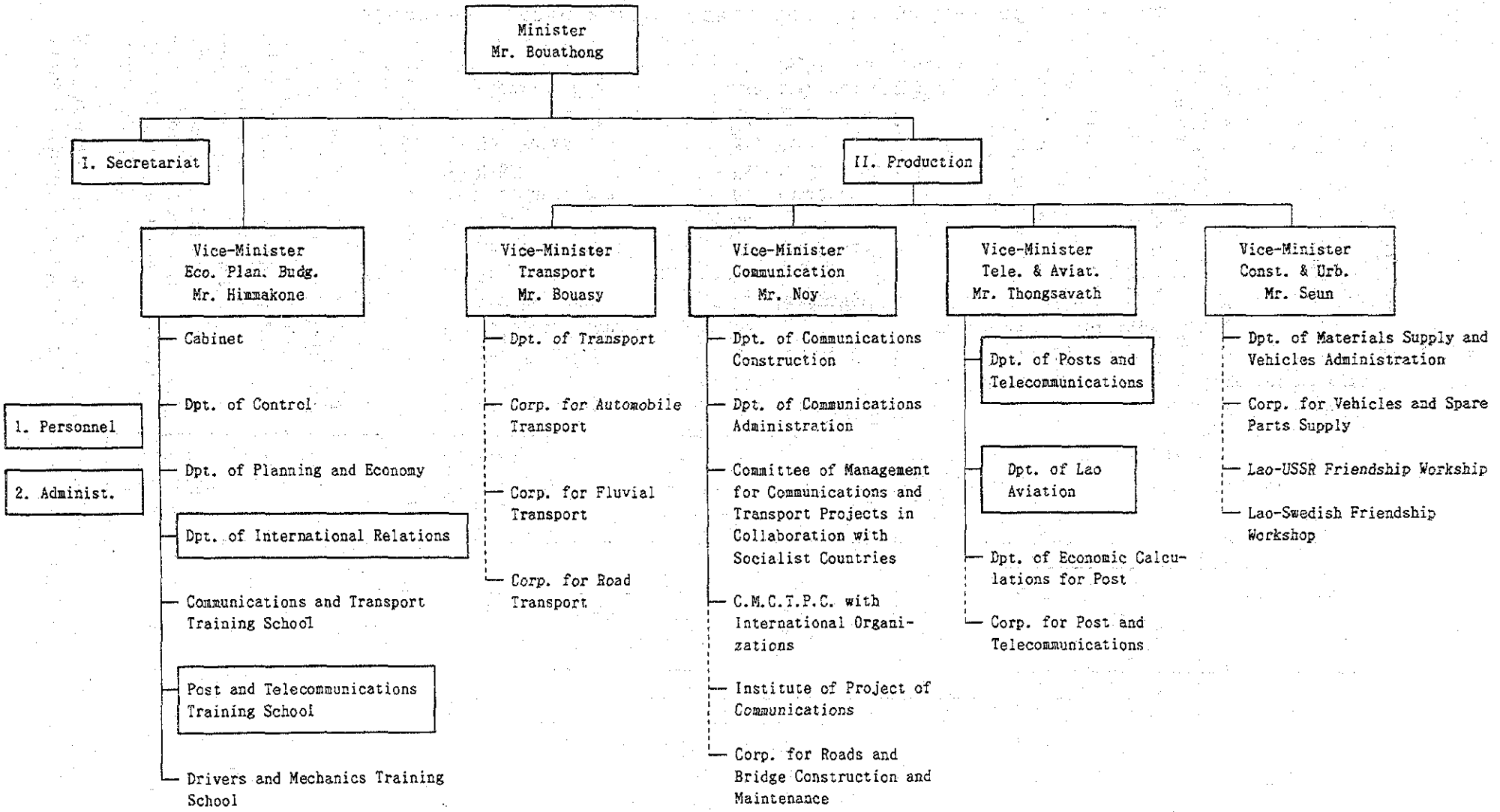

Figure-2 Organization Chart for Minsitry of Communication, Transport, Posts and Construction (MCTPC)

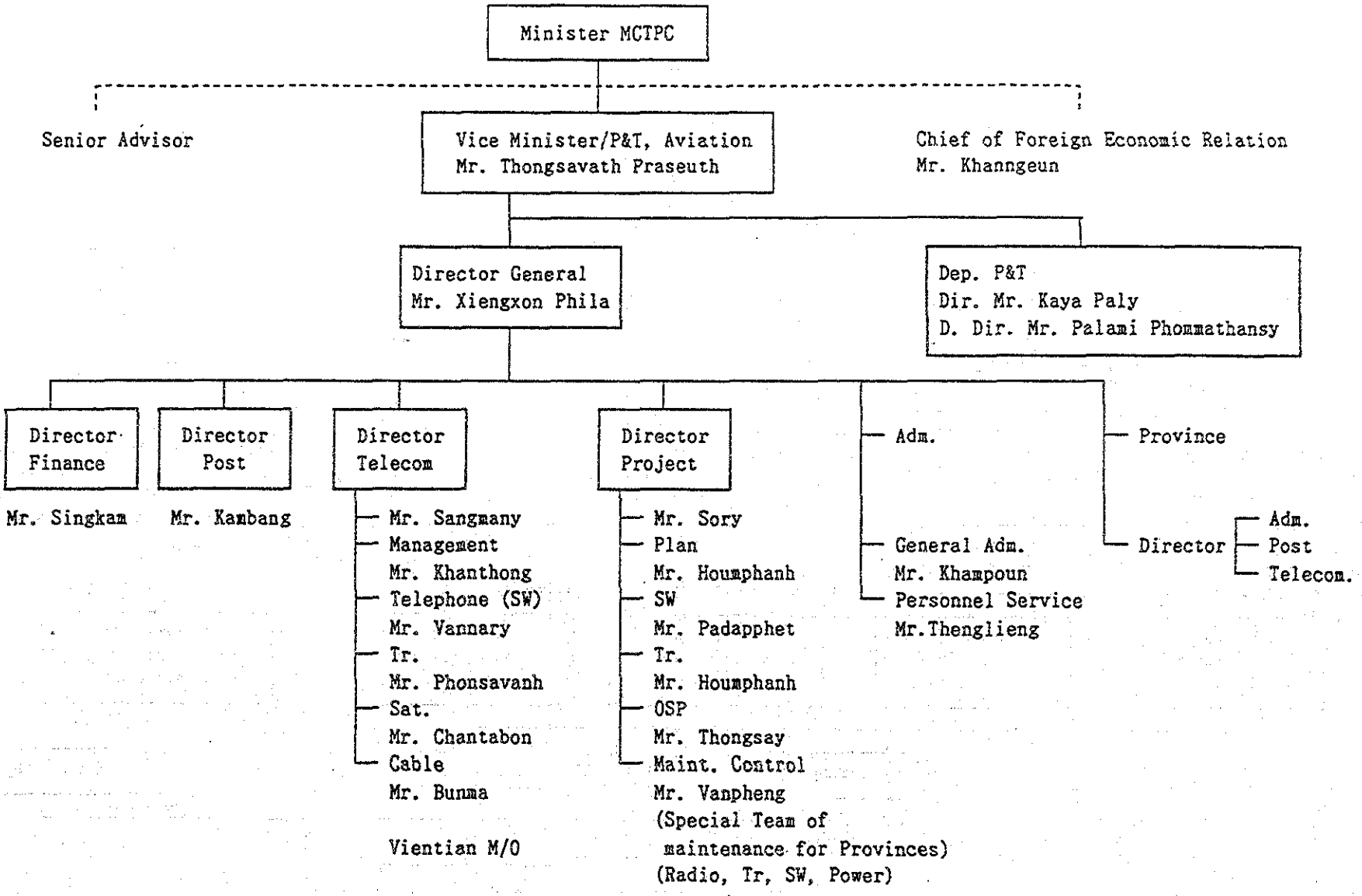

Figure-3 Organization Chart for Enterprices of Posts and Telecommunications in Lao (EPTL)

2-3 Outline of the Objective Areas

2-3-1 General Information

(1) Vientiane

Vientiane, the capital of the Lao PDR, is populated by some 430,000 people. A number of governmental agencies, banks, and commercial and industrial centers are concentrated in this city. Most of the foreign embassies and other diplomatic establishments are situated herein.

The city is divided into ten administrative areas as shown in Figure-4. The Vientiane multi-exchange area, the objective area of this Project, covers 6 administrative areas sandwiched between the River Mekong and the River Nam Ngum, including some 70% of another administrative area.

Chanta Bouli area wherein is installed Numphou Exchange which is a toll center of the nationwide telephone network, is the commercial and administrative center of the country. Most of the governmental agencies, such as Ministries of Home Affairs, Foreign Affairs, Finance, etc., as well as Presidential Office, are found in this area, in addition to Lao Airlines Head Office, foreign airlines offices, Lane Xang Hotel, Metropolitan Hotel, the EPTL Head Office, etc.

In Xaisettha area, Xaisettha Exchange will be installed. In its center lies That Luan Temple, which is surrounded by the offices of MCTPC, UNDP, Japanese Embassy, Army Headquarters, etc. It is one of the highest class residential quarters in Vientiane.

In Sisattanak area wherein is installed Sisattanak Exchange are situated Vientiane Buss Public Corp., Fire Defense Agency, Army Hospital, Vientiane Harbour, UNICEF, Australian Embassy, Japanese and Indonesian Ambassadors' official residences, etc. There are a lot of small and medium sized hotels to accommodate tourists coming in via Vientiane Harbor which is a gateway to the Lao PDR from Thailand.

Sikhottabong area has developed with the Vientiane International Airport ("Wattai" Airport) lying in its center. Louang Phabang Road (State Road No. 13) extending from the airport to Vientiane, is flanked on both sides by a number of small and medium sized hotels, including Vientiane Hotel and "Mitapub" Hotel. The Economic Planning Agency also lies in this area. To the west of Louang Phabang Road, a number of small and medium sized trading companies and markets exist. Behind the streets, National Military Base is found. Airport Exchange is to be located in this area to meet the telephone demands from those related to the Airport and Military Base. Other demands are to be covered by Numphou Exchange.

Naxaythong area extends along the State Road No. 13 leading from Louang Phabang Road. Nongteng and Houaxang Exchanges

will be located herein. In the Nongteng Exchange area, cement factories, professional schools, an education college, hospitals (with approx. 50 beds), a market with approx. 100 shops, etc. are found, in addition to several factories now under construction. Houaxang Exchange area accommodates administrative authorities of Naxaythong area, elementary and middle schools, brewing factories, construction machinery repair plant (constructed with the assistance of Sweden), etc.

Hatsayphong area lies in the eastern part of Vientiane, opposite to the Sikhottabong area. Nahai and Thadua Exchanges will be installed here. In Nahai Exchange area are located a pharmaceutical development center constructed with the aids from Japan, a beer brewery, petrochemical plants, a large scale woodworking plant, brickyards, etc. Thanaleng Harbor of this area is a gateway for goods to be imported into Vientiane. There is a plan to construct an international bridge, with Laotian side end in this area, for connection with Thailand. The work will be started next fiscal year and the future economic development is expected. In Thadua Exchange area lie such large plants as Pepsi Cola plant, concrete plant, Shell Oil Base, along with woodworking plants and brickyards. The administrative authorities of Hatsayphong area are also located in this area. With Thadua Harbor, which is a gateway for tourists to and from Thailand, like Vientiane Harbor in Sisattanak, this city is bustling with people all day long.

In Xaithani area south of the Nam Ngum River, Donnoun and Thangon Exchanges will be installed. Donnoun Exchange area extends southward from Vientiane along the State Road No. 13 which traverse the country lengthwise. The Vientiane bypath of the Road No. 13 starts in this area. There exist Dongdok University, agricultural experiment station, and other laboratories. This area is also expected to develop as the residential quarters of Vientiane. Thangon Exchange area is an urban district developed with the ferry of the River Nam Ngum along the Vientiane bypath. The midtown district is occupied by the hotels, markets, and restaurants to cater for tourists. In the suburbs are found chemical fertilizer plant, ironworks, rice mills, and an agricultural and marine experiment station constructed by the aids of Japan, etc. A Japan's grant aid project to construct a bridge over the River Nam Ngum is now under study.

A rough map of the area and the exchange site layout plan are attached.

(2) Louang Phabang

Louang Phabang stands third in major cities of the Lao PDR, with a population of approx. 78,000. It is an ancient city like Kyoto in Japan and there remains a palace in the days of the old Kingdom. Now it is a business center in the northern region of the Lao PDR, and also is the nucleus for the agricultural and mineral products distribution. At the

same time, it is one of leading tourist resorts and attracting a lot of tourists from abroad. In the midtown, there is a market consisting of approx. 500 stores. High class tourist hotels, souvenir shops, silverware workshops, etc. are also found. In the suburbs, a large scale of construction machinery repair plant, ironworks, woodworking shops and an education college are located. Louang Phabang Exchange will be installed in the premises of the existing exchange in the vicinity of the palace.

A rough map of the area and the exchange site layout plan is attached.

(3) Pakxan

Pakxan, the capital of Bolikhamxai Province, is located approx. 170 Km to the south of Vientiane, along the State Road No. 13. Pakxan is populated by some 30,000 people. The State Road No. 13 branches off here into the northern mountainous city, "Xieng Khouang". Having such an access, the city has flourished from the olden times, and is no less important at present. The construction of a transmission line connecting Vientiane and Pakxan will be started at the end of 1990, with the France's grant aid. A new exchange will be installed in the premises of the existing Pakxan Exchange located in the midtown.

(4) Thakhek

Thakhek, the capital of Khammouan Province, is a major city in the central region of the Lao PDR. It has a population of approx. 60,000 and is well known from the olden times as the gateway to Vietnam since the State Road No. 13 branches off into Dong Hoi, Vietnam, here. At present, the city is flourishing as the cargo booking place for the exports to Vietnam. Harbour facilities are maintained well and the streets are lined with a number of stores and high class hotels. In the suburbs, construction machinery repair plant, mills for South Sea lumber, etc. exist. Thakhek Exchange will be installed in the premises of the existing exchange in the midtown.

The exchange site layout plan is attached.

(5) Khanta Bouli

Khanto Bouli, the capital of Savannakhet Province and the second largest city in the country, is the center of the commercial and industrial activities in the southern region, with the population of 120,000. Local agencies of the Central Government to administrate the areas south of Vientiane are concentrated in this city. This city is a harbor town open to "Mukdahan" in Thailand and the agricultural products are collected here for export to Thailand. The fact that several tens of trucks are always waiting for

cargo boats proves the inflow of considerable amount of products into this city. The streets are paved well and lined with a row of stores. Trading companies from abroad (mainly from Thailand and Vietnam) who have opened their offices here number more than 10. However, there are only small or medium sized hotels. The construction of a large sized hotel is now under planning. In the suburbs are found a TV broadcasting transmitting station, chemical laboratory/factory, construction machinery repair plant (made by the assistance of U.S.S.R.), ironworks, brickyards, mills for South Sea lumber, small and large sized woodworking shops, and "Savannakhet" Airport. Khanta Bouli Exchange will be installed in the premises of existing exchange in the midtown.

A rough map of the area and the exchange site layout plan is attached.

(6) Pakxe

Pakxe, capital of Champasak Province, is a major city in the southernmost region of the Lao PDR, with a population of 55,000, and flourishing as the cargo booking place for agricultural products in this area. "Pakxe coffee", main crop in this area, is famous not only in the Lao PDR but also in the neighboring countries. This city is an entrance to the Athopeu remains and attracts a number of tourists. Pakxe Exchange will be installed in the premises of the existing exchange.

2-3-2 Social and Economic Conditions

The objective areas of this Project, i.e., the capital city, Vientiane, and 5 major cities, i.e., Louang Phabang, Pakxan, Thakhek, Khanta Bouli and Pakxe, are the hub of the social and economic activities in their respective areas, and they are densely populated. That is, approx. 18% of the national total are concentrated in these 6 cities.

With respect to the agriculture and livestock, which are main industries in the Lao PDR, the output in these cities accounts for a large percentage as shown below.

- Output of rice ..... 64% of the national total
- Output of vegetables .... 53% "
- Output of tobacco ..... 41% "
- Output of cotton ..... 33% "
- Output of sugar ..... 66% "
- Output of coffee ..... 75% "
- Output of livestock ..... 55% "

As seen from the above, importance of these cities in industrial sector is prominent.

Among the objective cities, Vientiane, Thakhek, Khanta Bouli and Pakxe have been closely related, from the olden times, with the neighboring country, Thailand, through the River Mekong, and through that channel people in these cities have familiarized themselves with the Western civilization. They are, therefore, intelligent as compared with other districts in the Lao PDR, and used to play an important role in social and cultural activities.

With such background, the infrastructure of the society in these areas is maintained relatively in good condition, with the exception of telecommunications. Particularly, the power system is almost satisfactory, except for Pakxan area.

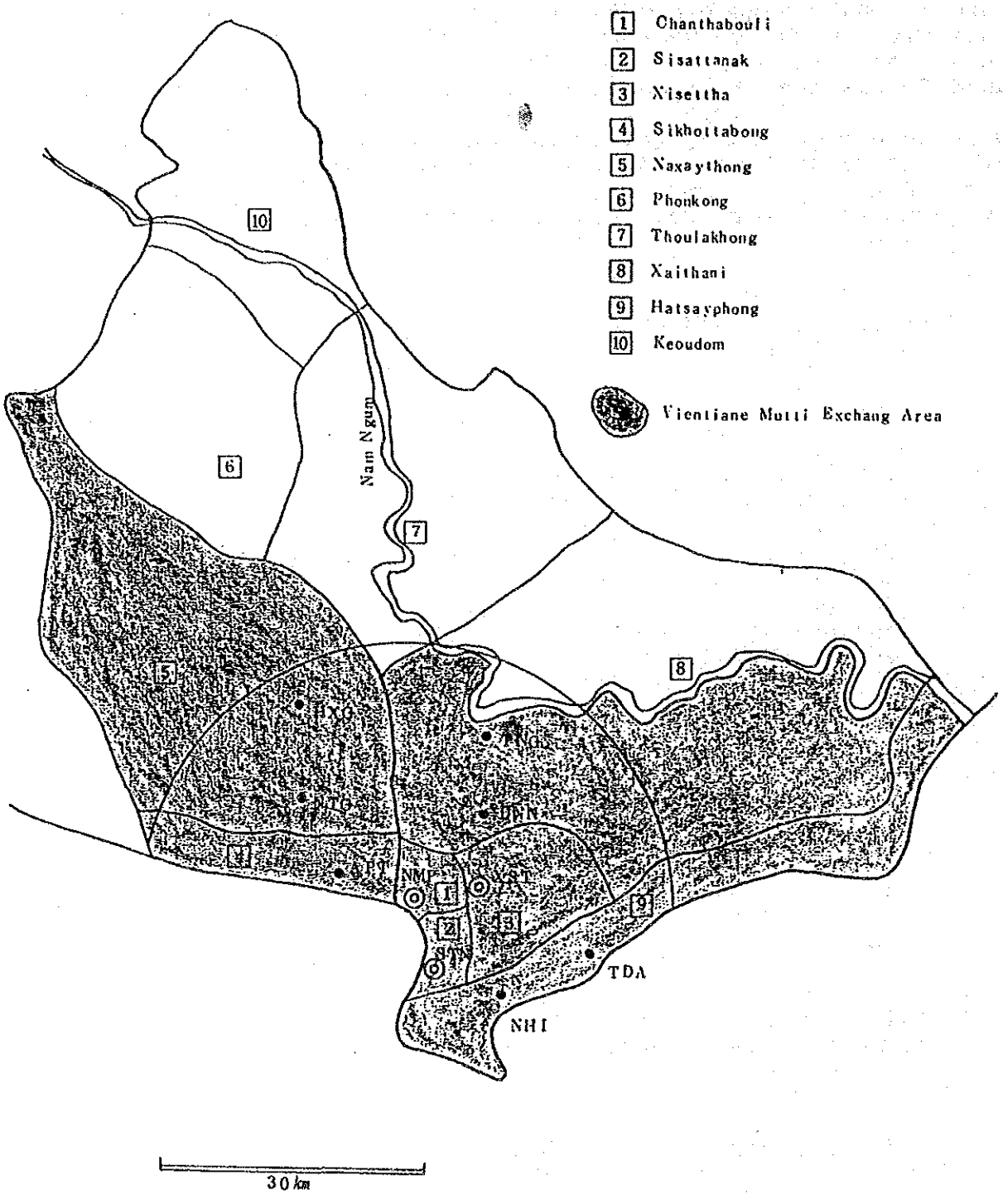

Figure-4 Area Condition of Vientiane City

2-4 Telecommunications Network Rehabilitation and Improvement Plan

After the revolution in 1975, no large scale rehabilitation nor improvement had been carried out for the telecommunications facilities in the Lao PDR, until the EPTL was established in 1986 as an integrated autonomous enterprise. Maintenance and repair of the existing facilities on individual unit basis was the only action so far taken. In consequence, the quality of telecommunications service could never be better than that in 1975, with the facilities aging year by year.

On the other hand, importance of the telecommunications infrastructure has been conspicuously magnified in these 10 years. Telecommunications services are considered requisite for promoting the social and economic development of a nation.

In view of the above, the Lao PDR proceeded to the modernization of the telecommunications services aiming at the revitalization of the national economy under the New System of Economic Management introduced in 1986, and the Telecommunications Rehabilitation and Technical Assistance Project (TELECOM I) was put to implementation for the period 1986-90. Following TELECOM I, the Second Telecommunications Project (TELECOM II) started in 1990. Each plan is outlined in the following:

2-4-1 Decentralization of Economy

At the 4th Convention of the Lao People's Revolutionary Party held in November 1986, it was decided to reform the economic policy comprehensively, by introducing a new economic management system. The new policy called "New System of Economic Management" intends:

a. Decentralization of the planned economy.
b. Increase of managerial and financial autonomy of public sector enterprises.
c. Elimination of production target control by the central government.
d. Reform of taxation system.
e. Transformation of banking system.
f. Higher interests.
g. Free economy based on free competition principle.
h. Liberalization of domestic and international trade.
i. Abolition of subsidies for basic consumption goods industry.
j. Abolition of subsidies for agricultural industry.

As can be seen from the above, this is an innovative policy to reform the economy, though gradually, from the controlled planning to the free economy based on the market mechanism principle.

With a view to procuring the funds from abroad necessary for carrying out the above significant policy, the Foreign Investment Law was enacted in July 1987. Under this law, restriction on

foreign investment has been completely eliminated: foreigners have a right to possess the property 100%, and foreign investors are given the guarantee of free activities with no risk of their property being nationalized.

2-4-2 Telecommunications Rehabilitation and Technical Assistance Project (TELECOM I)

(1) Objective

a. Improvement of facility capacity and service quality through rehabilitation of the existing facilities.
b. Introduction of modernized operation and maintenance system.
c. Preparation of investment plan

(2) Results

Investigation under this Project disclosed that (1) the Pentaconta type crossbar exchanges which account for more than 90% of the existing switching facilities are out-of-manufacturing because the manufacturing company, ITT France, has been merged into another company and the spares and repair materials necessary for rehabilitation of the existing facilities are not obtainable, and (2) ATSK type crossbar exchanges are also out of production since the manufacturing company, a national company in the Soviet Union, decided not to manufacture them and, accordingly spare parts and materials necessary for rehabilitation are not procurable. Under the above situation, TELECOM I could not bring about significant fruits.

However, in the light of the above investigation results, new Long Term Telecommunications Development Plan was drawn up, which directed the overall replacement of the existing facilities. On the basis of this Long Term Development Plan, the Investment Program 1990-95 (the Program) has been prepared, and then based on this Program, the Second Telecommunications Project (TELECOM II) has been launched.

2-4-3 Investment Program 1990-95

The Government of the Lao PDR recognized the importance of the telecommunications in promoting the economic development of the nation, and directed to formulate a new telecommunications development plan, taking into account the results of TELECOM I. In response to this direction, EPTL requested an expatriate telecommunications consultant (DETECON in German) to prepare a Long Term Telecommunications Development Plan to cover 20 years, together with the investment plan for the coming 5 years, with the financial assistance from IDA. This study was completed in May 1990.

(1) Long Term Telecommunications Development Plan (1990-2010)

The Long Term Development Plan is based upon the following assumptions:

- In 2010, GNP per capita will be 1,000 dollars, when the telephone density will be 2.4 per 100 inhabitants.

- The population will increase by 3% annually, and reach 7,000,000 in the year 2010, and the telephone subscribers will increase to 168,000.

- The population will continue to concentrate in Vientiane, and in the year 2010, Vientiane will be populated by some 1,000,000 people, with telephone subscribers numbering 50,000.

Long Term Development Plan based on the above assumptions is as follows:

- 1st Stage (1991-1993)

  To install new telephone exchanges in Vientiane, Louang Phabang, Pakxan, Thakhek, Khanta Bouli and Pakxe, with a capacity of 17,200 lines in total, together with the installation of necessary local subscriber cable network, and to construct long distance transmission lines as a backbone network to connect these exchanges.

- 2nd Stage (1994-1995)

  To install new telephone exchanges in other major cities than the above, with a capacity of 20,000 lines in total, and to construct long distance transmission lines to connect these exchanges.

- 3rd Stage (1995-2005)

  To install new telephone exchanges throughout the country, with a capacity of 40,000 lines in total, and then proceed with the expansion in such a manner that the total number of subscribers in the country reaches 168,000 in the year 2010, with the annual increase rate of 15%..

(2) Investment Program 1990-95

Investment Program 1986-90 is the first practical development plan based on the new Long Term Telecommunications Development Plan and consists of TELECOM II and TELECOM III.

TELECOM II Project (Second Telecommunications Project) is to realize 17,200 subscriber connections in major cities by the end of fiscal 1993, through the replacement of all the obsolete equipment, as mentioned previously. The

construction of long distance transmission lines, junction lines, local subscribers cable network, telephone exchanges, and telephone office buildings, etc. necessary for the above are included.

Funds for materialization of TELECOM II is extended from IDA, except for those for the telephone exchanges which are to be provided by Japan's grant aid.

TELECOM III Project is to cover the major cities not included in TELECOM II. It aims to install additional 20,000 telephones by the end of fiscal 1995. Funds and schedule are yet to be decided.

2-4-4 Second Telecommunications Project (TELECOM II)

TELECOM II is the first practical step under the Investment Program 1990-95. It was endorsed by the Government of the Lao PDR in September 1989, approved by IDA in May 1990, and then officially started.

TELECOM II consists of the construction of long distance transmission lines, junction lines, local subscriber cable networks and telephone office buildings financed by IDA, and the installation of digital telephone exchanges with a capacity of 17,200 lines, including the ancillary facilities to be financed by Japan's grant aid.

As for the portion to be materialized by IDA credit, detail design and preparation of specifications have already been completed and approved by IDA. Tender will be floated around the end of 1990. With respect to the technical assistance for project implementation and institutional strengthening of EPTL, contract negotiation is now under way with a foreign consultant, with the assistance of ITU.

Technical training of operation and maintenance staff is scheduled to be carried out by ITU experts, with the assistance of ITU, starting in 1991.

CHAPTER 3 SCOPE OF THE PROJECT

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3-1 Objective of the Project

This Project is to install new telephone exchanges in 6 major cities in the Lao PDR, including the capital city, Vientiane, replacing all the existing obsolete facilities, aiming at the upgrading of the telecommunications services, particularly the telephone services, which are extremely poor in quality at present, with no substantial improvement since 1975. This Project constitutes a first step of the nationwide and comprehensive modernization plan on the existing telephone facilities.

The role of telecommunications as the infrastructure to support social and economic activities has become more and more important particularly for these 10 years. Nowadays, social and economic activities can hardly dispense with telecommunications services.

When investments and loans from industrialized countries are considered for the national development, telecommunications will form a dominant factor: success in such efforts often depends upon the availability of adequate telecommunications.

The Government of the Lao PDR, well recognizing such importance of telecommunications in economy and society, accorded the top priority to the rehabilitation and expansion of the existing telecommunications facilities to achieve the improvement and reinforcement of the social and economic infrastructure. TELECOM II including this Project is thus under implementation by the Government vigorously.

To sum up, the objectives of this Project are:

a. To complete TELECOM II with the implementation of this Project which is an integral part of TELECOM II.

b. To substantially promote the economic development, the most important problem for the Government to solve, through the implementation of this Project, i.e, completion of TELECOM II.

3-2 Study of Request

3-2-1 Study of the Plan

(1) Demand Forecast

Demand forecast for the telephone services in the Lao PDR, based on the Long Term Telecommunications Development Plan, is shown in Table-4.

According to the estimates in the Long Term Plan, demands for telephone services in the objective areas of this Project, in 1993, are:

- Vientiane Metropolitan Area	13,963
- Louang Phabang	1,092
- Pakxan	124
- Thakhek	839
- Khanta Bouli	1,573
- Pakxe	765

In the Long Terms Development Plan, demands are projected, based on the correlation between the GDP/capita and telephone density (the number of telephone subscribers per 100 inhabitants), in accordance with the CCITT standard.

The forecasts given in Table-4 are adjusted as follows:

- The number of telephones for business use and that for residential use are estimated, based on the telephone density in each objective area estimated in the Long Term Plan; and

- The telephone density in each objective area are adjusted, based on the above estimation.

The adjusted forecasts are given in Table-5. In Table-6 and Table-7 are given the estimates of population and GDP taken into account in adjustment as the social and economic factors.

In the adjustment process, the following are taken into account:

In terms of the industrial structure:

- The ratio of the agricultural sector in GDP will gradually decrease. In 1993, it will be half the current value.

- On the other hand, the ratio of industrial and service sectors will increase, exceeding 40% in 1993.

- Private sector will grow steadily: ratio of their products in GDP will not change.

That is, the industrial structure in the central and southern regions will transform gradually from the agricultural oriented to the industrial/commercial oriented. In

consequence, the demand increase rate for telephone services in these regions will be higher than that in the northern region. For Thakhek and Khanta Bouli, telephone demand forecasts are readjusted, based on the field survey findings.

In the following are shown the readjusted value, together with the requested number of lines.

Unit: lines

Objective Area	Requested Number of Lines	Forecast (Adjusted)	Forecast (Long Term Plan)
Vientiane	13,500	13,964	13,963
Louang Phabang	1,000	1,092	1,092
Pakxan	200	249	124
Thakhek	500	559	839
Khanta Bouli	1,000	1,049	1,573
Pakxe	1,000	1,021	765

(2) Correlated Projects

TELECOM II consists of 4 major projects: (1) telephone exchanges installation project (this Project), (2) long distance transmission and junction cable lines construction project, (3) local cable network construction project, and (4) necessary buildings construction project.

Long distance transmission and junction cable project, local cable network project, and building construction project are now under way with the assistance of IDA.

1) Building Construction Project

The building construction project was started immediately upon the signing of the IDA assistance in 1989. At present, construction of Pakxan Exchange Office building was completed, and Numphou Exchange (Vientiane Telecommunication Center) Office building is under construction. Design works have already been completed, except for Xaisettha and Sisattanak in Vientiane Province. All the works are to be completed by the end of 1991.

The buildings and associated works necessary for the materialization of this Project will be completed by the end of 1991.

2) Long Distance Transmission/Junction Cable Network Project

As for the construction of the backbone long distance transmission route for Louang Phabang-Vientiane-Pakxan-Thakhek-Khanta Bouli-Pakxe, detail designs have been completed, and now preparation is being made for the tender to be floated by the end of 1990. The system to be constructed is a digital microwave link or optical fiber of 140 megabit/sec/section, consisting of one working system of 140 megabit/sec/section and one standby system having a capacity equivalent to 1,920 tele-

phone channels.
The construction works are scheduled to be completed in 1993. Priority in construction works is given to the junction cable route in Vientiane City.

3) Local Cable Network Project

The Local Cable Network Project is to cover the construction of telephone lines between the subscriber's telephone and the switching equipment in the telephone exchange. This project can be divided into three phases: supply of subscriber terminals, subscriber cable lead-in work (from the cross-connection point to the subscriber's premises), and cable network construction. All of these phases are to be materialized with the IDA credit. Detail designs have already been completed shown in Table-8 and Figure-5. Now, preparation is under way for floating the tender in December 1990, the same month with the transmission project.

In this Project also, priority in construction is given to the works in Vientiane City, which are scheduled to be completed by the end of fiscal 1992 (March 1993). The works in other cities are to be completed by the end of 1993 (March 1994).

The overall timetable of these projects is given in Table-9.

3-2-2 Study of the Requested Facilities

(1) Digital Telephone Exchanges

As mentioned in Section 2-2, the existing telephone switching facilities must be urgently replaced because they are extremely obsolete, though rather well maintained, and spare parts and materials necessary for maintenance and improvement of the system are unavailable. With these facilities, it is very difficult to satisfy the increasing telephone demands and upgrade the service quality.

Nowadays, the use of the digital telephone exchange is an international tendency and the adoption of the analogue type exchange is not recommendable also from the economical standpoint. In other words, introduction of digital telephone exchange for telephone network rehabilitation is reasonable.

(2) Digital Exchanges for Toll Calls

In the 6 major objective areas, the functions to control trunk traffic is provided, at present, in the respective existing local telephone exchanges. However, the capacity of such function is very limited: 39 lines in Numphou Exchange and 4 to 6 lines in other exchanges. Moreover,

such function is designed for HF radio link, with some limitation in signalling system. Therefore, in order to utilize this function for the new digital exchange network, it must be modified.

However, as mentioned previously, modification and/or expansion of the existing facilities are difficult due to the lack of necessary parts and tools. That is, the existing trunk traffic control function is difficult to be modified and, as the result, not utilizable for the new digital trunk exchange network to be constructed anew.

(3) International Digital Exchange

At present, international telephone service is provided by the 3 manual switchboard. The service quality is not satisfactory: each call connection requires at least several hours and sometimes a half or whole day.

(4) Billing System

The new digital telephone exchange is not equipped with a conventional visible charge meter but with an electronic charge recording system in which all the data are recorded on a magnetic drum or tape and then printed out.

In the case of the existing crossbar exchange, telephone charges are calculated once a month based on a meter reading (actually by taking a photograph of it).

Such calculation is not feasible with the digital exchange. Moreover, data for charging must be recorded on magnetic tape and/or printed on paper one a half or whole day, depending upon the mechanical requirements and also in consideration of reliability.

In consequence, it is a standard practice to use a billing computer for calculation of telephone charges in case of the digital exchange. In other words, a billing computer is an integral part of the digital exchange nowadays.

In introducing the digital exchange, therefore, a billing computer should also be introduced. If not, the digital exchange must be so designed as to have the charge calculation function. That is, the specifications for the exchange itself must be changed, requiring additional costs. Provision of a billing computer under this Project is indispensable rather than reasonable.

(5) Centralized Operation and Maintenance Facilities

The new digital exchange is so designed that it can be reliable and stable with extremely low fault ratio, without requiring every day operation and maintenance. Most of the troubles caused in the digital exchange are those by operational errors during the operation and maintenance work. To

avoid such troubles, remotely controlled centralized maintenance system is usually adopted for the digital switching system.

Adoption of the remotely controlled centralized maintenance system can also serve for the reduction of operation and maintenance costs as it facilitate the reduction of maintenance personnel, and further for creating the healthy management structure.

To realize the remotely controlled centralized maintenance system, two methods are conceivable. One is to installed a large scale facilities and realize full automatic operation. The other is to install the minimum necessary facilities. In the latter case, radical decrease in the number of maintain/operation staff cannot be expected, but the decrease in troubles due to operational error can be achieved by eliminating the opportunities of careless contact by the staff.

It is considered reasonable, therefore, to introduce the centralized maintenance system to the necessary minimum extent, i.e., to centralize the input/out units of the exchanges, under this Project, in consideration of the conditions in the Lao PDR, particularly the fact that the maintenance personnel cost is not so high.

Table-4 Demand Forecast (Projection of Potential Demand) (1/4)

Province Capital Locations	1993	1995	2000	2005	2010
Lao P.D.R.	21.300	26.200	44.800	89.000	182.000
Vientiane Municipality	13.963	16.632	24.531	36.748	57.500
Champasak	808	1.141	2.494	6.681	14.940
Pakxe	765	906	1.390	2.815	5.360
Kanasomboun	5	29	138	485	1.206
Bachiang	3	15	67	221	510
Phonthong	8	42	211	788	2.096
Pakxong	4	23	104	345	805
Pathoumphon	4	22	98	331	782
Champasak	5	28	134	471	1.170
Soukhouma	4	20	96	337	853
Khong	7	41	191	672	1.677
Mounlapamok	3	15	65	216	499
Savannakhet	1.629	2.157	4.249	10.672	23.239
Khanthabouli	1.573	1.861	2.856	5.782	11.044
Outhoumphon	10	55	259	908	2.273
Atsaphangthong	9	48	225	790	1.974
Phin	5	28	127	426	1.011
Xepon	4	24	109	366	867
Champon	14	75	375	1.403	3.741
Nong	2	8	38	125	281
Songkhon	8	41	182	613	1.463
Thapangthong	2	13	60	198	455
Samouay	2	4	18	61	130
Khammouan	858	1.096	1.999	4.713	9.785
Thakhek	839	993	1.523	3.084	5.864
Hinboun	5	28	132	464	1.152
Gnommalat	3	19	84	282	664
Boualaphd	2	9	42	138	315
Mahaxai	4	21	101	356	881
Nongbok	5	26	117	389	909
Xiangkhuang	858	1.096	1.999	4.713	9.785
Pek	839	993	1.523	3.084	5.864
Kham	5	28	132	464	1.152
Nonghet	3	19	84	282	664
Khoun	2	9	42	138	315
Mok	4	21	101	356	881
Souy	5	26	117	388	909

Table-4 Demand Forecast (Projection of Potential Demand) (2/4)

Province Capital Locations	1993	1995	2000	2005	2010
Luangphabang	1.118	1.439	2.651	6.285	13.090
Luangphabang	1.092	1.292	1.982	4.014	7.652
Ngoy	4	20	91	301	700
Nambak	4	22	96	318	742
Pakxeng	5	29	135	476	1.187
Pak-Ou	2	14	64	214	498
Xiang-Ngeun	5	29	134	472	1.175
Nan	3	15	69	228	525
Phonxai	3	18	80	263	611
Phongsali	121	157	450	1.285	3.752
Phongsali	109	145	305	634	1.356
Gnot-Ou	2	2	27	121	445
Bounxai	2	2	23	102	369
Samphan	3	3	35	158	589
Mai	2	2	26	117	424
Khoa	3	3	34	153	569
Luang-Namtha	124	162	428	1.136	3.122
Luang-Namtha	116	154	324	674	1.443
Sing	2	2	28	125	457
Long	2	2	24	107	391
Viangphoukha	2	2	21	94	335
Male	2	2	31	136	496
Oudomxay	169	216	714	2.216	6.852
Xai	144	191	403	838	1.806
Namo	2	2	28	126	465
La	2	2	20	89	320
Beng	2	2	32	141	514
Paktha	2	2	13	56	196
Nga	2	2	28	126	457
Hun	4	4	47	209	772
Pakbeng	2	2	26	116	427
Pha-Oudom	2	2	29	126	460
Xianghon	4	4	47	207	765
Hongsa	3	3	41	182	670
Bokeo	168	222	492	1.102	2.586
Houayxay	164	218	460	957	2.064
Meung	2	2	13	58	206
Tonpheung	2	2	19	87	316

Table-4 Demand Forecast (Projection of Potential Demand) (3/4)

Province Capital Locations	1993	1995	2000	2005	2010
Houaphan	198	257	760	2.240	6.912
Xam-Nua	177	236	497	1.034	2.235
Xiangkho	8	8	98	460	1.848
Viangthong	2	2	25	109	395
Viangxai	4	4	47	211	792
Houamuang	2	2	32	142	521
Xam-Tai	5	5	61	284	1.121
Xaignabouli	231	303	781	2.048	5.707
Xaignabouli	217	289	609	1.267	2.748
Phiang	3	3	36	160	588
Paklay	6	6	76	356	1.406
Kenthao	3	3	36	158	578
Boten	2	2	24	107	387
Vientiane	295	396	1.153	3.827	10.178
Phonhong	271	370	830	2.318	4.266
Kasi	3	3	41	184	687
Vangviang	4	4	50	235	923
Xaisomboun	2	2	23	102	369
Keo-Oudom	2	3	36	169	657
Hom	2	2	22	99	390
Thoulakhom	5	6	74	371	1.560
Fuang	3	3	41	181	669
Xanakham	3	3	36	168	657
Bolikhamxai	135	177	486	1.339	3.820
Pakxan	124	165	348	723	1.554
Bolikhan	2	2	19	86	308
Thaphabat	2	2	25	111	409
Vangthong	2	2	23	101	364
Khamkeut	2	3	43	194	727
Pakkading	2	3	28	124	458
Salavan	267	360	980	2.680	7.686
Salavan	251	343	770	1.707	3.960
Ta-Oy	2	2	23	102	371
Toumlan	2	2	18	80	290
Lakhonpheng	3	3	36	171	668
Vapi	2	2	29	130	472
Khongxedon	4	5	60	282	1.111
Laongam	3	3	44	208	814

Table-4 Demand Forecast (Projection of Potential Demand) (4/4)

Province Capital Locations	1993	1995	2000	2005	2010
Xekong	104	134	305	749	1.705
Lamam	100	130	263	523	1.065
Kalum	2	2	18	81	276
Dakchung	2	2	24	105	364
Attapu	89	115	277	697	1.838
Samakhixai	82	108	218	433	876
Xaisettha	3	3	36	159	584
Sanxai	2	2	2	9	33
Sanamxai	2	2	21	96	345

Table-5 Demand Forecast for Objective Areas

Province	City/Area	1993	1995	2000	2005	2010
Vientiane	Chanthabouli	4,394	5,168	7,526	10,880	16,960
	Sikhottabong	203	287	627	1,115	1,904
	Naxaythong	165	230	452	724	1,104
	Xaisettha	4,563	5,365	7,814	11,304	17,616
	Hatsayphong	226	321	658	1,100	1,755
	Sisattanak	4,128	4,855	7,074	10,232	15,938
	Xaithani	286	406	833	1,393	2,236
	(sub-total)	13,964	16,634	24,984	36,748	28,757
Louangphabang	Louangphabang	1,092	1,292	1,982	4,014	7,652
Bolikhamxai	Pakxan	249	331	503	1,040	2,072
Khammouan	Thakhek	559	764	1,238	3,084	5,864
Savannakhet	Khantabouli	1,049	1,432	2,678	5,782	11,044
Champasak	Pakxe	1,021	1,185	1,651	2,816	5,360
	Total	17,934	21,638	33,036	53,484	60,749

Table-6 Estimated Number of Population on Objective Areas

Province	City/Area	1985	1986	1987	1988	1989	1990	1993	1995	2000	2005	2010
Vientiane	Chanthabouli	48,846	50,400	51,900	53,400	55,000	56,700	67,600	76,000	101,700	136,000	181,000
	Sikhottabong	53,004	54,700	56,300	58,000	59,700	61,500	67,500	71,800	89,500	111,500	138,000
	Naxaythong	44,250	45,700	47,000	48,400	49,900	51,400	55,000	57,600	64,600	72,400	80,000
	Xaisettha	51,562	53,200	54,700	56,400	58,100	58,900	70,200	78,900	105,600	141,300	188,000
	Hatsayphong	58,903	60,800	62,600	50,200	66,400	68,600	75,400	80,300	94,000	110,000	127,200
	Sisattanak	45,965	47,400	48,800	81,900	51,700	53,300	63,500	71,400	95,600	127,900	170,100
	Xaithani	74,879	77,200	79,500	64,500	84,300	86,800	95,400	101,600	119,000	139,300	162,000
	(sub-total)	377,409	389,400	400,800	412,800	425,100	437,200	494,600	537,600	670,000	838,400	1,046,300
Louangphabang	Louangphabang	68,887	70,900	73,000	75,200	77,500	79,800	91,000	99,400	123,900	154,400	191,300
Bolikhamxai	Pakxan	24,611	25,300	26,000	26,700	27,500	28,300	31,100	33,100	38,700	45,200	51,800
Khammouan	Thakhek	53,066	54,600	56,200	57,800	59,500	61,200	69,900	76,400	95,200	118,600	146,600
Savannakhet	Khantabouli	99,387	102,300	105,300	108,400	111,600	114,900	131,100	143,200	178,500	222,400	276,100
Champasak	Pakxe	48,519	49,900	51,300	52,800	54,300	55,900	63,800	69,700	86,900	108,300	134,000

Table-7 GDP Configuration in Lao PDR

a. GDP in each industries category

Item	1984	1985	1986	1987	1988	1989	1990	1993	1995	2000	2005	2010
Agriculture	107,777	119,657	130,082	117,784	122,169	121,831	128,649	157,966	174,280	185,695	195,872	204,426
(%)	60	61	62	60	60	56	55	54	53	48	43	39
Industry	29,056	30,147	34,435	20,021	27,841	35,133	38,690	54,361	65,964	81,241	104,769	125,801
(%)	16	15	16	14	14	16	17	18	20	21	23	24
Services	40,274	44,818	44,370	48,257	50,982	57,320	61,508	76,445	84,917	112,191	145,765	178,218
(%)	23	23	21	25	25	26	26	26	26	29	32	34
Import Duties	1,875	780	679	743	4,086	4,207	4,537	5,850	6,155	7,737	9,110	15,725
(%)	1	0	0	0	2	2	2	2	2	2	2	3
Total GDP	178,982	195,402	209,566	194,805	205,078	218,491	233,384	294,622	331,316	386,864	455,517	524,170
(%)	100	100	100	100	100	100	100	100	100	100	100	100

(Unit: Million Kip)

b. GDP in each categories

Item	1984	1985	1986	1987	1988	1989	1990	1993	1995	2000	2005	2010
Export	24,397	34,166	34,602	35,113	40,190	29,560	38,854	51,527	58,200	69,636	81,993	94,351
(%)	14	17	17	18	20	14	17	17	18	18	18	18
Import	-55,622	-72,837	-64,582	-68,743	-73,978	-79,938	-87,172	-113,045	-118,577	-139,271	-163,986	-188,701
(%)	-31	-37	-31	-35	-36	-37	-37	-38	-36	-36	-36	-36
Public Investment	32,217	32,631	32,830	28,451	26,148	27,246	37,242	52,895	59,212	69,636	81,993	94,351
(%)	18	17	16	15	13	12	16	18	18	18	18	18
Public Consumption	35,259	40,003	38,449	34,056	34,228	32,706	35,681	46,805	48,103	54,161	63,772	73,384
(%)	20	20	18	18	17	15	15	16	15	14	14	14
Private Expenditure	142,730	161,439	168,267	164,928	178,490	208,917	210,781	256,440	284,378	332,703	391,745	450,786
(%)	80	83	80	85	87	96	90	87	86	86	86	86
Total GDP	178,981	195,402	209,566	193,805	205,078	218,491	235,386	294,622	331,316	386,864	455,517	524,170
(%)	100	100	100	100	100	100	100	100	100	100	100	100

(Unit: Million Kip)

Table-8 Local Cable Installation Program for each Exchange Area

(Vientiane Area) Numphou Exchange	0.4 mm	300 Pairs 1200 Pairs x 2 1500 Pairs x 2 2100 Pairs
	0.6 mm	900 Pairs 1200 Pairs
	Total	9900 Pairs
Xaisettha Exchange	0.4 mm	600 Pairs 900 Pairs x 2 1200 Pairs 1500 Pairs
	0.6 mm	1200 Pairs
	Total	6300 Pairs
Sisattanak Exchange	0.4 mm	900 Pairs 1500 Pairs x 3 2100 Pairs
	0.6 mm	600 Pairs
	Total	8100 Pairs
(Other Cities) Louang Phabang Exchange	0.4 mm	400 Pairs 600 Pairs 900 Pairs
	0.6 mm	200 Pairs
	Total	2100 Pairs
Thakhek Exchange	0.4 mm	300 Pairs 600 Pairs x 2
	Total	1500 Pairs
Khantabouli Exchange	0.4 mm	400 Pairs 600 Pairs 900 Pairs
	0.6 mm	200 Pairs
	Total	2100 Pairs
Pakxe Exchange	0.4 mm	400 Pairs 600 Pairs 900 Pairs
	Total	1900 Pairs
Pakxan Exchange	0.6 mm	150 Pairs x 2
	Total	300 Pairs

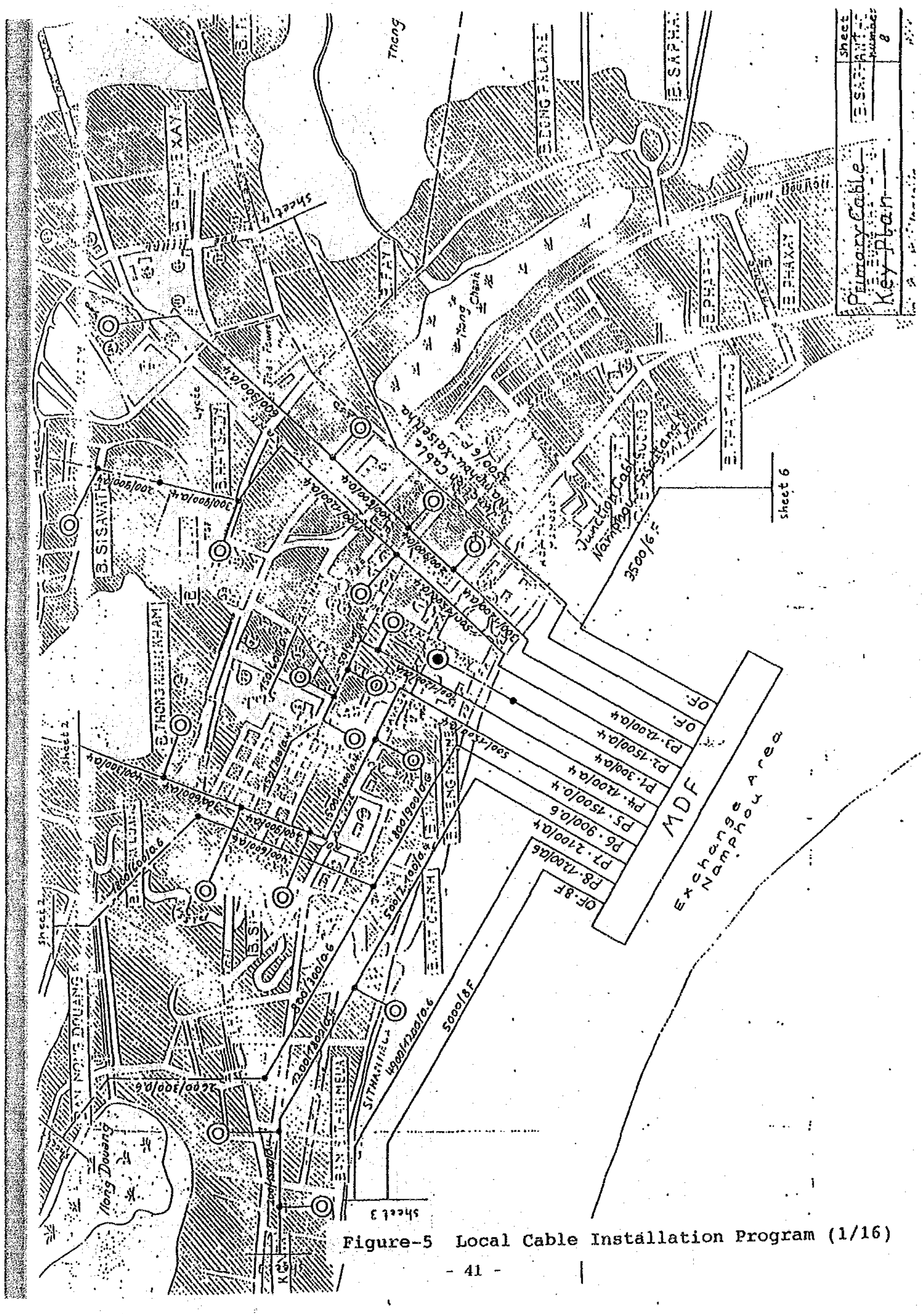

Figure-5 Local Cable Installation Program (1/16)

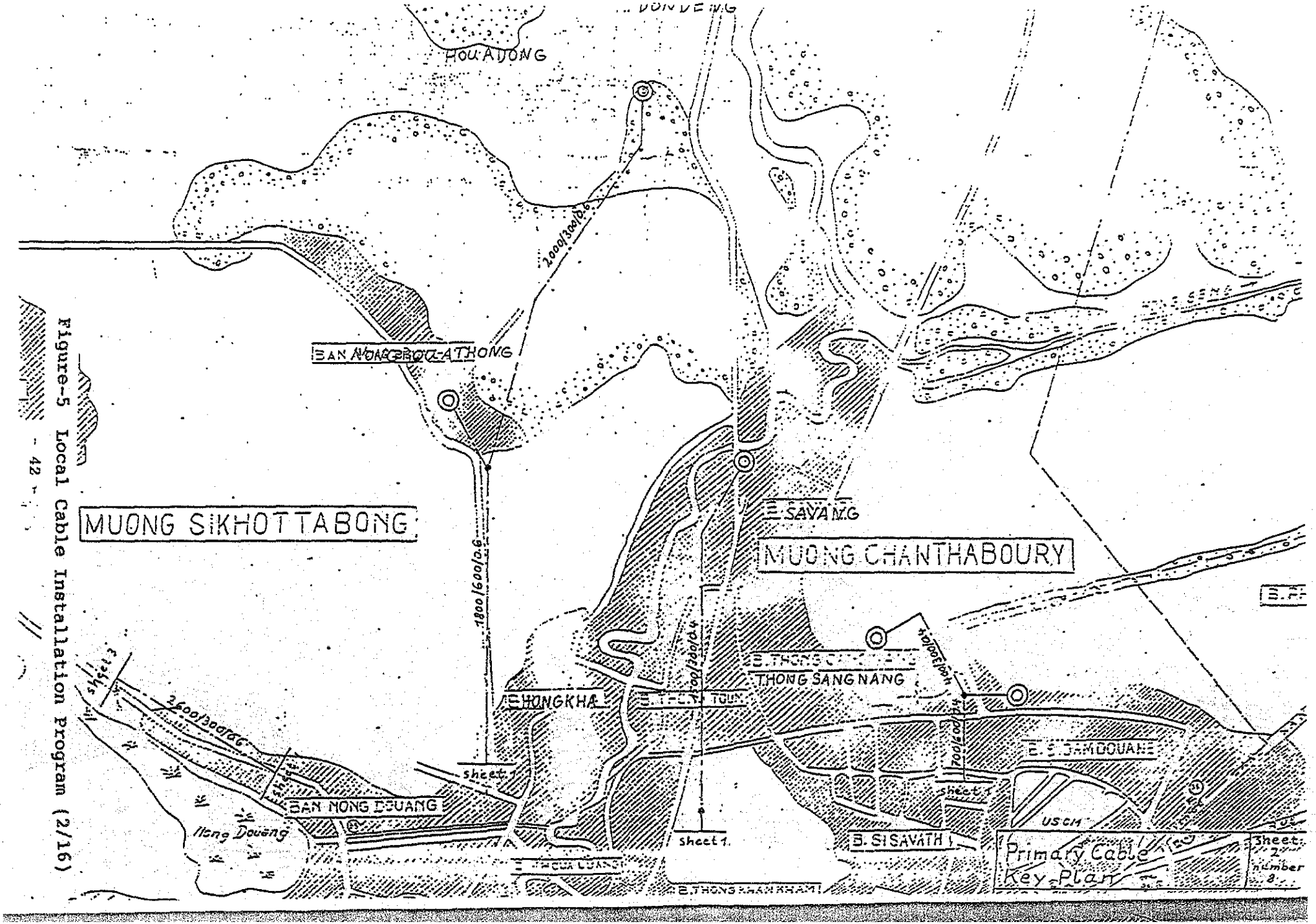

Figure-5 Local Cable Installation Program (2/16)

Figure-5 Local Cable Installation Program (3/16)

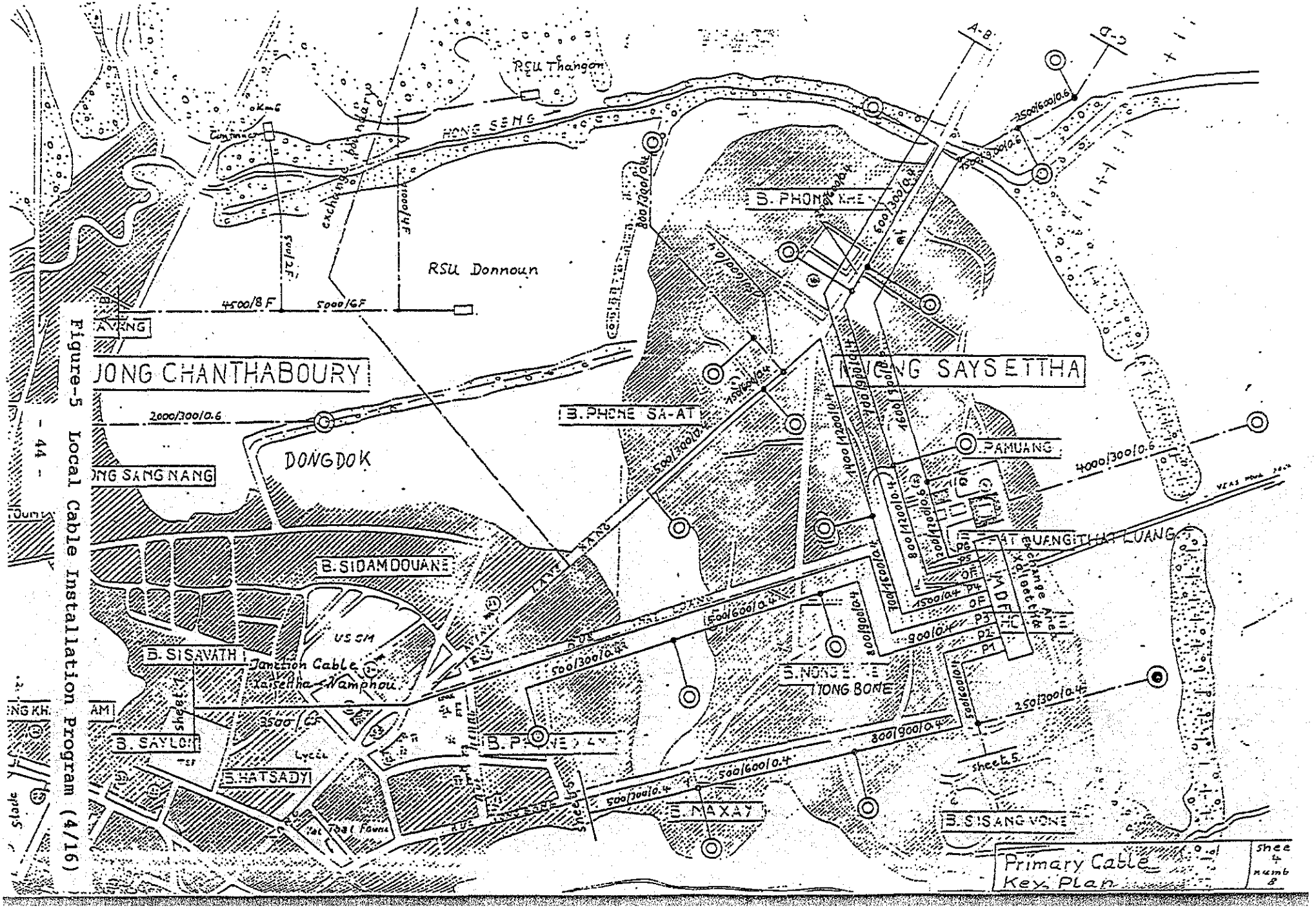

Figure-5 Local Cable Installation Program (4/16)

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

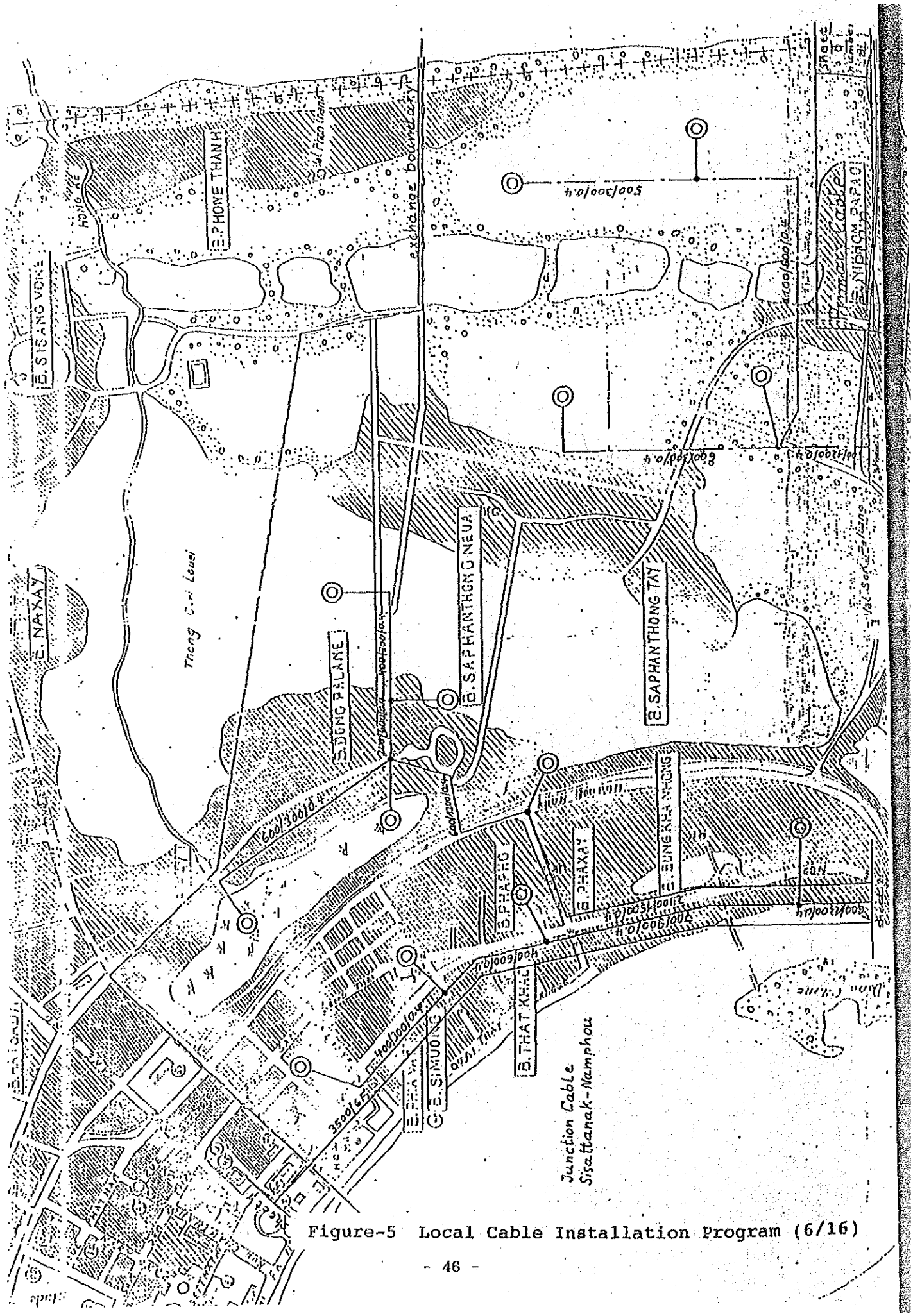

Figure-5 Local Cable Installation Program (6/16)