JAPAN INTERNATIONAL COOPERATION AGENCY

MINISTRY OF COMMUNICATIONS AND TRANSPORT
THE UNITED REPUBLIC OF TANZANIA

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR
TELEPHONE NETWORK REHABILITATION
IN
DAR ES SALAAM
IN
THE UNITED REPUBLIC OF TANZANIA

JANUARY 1993

NIPPON TELECOMMUNICATIONS CONSULTING CO., LTD.

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PREFACE

In response to a request from the Government of the United Republic of Tanzania, the Government of Japan decided to conduct a basic design study on the Telephone Network Rehabilitation Project in Dar es Salaam and entrusted the study to the Japan International Cooperation Agency (JICA).

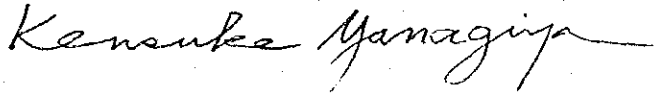
JICA sent to Tanzania a study team headed by Mr. Mabito Yoshida, Deputy Director of Tariff Division, Telecommunications Bureau, Ministry of Posts and Telecommunications, and constituted by members of Nippon Telecommunications Consulting Co., Ltd., from September 14 to October 13, 1992.

The team held discussions with the officials concerned of the Government of Tanzania and conducted a field study at study area. After the team returned to Japan, further studies were made. Then, a mission headed by Mr. Naoki Okano, Deputy Director of Telecommunication Systems Division, Telecommunications Bureau, Ministry of Posts and Telecommunications, was sent to Tanzania from December 14 to December 26, 1992, in order to discuss the draft report and the present report has been prepared.

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

I wish to express my sincere appreciation to the officials concerned of the Government of Tanzania for their close cooperation extended to the teams.

January 1993



Kensuke Yanagiya
President
Japan International Cooperation Agency

January 1993

Mr. Kensuke Yanagiya
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Telephone Network Rehabilitation Project in Dar es Salaam in the United Republic of Tanzania.

This study has been made by Nippon Telecommunications Consulting Co., Ltd., based on a contract with JICA, from September 7, 1992 to January 29, 1993. Throughout the study we have taken into full consideration the present situation in the United Republic of Tanzania, and have planned the most appropriate project in the scheme of Japan's grant aid.

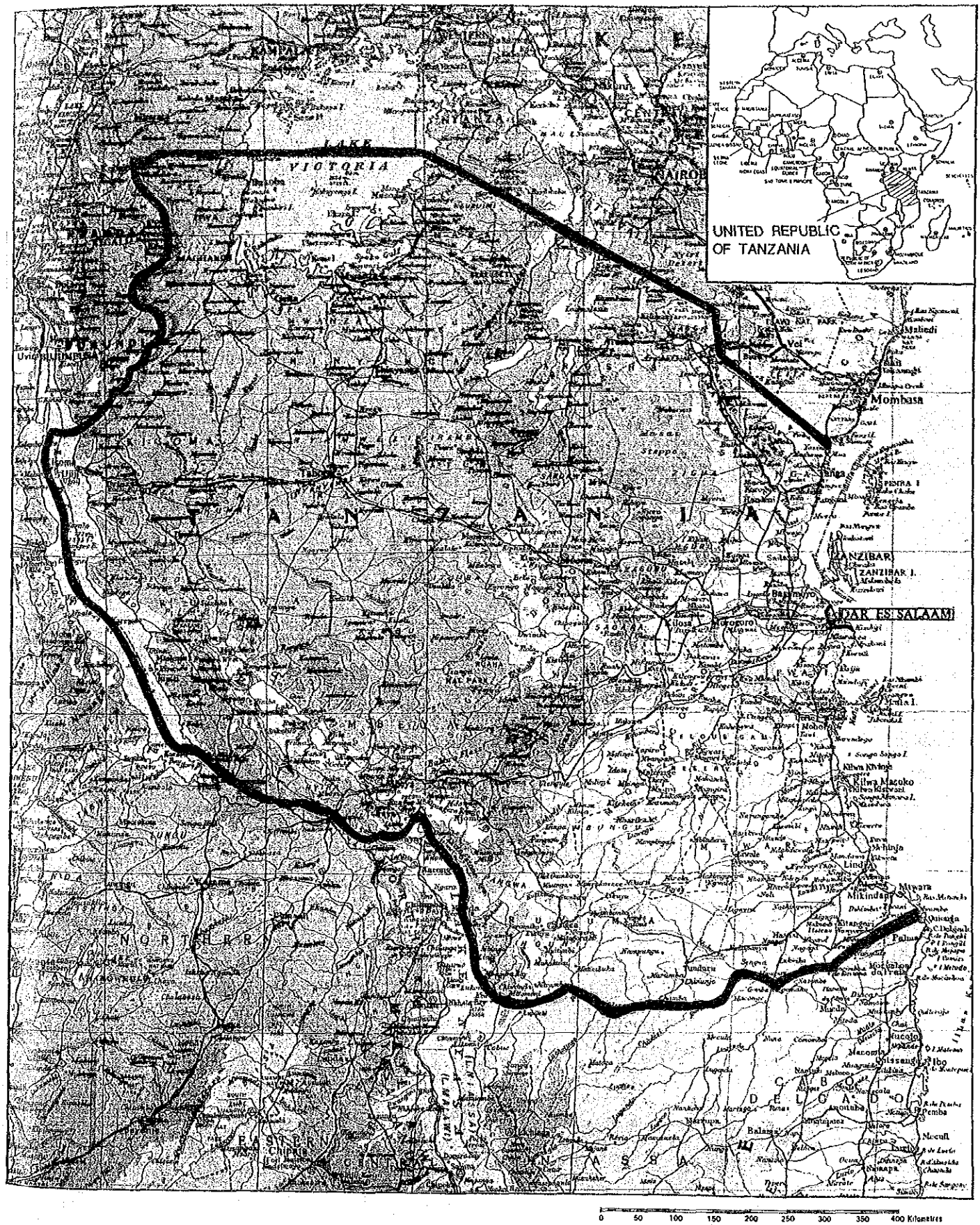
We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, Ministry of Foreign Affairs and Ministry of Posts and Telecommunications. We also wish to express our deep gratitude to the officials concerned of Tanzania Posts and Telecommunications Corporation, Embassy of Japan in Tanzania and JICA Tanzania Office, for their close cooperation and assistance during our study in Tanzania.

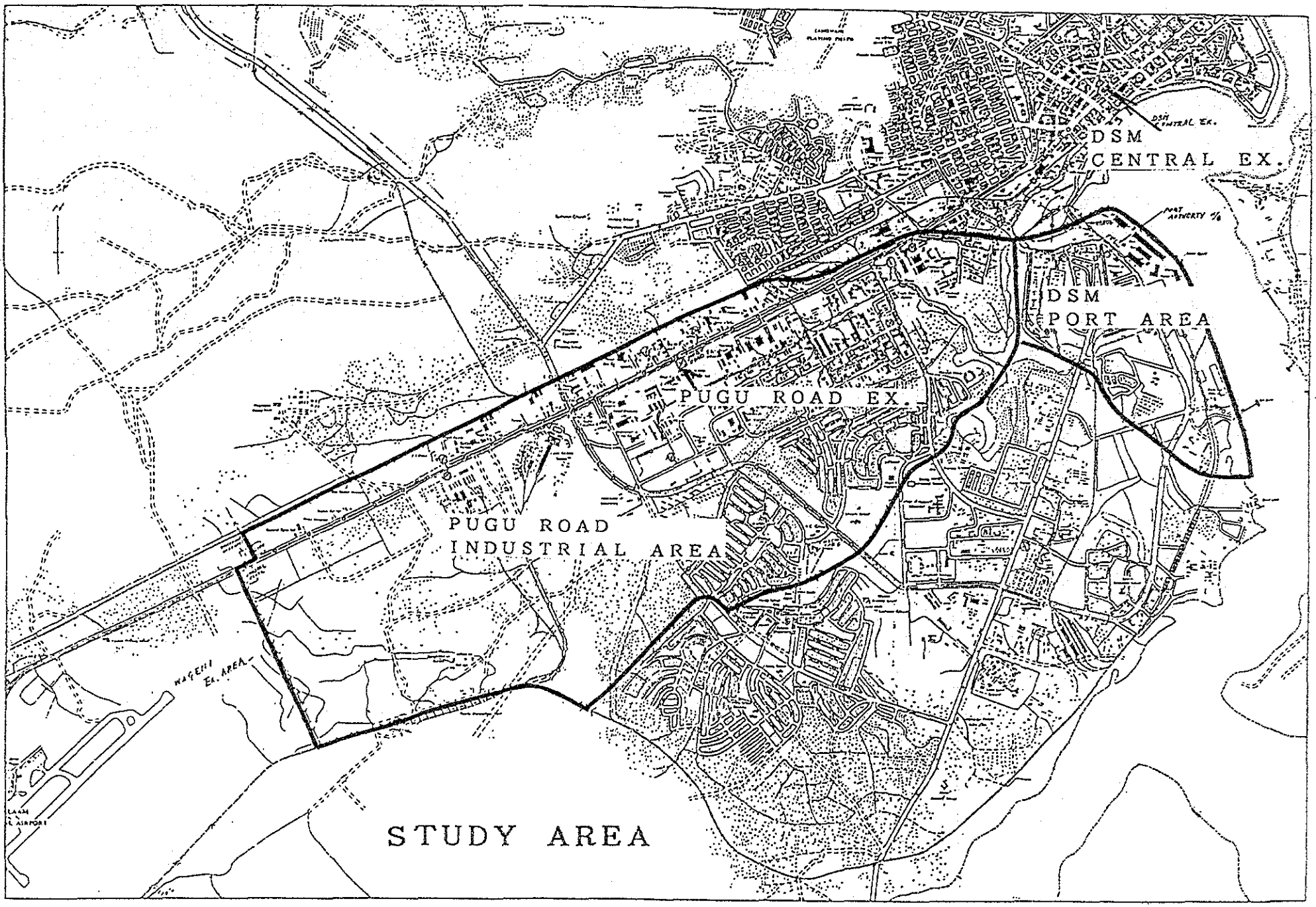
At last we hope that this report will be effectively used for the promotion of the project.

Very truly yours,

Kenji Tsuboi
Project Manager
Basic Design Study Team on the
Telephone Network Rehabilitation
Project in Dar es Salaam
Nippon Telecommunications Consulting Co., Ltd.

UNITED REPUBLIC OF TANZANIA




DSM
CENTRAL EX.
DSM
PORT AREA
PUGU ROAD EX.
PUGU ROAD
INDUSTRIAL AREA
STUDY AREA

SUMMARY

SUMMARY

In 1986, the Government of the United Republic of Tanzania launched the First Economic Recovery Programme (1986-1989), putting emphasis on the rehabilitation of infrastructures. The average annual growth rate of GDP envisaged under the Programme was 4.5%. The Programme could almost achieve the targets, though the annual growth rate remained to be 4.0%, slightly lower than the target value. Then, the Government planned the second recovery plan named Economic and Social Action Programme (1989/90-1991/92), aiming at the expansion of agriculture production and exports, effective utilization of domestic resources, rehabilitation of telecommunications and transportation facilities and other infrastructures, revitalization of industries, etc. This Action Programme is now being implemented.

Most of the telecommunications facilities in Tanzania were constructed prior to its national independence in 1961 and deteriorated. Therefore, the rehabilitation of these facilities is an urgent need for the Tanzania Posts and Telecommunications Corporation (TPTC).

In 1990 and 1991, the local telephone networks in the government office areas and the Oyster Bay Exchange area in Dar es Salaam were rehabilitated with the Japan's grant aid. With this, the successful call ratio in these areas have been remarkably improved.

However, telecommunications facilities in other areas are kept as installed more than 30 years ago and superannuated. Hence they cannot function well. Outside plant facilities which are made of extremely deteriorated paper insulated cables, among others, frequently suffer from serious troubles, resulting in a long term of telephones. In rainy seasons, it often continues as long as 2-3 months. To cope with this problem, TPTC has drawn up a local telephone network rehabilitation project for the port and industrial areas in Dar es Salaam, and requested the Japanese Government's grant aid for its realization.

In response to this request, the Japanese Government decided to conduct the basic design study for this project, and Japan International Cooperation Agency (JICA) sent a basic design study team to Tanzania from September 14 to October 13, 1992, for field investigations.

The study team carried out the investigation of the status quo of telecommunications and other related matters in Tanzania, as well as the background factors and contents of this project. The team exchanged views with the staff concerned of the Government of Tanzania through repeated discussions, and surveyed the project sites and condition of the existing facilities, including their availability.

After returning to Japan, the team studied and analyzed the data obtained through the field survey, and drafted the Basic Design Study Report comprising the basic design and the implementation plan. Then the team visited Tanzania again from December 16 to December 24, 1992, to discuss and explain on the Report to the staff concerned of the Government of Tanzania.

The contents of the project formulated through the above study are as follows:

(1) Scope of the Project

Subscriber cable facilities in the port area of the Central Exchange area and the industrial area of the Pugu Road Exchange area in Dar es Salaam, and civil facilities pertaining thereto will be rehabilitated as follows:

Main Facilities	DSM Central Exchange	Pugu Road Exchange
Replacement of main distribution frame	1 system	-
Replacement of primary cables	1,600 pairs	5,200 pairs
Replacement of cross connection cabinets	3 ea	10 ea
Replacement of secondary cables	1 system	1 system
Replacement of civil facilities pertaining to the above	1 system	1 system

(2) Materials to be Adopted

For subscriber cables, jelly-filled, polyethylene insulated cables which are easy to maintain and superior in reliability will be adopted, to replace the gas-pressurized, paper insulated cables now in use.

For civil facilities, concrete manholes and rigid polyvinyl pipes will be adopted, to replace brick manholes and asbestos pipes.

With the above, low insulation resistance of cable conductors due to water penetration which is the main cause of communication failures can be eliminated.

The supporting local funds needed for performance of this project, estimated at 15.8 million Tanzania Shillings (6.5 million yen equivalent), are to be appropriated from the national development budget of the Tanzania Government.

The time required for materialization of this project, following the Exchange of Notes (E/N) by both the governments, is estimated 6 months for detailed design through completion of contract signing, and 12 months for construction works. An implementation agency of this project is Tanzania Posts and Telecommunications Corporation (TPTC).

Upon completion of this project, line failures due to deteriorated overage cables, water penetration into cables in rainy seasons, etc. can be eliminated, and stable communication services can be provided. The improved communication services will effectuate rapid transmission of various kinds of information, serving for improvement of efficiency in government and public sector activities, enhancement of economic development and social welfare, as well as the alleviation of traffic congestion increased by the substitutes for telecommunications.

Currently, Tanzania is vigorously proceeding with the Economic and Social Action Program. The improvement of telecommunications in Dar es Salaam, the capital city, will effectively support its successful realization, through the activation of national economy and enhancement of

social welfare. Hence the grant aid from the Japanese Government to Tanzania for modernization of telecommunications in the objective areas will be extremely significant.

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CHAPTER 1 INTRODUCTION

CHAPTER 1 INTRODUCTION

The telecommunications and postal services in the United Republic of Tanzania are provided by the Tanzania Posts and Telecommunications Corporation (TPTC) under the authority of the Ministry of Communications and Transport.

TPTC is now proceeding with the improvement and expansion of telecommunications, with financial assistance from the World Bank, AfDB, Italy, Sweden, Japan, etc., in line with the Economic and Social Action Programme (1989/90-1991/92), which envisages the rehabilitation of telecommunications and transport infrastructure.

Telecommunications services in the capital city, Dar es Salaam, are extremely poor because of the superannuated facilities. Particularly in rainy seasons (twice a year), services turn all the more worse with a number of prolonged line failures mainly due to low insulation resistance.

The number of subscribers in Dar es Salaam is approx. 32,000 with waiting applicants numbering approx. 56,600 as of October 1992, which goes on increasing.

Telecommunications facilities in the port area of Dar es Salaam Central Exchange and the factory area of Pugu Road Exchange, both being the center of the economic and industrial activities in the nation, are extremely deteriorated, because more than 30 years have passed since their installation. In addition, maintenance of local outside plant facilities in these areas is becoming harder and harder because of the difficulty in obtaining maintenance materials such as spare cables and splicing materials.

To cope with the above situation, TPTC formulated the Local Telephone Network Rehabilitation Project in Dar es Salaam, giving high priority to the improvement of telecommunications facilities in these areas. That is, the Government of Tanzania designated the rehabilitation of telecommunications facilities in the port area of the Dar es Salaam (DSM) Central Exchange and in the industrial area of the Pugu Road Exchange as an urgent project and requested the Japan's grant aid for its realization.

In response to this request, the Government of Japan decided to conduct the basic design study on this project, and Japan International Cooperation Agency sent a basic design study team to Tanzania from September 14 to October 13, 1992. The team was headed by Mr. Mabito Yoshida, Deputy Director of Tariff Division, Telecommunications Bureau, Ministry of Posts and Telecommunications.

In order to study the appropriateness of this project as a grant aid project, and examine the contents and scope of the cooperation, the team carried out field investigations on status quo of the existing telecommunications facilities, their utilization, operation and maintenance conditions, staff training curriculum, social and economic infrastructures, etc. Discussions were made with the officials concerned of the Tanzania Government and TPTC. The minutes of discussions were agreed upon and signed by both the parties.

After returning to Japan, the study team further studied and analyzed the survey results and findings, and confirmed the appropriateness of this project for a grant aid. Then the team worked out the basic design, the implementation plan, the operation and maintenance plan, and the project evaluation, in the form of draft Final Report.

The team headed by Mr. Naoki Okano, Deputy Director of Telecommunication Systems Division, Ministry of Posts and Telecommunications, visited Tanzania from December 16 to December 24, 1992, to explain on the draft final Basic Design Study Report. After discussions with the officials concerned of Tanzania, the minutes of discussions were agreed upon and signed by both the parties.

This report presents the results of the basic design study carried out as described above.

The member list of the survey team, survey schedule, member list of government officials of Tanzania and the minutes of discussions are attached to this report as APPENDIX.

CHAPTER 2 BACKGROUND OF THE PROJECT

CHAPTER 2 BACKGROUND OF THE PROJECT

2-1 Background of the Project

The Tanzania Posts and Telecommunications Corporation (TPTC) was established in 1978, following the crumbling of the East Africa Community. The postal and telecommunications services which had been provided by the East African Community were then transferred to TPTC. Thereafter TPTC is in charge of construction, operation and maintenance of domestic and international telecommunications systems, under the authority of the Ministry of Communications and Transport.

To support the advancement of the Economic Recovery Programme planned by the Government of Tanzania for the rehabilitation of social and economic infrastructure, TPTC implemented its own Development Five-Year Plan (1984-1989) to rehabilitate and improve telecommunications facilities.

TPTC has further formulated the Telecommunications Reconstruction Plan (1990-1995). Main objectives of this Plan are to improve the telephone density up to 0.7 per 100 inhabitants by the end of 1995, which is currently as low as 0.3, and to upgrade the ratio of connected lines to the total telephone demands to 50%, which currently remains to be 30%.

However, in spite of the utmost endeavour by the staff concerned of TPTC over a long period in constructing, operating and maintaining the telecommunications facilities, tangible countermeasures for improvement could not be taken by TPTC for these 10 years on account of the financial constraints. As the results, telecommunications in Tanzania are in extremely critical condition.

Telecommunications facilities throughout the country as of December 1991 are as listed below. Those in the Dar es Salaam Metropolitan area are given in Table 2-1 by exchange.

1) Local Telephone Facilities

a)	Number of line units	106,258
	- Automatic	87,529
	- Manual	18,738
b)	Number of automatic exchanges	49
c)	Number of manual exchanges	172
d)	Number of main telephones	76,924
e)	Number of waiting applicants	130,447

2) Trunk Facilities

The direct distance dialling service is available among 14 cities throughout the country at present. Fig. 2-1 presents the nationwide trunk line networks.

3) Telex Facilities

Four telex exchanges are in operation, comprising one international exchange and three domestic exchanges, with subscribers numbering 1,796, and waiting applicants, 3,307.

4) International Communication Facilities (excluding those for Kenya and Uganda)

a)	Number of telephone lines	192
b)	Number of telex lines	107

International telephone and telex lines to foreign countries are listed in Table 2-2A and 2-2B.

Recently local, toll and international calls are growing larger and larger keeping pace with the rapid social and economic expansion and development in the nation.

The staff of TPTC have been exerting all possible efforts in constructing, operating and maintaining facilities for a long period. However, due to financial constraints, no effective measures have been worked out for telecommunications service improvements for more than a decade: no action has been taken for replacement of obsolete telecommunications facilities, expansion of facilities to meet the increasing demands, introduction of new technologies to meet the technological renovation, etc. As the results, telecommunications facilities are now critically deteriorated.

In 1990, defective facilities began to be rehabilitated, with financial assistance from Belgium, Canada, Italy, Japan, etc., however, areas not covered by these rehabilitation projects have been left unimproved.
Telecommunications Projects recently financed by Grant Aid and/or Loans from foreign countries, are shown in Table 2-3 and Fig.2-2. In addition, Fig.2-3 shows both the previously implemented Japanese Grant Aid Project Area and the proposed project area.

However, telecommunications facilities in these areas are far from satisfactory. Outside plant facilities in the DSM Central and Pugu Road Exchange areas are made up of obsolete paper insulated, lead sheathed cables which were installed more than 30 years ago. Only recent improvement in the Pugu Road Exchange area is the introduction of the up-to-date digital switching system, realized with the grant aid from the Japanese Government.

With these facilities, telecommunications services in these areas are extremely poor. Particularly in rainy seasons, tens of, or sometimes hundreds of, subscriber lines become faulty due to penetration of water into cables, preventing the provision of satisfactory telecommunications services, in spite of utmost efforts by the TPTC staff.

Civil facilities, such as manholes and conduits, are also superannuated. For conduits, in particular, overage concrete pipes are being used and a lot of them are defective. In addition, there are no spare conduits, making it difficult to replace faulty cables. Hence, facilities can hardly be maintained in good condition.

The capacity of the existing facilities for which no expansion has been made for a long period is too small to meet the increasing demands for telephones.

With the rehabilitation and improvement of the deteriorated outside plant facilities in these areas, troubles of important subscribers in the commercial and industrial areas can be reduced remarkably. Improved telecommunications services thus achieved will contribute to the promotion of industrial, economic and social activities not only in these objective areas but also throughout the country.

2-2 Outline of the Request

(1) Background of the Request

Following the Economic Recovery Programme (ERP: 1086-1989), the Tanzania Government is now implementing the Economic and Social Action Programme (ESAP: 1989/90-1991/92), aiming at the rehabilitation of social and economic infrastructures.

In ESAP, high priority is given to the rehabilitation and improvement of telecommunications and roads. In line with ESAP, TPTC, has formulated the Telecommunications Recovery Programme (1990-1995). In accordance with this Programme, the numbers of telecommunications projects are now being planned and implemented, with the assistance from Japan and other foreign countries.

However, telecommunications facilities in Tanzania are still extremely poor both qualitatively and quantitatively. Particularly, outside plant facilities in the capital city, Dar es Salaam, are obsolete and spare parts can hardly be obtained now, making it difficult to properly maintain them. And also, the numbers of existing subscribers and the waiting applicants as of October 1992 amount to approx. 89,000, which is growing larger every year.

To cope with the above situation, TPTC has given the priority to the improvement of telecommunications facilities in Dar es Salaam under the Recovery Programme, and formulated the Telephone Network Rehabilitation Project in Dar es Salaam. More precisely, the top priority has been given to the rehabilitation and replacement of the superannuated outside plant facilities in the port area of the DSM Central Exchange area and in the industrial area of the Pugu Road Exchange area, both being the objective areas of this project and, in 1992, the Government of Tanzania requested the Japanese Government's grant aid for its realization.

(2) Objective areas

The areas of the project for which the Japanese Government's grant aid is requested by the Tanzania Government are:

a) DSM Central Exchange Area
   - Dar es Salaam Port area.

b) Pugu Road Exchange Area
   - Industrial area along the Pugu Road and adjacent residential area.

2-3 Outline of the Project Area

Dar es Salaam Port is the biggest port along the East African coast, and playing an important role not only for Tanzania but also for landlocked countries in Africa, such as Malawi, Zambia, Rwanda, Burundi, Zaire, etc., for export and import of agricultural and industrial products, as well as daily necessities.

In the port area, one of objective areas of this project, a number of important organizations and facilities are located, such as Tanzania Port and Harbor Bureau, Flour Mill Public Corp., Tanzania Railway Corp., Tanzania-Zambia Railways Corp., silos, oil tank yards, railway siding, warehouses, etc. That is, this is a nucleus area for international and domestic economic development of the nation.

In the Pugu Road industrial area, another objective area of this project, some 250 factories, large and small, are concentrated, accounting for 37% of the national total, with more than 40,000 employees working therein. In other words, this is a center of the industrial and commercial activities of Dar es Salaam, and assumes a very important position in the social and economic development of Tanzania.

Table 2-1 TELECOMMUNICATIONS FACILITIES IN DAR ES SALAAM METROPOLITAN AREA BY EXCHANGE

Exchange	Subscribers		Switching Equipment		
	Connected	Waiting	Type	Instal. Year	L.U.
DSM Central	19,312	26,901	C400 STR STR GX	1980 1958 1972 1989	10,000 4,000 5,000 1,000
Pugu Road	2,206	4,959	STR GX NEAX	1960 1989 1992	2,000 500 7,000
Oyster Bay	2,200	5,244	NEAX	1991	3,000
Msasani	963	748	C23 GX	1988 1990	1,000 1,000
Kijitonyama	3,337	5,110	C400 GX	1987 1990	4,000 1,000
Ubungo	1,880	7,578	C400	1980	2,000
Kawe	554	2,102	C23	1979	800
Wageni	595	1,213	C23 GX NEAX	1980 1990 1992	600 500 3,000
Kurasini	910	2,735	STR GX	1972 1990	1,200 1,000
Total	31,957	56,590	STR C23 C400 GX NEAX		12,200 2,400 16,000 5,000 13,000

Exchange	Outside Plant				
	Pair No. (at MDF)	LE Cable (KM)	PE Cable (KM)	ARM Cable (KM)	ASSC Cable (KM)
DSM Central	26,900	55.1	104.2	75.9	7.8
Pugu Road	4,090	11.6	47.5	8.6	2.9
Oyster Bay	4,600	15.2	28.3	45.0	21.6
Msasani	2,600	-	9.9	4.5	4.3
Kijitonyama	6,275	1.3	63.2	8.6	20.8
Ubungo	3,700	0.6	14.6	11.1	22.5
Kawe	1,200	-	13.5	2.0	23.6
Wageni	1,660	0.6	15.0	6.8	9.0
Kurasini	1,300	3.1	25.3	6.1	2.1
Total	53,325	87.5	321.5	168.6	114.6

Table 2-2A INTERNATIONAL TELEPHONE LINES

No.	Section	Nos. of circuit	Transmission
1	DSM ~ London	50	30:I/C, 20:B/W, Sta."A"
2	DSM ~ USA	18	FDM, Sta."A"
3	DSM ~ Canada	11	FDM, Sta."A"
4	DSM ~ Germany	12	FDM, Sta."A"
5	DSM ~ Sweden	6	FDM, Sta."A"
6	DSM ~ Switzerland	5	FDM, Sta."A"
7	DSM ~ Belgium	2	FDM, Sta."A"
8	DSM ~ Holland	5	FDM, Sta."A"
9	DSM ~ Mozambique	2	FDM, Sta."A"
10	DSM ~ Rome	10	SCPC, Sta."B"
11	DSM ~ India	6	SCPC, Sta."B"
12	DSM ~ UAE	12	SCPC, Sta."B"
13	DSM ~ France	6	SCPC, Sta."B"
14	DSM ~ Singapore	4	SCPC, Sta."B"
15	DSM ~ Japan	4	SCPC, Sta."B"
16	DSM ~ Lusaka	11	FDM, Micro Wave
17	DSM ~ Malawi	4	FDM/Digital, Micro Wave
18	DSM ~ Zimbabwe	6	FDM, Micro Wave
19	DSM ~ Addis Ababa	2	FDM, Micro Wave
20	DSM ~ Nairobi	6	FDM, Micro Wave
21	DSM ~ Burundi	10	FDM, Micro Wave
	Total	192	

Note : Sta."A"....Atlantic In-telsat - 604
Sta."B"....Indian In-telsat - 504

Table 2-2B INTERNATIONAL TELEX LINES

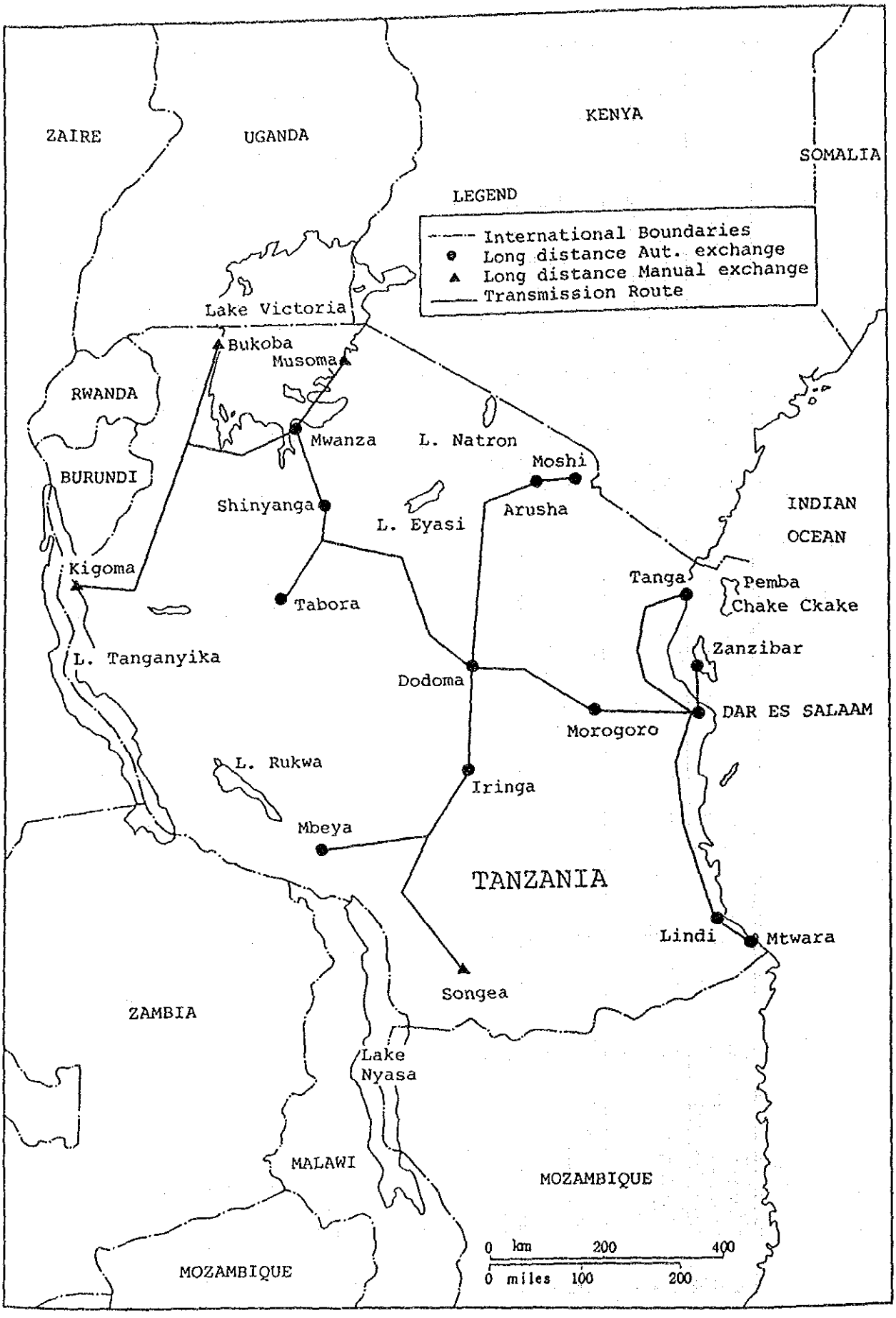
No.	Section	Nos. of circuit	Transmission
1	DSM ~ London	19	FDM, Sta."A"
2	DSM ~ USA	20	FDM, Sta."A"
3	DSM ~ Rome	14	FDM, Sta."B"
4	DSM ~ Japan	7	FDM, Sta."B"
5	DSM ~ Germany	6	FDM, Sta."A"
6	DSM ~ Lusaka	7	FDM, Micro Wave
7	DSM ~ Nairobi	10	FDM, Micro Wave
8	DSM ~ Kampala	5	FDM, Micro Wave
9	DSM ~ Mombasa	5	FDM, Micro Wave
10	DSM ~ Malawi	6	FDM, Micro Wave
11	DSM ~ Berne	4	FDM, Sta."A"
12	DSM ~ Burundi	4	FDM, Micro Wave
	Total	107	

Note : Sta."A"....Atlantic In-telsat - 604
Sta."B"....Indian In-telsat - 504

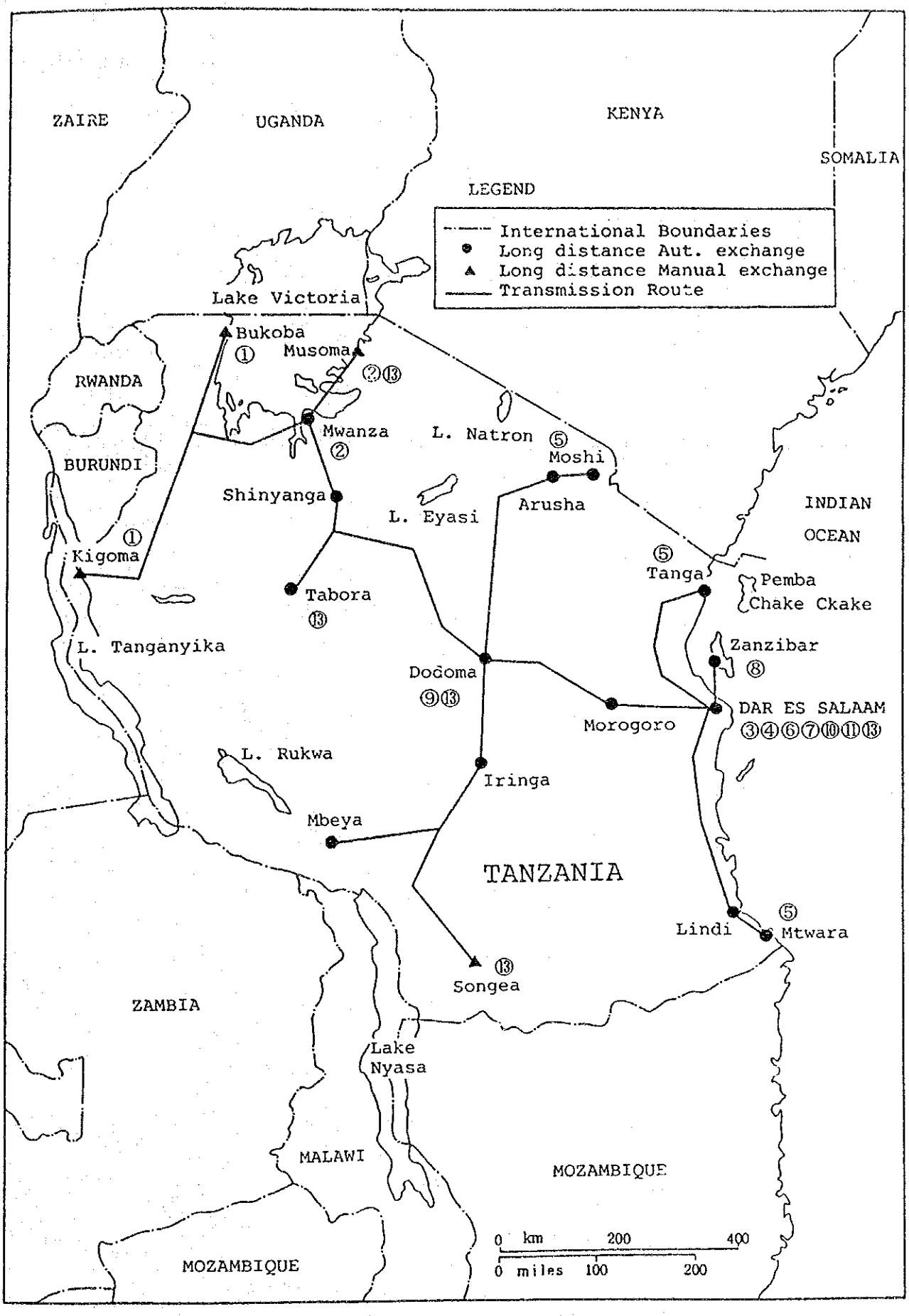
Table 2-3 TELECOMMUNICATIONS FOREIGN FUNDED PROJECT

No.	PROJECT	FINANCIER OR DONOR	FOREIGN COST	YEAR COMPLETED	SCOPE OF WORK
1	KBO Telecommunications Project	ADB Loan	US$: 5.0M	1991	- Exchange for: Bukoba 4000L, Kigoma 4000L - Microwave Links to Rwanda, Burundi and Uganda
2	Mwanza - Musoma Digital Microwave Link	Bilateral Aid, ITALY	LIRA: 4,749.5M	March, 1992	- Microwave Link, 2+1,34 Mbits system. - Radio equipment between Mwanza and Musoma, Installed Tower and Antena.
3	Earth Station Sta. "A" and Mwenge - Extelecoms. House, Microwave Radio Link	Grant Aid ITALY	LIRA: 11,720.0M	September, 1991	Sta. "A" Earth Station.
4	Wageni - Pugu Road, DSM Radio Link	Loan, Open General License	Yen: 158.0M	1993	Microwave Link 140 Mbits system.
5	Second IDA Telecommunications Project	IDA 2nd Loan	US$: 23.0M	March, 1992	- Exchanges for: Tanga 6000L, Moshi 6000L, Singida 1000L, Mtwara 1000L - Transport and other equipment, spares.
6	Japanese Commodity support to the Telecommunications Sector	Grant Aid JAPAN	Yen: 400.0M	1992	- Telephone exchanges for: Wageni 3000L, Pugu Rood 7000L
7	Dar-es-Salaam Rehabilitation Project, Phase I & II	Grant Aid JAPAN	US$: 10.0M	March, 1992	- Oyster Bay Telephone Exchange: 3000L. - Junction network between DSM Central and Oyster Bay. - Local Network for Oyster Bay and part of DSM Central.
8	Zanzibar Digital exchange 1000L additional	Grant Aid, (SIDA) SWEDEN	SEK: 3.1M	1991	- Zanzibar digital exchange. - Commodity support to Zanzibar.
9	Dodoma Telex exchange 2000L	Grant Aid FRANCE	FF: 12.5M	September, 1991	- Telex exchange of 2000L
10	DSM International digital telephone exchange ITE	Grant Aid, BELGIUM	BF: 198.5M	July, 1991	- Telephone exchanges of 2000 turnks.

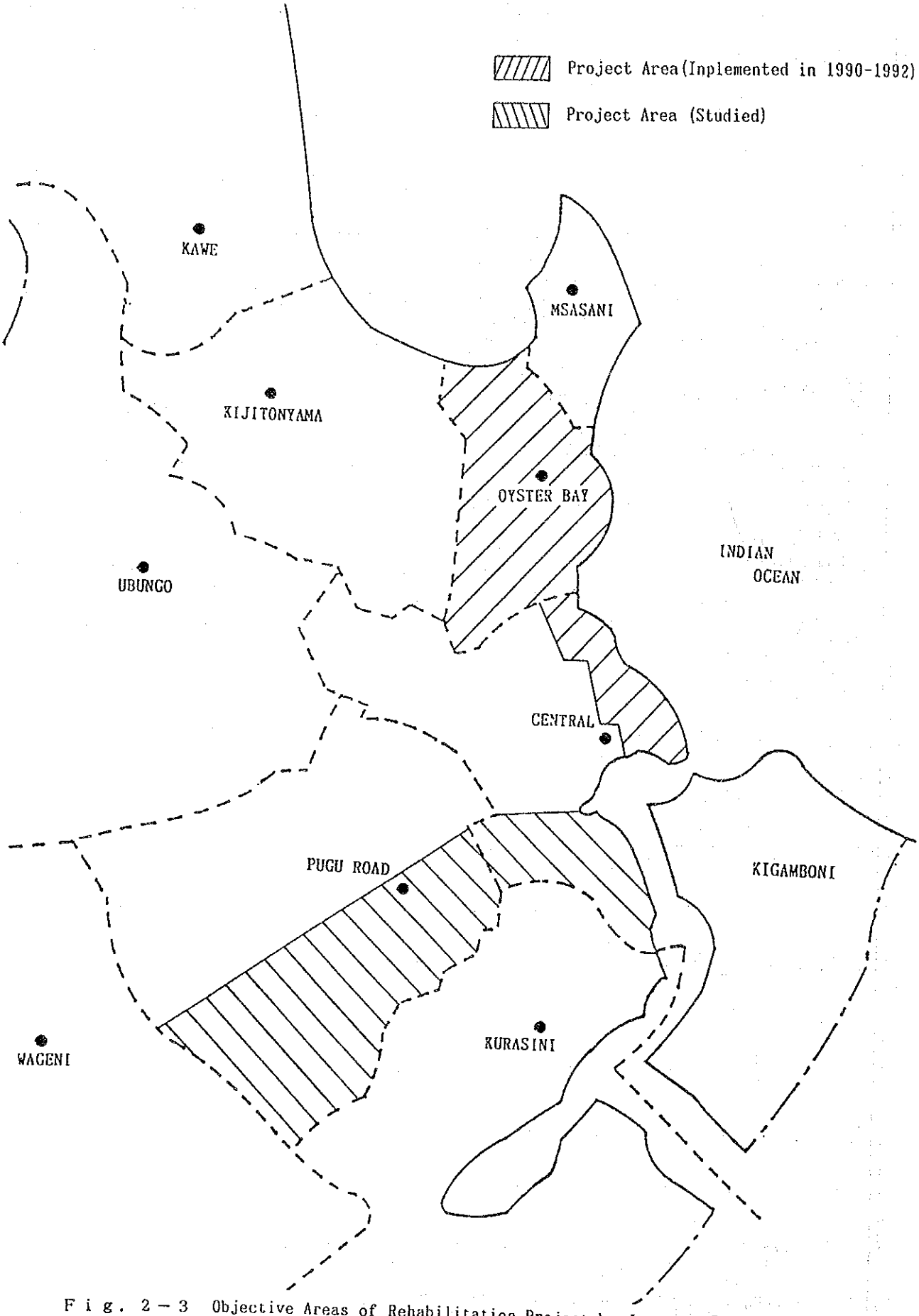
11	Import support from Belgium Government to the Telecomms. Sector	Grant Aid, BELGIUM	BF: 20.0M	(1993)	- Purchase and installation of digital exchanges of 1000L for Kigamboni Radio Link, between DSM Central
12	SIDA Support to Telecomms Sector	Grant Aid SWEDEN	SEK: 25.0M	(1993)	- Technical assistance, spares and materials for Rehabilitation and Maintenance: Materials for use by various departments including consumable items.
13	Canadian Import Support to the Telecomms Sector	Grant Aid, CANADA	C$: 5.7M	June, 1992	- Provision of GX-5000 Telephone exchanges (total 10,000 L): at DSM Central Songea, Kurasini, Musoma, Dodoma, Msasani, Ubungo, K'Nyama, Tobora, Usa River and Njombe



F i g . 2-1 Long distance Network



F i g . 2 – 2 Telecommunications Networks financed by Foreign Funds in Tanzania
(13 Projects in total : number in ○ corresponds to that given in Table 2-3)



F i g . 2 − 3 Objective Areas of Rehabilitation Project by Japanese Grant Aid

CHAPTER 3 OUTLINE OF THE PROJECT

CHAPTER 3 OUTLINE OF THE PROJECT

3-1 Objective

The objective of this project is to rehabilitate and improve the local outside plant facilities in the port area of the DSM Central Exchange area and in the industrial area along the Pugu Road and the adjacent residential area of the Pugu Road Exchange area. These facilities were installed more than 30 years ago, and are now superannuated and frequently suffer from line faults. The project aims to upgrade the communication services in these important areas through the rehabilitation of local outside plant facilities.

The map of objective areas is given in Fig. 3-1.

3-2 Study and Examination on the Request

(1) Scope of Work

The scope of work requested by the Tanzania Government mainly consists of the following:

	DSM Central Exchange	Pugu Road Exchange
Replacement of main distribution frame	1 system	-
Replacement of primary cables	2,000 pairs	4,800 pairs
Replacement of cross connection cabinets	3	9
Replacement of secondary cables	1 system	1 system
Replacement of civil facilities pertaining to the above	1 system	1 system

(2) Modification Based on Study and Examination Result

In the distribution block of No. 19 cross connection cabinet in the DSM Central Exchange area, the district which is located on the south of the Pugu Road, extending along the Pugu Road Exchange area, is to be accommodated in the Pugu Road Exchange area, since the study results prove it preferable for cost saving and easy maintenance, in view of geographical conditions and a distance to each exchange.

In consequence, the number of primary cables to be replaced will be modified from 2,000 pairs to 1,600 pairs for DSM Central Exchange, and from 4,800 pairs to 5,200 pairs for Pugu Road Exchange, because of shifting of an area partially from DSM Central exchange to Pugu Road exchange.

(3) Necessity and Justification of the Project

This project aims to rehabilitate the outside plant facilities in the objective areas so as to upgrade the telecommunications services in these areas.

Upon completion of this project, the fault ratio of the outside plant facilities in the DSM Central Exchange area will be improved to approx. 255 per 100 subscribers per year from the current 390, and in the Pugu Road Exchange area, to approx. 125 per 100 subscribers from the current 416.

For the Pugu Road Exchange, digital switching equipment has been introduced using Japan's grant aid and was commissioned in operation at the end of 1992. With the rehabilitation of outside plant facilities under this project, therefore, the telephone service in the Pugu Road Exchange area will be remarkably improved.

3-3 Project Description

3-3-1 Executing Agency and Operational Structure

The government authority in telecommunications in Tanzania is the Ministry of Communications and Transport, and the operation agency is the Tanzania Posts and Telecommunications Corporation (TPTC).

The execution of this project is undertaken by TPTC under the authority of the Ministry. The organization chart of TPTC is given in Fig. 3-2, 3-3 and 3-4.

As of June 1992, TPTC employs a total of 8,011 persons, which consists of the following:

Divisions	Number of Employees
Postal Services	2,108
Telecommunications Services	5,078
Others (for whole TPTC)	825
Total	8,011

Those of Telecommunications Engineering Division can further be broken down as follows:

Class		Number of Employees
Engineers	:	65
Technicians	:	1,701
Labourers	:	245
Total	:	2,011

3-3-2 Location and Condition of Project Sites

The port area in the DSM Central Exchange area, one of the project sites, embraces offices of competent authorities and private organizations related to port/harbour business, transport and trading, as

well as warehouses, oil tanks, railways sidings, etc. This area, therefore, constitutes a nucleus of international commercial activities for not only Tanzania but also landlocked countries in Africa.

The industrial area along the Pugu road, another project site of this project, is the biggest factory district in Tanzania and the center of the industrial production.

The outside plant facilities in the objective areas, particularly in rainy seasons, tens or sometime hundreds of telephone lines suffer from breakdowns simultaneously as often as 3 or 4 times a month, due to water penetration into cables. Under the above situation, provision of adequate telecommunication services is very difficult, in spite of the great efforts by the maintenance staff of TPTC.

Civil facilities consisting of manholes and underground conduits are also overage. In particular, a number of conduits made of deteriorated concrete pipes are damaged. In addition, there is no spare conduit, and replacement of faulty cable is not practicable, making it more difficult to maintain cable facilities.

Since no expansion has been made on the existing facilities over a long period, capacities of facilities are too small to cater for the large demands. Facilities in these two Exchange areas, approx. 2.3 times as much, in capacity, as the existing are required to meet the demands.

3-3-3 Outline of Facilities

In DSM Central Exchange, three types of switching systems are in operation: (1) crossbar switching equipment of 10,000 L.U. (installed in 1980), (2) step-by-step switching equipment of 9,000 L.U. (installed in 1958 and 1972), and (3) digital switching equipment of 1,000 L.U. (installed in 1989). However, half of them, i.e., 10,000 L.U., are outdated, and spare parts for their repair and maintenance are difficult to obtain now. It is an urgent need to replace them with digital switching equipment.

In Pugu Road Exchange, introduction of digital switching equipment of 7,000 L.U. has been realized with the grant aid from the

Japanese Government. It is scheduled to be put into operation at the end of 1992.

However, as for outside plant facilities, most of the existing primary and secondary cables are obsolete paper insulated, lead sheathed cables which have been in use beyond their respective durable years. For them, a preventive maintenance system by gas pressurization method has been adopted. Under this system, dry air is pressurized into a cable to detect a pinhole on the cable sheath. Actually, however, the system fails to function as desired, since extreme deterioration of cables lead sheaths results in a large amount of gas leakage, due to overwork and then finally the failure of the gas supplying equipment.

3-3-4 Operation and Maintenance Plan

(1) Operation and Maintenance Organization

The operation and maintenance of local and junction cables and civil facilities pertaining thereto in the objective areas are now undertaken by the Construction/Maintenance Department in Dar es Salaam which falls under the Customer Service Division of TPTC Headquarters. The number of staff engaged is approx. 150. Upon completion of this project, fault ratio of outside plant in this area will be remarkably improved and, therefore, the current organization scheme and manpower resource will be adequate for operation and maintenance of the completed system.

(2) Operation and Maintenance Costs

The TPTC's annual budget for telecommunications, the budget for operation and maintenance, as of fiscal year in 1990, are listed below:

- Annual budget for telecommunications Tsh. 8,276 M Tsh.
- Ratio of the above to the national budget Approx. 6.9%
- Annual budget for operation and maintenance Tsh. 332 M Tsh.

- Ratio of the above to the annual telecom. budget	Approx. 4.0%
- Annual budget for operation and maintenance of Dar es Salaam area	139.8 M Tsh.
- Ratio of the above to the annual telecom. operation/maintenance budget	Approx. 42.1%

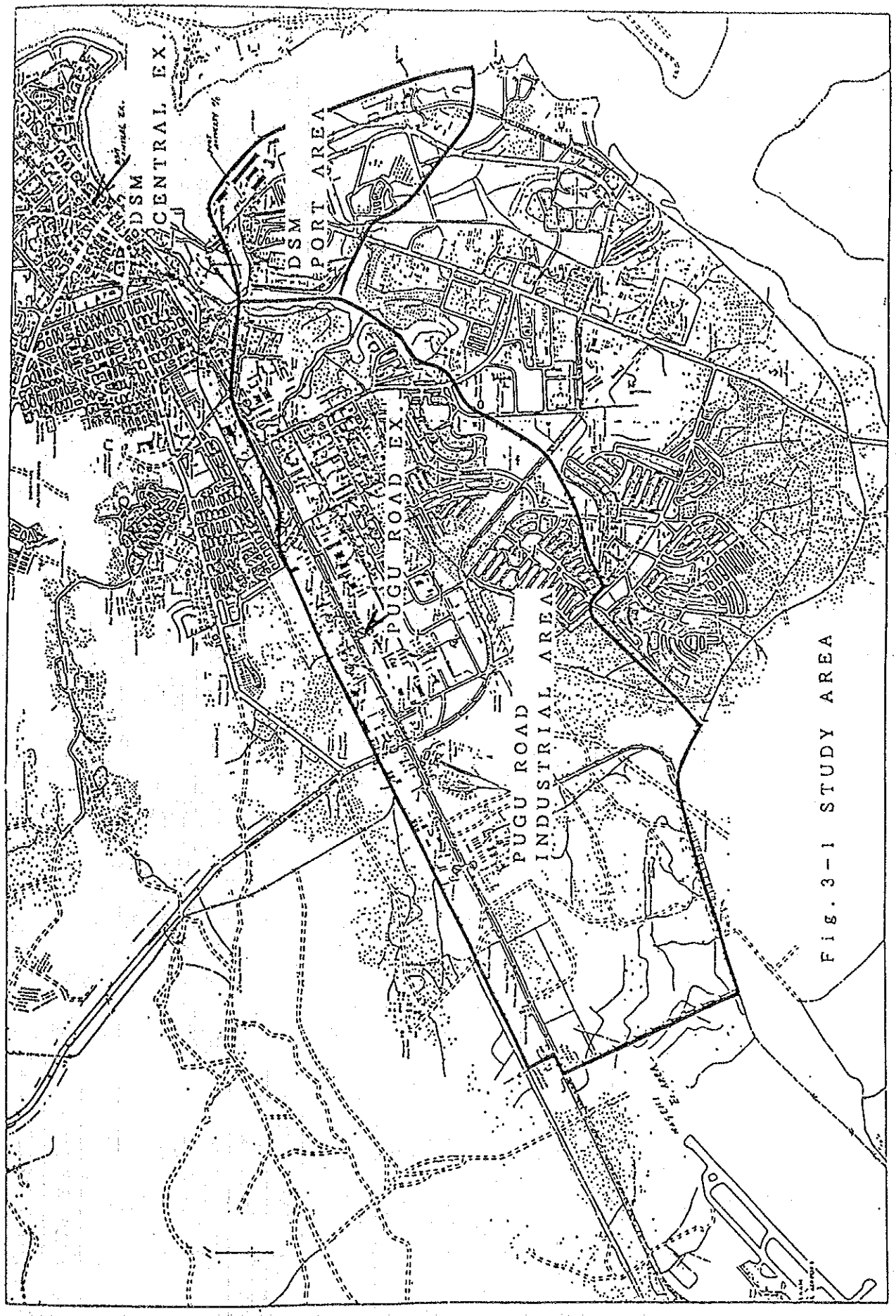


Fig. 3-1 STUDY AREA

Fig. 3-2 Organization of TPTC (Approved Organization Structure)

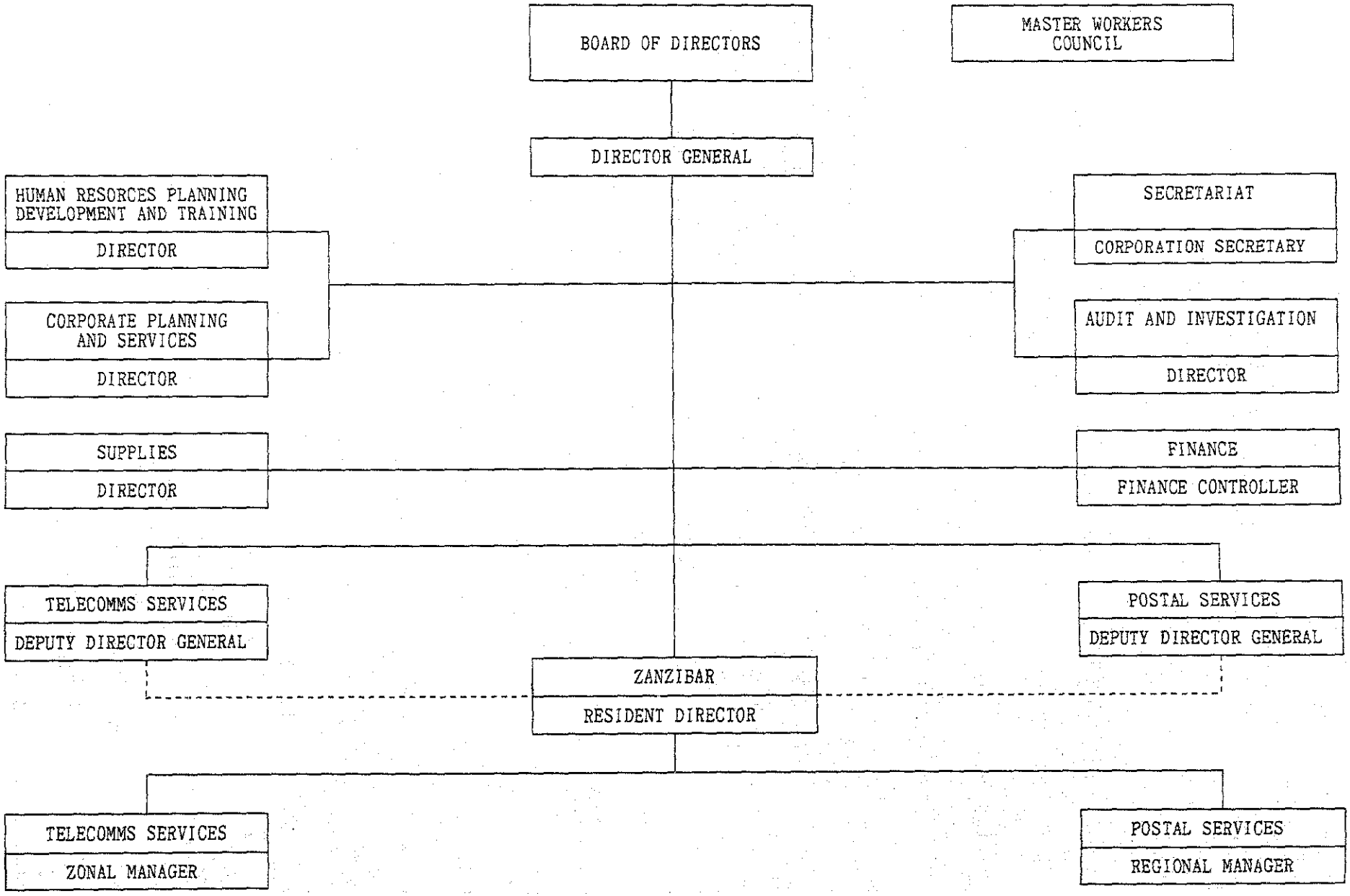
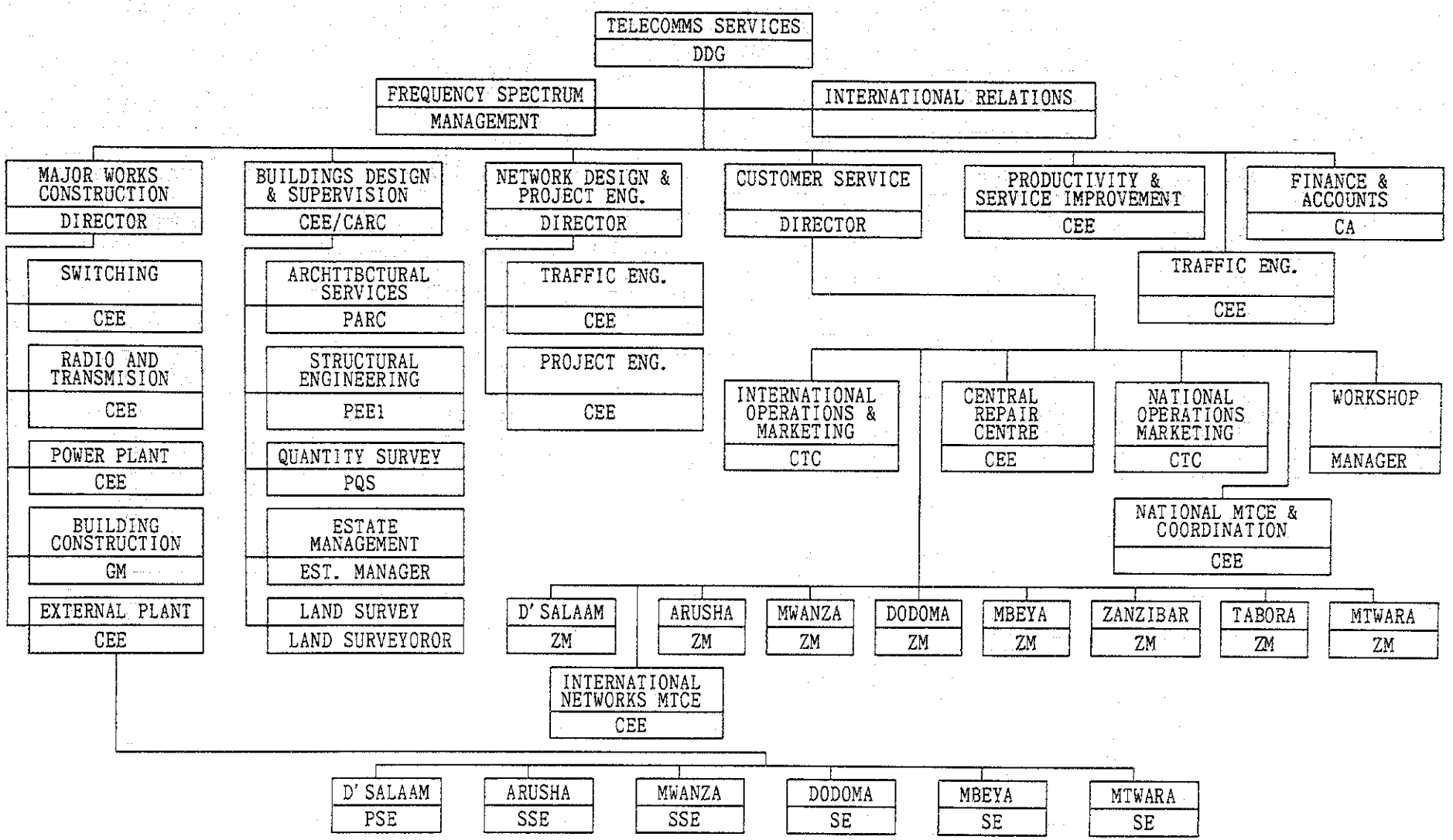


Fig. 3-3 Organization of TPTC (Approved Organization Structure for Telecomms Services)

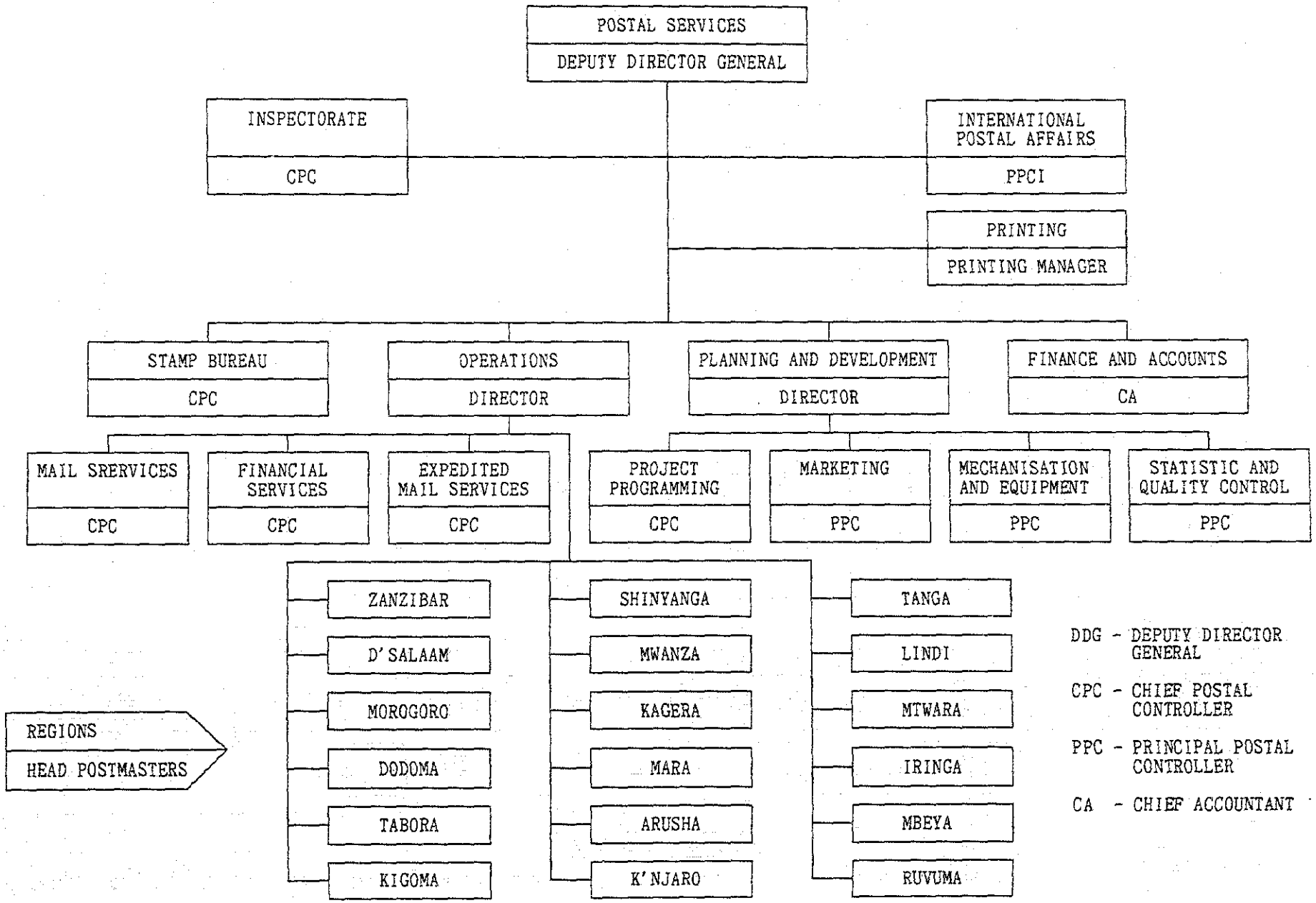


DDG: DEPUTY DIRECTOR GENERAL
CEE: CHIEF EXECUTIVE ENGINEER
PEE: PRINCIPAL EXECUTIVE ENGINEER
CTC: CHIEF TELECOMMS CONTROLLER
PTC: PRINCIPAL TELECOMMS CONTROLLER

CARC: CHIEF ARCHITECT
PARC: PRINCIPAL ARCHITECT
PQS : PRINCIPAL QUANITTY SURVEYOR
GM : GENERAL MANAGER
ZM : ZONAL MANAGER

PSE: PRINCIPAL SECTIONAL ENGINEER
SSE: SENIOR SECTIONAL ENGINEER
SE : SECTIONAL ENGINEER
CA : CHIEF ACCOUNTANT

Fig. 3-4 Organization of TPTC (Approved Structure for Postal Services)



CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4-1 Design Policy

The basic design policy for the outside plant facilities to be rehabilitated by this project is as follows, taking into consideration the natural, social and local conditions, including the policy on the construction method and period.

(1) Natural Conditions

In Dar es Salaam which faces the Indian Ocean, temperatures are high with little variations throughout a year. There are two rainy seasons in a year and rainfall is plentiful, therefore, communication lines often suffer from breakdowns due to penetration of rainwater into cables, low insulation resistance of cable conductors or wires, etc., but damage is seldom caused by typhoons, earthquakes, etc.

(2) Social Conditions

The objective areas of this project are composed of a harbor/port area, a factory area and a residential area. Most of the buildings in these areas are brick laid or reinforced concrete buildings and are not so tall, hence no special consideration is required with respect to the installation and fixing of lead-in cables and drop wires onto buildings. Also there exist no historic buildings nor specific structures which require special consideration.

Therefore, conditions to be taken into consideration in designing the outside plant facilities are formation of streets and roads in each area, configuration of cities and towns concerned, and presence of underground facilities, such as power and water works, etc. For the distribution system, an aerial or direct buried system is to be adopted.

(3) Local Conditions

All the outside plant facilities under this project will require, in construction, road (and bridge) occupancy (both under and above the road), which necessitates the application for and acquisition of approval of the Dar es Salaam City Council (necessary formalities are to be followed by TPTC). Road pavement restoration works are to be sublet to a contractor designated by the Dar es Salaam City Council, and the costs of such works are to be paid directly to that contractor. Cable installation, pole erection, manhole construction, and installation of underground conduits are to be sublet to local construction company(ies), as several reliable companies are now available in Dar es Salaam.

Of the materials necessary for this project, cement, sand, gravel, crushed rock, iron bars, and wooden poles are to be procured in Tanzania. Cement and iron bars procurable in Tanzania can meet the British Standards, and other items procurable locally are almost the same in quality with those on the general market.

(4) Policy on Construction Method and Period

In principle, the standards construction practice adopted by TPTC will be observed. The construction practice usually depends upon the types of cables and other associated materials to be used. The equipment and materials to be adopted for this project are limited to those which can satisfy the TPTC specifications and, therefore, no problem will be caused in this respect.

The construction period is divided into two parts: (1) detailed design and procurement and (2) construction work. However, with a view to earliest possible completion of the project, construction of civil facilities is to be started immediately after the contract signing, since the

necessary materials can be easily procured in Tanzania. Refer to Table 4-2 Time Schedule.

4-2 Study and Examination of Design Criteria

Telecommunications outside plant consists of cable facilities and civil facilities. Basic design criteria for them are as described below.

4-2-1 Cable Facilities

(1) To achieve easy maintenance and efficient distribution of cables, a cross connection cabinet system will be employed, in which primary and secondary cables are connected. In case where no efficiency can be achieved with the adoption of this system, a direct distribution system (EO: exchange ordinance) will be employed.

(2) For primary and secondary cables to be accommodated in underground conduits or for direct buried cables, jelly-filled, polyethylene insulated and polyethylene sheathed cables will be used, to prevent cable breakdown due to penetration of water into cables and thereby maintain cables in good condition.

(3) For primary cables, an underground conduit system will be adopted, to protect cables from damages due to construction works by competent authorities for such underground structures as power lines, water pipes, etc.

(4) For secondary cables, a direct buried system using steel tape armored cables or an aerial cable system using self-supporting type cables will be adopted. The former will be used mainly for business quarters and factory areas, and the latter for residential areas.

(5) For cross connection cabinets, the fibre reinforced plastic (FRP) box will be adopted to protect the cabinets from damages due to salty air, etc. They will be

installed at such locations on pavements as not to disturb passersby.

(6) For terminal boxes to be installed outdoors, two types are available: pole-mounted and wall-mounted. In case boxes are installed indoors, the indoor type will be used.

(7) The existing paper insulated lead sheathed cables, to be removed, will not be reused. However, such facilities as cross connection cabinets, terminal boxes, poles, etc. will be reused, if applicable.

4-2-2 Civil Facilities

Construction of civil facilities necessitates a huge amount of investments. Hence, close attention should be paid in selection of underground conduit routes, calculation of necessary number of conduits, decision of shapes and dimensions of manholes, so that the facilities designed can be optimum from the standpoint of cost saving and security, as well as ease of operation and maintenance.

1) Selection of conduit routes

Conduit routes should be selected, based on an overall study of technical matters involved in construction and maintenance of civil facilities, by referring to relevant data on city planning, etc.

2) Number of conduits to be installed

The number of conduits to be installed under this project will be the number of new conduits necessary for this plan plus one (to be used at the time of replacing a defective cable). The necessary number of conduits for this plan will be calculated in due consideration of an entire programme of TPTC, as well as technical matters involved in construction, to realize efficient rehabilitation.

3) Manholes and handholes

A cover for a new manhole will be round in shape, and that for a new handhole, square. They should be in compliance with the Japanese standards.

4-3 Basic Plan

The basic plan for rehabilitation of the objective areas of this project is described in the following. This basic plan is based on the field survey findings and the basic design study results described in the previous chapters. However, final decision on installation of manholes, cross connection cabinets, DP, etc. is subject to investigation and confirmation at the time of detailed designs of the project implementation.

4-3-1 Objective Areas

This project aims to rehabilitate and improve the local telephone outside plants in the port area of the DSM Central Exchange area and in the industrial area along the Pugu road of the Pugu Road Exchange area. Distribution blocks of the undermentioned cross connection cabinets in respective exchange areas are the objective areas of this project.

- DSM Central Exchange : Nos. 1A, 19, 24, 1B (THA)
- Pugu Road Exchange : Nos. 8, 12, 14, 15, 17, 18, 19, 20, 21, 22, E01.

* 1B (THA): Tanzania Port Authority

4-3-2 Cable Facilities

(1) Cable termination

A primary lead-in cable is connected with a PVC termination cable, and then terminated at MDF. Compound is injected into the splicing portion of the primary cable

and the termination cable to make a moisture dam to prevent water penetration into the cables.

(2) Primary and secondary cables

1) Cable specifications

Primary and secondary cables to be installed in conduits must be protected from water penetration so as to maintain required insulation of cable conductors. For them, therefore, PE (polyethylene) insulated, unit-pair twisted, jelly-filled, PE-LAP sheathed cables are used.

For secondary cables to be directly buried, PE insulated, unit-pair twisted, jelly-filled cables are used. In addition, they should be PE-LAP steel-tape armored cables, because of direct buried.

2) Combinations of cables having different conductor diameters

For primary cables, those having the same conductor diameter are used.

For secondary cables, combinations of two types of cables having different conductor diameters will be considered. Applicable combinations are shown below:

0.4	mm	+	0.5	mm	..... Acceptable
0.4	mm	+	0.65	mm	..... Not acceptable
0.4	mm	+	0.9	mm	..... Not acceptable
0.5	mm	+	0.65	mm	..... Acceptable
0.5	mm	+	0.9	mm	..... Not acceptable
0.65	mm	+	0.9	mm	..... Acceptable

3) Cable splicing

For cable splicing, a closure type splicing will be

employed, to ensure speedy and uniform work performance.

4) Transmission standard

The conductor diameter of a local telephone cable is designed, based on the undermentioned standards of transmission loss:

- d.c. resistance : 1500 ohms (maximum)
- attenuation (1.5 kHz) : 8.0 dB (maximum)

5) Type of cables to be used

Cables to be used in this project are to be in compliance with the specifications adopted by TPTC. Therefore, applicable pair numbers and conductor diameters are listed in Table 4-1 below.

Table 4-1 Cable Pair Number and Conductor Diameter

Cable	Conductor Diameter (mm)	Pair Number							
Conduit cable	0.4	2,400	2,000	1,600	1,200	1,000	800	600	
		400	300	200	100	50	30	20	10
	0.5	1,600	1,200	1,000	800	600	400	300	
		200	100	50	30	20	10		
Direct Buried Cable	0.4	200	100	50	30	20	10		
	0.5	200	100	50	30	20	10		
	0.65		100	50	30	20	10		
Aerial Cable	0.4	(200)	100	50	30	20	10		
	0.5	(200)	100	50	30	20	10		
	0.65		100	50	30	20	10		
	0.9			50	30	20	10		

6) Depth of direct buried cables

The depth from the ground surface to the uppermost part of a direct buried cable is designed to be more

than 100 cm when it is installed along the road, to protect it from possible damages due to water, drainage, power, etc. works, since road infrastructure in Tanzania has not been fully completed yet.

(3) Cross connection cabinets

Cross connection cabinets are employed for connection of primary and secondary cables, aiming at the efficient utilization of cables.

1) Location

A cross connection cabinet is installed at such a location in a distribution block that secondary cables can be distributed most efficiently and the relocation of the cabinet is not likely to be required even in the future.

2) Capacity

The capacity of a cross connection cabinet is either 1,200 pairs or 1,600 pairs, depending upon the number of pairs of primary and secondary cables to be accommodated in it, based on the number of expressed demands in the C.C.C.'s distribution block.

(4) Terminal box

1) Types of terminal boxes

Three types of terminal boxes are available: pole-mounted, wall-mounted and indoor types. The former two are the outdoor type. When a terminal box is installed on a pole or an outer wall, the outdoor type is used. When it is installed in a building or residential house, the indoor type is used.

2) Selection of terminal box location

A pole-mounted terminal box should be mounted on a pole which permits easy installation of a drop wire to an objective subscriber, causes no obstruction to road traffic, and has least possibility of relocation in the future.

A wall-mounted box should be mounted on an outer wall of a solid building which permits easy installation of a drop wire and easy extension of it to neighboring houses, when occasion demands, with the least possibility of suffering from damages by third parties, and of relocation in the future.

An indoor type terminal box should be installed at a location which permits easy indoor wiring to a telephone and easy access to the box by maintenance staff, and provides good working conditions.

4) Protection of riser cables to terminal boxes

Riser cables to pole-mounted, wall-mounted and indoor type terminal boxes are protected by cable covers.

5) Protection of riser cables

In case a conduit system is adopted for the section between manhole/handhole and a cable rising point, a steel pipe is used for the vertical portion of a riser cable up to a terminal box for protection.

4-3-3 Civil Facilities

(1) Types of conduits

For underground conduits, PVC pipes are employed in general. When cables are attached to a bridge or

installed across the crossing of heavy traffic main streets, steel pipes are used.

(2) Types of manholes and handholes

Manholes and handholes are installed at cable jointing or branching points, and any other points necessary for cable installation and maintenance.

Manholes are to be used with inside cover so as to prevent infiltration of rainwater into the manhole.

A manhole size is determined, taking into account the following:

a) Number of conduits to be accommodated.
b) Necessary work space.
c) Presence of cable joints.
d) Necessary radius of curvature of a cable.

Manhole and handhole types and their respective dimensions are given below.

Types	Length (m)	Width (m)	Depth (m)	Number of Pipes
Handhole HH -1	1.2	0.6	1.1	3
Manhole S -1	1.8	1.0	1.8	4
Manhole S -2	2.3	1.3	1.8	9
Manhole S -3	3.0	1.4	1.8	16
Manhole L -1	1.9	1.0	1.8	4
Manhole L -2	2.5	1.3	1.8	9
Manhole L -3	3.4	1.4	1.8	16
Manhole T -1	2.3	1.1	1.8	4
Manhole T -2	2.5	1.3	1.8	9
Manhole T -3	3.4	1.4	1.8	16

(3) Manhole span

Manhole spans for local cables are determined, depending upon cable branching, location of cross connection cabinets, and other geographical conditions. In any case, however, they should not exceed 200 m.

(4) Depth of underground conduits

The depth from the ground surface to the uppermost part of the underground conduits is designed to be more than 100 cm when they are installed along the road, to protect them from probable damages due to water, drainage, power, etc. works.

(5) Warning tape

A warning tape is installed between the ground surface and direct buried cables to draw attention to the presence of communication cables, so that probable damages to the cables due to other construction works (for power lines, water pipes, etc.) can be prevented.

4-3-4 Basic Design Drawings

Primary cable drawings and underground conduit drawings for the objective areas in the DSM Central Exchange area and the Pugu Road Exchange area are given in the Key Map and Fig.1/6 through Fig.6/6.

4-4 Implementation and Procurement Plan

4-4-1 Implementation organization

This project must be implemented through joint operation between the Japanese Contractor and TPTC under the coordination and supervision of a Consultant.

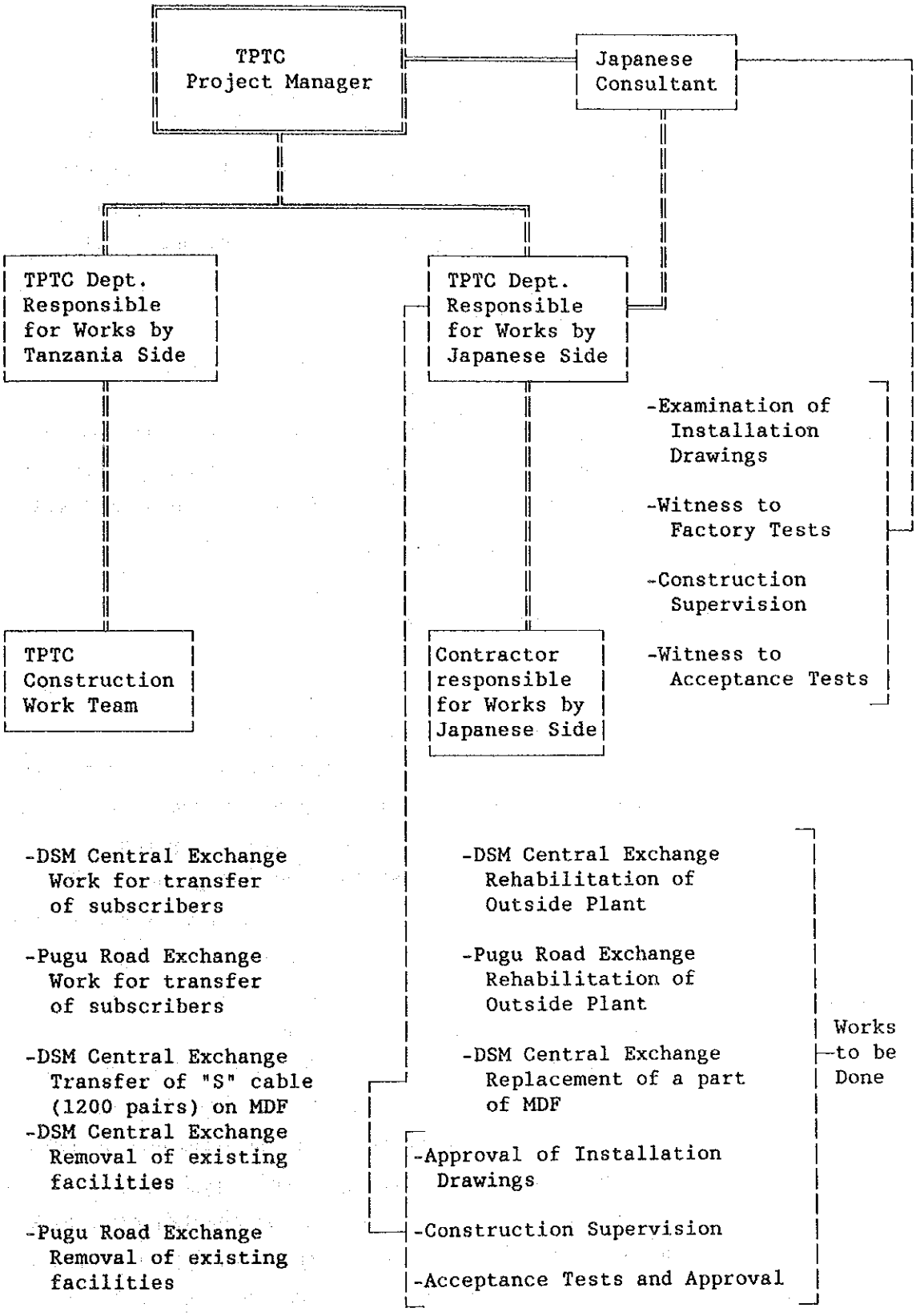
In order to complete the project implementation smoothly without delay, TPTC, the responsible agency for the project implementation, is required to control project operations particular with respect to the coordination and adjustment of implementation schedules for correlated fields, in cooperation with the consultant.

To achieve the above, it is proposed to establish an operational organization in TPTC as shown in Fig. 4-1.

TPTC will nominate the project manager for this project. He will cooperate with the consultant and, prior to the commencement of the construction work, will study and review formalities to be required by competent authorities in project implementation, including acquisition of road utilization/occupancy approval, adjustment of road excavation schedules, etc., in addition to matters related to MDF terminal replacement, transfer of existing subscribers, and individual work schedules. A minute overall project implementation plan will be formulated, based on these studies. In accordance with the plan thus formulated, the project will be implemented, with adjustment where necessary.

As of the end of 1991, TPTC had a total of approx. 8,000 employees, consisting of 2,100 postal service staff, 5070 telecommunications services staff and 830 miscellaneous staff. Therefore it can be said that TPTC has adequate managerial and technical resources for instituting an organization necessary for implementation of this project.

Fig. 4-1 Operational Organization to be Established in TPTC



4-4-2 Project Implementation and Procurement Plan

(1) Implementation condition

This project is to rehabilitate local telephone outside plants and civil facilities in objective areas in Dar es Salaam. In order to complete the works in a short term efficiently, the portions of the project which Japan is financing will be implemented on a full turnkey basis.

(2) Construction and supervision plan

1) Examination of installation drawings

The consultant will examine the installation drawings submitted by the contractor and report the examination results to TPTC.

2) Witness to factory tests

The consultant will witness the factory tests prior to the shipment of equipment and materials by the contractor, and verify the equipment and materials to be shipped in accordance with the contract specifications. The contractor will ship the equipment and materials after obtaining the consultant's approval. The consultant will report the test results to TPTC.

3) Supervision of construction works

The installation methods and bill of quantities submitted by the contractor will be examined by TPTC and the consultant. The consultant will send engineers to work sites during the construction work period for on-site technical inspection to check whether the works conform to the contract specifications or not, and for monitoring of the work progress.

4) Acceptance tests

The consultant will examine the as-built drawings submitted by the contractor at the completion of the construction works, and witness to the acceptance tests consisting of electrical tests, quantity check, and construction method inspection, to confirm that the completed works comply with the contract agreement concerning the acceptance of the completed facilities.

5) Materials procurement plan

Of the materials necessary for this project, cement, sand, gravel, macadam, iron bars, and wooden poles are to be procured in Tanzania.

6) Project implementation schedule

The consultant will prepare detail designs and tender documents necessary for implementation of this project, and announce the tender. After the tender has been closed, the consultant and TPTC will evaluate the tenders received, and the construction work contract will be concluded between TPTC and the successful tenderer.

Supervision of construction work is to be executed under organizational and operational entities within TPTC.

The implementation time schedule is given in Table 4-2.

4-4-3 Demarcation of Work to be Undertaken by the Japanese Side and the Tanzania Side

Work to be undertaken by the Japanese side and the Tanzania side, respectively, is as described below.

(1) Work to be done by the Japanese Side

The Japanese side is responsible for the following:

1) Rehabilitation and replacement of primary and secondary cables from MDF to each DP, including pertaining outside and civil facilities.

2) Provision of drop wires, jumper wires and associated parts and materials necessary for transfer of the existing subscribers from the existing to new facilities, after completion of new facilities.

3) Provision of measuring equipment, tools and materials necessary for maintenance of local telephone facilities after completion of this project.

4) Compensation of the costs for recovery of concrete and asphalt roads excavated for the project.

(2) Work to be Done by the Tanzania Side

TPTC acting on behalf of the Tanzania Government is responsible for the following:

1) Re-installation of drop wires between DP and subscriber's premises, and jumper wiring in MDF and cross connection cabinets necessitated for the above, in connection with the transfer of the existing subscribers from the existing to new facilities, after installation of new cables.

2) Replacement of secondary cables in the port area, which are being accommodated in a subscriber distribution frame in the Port and Harbour Bureau building in DSM Central Exchange area.

3) Re-termination of the existing "S" cable to a vacant arrestor and the associated work, as necessitated in

connection with the partial replacement of the existing MDF in DSM Central Exchange by this project.

4) Removal of primary and secondary cables, cross connection cabinets and other outside plant facilities which have become disused upon completion of this project.

Work for Item 3) above will require approx. one (1) week during the construction work of this project.

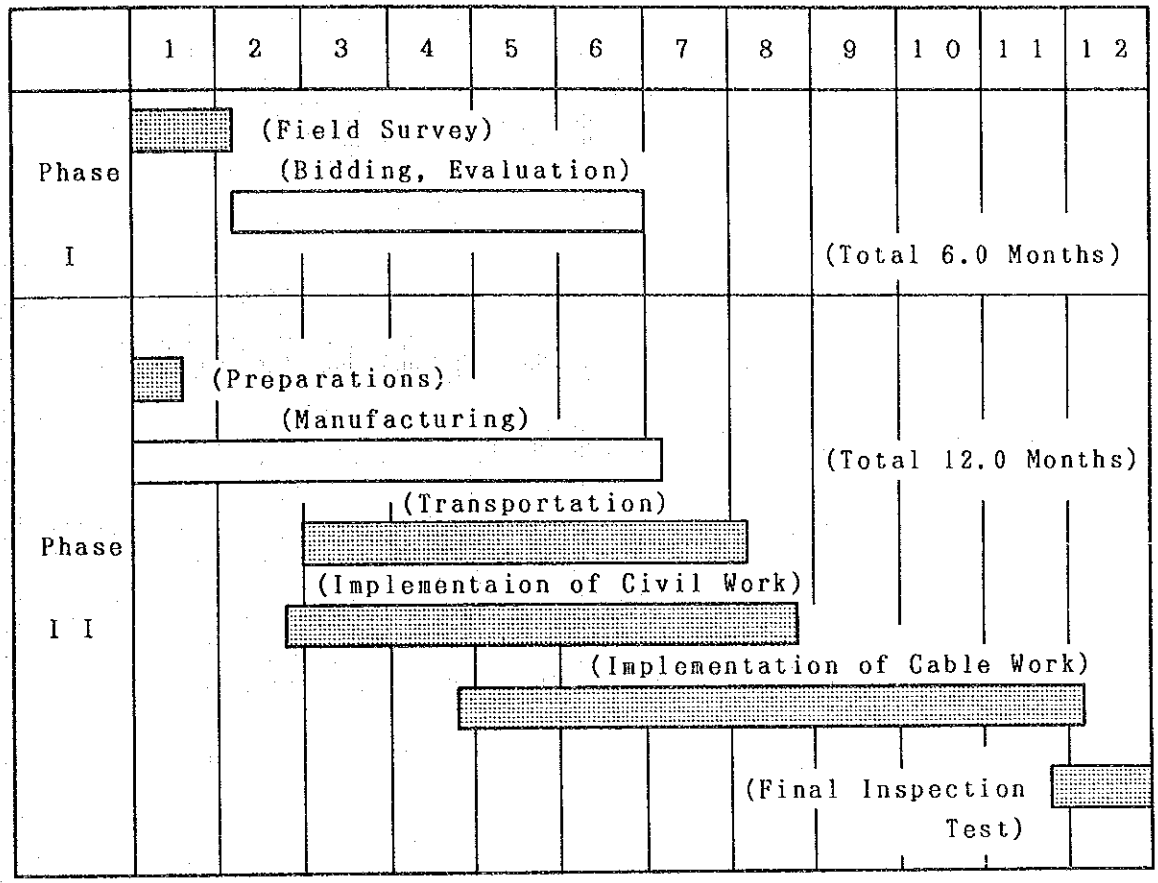
Work for Items 2), 3) and 4) above will require approx. six (6) months after the completion of the construction work under this project.

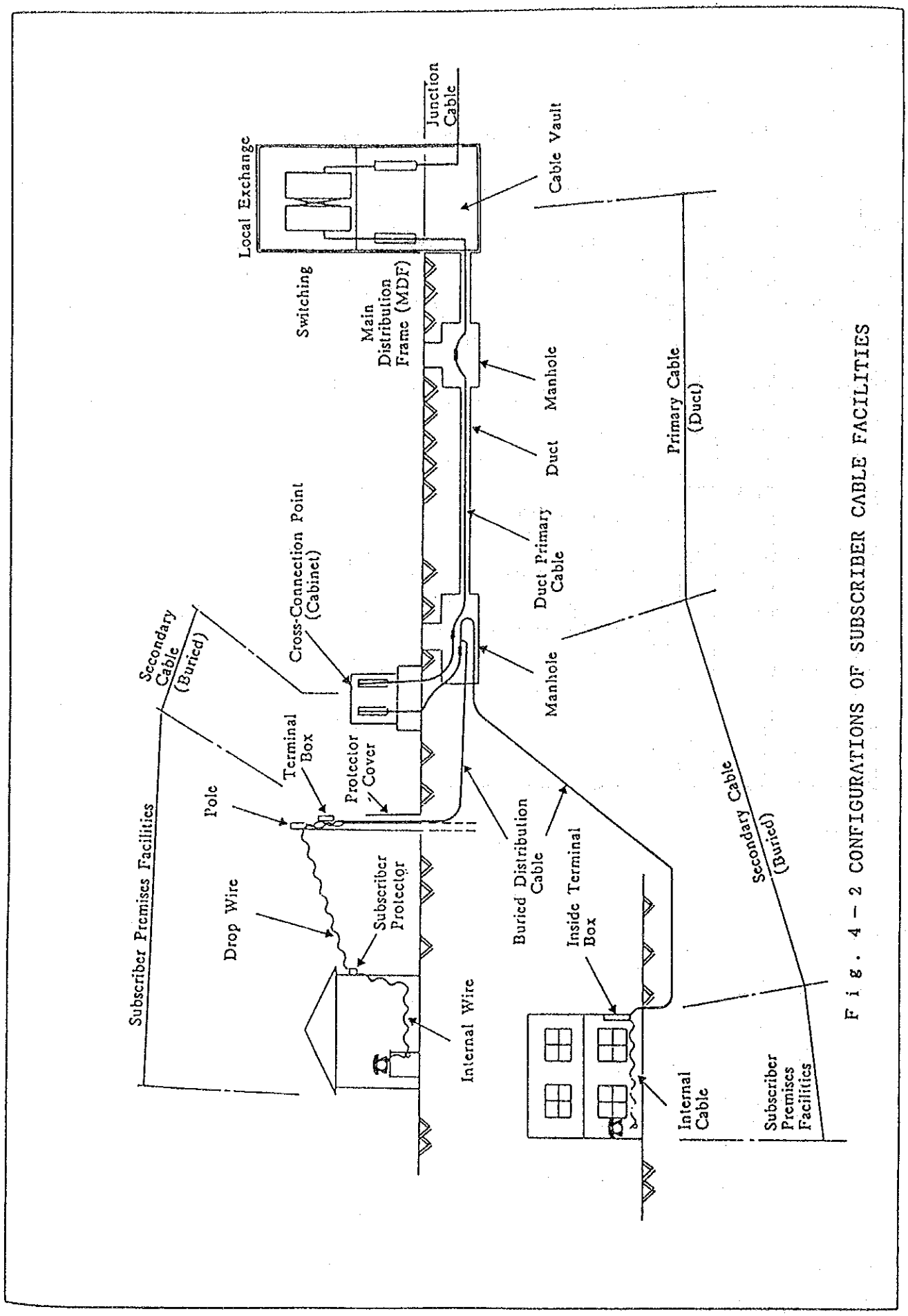
The main work and its costs in detail to be borne by the Tanzania side are as shown in following Table 4-2.

Table 4-2 Costs of Work UNIT: Thousand Tsh.

	ITEM	UNIT	Q'TY	TOTAL
1	Removal of Lead Sheath Cable in Conduit	KM	27.1	4,279
2	Removal of PE Sheath Cable in Conduit	KM	13.1	4,170
3	Removal of Aerial Cable (ASSC)	KM	0.6	1,709
4	Removal of Wooden Pole	Pole	255	95
5	Termination to MDF (1600P)	ea.	1	164
6	Running of Jumper Wire (MDF)	100 Lines	25.0	697
7	Running of Jumper Wire (C.C.C)	100 Lines	21.0	441
8	Replacement of Dropwire	100 Lines	15.0	4,223
	Total			15,778

Table 4-3 IMPLEMENTATION TIME SCHEDULE





F i g . 4 – 2 CONFIGURATIONS OF SUBSCRIBER CABLE FACILITIES

CHAPTER 5 PROJECT EVALUATION AND CONCLUSION