THE SOCIALIST REPUBLIC OF THE UNION OF BURMA

SIPORT ON TELEPHONE PLANT PLANNING PROJECT-

NOLUME I

· 回答和代码 - 1117年

JAPAN INTERNATION AL COOPERATION AGENCY

# THE SOCIALIST REPUBLIC OF THE UNION OF BURMA

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# REPORT ON TELEPHONE PLANT PLANNING PROJECT

# VOLUME I

October 1976

# JAPAN INTERNATIONAL COOPERATION AGENCY

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#### PREFACE

In compliance with the request of the Government of the Socialist Republic of the Union of Burma, the Government of Japan decided to make a study on the telephone plant planning project as part of Japan's overseas technical cooperation programmes and this study was executed by the Japan International Cooperation Agency.

The Japan International Cooperation Agency organized a nine-member expert team headed by Mr. Susumu Saito, Senior Staff Engineer of the International Affairs Bureau, Nippon Telegraph and Telephone Public Corporation, and dispatched it to Burma to carry out a field survey for approximately three months from March 9, 1976.

The survey team, in close cooperation with the officials concerned of the Posts and Telecommunications Corporation of the Socialist Republic of the Union of Burma made the investigation of telephone facilities, as well as the necessary field surveys and designs.

After its return to Japan the survey team made a further detailed study on the result of field survey in Burma. This report has been prepared in due consideration of the results of consultations with all authorities concerned in Burma. It is our great pleasure if the report proves to be useful for the extension and improvement of the telephone network of the country and thus contributes to the further development of her society and economy and at the same time serves for enhancement of the friendly relationship between our two countries.

Finally I would like to express my sincere gratitude to the officials of the all governmental organizations concerned of the Socialist Republic of the Union of Burma and the Posts and Telecommunications Corporation for the valuable assistance offered to the team throughout the survey period.

October 1976

Shinsaku Hogen President Japan International Cooperation Agency

#### LETTER OF TRANSMITTAL

Mr. Shinsaku Hogen President Japan International Cooperation Agency

I have the honor to hereby submit a report on survey in regard to telephone plant planning project in the Socialist Republic of the Union of Burma.

The survey team headed by myself was dispatched to Burma from March 9, 1976, through June 7, 1976, and carried out the detail design for local telephone network in Mayangon Exchange Office area in Rangoon, the capital city, and in Maymyo Exchange Office area in the State of Upper Burma.

During this while the exchange of views was conducted when necessary with the persons concerned of the Posts and Telecommunications corporation of the Socialist Republic of the Union of Burma. Their demands and desires are reflected to the maximum in this report.

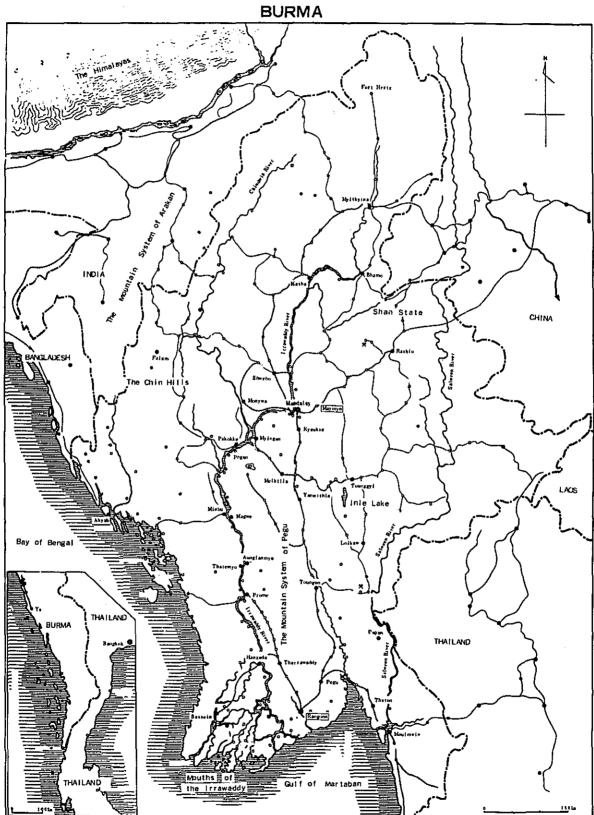
After the return to Japan the survey team made a further study of the result of survey for approximately three months, consulting the opinions of other experts when necessary. This report represents the fruition of such careful study. The report thus contains optimum information, to be sure, for the extension and improvement of telephone network in the Socialist Republic of the Union of Burma.

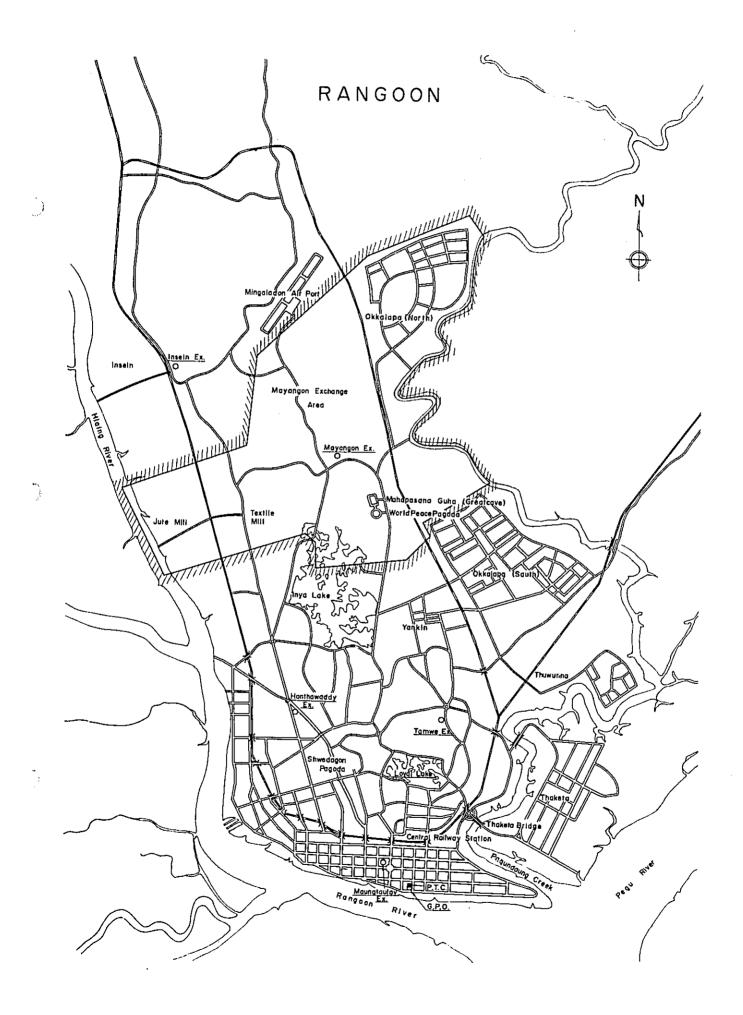
Thanks are hereby expressed to the authorities concerned of the Government of the Socialist Republic of the Union of Burma who kindly extended aid and assistance to the survey team throughout the period of its performance of duty. Thanks are also directed to the Posts and Telecommunications Corporation of the Socialist Republic of the Union of Burma and the Japanese Embassy in Burma, as well as the Ministry of Foreign Affairs, Ministry of Posts and Telecommunications, Japan International Cooperation Agency, Nippon Telegraph and Telephone Public Corporation, Japan Telecommunications Consulting Association and Nippon Telecommunications Consulting Co., Ltd., to whom the survey team owed a great deal for the successful fulfillment of its duty.

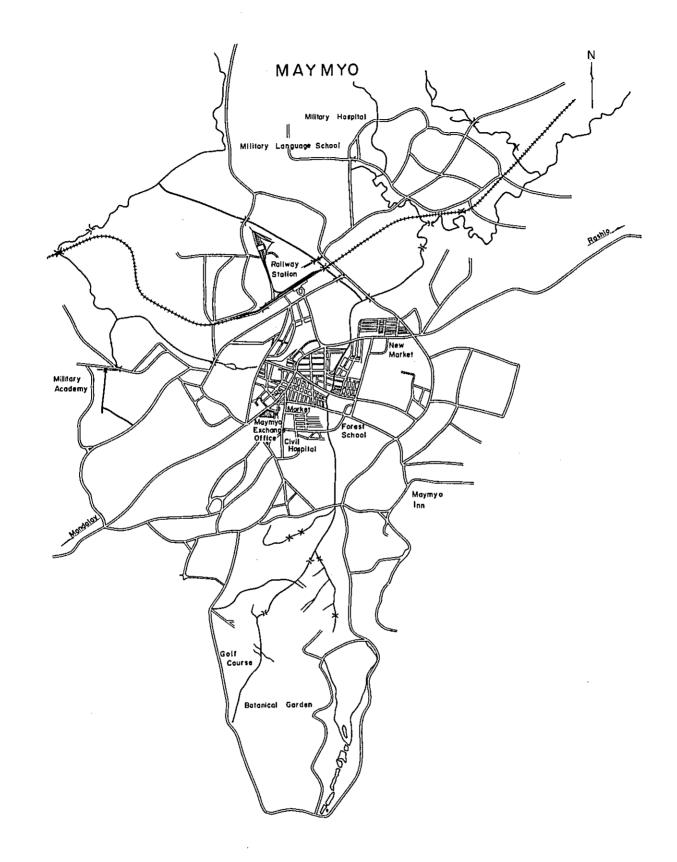
October 1976

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Susumu Saito Leader of Survey Team







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# - PART I

# SUMMARY

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### CHAPTER 1 STATUS QUO AND OBJECTIVE OF SURVEY

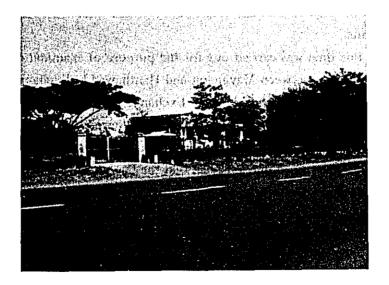
#### 1.1 Objective of Survey

The survey team carried out the field survey for the purpose of executing the detail design of inside plants and outside plants of Mayangon and Maymyo Exchange Offices, which in turn was to realize the grant of telephone facilities based on the request from the Government of the Socialist Republic of the Union of Burma (hereinafter called the Government of Burma in this report).

- (1) Inside Plants
  - a) Mayangon Exchange Office (where C2 type automatic exchange is scheduled to be installed)

The local telephone network in the city of Rangoon at present comprises five branch telephone offices. Mayangon Exchange Office is one of them and is located in the northern part of the city.

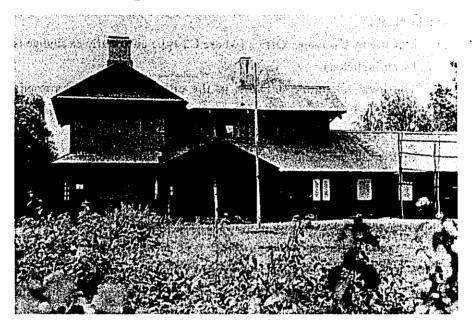
In the city of Rangoon the telephone facilities extension and improvement work by the loan of the International Bank for Reconstruction and Development (hereinafte rcalled the World Bank Project in this report) is scheduled to get underway in the near future. Therefore, the objective of survey was set not only at the examination and design of C2 type automatic exchange to be installed at Mayangon Exchange, but also study of interworking with the existing exchanges (Ericson's ARF-101 type) at other exchange offices, and the exchanges to be installed under the World Bank Project.



View of Mayangon Ex. Office

b) Maymyo Exchange Office (where C1 type automatic exchange is scheduled to be installed)

Maymyo Exchange Office is operated at present by the common battery system. This exchange is an end office so that it has nothing to do with the World Bank Project. The objective of survey was to examine and design the exchange facilities, as well as the toll board and line test equipment, to be newly installed at this exchange office.



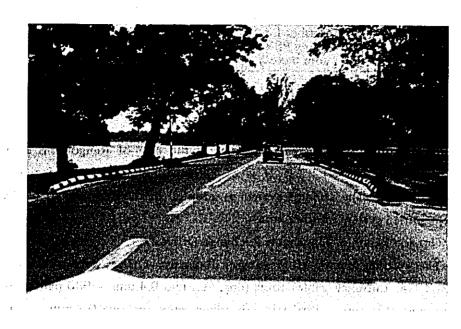
View of Maymyo Ex. Office

## (2) Outside Plants

The survey this time was carried out for the purpose of examination, survey and design of junction cable between Mayangon and Hanthawaddy Exchange Offices and of outside plants of Mayangon and Maymyo Exchange Offices.

a) Junction Cable between Mayangon and Hanthawaddy Exchange Offices

Mayangon Exchange Office is one of branch exchange offices in the city of Rangoon as mentioned previously so that the line units, as well as the outgoing and incoming trunks after the completion of the World Bank Project, of this exchange office have to be increased. Therefore, the work consisted of examination, survey and design of junction cable between Mayangon and Hanthawaddy Exchange Offices.



Junction Cable Route

# b) Mayangon and Maymyo Exchange Offices

For both exchange offices the work was to examine, survey and design subscriber cables, based on the existing subscriber and pending application distribution chart prepared by the Posts and Telecommunications Corporation of Burma (hereinafter called PTC in this report).

# 1.2 Status Quo

(1) Inside Plants

a) The numbers of line units, existing subscriber lines and pending applications at various exchange offices in the city of Rangoon are shown below. ARF-101 exchanges are used at all exchange offices.

Exchange Office	Number of Line Units	Number of Existing Subscriber Lines (Including PBX and coin boxes)	Number of Pending Applications
Maungtaulay	9,000	8,748	4,771
Hanthawaddy	3,000	2,799	1,257
Tamwe	3,000	2,520	1,732
Mayangon	1,000	858	298
Insein ·	1,000	713	214
Total	17,000	15,638	8,272

b) Numbers of line units, existing subsriber lines and pending applications of Maymyo Exchange Office are as follows:

Number of Line Units	Number of Existing Subscriber Lines (Including PBX and coin boxes)	Number of Pending Applications
300	115	56

#### (2) Outside Plants

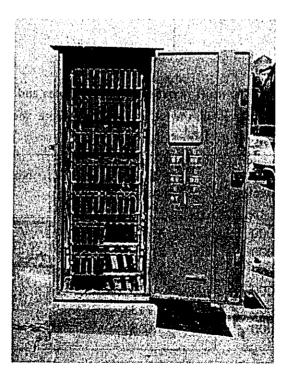
a) The existing junction cable system in the city of Rangoon is shown in Fig. I.1.2.1 and Table I.1.2.1. It is of Ericson design (1961), using different loading systems. The conduit system is adopted in the central part of the city and the buried system in other areas.

## b) Outside Plants of Mayangon Exchange Office

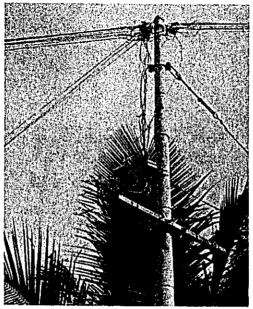
The outside plants of Mayangon Exchange Office were constructed in 1963–1974. Entrance cables total four, i.e., two 0.4 mm – 900 pair subscriber cables, one 0.8 mm - 100 pair subscriber cable and one 0.8 mm - 200 pair junction cable.

The subscriber cable is composed of the exchange-cabinet primary cable and the cabinet-distribution point secondary cable. The primary cable is shown in Fig. I.1.2.2 and Table I.1.2.2 and is buried in all cases.

The secondary cable comprises buried cable and aerial cable. Drop wire or open wire is used between the distribution point and the subscriber.



Existing Cabinet - 6 -

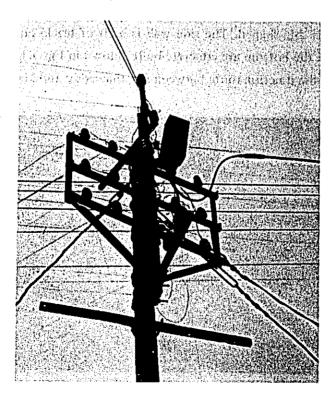


Existing Terminal Box

c) Outside Plants of Maymyo Exchange Office

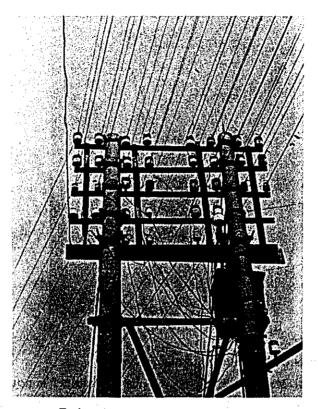
In the case of Maymyo Exchange Office the cabinet is not used. Entrance cables total four, i.e., two 100 pair cables, one 60 pair cable and one 40 pair cable.

Buried cable is used between the exchange and the distribution point and open wire between the distribution point and the subscriber.



## Existing Distribution Point

- 7 --



Existing Open Wire Line

d) Conduit, Manhole and Pole

Conduit is the concrete-made porous pipe, measuring 90 mm in inner diameter and 1.0 m in length. The four-pore pipe is used in many cases.

Manhole is ship-shaped. The side wall is built of bricks and mortar-finished. The ceiling and the bottom are concrete-built. Shown in Fig. I. 1.2.3 is an example of manhole on the junction route between Hanthawaddy and Mayangon Exchange Offices.



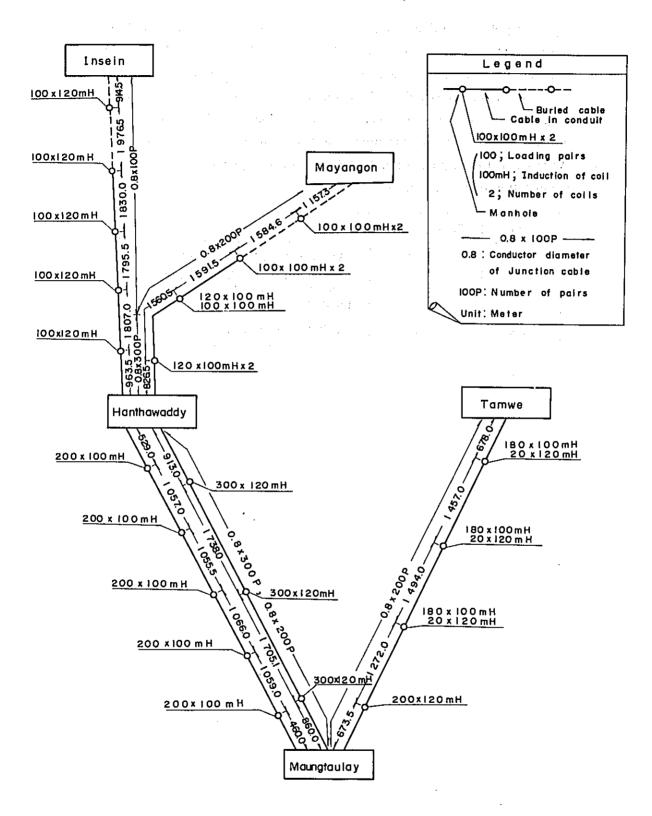
Cable Vault in Hanthawaddy Ex.

For poles the tubular steel pole (spliced pole), wooden pole and rail pole are used. On the main routes the tubular steel poles are used. Wooden and rail poles are used on small branch routes and for entrances only.

The tubular steel pole (spliced pole), as shown in Fig. I.1.2.4, is eight feet long and has the case iron-made socket (see Fig. I.1.2.5) at the bottom.

The A and B portions of the tubular steel pole are of half length and are called A4 (four feet of A portion) and B4 (four feet of B portion). An example of the combination of portions is as follows:

Name Pole Length		Remarks
A4BC	20 feet	A4 : 4 feet, B: 8 feet, C: 8 feet Pole length shows the height above ground excluding the socket portion.
ABC	24 feet	A, B, C: 8 feet each





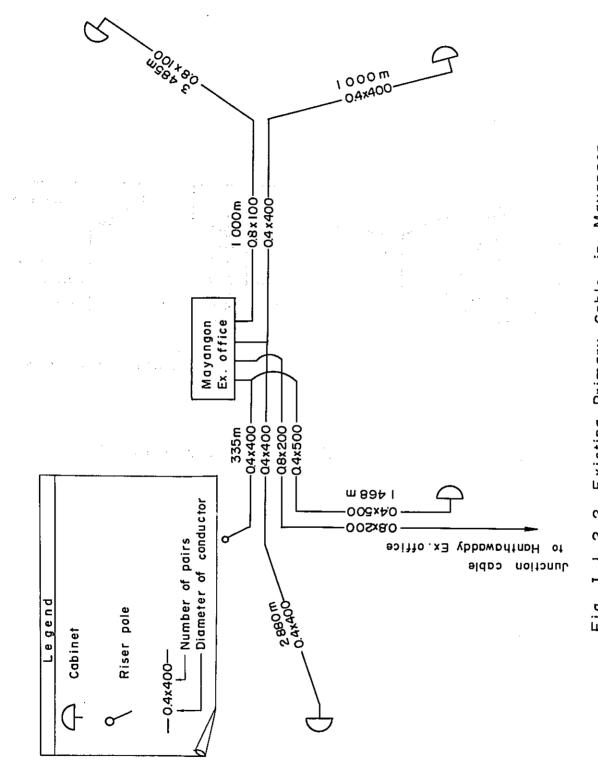
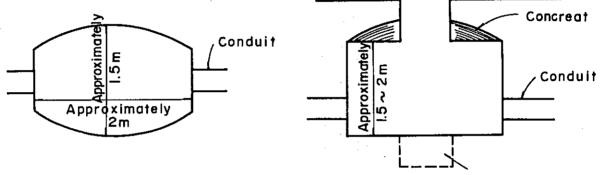


Fig. I.I.2.2. Existing Primary Cable in Mayangon

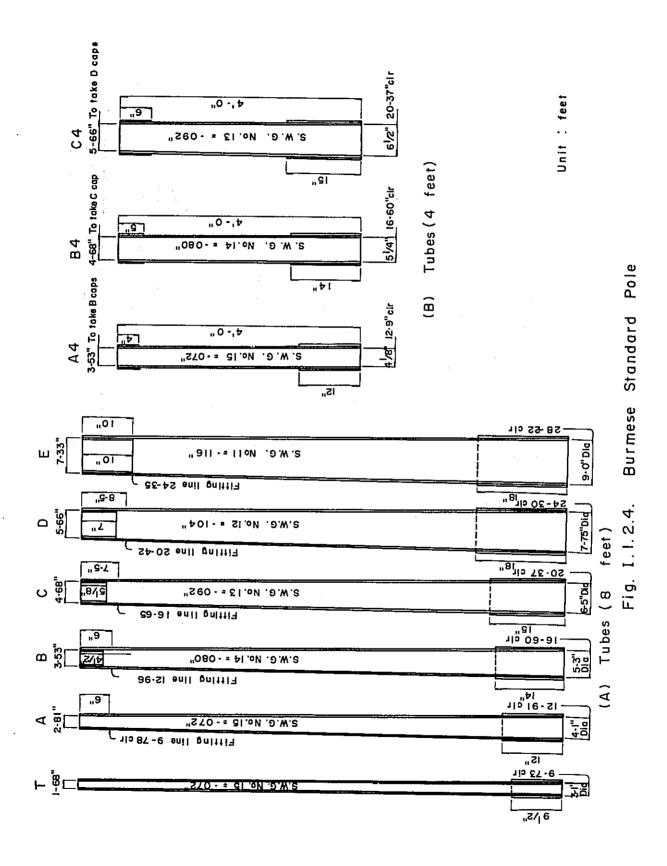
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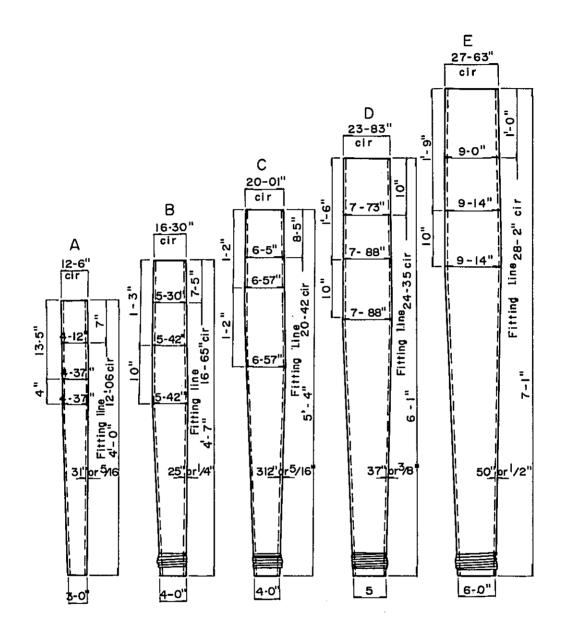


Loading coil manhole





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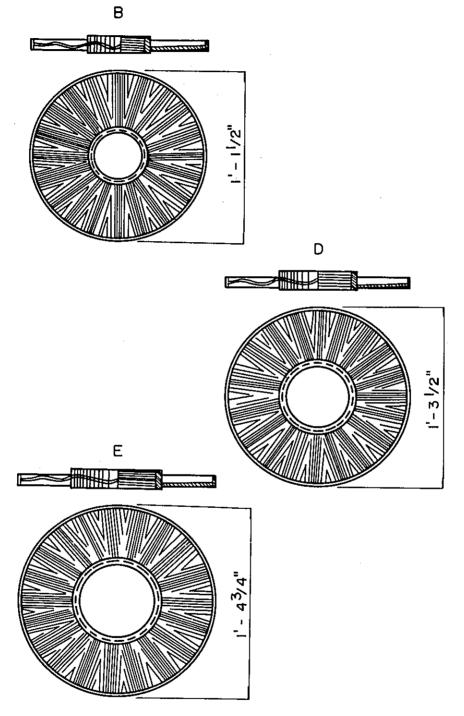


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Unit : feet

Fig. 1.1.2.5. Sockets



Unit : feet



Table	1.1.2.1.	Existing	Junction	Cable	In	Rangoon
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Name of	sec	tion	Kind of cable	· · · · ·	Quantity (m)
Maungtaulay	~	Tamwe	08-200 Conduit ca	ble	5 574.5
"	~	Hanthawaddy	0.8-200 "	· .	5 2 1 6. 1
11	~	"	0.8-300 //		5216.1
Hanthawaddy	~	Insein	0.8 - 300 #		
4	~	"	0.8-100 *		6 396.0
"	~	"	0.8 - 100 Direct buried	cable	2 891.0
Hanthawaddy	~	Mayangon	0.8 –`300 Conduit cab	le	
11	~	*	0.8 - 200 //		3978.5
11	~	"	0.8 - 200 Direct buried	l cable	2 741.9

# Table I.1.2.2.

Existing Primary Cable in Mayangon

Kind of cable	Quantity (m)	Remarks
0.4 - 400 Direct buried cable	5 550.0	Paper insulated lead sheathed, double polyethyline covered
0.4 - 500	1 803.0	"
0.8 - 100	4 485.0	"

## CHAPTER 2 BACKGROUND

## 2.1 Request from the Government of Burma

The Government of Japan, based on the request from the Government of Burma for cooperation in regard to the installation of transportable exchanges and the local telephone network improvement and extension plan decided to dispatch the first survey team to study the technical requirements concerning the above.

# 2.2 Dispatch of First Survey Team

A six-member survey team headed by Mr. Sanenobu Hayashi of the Nippon Telegraph and Telephone Public Corporation was dispatched to Burma for a period from November 11, 1975, through December 10, 1975. The team consulted with PTC concretely with respect to the locations of installation of C1 and C2 type automatic exchanges, as well as the technical requirements concerning the installation including the outside plants.

The organization of the first survey team is shown below.



Discussion by First Survey Team

# 2.3 Organization of First Survey Team

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Leader:	Sanenobu HAYASHI Nippon Telegraph and Telephone Public Corporation
Member:	Kunio SAKURAI Nippon Telegraph and Telephone Public Corporation
Member:	Masao NAMIWAKA Nippon Telegraph and Telephone Public Corporation
Member:	Masayoshi SHIMIZU Nippon Telegraph and Telephone Public Corporation
Member:	Katsumi HIRAKAWA Ministry of Posts and Telecommunications
Member:	Isamu ISHIHARA Japan International Cooperation Agency

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## CHAPTER 3 OUTLINE OF SURVEY

#### 3.1 Scope of Work

Based on the results of survey made by the first survey team, the decision was made to dispatch the second survey team to Burma. The scope of work of the second survey team is as follows:

(1) Exchange Offices to be Surveyed

Mayangon and Maymyo Exchange Offices

- (2) Subjects of Survey
  - Interworking of C2 type automatic exchange with the existing exchanges and those to be established under the World Bank Project.
  - Interworking between C1 type automatic exchange and manual trunk switchboard.
  - Equipment required consequent upon the installation of C1 and C2 type automatic exchanges.
  - Clarification of C1 and C2 type automatic exchange specifications.
  - Junction circuits in the city of Rangoon.
  - Subscriber cable network of Mayangon and Maymyo Exchange Offices.
  - Detail design by which to execute the work.
- (3) Sequence of Survey
  - a) First Step
    - Consultation with PTC and collection of data.
    - Survey of interworking with the existing exchanges in the city of Rangoon.
    - Field survey of junction cable route between Mayangon and Hanthawaddy Exchange Offices and subscriber cable routes of Mayangon Exchange Office.
  - b) Second Step
    - Collection of data at Maymyo.
    - Survey of equipment required consequent upon the installation of C1 type automatic exchange.
    - Field survey of subscriber cable routes of Maymyo Exchange Office.
  - c) Third Step
    - Detail design of junction cable between Mayangon and Hanthawaddy Exchange Offices.
    - Detail design of subscriber cables of Mayangon Exchange Office.
    - Consultation with switching engineers.

d) Fourth Step

• Detail design of subscriber cables of Maymyo Exchange Office.

e) Fifth Step

• Final consultation with PTC.

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(4) Period of Survey Three months.

(5) Number of Report Copies Required

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To present the following number of reports in English to the Government of Burma:

a)	General Description		90 copies
b)	<b>Detailed Description</b>	•	25 copies
c)	Drawings		40 copies

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# 3.2 Organization of Survey Team and Time Schedule of Survey

Leader : Susun

# Susumu SAITO

Nippon Telegraph and Telephone Public Corporation

March 9, 1976 - June 7, 1976

Member: Hideo SEKIGUCHI

Ministry of Posts and Telecommunications March 9, 1976 – March 18, 1976

Member:

## : Kazuo TASHIRO

Nippon Telegraph and Telephone Public Corporation March 9, 1976 – June 7, 1976

Member: Katsuyo MUNAKATA

Nippon Telegraph and Telephone Public Corporation March 9, 1976 – June 7, 1976

Member:

#### Shigeo NOMOTO

Nippon Telegraph and Telephone Public Corporation March 9, 1976 – April 8, 1976

Member:

#### r: Norio NEMOTO

Nippon Telecommunications Consulting Co., Ltd. March 9, 1976 – June 7, 1976

Member: I

### r: Kunio YUKINO

Nippon Telecommunications Consulting Co., Ltd. March 9, 1976 – June 7, 1976

Kenji NAGATA

Japan Telecommunications Consulting Association

March 9, 1976 – April 8, 1976

Member:

Member:

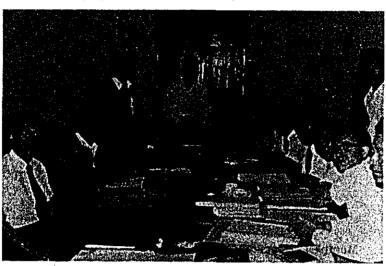
#### : Isamu ISHIHARA

Japan International Cooperation Agency March 9, 1976 – March 27, 1976 May 18, 1976 – June 7, 1976

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#### 3.3 Outline of Survey

After the consultation with PTC concerning the scope of work and the collection of data the survey team was divided into two groups, i.e., the group of inside plant engineers and the group of outside plant engineers. Field survey was carried out by these two groups.



Discussion by Second Survey Team

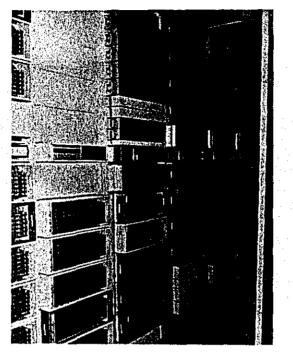
(1) Inside Plant

a) Investigation was made of interworking of C2 type automatic exchanges to be installed in Mayangon Exchange Office with the existing exchanges in the city of Rangoon and the exchanges to be installed under the World Bank Project, as well as signal tones of all kinds and installation location for C2 type automatic exchanges.

Installation location for C2 type automatic exchanges is shown in Fig. I.3.3.1.



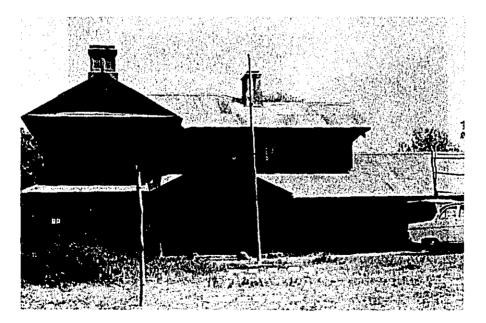
C2 Type Ex. Installation Site



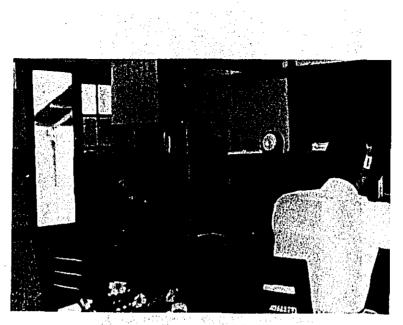
Existing Exchange in Mayangon

b) Survey was made of installation location for C1 type automatic exchanges in Maymyo Exchange Office and installation location for manual trunk switchboard and related equipment.

Installation locations for C1 type automatic exchanges and for manual trunk switchboard and related equipment are shown in Fig. I.3.3.2 and Fig. I.3.3.3, respectively.



C1 Type Ex. Installation Site

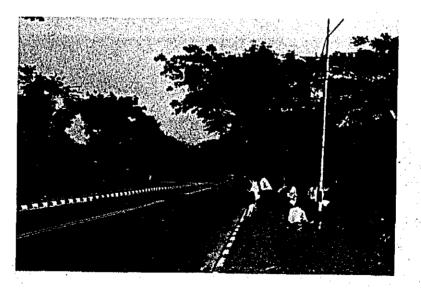


Existing Manual Board in Maymyo

(2) Outside Plant

Survey of outside plant comprises the following four major items:

a) Investigation, measuring and design of junction cable route between Mayangon and Hanthawaddy Exchange Offices. (Total cable length: approximately 6.8 km. Type of cable: 0.9 mm 400-pair cable.)



Field Survey for Junction Cable Route

b) Investigation, measuring and design of underground subscriber cable routes of Mayangon Exchange Office. (Total cable length: approximately 13.1 km.)
 Underground subscriber cable routes of Mayangon Exchange Office are shown in Fig. 1.3.3.4.



Field Survey in Mayangon

c) Investigation, measuring and design of aerial subscriber cable routes of Mayangon Exchange Office. (Total cable length: approximately 82.8 km – including SD wire.)

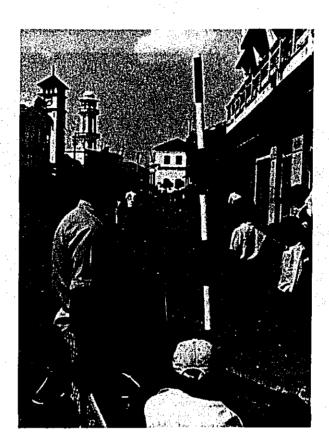
Aerial subscriber cable routes of Mayangon Exchange Office are shown in Fig. I.3.3.4.

d) Investigation, measuring and design of aerial subscriber cable routes of Maymyo Exchange Office. (Total cable length: approximately 40.6 km – including SD wire.)

Aerial subscriber cable routes of Maymyo Exchange Office are shown in Fig. 1.3.3.5.



Field Survey in Maymyo



Field Survey in Maymyo

- (3) Measurement of Existing Earthing Resistance and Earth Resistivity
  - a) Measurement at Mayangon Exchange Office

	Date:	April 2 and 3, 1976
	<b>Existing Earthing Resistance:</b>	8.2 ohms
	Earth Resistivity:	158 ohms.m
b)	) Measurement at Maymyo Exchange Office	
	Date:	March 22 and 26, 1976
	Existing Earthing Resistance:	3.4 ohms
	Earth Resistivity:	168 ohms.m

An outline of measurement is shown in Chapter 7: Reference.

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Measurement of Existing Earthing Resistance

(4) Transportation and Storage in Burma

Through consultation with PTC it was agreed that the transportation and storage in Burma of equipment and materials required in this construction work be carried out at the expense and responsibility of PTC. For transportation of exchanges, in particular, it was further agreed that, based on the result of field survey, the crane and road clearance be procured by PTC.

(5) Cooperators in Outside Plant Survey

Persons from PTC who participated in the survey of outside plants of Mayangon and Maymyo Exchange Offices were as follows:

At Mayangon Exchange Office

U Thein, U Kyi Nyunt and others.

At Maymyo Exchange Office:

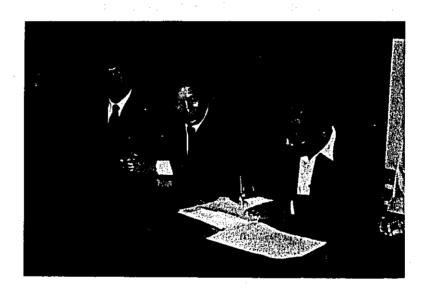
U Hteik Tin Mg, U Aung Khin, U Kyaw Hmwe, U Bahadur and others.

(6) Summary Records of Discussion

Summary records of discussion held from time to time during the period of survey appear in Chapter 7: Reference.



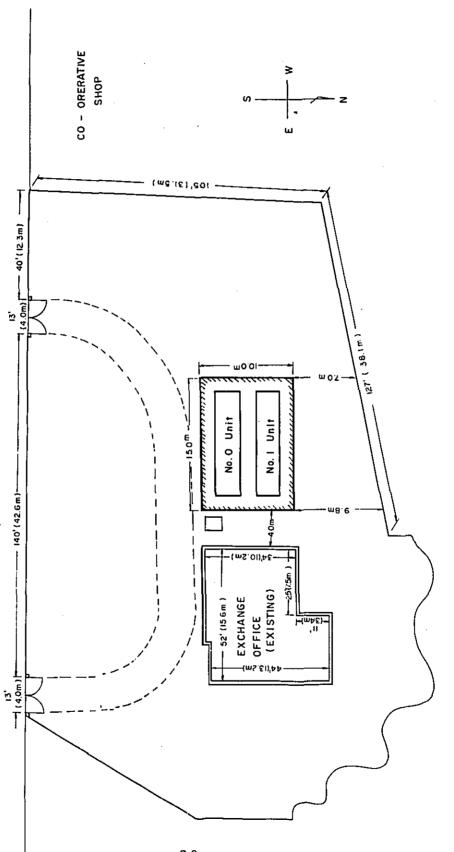
Final Discussion



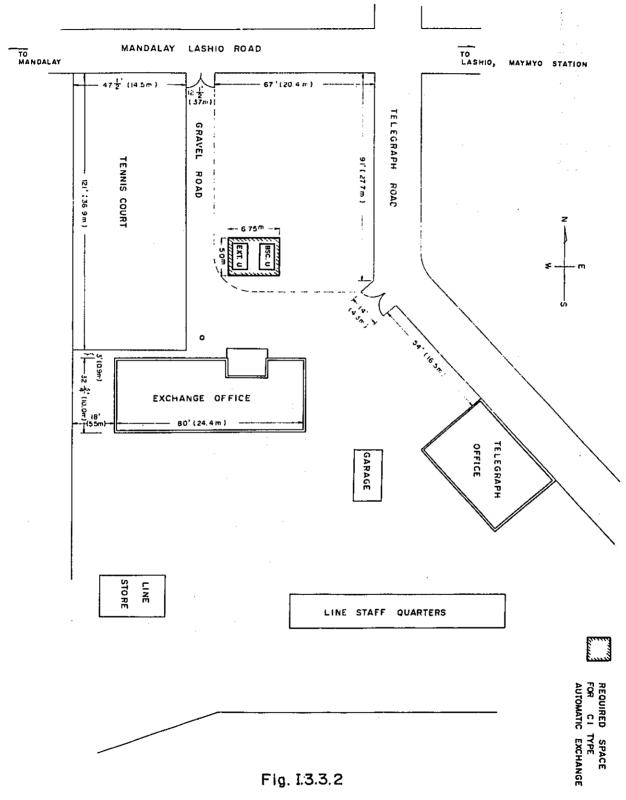
Exchange of Discussion Records







Plan for C2Type Automatic Exchange in Mayangon Site Fig. I. 3.3.I



Site Plan for Cl Type Automatic Exchane in Maymyo

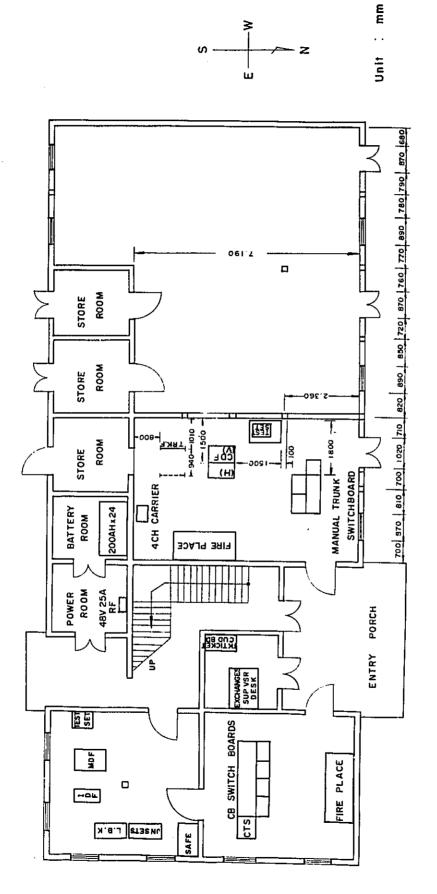
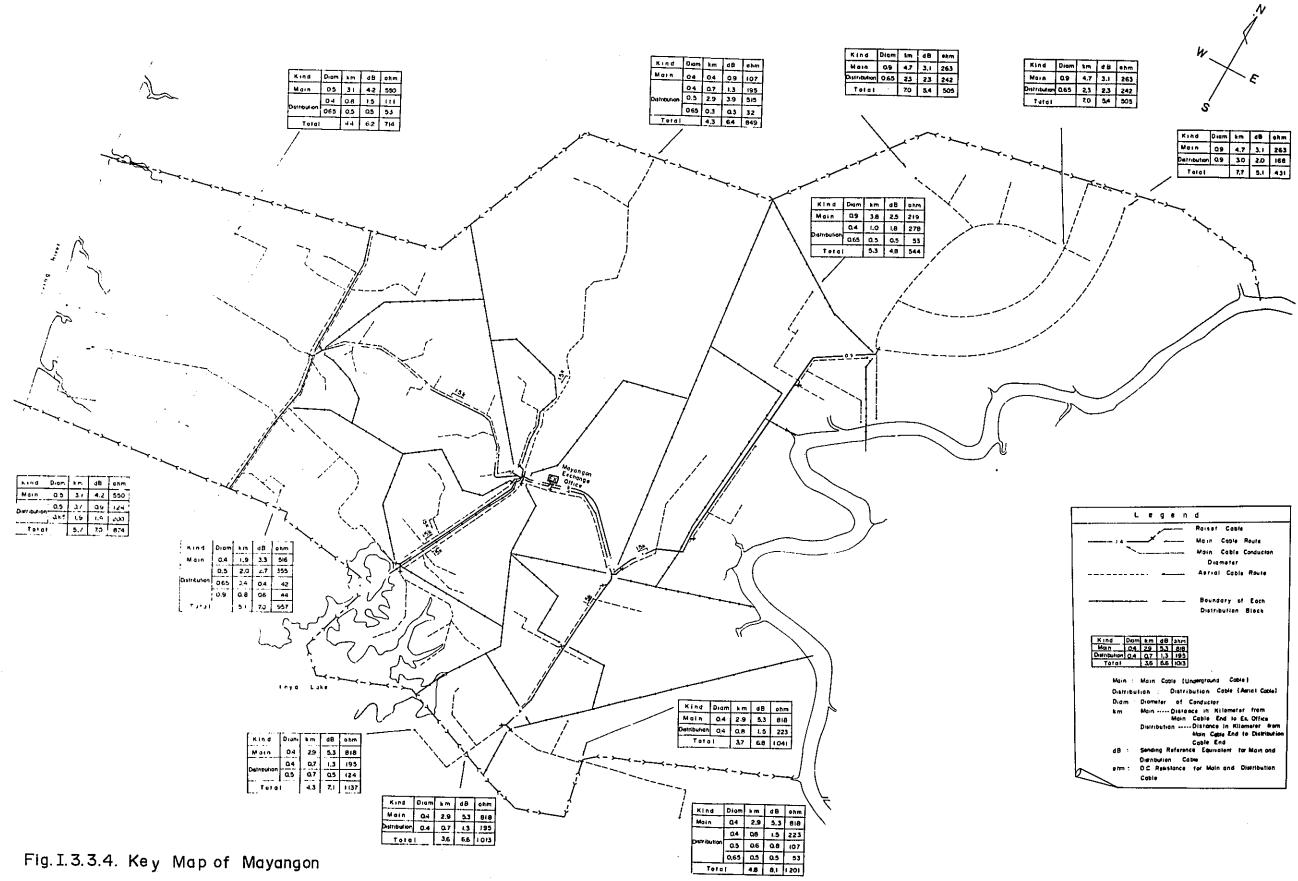


Fig. I.3.3.3. Floor Layout of Maymyo MDF Room

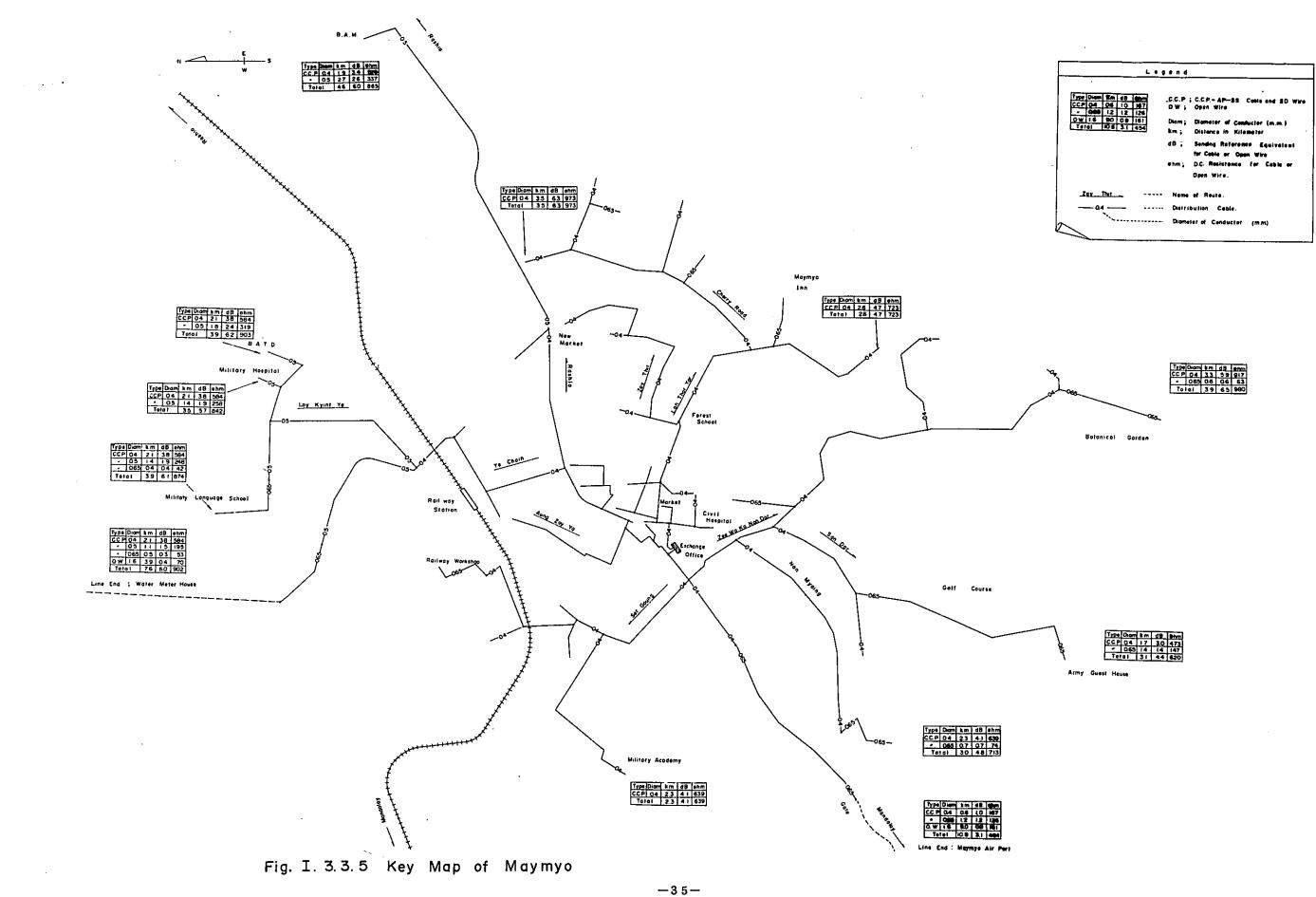
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I	Legen	d
		Raiser Cable
	~	Main Cable Route
	·	Main Cable Conducton
		Digmeter
		Asrial Cable Route
		Boundary of Each
		Distribution Black
(ind Dep		
Agin 04		
Total	36 6.6 1013	
Main :	Main Coble [Ur	ngerground Cobie )
Distribu	ution : Distriz	oution Coble (Aerial Coble)
Diam	Diometer of C	Conductor
k m		ice in Kilometer from
		Cable End to Es. Office
	Distribution	Distance in Kliometer from Main Caple End to Distribution
		Cable End
dB :	Sonding Reference	e Equivalent for Main and
	Disribution Cal	be
etm t	DC Resistance	for Moin and Distribution
	Cable	

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# 3.4 Effect of Execution of this Project

#### 3.4.1 General Description

In Burma a large scale telecommunications project is not being carried out since 1964. Telephone exchange offices now operating in the country number 136. Automatic system exchange offices are only five in Rangoon, the capital city. Others are four common-battery type exchange offices and 127 magneto type exchange offices.

Maymyo, where Maymyo Exchange Office to be equipped with two C1 type automatic exchanges under this project is located, lies approximately 70 km east of Mandalay, the No. 2 city in Burma, and is a high land city with an elevation of about 1,000 m above sea level. Since a long time ago many government related organizations are located in Maymyo.

Maymyo Exchange Office is not included in the World Bank Project which envisages the opening of two new branch exchange offices in Rangoon and the adoption of automatic system in 13 local exchange offices. Therefore, this project to initiate the automatic system at Maymyo Exchange Office has aroused great expectations among the local residents.

Pending applications at Maymyo numbered 56 at the end of February 1976. However, since the beginning of investigation by the survey team the number of pending applications fast increased, totaling as many as 150 at the middle of May 1976.

Mayangon Exchange Office, where two C2 type automatic exchanges will be newly installed under this project, is located in the northern part of Rangoon. At present, it is equippped with Ericson's ARF-101 type automatic exchange with 1,000 terminals. In the southern part of its service area are many high grade residences including the President's official residence. The western part is the factory district and the northeastern part the newly opened residential district.

This project not only contributes to the development of Burmese national economy but also brings great benefits to the urban dwellers in the form of the expansion of residential districts and the improvement of social life environment. Telecommunications, like highway and transportation services, are essential to the city life.

#### 3.4.2 Telephone Diffusion Rate

The existing subscriber telephone network in the city of Rangoon is joined by five exchange offices. Subscribers total 15,638 while the number of terminals installed is 17,000. The diffusion rate per population of 100 is 0.83 and, when seen from the number of terminals installed, 0.91. (The total population numbers 1,877,000.)

The World Bank Project aims at an increase of terminals by 7,200 (the initial plan was to increase 6,200 terminals and this number was subsequently changed to 7,200 terminals). When a further increase by 2,000 terminals under this project is added the total increase reaches 9,200 terminals. At this figure the diffusion rate per population of 100

grows to 1.40. In other words, this project takes care of some 22% of the number of terminals to be increased in the city of Rangoon.

In the case of Maymyo Exchange Office the subscribers number 115 against the population of 42,966 (as of 1975) so that the diffusion rate per population of 100 is 0.27. When the pending applications numbering 150 as mentioned in the preceding paragraph have become subscribers the diffusion rate increases to 0.62. When seen from the number of terminals installed totaling 384 the diffusion rate turns out to be 0.89. This figure is nearly equal to the present diffusion rate in Rangoon.

#### 3.4.3 Expected Income Increase from Subscriber Increase

(1) Expected Income Increase from General Subscriber (including PBX subscriber) Increase

Out of 2,000 telephone sets to be procured in Japan the following number will be installed as subscriber telephones under this project:

May	angon Exchange Office area
	(Existing: 858; Total: 1,500)
Мау	myo Exchange Office area
	(Existing: 115; Total: 300)
Tot	al new installations
	(Total subscriber lines: 1,800)
a)	Income increase by deposit amounts of new subscribers
	300 kyats x 827 subscriber lines = 248,100 kyats
b)	Income increase by installation fees

150 kyats x 827 subscriber lines = 124,050 kyats

- c) Income increase by subscription fees (annual)
   360 kyats x 827 subscriber lines = 297,720 kyats
- d) Income increase by use of telephones by new subscribers

The average numbers of calls per subscriber line at Mayangon Exchange Office and Maymyo Exchange Office are supposed to be 12 calls/day and 2 calls/day, respectively. Even assuming that all are local calls, the following income increase per annum can be expected:

(12 calls x 642 subscriber lines x 22 days x 12 months) + (2 calls x 185 subscriber lines x 22 days x 12 months) = 2,131,536 calls

0.2 kyats x 2,131,536 calls = 426,307 kyats

Note: The average number of calls per subscriber line at Mayangon and Maymyo Exchange Offices quoted above are based on the busy hour rate of 15% and the average holding time of call of 150 seconds.

#### (2) Expected Income Increase from Public Coin Box Telephone

Exchange Office Area	Outdoor Type Coin Box Telephone	Indoor Type Coin Box Telephone
Mayangon Exchange Office area	6	9
Maymyo Exchange Office area	2	4
Total	8	13

The following number of public coin box telephones will be installed under this project:

Usually the number of calls from public coin box telephones is by far larger than the number of calls from general subscribers. Hence the former contributes a great deal to the telephone service income. For locations where to install public coin box telephones such places should be chosen where a large number of people usually gather and where a high rate of utilization can be expected. Furthermore, the number of pulses should be periodically investigated in order to realize the most effective installation and operation of public coin box telephones.

Following is the case with a certain city in Southeast Asia: At a place where the largest number of calls was recorded the number of calls was 21,168 calls/year, at another place where the third large number of calls was recorded the number of calls was 20,160 calls/year and at still another place where the sixth large number of calls was recorded the number of calls was 12,144 calls/year. (Each figure was obtained by multiplying the January 1975 data by 12.)

Thus the income from public coin box telephones varies from place to place. Furthermore, in Japan, there is a big difference in service income according to service hours between outdoor type and indoor type public coin box telephones.

Assume that the numbers of calls of outdoor type and indoor type public coin box telephones in Mayangon and Maymyo Exchange Office areas are 20,000 calls/ year and 10,000 calls/year, respectively. Then the service income will be:

Outdoor type public coin box telephones:

0.5 kyats x 20,000 calls x 8 telephones = 80,000 kyats Indoor type public coin box telephones:

# 0.5 kyats x 10,000 calls x 13 telephones = 65,000 kyats Total 145,000 kyats

(3) Income Increase Forecast for Each Year

The income increase forecast for each year based on the preceding paragraphs

# (1) and (2) is as follows:

a)	For initial year	1,241,177 kyats
	Breakdown:	
	Income increase by deposit amounts	248,100 kyats
	Income increase by installation fees	124,050 kyats
	Income increase by subscription fees	297,720 kyats
	Income increase by use of subscriber	
	telephones	426,307 kyats
	Income increase by use of public coin	
	box telephones	145,000 kyats
b)	For second and each subsequent year	869,027 kyats
	Breakdown:	
	Income increase by subscription fees	297,720 kyats
	Income increase by use of subscriber	
	telephones	426,307 kyats
	Income increase by use of public coin	
	box telephones	145,000 kyats

The above income increase forecast derives from subscriber service covering 1,821 subscriber lines (including 21 public coin box telephones) in the initial year at both Mayangon and Maymyo Exchange Offices without taking the subsequent subscriber increases into account. However, the terminals installed include 563 ((2,000 + 384) - 1,821 = 563) idle terminals. Therefore, when further new subscribers filling these idle terminals are considered, the above income increase forecast will not be excessive.

#### 3.4.4 Effect from Viewpoint of Maintenance

As previously stated, the existing distribution facilities of both Mayangon and Maymyo Exchange Offices consist of open wire and drop wire. In the open wire sections the insulator damage is conspicuous and in the drop wire sections the damage due to low ground clearance is found at many places.

Under this project the open wire sections will be replaced with cable or SD wire except for two routes in the Maymyo Exchange Office area and for the drop wire sections also the required ground clearance will be secured. Therefore, the damage will be reduced to a great extent and at the same time the high quality service will be provided. This will, in turn, lead to maintenance cost economy.

# CHAPTER 4 SUMMARY OF INSTALLATION WORKS

#### 4.1 General Description

This chapter summarizes the installation works under this project, including the consultant service and guidance on installation works to be required to ensure successful implementation of the project. The installation works are broadly divided into two parts: the inside plant work which includes power plant for emergency use, and the outside plant work which includes gas system.

#### 4.1.1 Consultant Service

The consultant under takes the following works for the purpose of smooth progress of this project:

- a) Preparation of tender document and assistance to PTC in selecting contractors.
- b) Witness to factory test.
- c) Supervision of installation.
- d) Witness to final acceptance test.

### 4.1.2 Guidance on Installation Works

The instructor who takes care of guidance on installation works is required to prepare the instruction text on installation works and to undertake the guidance on installation works on the following for the PTC personnel who will engage in this project for a certain substantial period:

- a) Outside plant installation works.
- b) C1 type automatic exchange and trunk switchboard installation works for Maymyo Exchange Office.
- c) C2 type automatic exchange and remote test equipment installation works for Mayangon Exchange Office.

# 4.2 Inside Plant

An outline of inside plant engineering and related works is shown in Table I.4.2.1.

#### 4.3 Outside Plant

An outline of outside plant engineering and related works is shown in Table I.4.3.1. Meanwhile, to facilitate the outside plant installation and to reduce the manpower works the following construction vehicles are to be assigned to Mayangon and Maymyo Exchange Offices:

Kind of Cars	Mayangon Exchange Office	Maymyo Exchange Office	Total	
Cylindrical Hydraulic Auger Crane Car	1	1	2	.  ;
Expansion Ladder Car	2	1	3	

## 4.4 Subscriber's Premises Plant

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An outline of subscriber's premises plant engineering and related works is shown in Table I.4.4.1.

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Table	I.4.2.1.	Summary	of	Works	for	Inside	Plant
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	1			· · · · · · · · · · · · · · · · · · ·
Ltem	Unit	Mayangon exchange	Maymyo exchange	Remarks
Automatic exchange	Unit	2 (C2 Type)	2 (C Type)	Nofe
Manual trunk switchboard	board		1	
Trunk equipment	set		l .	
Line test equipment	set		I	· · · · · · · · · · · · · · · · · · ·
Remote test equipment	set	I	<u> </u>	Installed in Maungtaulay Ex.
Distribution frame	set	l	I	
Repeating coil	set	2		V.D type Mayangon Ex.: Iset Hanthawaddy Ex.: Iset
Emergency engine generator	set	2	2	

Note : Line Capacity is as follows

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Mayangon exchange : IDOO terminals/unit including about 10 terminals for miscellaneous services.

Maymyo exchange : 192 terminals/unit including about 4 terminals for miscellaneous services.

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# Table I.4.3.1. Summary of Works for Outs

utside <u>Plant</u>	
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Ltem	Unit	Mayangon	Maymyo	Total	Remarks
Junction cable_					
Cable	k m	6.8	-	6.8	
Loading coil	pcs	4	<u> </u>	4	
Subscriber cable					
Underground cable	km	13.1	—	13.1	
Aerial cable	¥	82.8	40.6	123.4	Including SD wire
Terminal box	pcs	942	270	1212	Including indoor terminal box
				-	
Pole					
Japanese standard	pcs	820	404	1224	
Burmese standard	"	375	246	570	Excluding partial installation
<u>Stay</u>					
Upper stay	pcs	753	369	1122	
Lower stay	"	742	. 318	1060	
· · · · · · · · · · · · · · · · · · ·					
Gas pressurization					
<u>equipment</u>					
Dry air supply					
equipment	set	1	—	1	
Dry air distribution					
equipment	"	ſ		l	

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# Table I.4.4.1

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# Summary of Works For Premises Plant

Ltem	Unit	Mayangon	Maymyo	Remarks
Desk type telephone	pcs	1 500	300	
Public coin box telephone (Indoor type)	pcs	9	4	
Public coin box telephone (Outdoor type)	pcs	6	2	
Subscriber's telephone protector	pcs		308	

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# CHAPTER 5 PROJECT SEGMENT TO BE EXECUTED BY AND AT THE COST OF GOVERNMENT OF BURMA

#### 5.1 General Description

In regard to the project segment to be executed by and at the cost of the Government of Burma out of the work items described in Chapter 4 the survey team consulted with PTC. Both parties agreed as follows:

Installation works envisaged in this project is to be carried out by the engineering practice administered by the instructor and under the supervision of the consultant and at the cost and responsibility of the Government of Burma.

Agreement was also reached to the effect that the Government of Burma would be responsible for procuring equipment and materials produced in Burma, as well as those not procurable in Japan such as equipments to be additionally equipped in the existing exchanges.

The following are common to both inside plant and outside plant engineerings:

Classification	Mayangon Exchange Office	Maymyo Exchange Office	Total
<ol> <li>Project Manager</li> <li>Assistant Project Manager</li> </ol>			l man x 15 months
<ul> <li>Inside plant and related works</li> <li>Outside plant</li> </ul>	1 man × 4 months	1 man x 4 months	8 man-months
and related works	1 man x 15 months	1 man x 13 months	28 man-months
<ul> <li>(3) Skillfull technicians         <ul> <li>Inside plant and related works</li> <li>Outside plant</li> </ul> </li> </ul>	4 men x 3 months	4 men x 3 months	24 man-months
and related works	47 man-months	13 man-months	60 man-months
(4) Skillful laborers			
<ul> <li>Inside plant and related works</li> <li>Outside plant</li> </ul>	1 man x 1 month	1 man x 1 month	2 man-months
and related works	238 man-months	48 man-months	286 man-months
<ul> <li>(5) Laborers         <ul> <li>Inside plant and related works</li> <li>Outside plant</li> </ul> </li> </ul>	6 man-months	4 man-months	10 man-months
and related works	678 man-months	45 man-months	723 man-months

## 5.1.1 Procurement of Necessary Manpower for Installation Work

#### 5.1.2 Transportation and Storage in Burma of Equipment and Materials Procured in Japan

Equipment and materials procured in Japan and shipped to Burma are landed at Port of Rangoon. Transportation and storage of those equipment and materials in Burma, including customs entry at Port of Rangoon, storage in warehouse, transportation from Port of Rangoon to Mayangon and Maymyo Exchange Offices, as well as adjustment of overhead structures, such as power lines and telephone lines which impede land transportation are to be taken care of by the Government of Burma.

For crane, trailer trucks and low floor wagons which are necessary for transportation and installation of exchanges, proper arrangements must be made in advance.

The external appearances of exchanges are shown in Fig. I.5.1.1 and Fig. I.5.1.2. The weights of exchanges are as follows:

C1 type automatic exchange approximately 5 tons/unit

C2 type automatic exchange approximately 20 tons/unit

Though a matter of course the safety factor for crane must be 2. That is to say, the 10-ton crane is necessary for C1 type exchange and the 40-ton crane for C2 type exchange.

#### 5.1.3 Removal of Existing Facilities

Removal of the existing facilities during the work period of this project or after the completion of this project is to be undertaken by the Government of Burma.

#### 5.2 Inside Plant Work

#### 5.2.1 Construction of Foundation

The construction of foundation for C2 type automatic exchange at Mayangon Exchange Office (see Fig. 1.5.2.1-2) and foundation for C1 type automatic exchange for Maymyo Exchange Office (see Fig. 1.5.2.3-4) and the ground leveling for the construction of foundation are to be undertaken by the Government of Burma.

At the time of the construction of foundation the earthing work must be done. For signal earthing the earth bar procured in Japan is used, connecting it by conductor to the existing buried earth. For protective earth also the earth bar procured in Japan is used.

#### 5.2.2 Construction of Sunshine Shelter

Both C1 type and C2 type automatic exchanges are equipped with the air-conditioner. However, the air-conditioner goes out of operation during power failure or is put out of operation for maintenance. In order to prevent trouble due to exposure to sunshine and consequent rise of exchange room temperature (especially to protect the electronic parts), the sunshine shelter is to be constructed by and at the cost of the Government of Burma.

# 5.2.3 Power Reception

Up to the installation of watt-hour meter to supply commercial AC power to the exchange comes under the responsibility of the Government of Burma. For this purpose it is necessary to investigate the distribution line capacity and, if the capacity is not sufficient, to increase the distribution system capacity and at the same time install drop wire, lead-in pole and watt-hour meter and thereby make power reception possible shortly after the installation of exchange.

#### 5.2.4 Remodeling of Exchange Office

The Government of Burma is to undertake the remodeling of Maymyo exchange office which becomes necessary in connection with the execution of this project.

# 5.2.5 Additional Equipment in Associated Exchanges

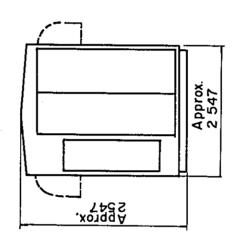
In the case of Mayangon Exchange Office the installation of C2 type automatic exchange will increase the subscriber lines from the present 1,000 to 2,000. Thus, at Hanthawaddy and Maungtaulay Exchange Offices to be connected to Mayangon Exchange Office by C2 type automatic exchange it becomes necessary to make additional installation of junction equipment, as well as common equipment for control of junction equipment, and to increase junction lines. PTC is to take care of calculation of the necessary number of these equipment and purchase of them plus installation work and testing. These are to be completed before the test on C2 type automatic exchange begins at Mayangon Exchange Office.

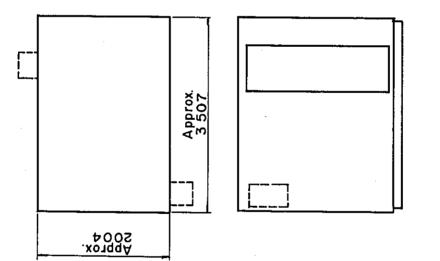
#### 5.2.6 Emergency Engine Generator Room

Floor type emergency engine generator shall be installed in Mayangon Exchange Office, therefore the construction of the foundation and the engine room is to be undertaken by the Government of Burma.



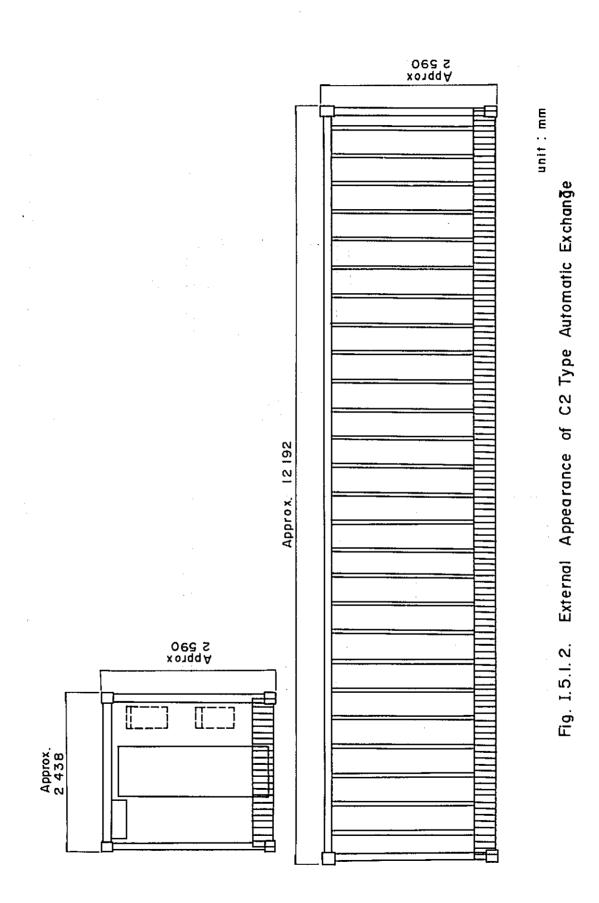
unit : mm



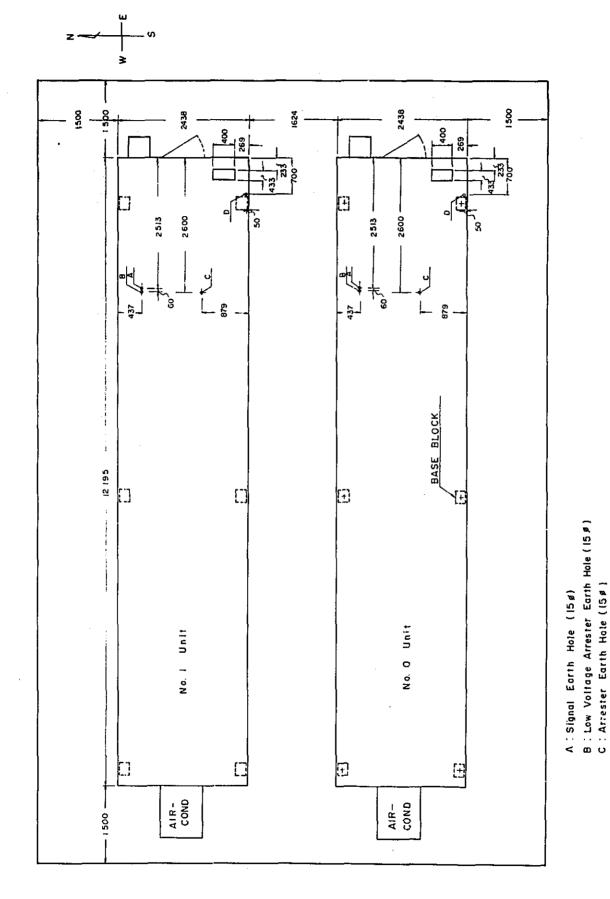


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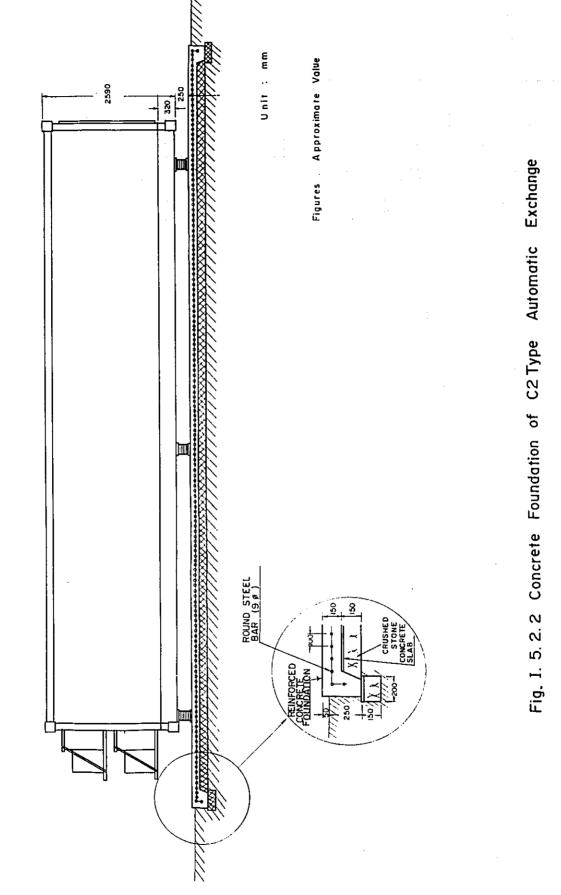


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Figures : approximate Value Fig. 1.5.2.1 Concrete Foundation of C2 Type Automatic Exchange

D: Protective Earth Hole (158)



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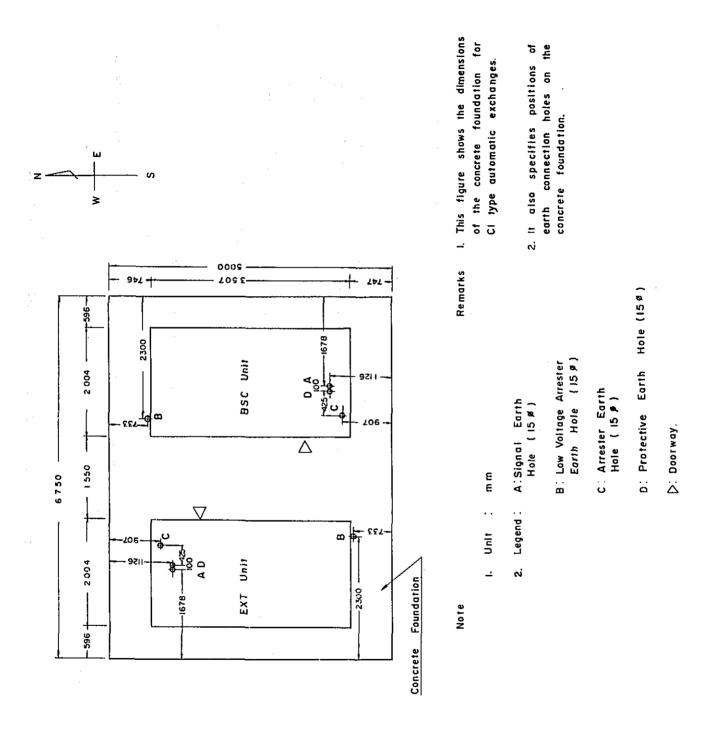
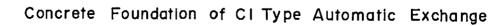
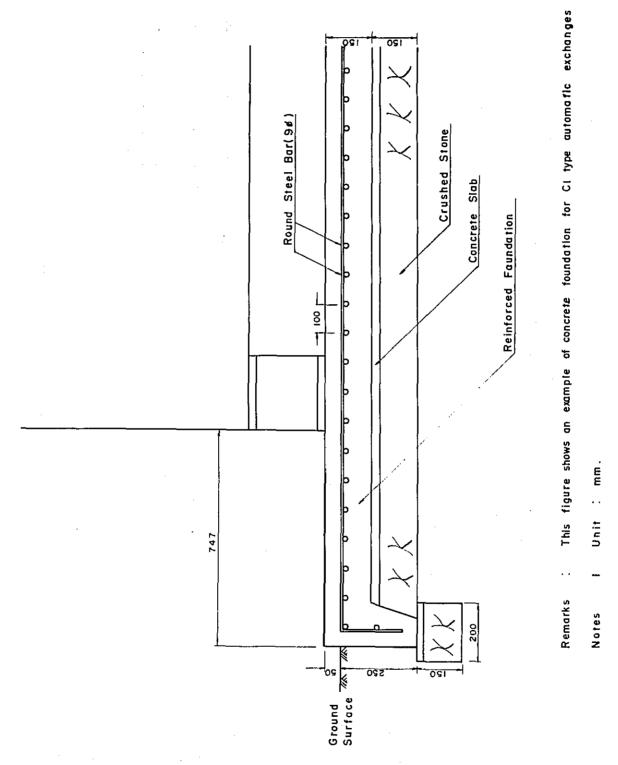


Fig. 1.5.2.3







#### 5.3 Outside Plant Work

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#### 5.3.1 Supply of Burmese Standard Poles

Steel tubular poles of Japanese standard are to be used on the newly designed main routes. However, to mitigate the burden on the part of the Government of Burma, it was so designed that the Burmese standard poles could also be reused. More specifically, the existing Burmese standard poles in the neighborhood of exchange offices are to be replaced with Japanese standard poles so that the withdrawn poles of Burmese standard can be used as interposal poles in the long span sections of the existing routes where Burmese standard poles are used. Decision was made to have the following quantity of Burmese standard poles supplied by the Government of Burma. They include the additional poles necessary at the start of installation works.

Į	Exchange Office	Quantity
[	Mayangon	approximately 170 poles
	Maymyo	approximately 70 poles

The quantity quoted above is the quantity of spliced poles of Burmese standard. The breakdown by sections follows:

	Section					
Exchange Office	A:4	A	B4	<u> </u>	D	
Mayangon	160	41	8	158	118	2
Маутуо	52	30	-	79	35	-

It must be noted that the quantity quoted above is based on the assumption that 60% of withdrawn poles will be reused.

#### 5.3.2 Civil Work

(1) Construction of New Manholes

Four new manholes are to be constructed by the Government of Burma. Out of these four two are to contain loading coil to be inserted in the buried junction cable section between Mayangon and Hanthawaddy Exchange Offices. The other two are for connection of subscriber cables (including a junction cable).

Two new manholes for loading coil are to be located on Prome Road. Two new manholes for subscriber cables are to be located at the intersection of Kaba Aye Road in front of Mayangon Exchange Office and the intersection of Prome Road and Kaba Aye Road.

#### (2) Increase of Conduit

a) For the laying of junction cable between Mayangon and Hanthawaddy Exchange Offices a new conduit is to be constructed by the Government of Burma in the following existing section without a spare conduit:

No: 595 Manhole – No. 655 Manhole (2,283.8 m)

b) For the laying of subscriber cables (including a junction cable) of Mayangon Exchange Office a new conduit is to be constructed in the following section by the Government of Burma:

Existing manhole in front of Mayangon Exchange Office – Manhole to be newly constructed (16.0 m).

(3) Reservation of Conduit

For the laying of a junction cable the inspection of designated conduit is to be carried out in the Hanthawaddy Exchange Office - No. 595 manhole section (approximately 1.6 km). If necessary, repair is made to keep at least one conduit in good condition.

#### 5.3.3 Others

(1) Riser Cable Protector

For riser cable protector the Burmese standard one now in use is to be adopted.

(2) Mounting Plate for Indoor Terminal Block

The mounting plates for indoor terminal block are to be equipped by the Government of Burma.

Mayangon Exchange Office	22 places
Maymyo Exchange Office	1 place
Total	23 places

(3) Burmese Standard Terminal Box

On the following routes to be kept as Mayangon Exchange Office's subscriber lines belonging to other exchange areas before the completion of the World Bank Project the Burmese standard terminal boxes are to be mounted.

Kaba Aye No. 1 Route	2
Parami Route	3
Total	5

(4) Protection of Buried Cable

Materials, such as bricks, to protect buried subscriber cables of Mayangon Exchange Office and buried section of a junction cable are to be procured by the Government of Burma. Protective steel pipes for the abovementioned buried cables traversing the roadway or crossing the river under or alongside the bridge are to be procured in Japan.

(5) Remodelling of Power Line

Non-insulated power lines crossing the aerial cable route should be remodelled, whenever necessary to secure required road clearance of the aerial cables. Such remodelling works are to be undertaken by the Government of Burma.

Exchange Offices	Number of Sections to be Remodelled
Mayangon Exchange Office	59
Maymyo Exchange Office	24

#### **CHAPTER 6 RECOMMENDATIONS**

For the purpose of smooth progress of this project and ease of maintenance after the completion of construction work it is desired that attention be directed to the points mentioned below.

#### 6.1 Training of Engineers

Both C1 type and C2 type automatic exchanges to be installed this time are the first of their kind to be introduced in Burma. At the same time, the equipment, as well as the engineering practice, to be used in the outside plant construction are for the most part not popular in Burma. In this connection, it is considered necessary to administer technical training of engineering staff who will handle those equipment.

The technical training comprises two major categories: leadership training and local training. Leadership training is to be given to PTC personnel who will take charge of local training on inside plant and outside plant. Leadership training on outside plant is now being carried out in Japan.

Local training is to be given to personnel to take charge of construction and maintenance of inside plant and outside plant. It is most effective to have the training on equipment finished before the construction work begins so that the personnel who have received the training can improve their technical capability in the course of the construction work.

Local training on inside plant will require approximately three months and that on outside plant about one month.

#### 6.2 Arrangements with Authorities Concerned

Progress of this project depends to a great extent upon arrangements with authorities concerned. With the Electric Power Corporation (EPC), for instance, it is necessary to arrange as to have the existing power line height further lifted so as to secure the road clearance of aerial cables to be newly installed in the construction work or to receive the power supply to C1 type and C2 type automatic exchanges. Among others are the arrangements to secure the crane, trailers, low floor wagons, etc., for the transportation of exchanges, to have the road occupation permitted for conduit construction and buried cable laying, or to survey underground structures in connection with excavation by the cylindrical hydraulic auger crane car.

It is desirable, therefore, to get into contact in advance with all authorities concerned, informing them of the size of project and details of associated works, as well as the time they are required, in order that there will be no mismanagement when the construction work gets underway.

#### 6.3 Acceptance of Expert

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As stated in Paragraph 6.1 there is need for training of exchange engineers because C1 type and C2 type automatic exchanges are to be introduced in Burma for the first time. For the same reason it is desirable that the acceptance of exchange engineering expert be considered so as to receive guidance on maintenance after the completion of installation work.

The exchange engineering expert may assume following duties:

a) Technical guidance

Technical guidance will include training, guidance on the countermeasure at the time of trouble with exchanges, and guidance on routine work.

b) Maintenance management

Maintenance management will include guidance on preventive maintenance, analysis of trouble data, and plant record making, etc.

# CHAPTER 7 REFERENCE

# 7.1 Summary Record of First Discussion

#### 7.1.1 Date, Time and Place

March 11 and 12, 1976. 10:00 – 16:00. At PTC Managing Director's Office.

#### 7.1.2 Participants

#### PTC:

	and a second	Survey Team		
U Kyaw Win,	Managing Director	Susumu	SAITO,	Leader
U Thaung,	Deputy Managing	Hideo	SEKIGUCHI	Member
	Director	Kazuo	TASHIRO,	Ditto
U Tha Tun,	Director, Stores cum	Shigeo	NOMOTO,	Ditto
	Superintending Engineer,	Katsuyo	MUNAKATA	"Ditto
	Rangoon Telephone System	Norio	NEMOTO,	Ditto
U Hla Thaw,	Director, Planning	Kenji	NAGATA,	Ditto
U Tin Aye,	Commercial Officer,	Kunio	YUKINO,	Ditto
	Rangoon Telephone System;	Tsamu	ISHIHARA	Ditto
	Secretary of the Meeting			

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# 7.1.3 Subject of Discussion

Scope of Work.

#### 7.1.4 Proceedings

a) Mayangon and Maymyo Exchange Offices are the work sites of project. Detail design will be made for subscriber telephone network of both exchange office areas.
b) PTC decided to cancel the initially scheduled work for Mayangon Exchange Office under the World Bank Project.

c) Survey will be made for interworking between C2 type automatic exchanges to be installed in this project, on one hand, and the existing exchanges and the exchanges scheduled to be installed under the World Bank Project, on the other. Trunking system and signalling system will be designed to comply with the World Bank Project specifications if possible.

d) Equipment (FUR, FIR, common control equipment, etc.) to be installed in the existing exchanges and the exchanges to be installed in the World Bank Project for the purpose of connection to C2 type automatic exchange to be installed in this project will be procured and installed by the Government of Burma.

e) Storage and transportation in Burma of equipment and materials required in this project will be undertaken by the Government of Burma.

f) For C1 type and C2 type automatic exchanges the sunshine shelter will be constructed at the cost and responsibility of the Government of Burma.

g) In order to reduce the installation period of this project MDF will be newly installed in the MDF room of Mayangon Exchange Office.

h) Dismantling of the existing equipment in connection with this project will be carried out by the Government of Burma.

i) Items to be procured in Japan and those to be undertaken by the Government of Burma for the realization of this project will be clarified in the report.

j) Equipment and materials to be procured in Japan and used in this project will in principle be of Japanese standard.

# 7.2 Summary Record of Second Discussion

## 7.2.1 Date, Time and Place

April 1, 1976. 10:00 – 13:00 and 15:35 – 19:45. At PTC Managing Director's Office.

#### 7.2.2 Participants

PTC:

#### Survey Team:

U Kyaw Win,	Managing Director	Susumu	SAITO,	Leader	
U Thaung,	Deputy Managing	Kazuo	TASHIRO,	Member	
	Director	Shigeo	NOMOTO,	Ditto	
U Tha Tun,	Director, Stores cum	Katsuyo	uyo MUNAKATA,Ditto		
	Superintending Engineer,	Norio	NEMOTO,	Ditto	
	Rangoon Telephone	Kenji	NAGATA,	Ditto	
	System	Kunio	YUKINO,	Ditto	
U Hla Thaw,	Director, Planning				
U Kyaw Thein, Divisional Engineer,					

Rangoon Telephone System

U Soe Tha, Assistant Engineer, Planning

U Tin Aye, Commercial Officer, Rangoon Telephone System;

Secretary of the Meeting

# 7.2.3 Subject of Discussion

Exchange equipment design.

#### 7.2.4. Proceedings

- a) Exchange Capacity
  - C2 type automatic exchange: 1,000 terminals x 2 units
  - C1 type automatic exchange: 192 terminals x 2 units
- b) Numbering Plan
  - C2 type automatic exchange: Subscriber number in 5 digits
  - C1 type automatic exchange: Subscriber number in 4 digits
- c) Charging System

Local call: Single metering

Toll call: Manual ticketing

- d) Signalling System
  - C2 type automatic exchange:

DC loop system for line signal.

Register signal: Initial, DC signal system

Future, MFC-R2 system

- e) Telephone Set
  - Two-party facilities will not be used.
  - Push-button telephone set will not be used.
  - For public coin box telephone the single metering type telephone set will be used.
- f) Subscriber Line Loop Resistance Limit Value
  - C2 type automatic exchange:
    - 1,700 ohms or less
    - (Line loop resistance: 1,500 ohms or less)
  - C1 type automatic exchange:
    - 1,200 ohms or less
    - (Line loop resistance: 1,000 ohms or less)
- g) Power Equipment
  - Rectifiers and batteries of Japanese standard will be used.
  - Installation of emergency power plant is not included in this project. Advisability of installing AC system emergency power plant at the cost of the Government of Burma will be stated in the report. Note: The survey team further studied this problem after returning
    - to Japan, and reached the conclusion that the installation of emergency power plant be included in this project.

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- h) Additional Equipment
  - Manual trunk switchboard, trunk equipment and testing equipment will be installed at Maymyo Exchange Office.
  - The existing DC power plant at Maymyo Exchange Office will be used as power source for above equipments.
- i) PBX Equipment

)

Remodelling of the existing PBX equipment, if necessary, will be carried out by the Government of Burma.

j) Item to be Undertaken by the Government of Burma

Refer to Chapter 5.

#### 7.2.5 Decision Deferred

Decision on location where to install C2 type automatic exchange at Mayangon Exchange Office has been deferred from the viewpoint of security until the next meeting with PTC at a later date.

#### 7.3 Summary Record of Third Discussion

7.3.1 Date, Time and Place

April 30, 1976. 10:00 - 12:15. At PTC Managing Director's Office.

#### 7.3.2 Participants

PTC:

°C:	Survey Team:			
U Thaung,	General Manager	Suzumu	SAITO	Leader
U Tha Tun,	Director, Operation	Kazuo	TASHIRO,	Member
U Kyaw Their	n, Superintending	Kazuyo	MUNAKATA,	Ditto
	Engineer, Rangoon Telephone	Norio	NEMOTO,	Ditto
	System	Kunio	YUKINO,	Ditto
U Myint Win,	Assistant Engineer,			
	Installation, Rangoon Telephor	ie System		
U Ba Cho,	Assistant Engineer, U/G			
	Cables			
U Phone Kyi,	Assistant Engineer, O/H			

Cables

# 7.3.3 Subject of Discussion

Outside plant design

### 7.3.4 Proceedings

a) Outside plant design

Refer to Chapter 2, Part II.

b) In order to keep the sending reference equivalent (SRE) within the limit value, two existing open wire routes of Maymyo Exchange Office will be used after the completion of this project also.

c) Pole step will be mounted at the uppermost step only of the pole where cable terminal exists, from the viewpoint of security.

d) Joint-use of power line poles will be avoided from the viewpoint of maintenance.

e) Pole route name and pole number will be identified on the design drawing.

f) For the Mayangon Exchange Office subscriber line belonging to other exchange area, the cable newly laid from the exchange office and the subscriber cable of other exchange area will be connected via their terminal boxes mounted on the pole located at the exchange area boundary.

g) Cabinet will not be used in this project.

### 7.4 Summary Record of Final Discussion

### 7.4.1 Date, Time and Place

May 28, 1976. 15:00 - 17:00 and May 29, 1976. 9:00 - 11:00. At PTC Managing Director's Office.

### 7.4.2 Participants

PTC:

Survey Team:

U Khin Mg Tun,	Managing Director	Susumu	SAITO,	Leader
U Thaung,	General Manager	Kazuo	TASHIRO,	Member
U Tha Tun,	Director, Operation	Katsuyo	MUNAKATA,	Ditto
U Hla Thaw,	Director, Planning	Norio	NEMOTO,	Ditto
U Soe Thin,	Divisional Engineer, South Burma	Kunio	YUKINO,	Ditto
U Kyaw Thein,	Superintending Engineer	Isamu	ISHIHARA,	Ditto
U Ohn Hlaing,	Assistant Chief Engineer			
U Soe Tha,	Assistant Engineer, Planning			
U Myint Win,	Assistant Engineer,			
	Installation,			

U Ba Cho, Assistant Engineer,

U/G Cables

U Saw Bonny, Assistant Engineer, Exchange

U Ye Win, Assistant Engineer, PBX

### 7.4.3 Subject of Discussion

Final discussion (concerning outside plant work)

### 7.4.4 Proceedings

- a) Items of General Nature
  - Mayangon and Maymyo Exchange Offices are the work sites of project.
    - The construction work is to be undertaken by the Government of Burma.
    - Equipment and materials of Burmese standard to be used in the outside plant work are to be procured by the Government of Burma.
- b) Outside Plant Design

Refer to Chapter 2, Part II.

- c) Poles (Burmese standard poles and Japanese standard poles)
  - In order to avoid confusion in the way of maintenance the Japanese standard poles will in principle be used on the newly designed main cable routes and the Burmese standard poles as additional poles on the existing routes and on branch routes.
- d) Number of Report Copies to be Submitted to the Government of Burma

0	General Description	90 copies
0	Detailed Description	25 copies

- Drawings 40 copies
- e) Main Installation Work

Refer to Chapter 4.

f) Items to be undertaken by the Government of Burma

Refer to Chapter 5.

Discussion was made and agreement reached on the completion time for items to be undertaken by the Government of Burma also in order not to delay the completion time for the whole project.

g) Location of Installation of C2 Type Automatic Exchange at Mayangon Exchange Office

Location decided in the meeting with PTC Officers was newly submitted.

h) Equipment and Materials, and Engineering Practice to be Applied in This Project

Japanese standard will be applied in principle.

### i) Records of Three Discussions in the Past-

Records of the past three discussions are as effective as this record of final discussion. They constitute an integral part of this record of final discussion.

### 7.4.5 Decision Deferred

Decision was deferred on the loading system for junction cable and the increase of outgoing and incoming junction relays at Mayangon Exchange Office as the result of installation of 2,000 terminals at Mayangon Exchange Office initially scheduled in the World Bank Project having been transferred to Maungtaulay Exchange Office.

Note: After returning to Japan, the survey team further studied the above problem and a conclusion is reached as follows:

- a) Loading system for junction cables
  H-type 88 mH loading system be adopted.
  (Refer to Para. 2.1, Part II.)
- b) Increase of outgoing and incoming junction relays for Mayangon Exchange Office.

Increase of outgoing and incoming junction relays for Mayangon Exchange Office be included in this project.

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Fig. I..7.4.1 Implementation Plan

### 7.5 Measurement of Existing Earthing Resistance and Earth Resistivity

For the measurement, the special earth resistance tester Type 3244 (Yokogawa Electric Works, Ltd.) was used.

The measurement at the existing earth was made in the light traffic hours during night time and early morning. Earth resistivity was measured in the dry season so that the measured value is one available under the worst condition.

a) Measurement at Mayangon Exchange Office

• Measurement of Existing Earth

Date: April 3, 1976

Time: 5:30

Weather: Fine

Earthing resistance: 8.2 ohms

(The measured value was 10.2 ohms. However, since the lead wire used was short -50 m, the measured value was multiplied by the correction coefficient 0.8.)

Discharge current value at the time of the measurement: 6.0 A

The discharge current values at different hours of March 25, 1976, are shown below.

The discharge current value at the time of this measurement\* was so small that it is considered that the influence from the discharge current can be ignored.

Discharge current values on March 25, 1976:

Hour	Discharge Current Value
10:00	50.0 A
10:30	55.0 A
11:00	58.0 A
11:30	49.0 A
12:00	42.0 A
13:00	36.0 A
14:00	28.0 A
15:00	26.0 A
16:00	24.0 A

\*This data was obtained from Mayangon Exchange Office's Staff.

• Measurement of Earth Resistivity

Date: April 2, 1976 Time: 14:00 – 15:00 Weather: Fine

Measured value: 158 ohms.m.

(This value was obtained 3.0 m below earth surface.)

- b) Measurement at Maymyo Exchange Office
  - Measurement of Existing Earth

Date: March 26, 1976

Time: 21:30

Weather: Fine

Earthing resistance: 3.4 ohms

(The measured value was 4.2 ohms. However, since the lead wire used was short -50 m, the measured value was multiplied by the correction coefficient 0.8.)

The traffic at the time of the measurement was zero.

The conditon of burial of the existing earth obtained from the Maymyo Exchange Office's Staff is shown in Fig. 1.7.5.1.

• Measurement of Earth Resistivity

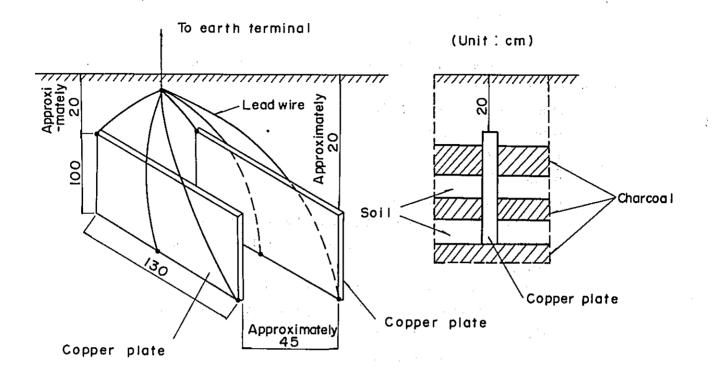
Date: March 22, 1976

Time: 10:30 – 12:00

Weather: Fine

Measured value: 168 ohms,m.

(This value was obtained 3.0 m below earth surface.)



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## Fig. I.7.5.1.

Existing Earth of Maymyo Exchange Office

# PART II OUTLINE OF DESIGN

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### CHAPTER 1 OUTLINE OF INSIDE PLANT DESIGN.

### 1.1 Mayangon Exchange Office

### 1.1.1 Status Quo

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(1) Outline

Mayangon Exchange Office where C2 type automatic exchange will be installed is one of the five exchange offices in the city of Rangoon. ARF-101 automatic exchange with 1,000 subscriber terminals has been installed in this exchange office at present. After the installation of C2 type automatic exchange this ARF-101 automatic exchange is scheduled to be dismantled. Therefore, Mayangon Exchange Office to be equipped with C2 type automatic exchange will become one exchange office in the multi-exchange network in the city of Rangoon so that its numbering plan, charging system, junction circuits, signalling system, etc., have to be coordinated to those of the existing exchange network.

(2) Numbering Plan

The numbering plan of Rangoon exchange network is as follows:

a)	Local number 5 dig	its
	Maungtaulay Exchange Office	1XXXX
	Hanthawaddy Exchange Office	3XXXX
	Insein Exchange Office	4XXXX
	Tamwe Exchange Office	5XXXX
	Mayangon Exchange Office	6XXXX
b)	Special service code 3 dig	its
	Trunk booking	001
	Fault complaint	002
	Time announcement	005
	Ambulance	008
	Police	009
	Fire	000
-)	Travels soll	

c) Trunk call ..... Booking call by dial "001"

(3) Charging

Charging is made by the following method:

a) Local call

Unit fee, untimed.

When the called subscriber answers the individual metering by message register is made.

b) Trunk call

Exchange ticket is recorded by the operator.

- c) Charged special service call
  - Unit fee, untimed.

When the call is answered the metering by message register is made.

- d) International call
  - Exchange ticket is recorded by the operator.
- (4) Routing and Number of Junction Circuits Routing and the number of junction circuits are shown in Fig. II.1.1.1.

(5) Signalling System-

The signalling system which is used is as follows:

- a) Line signals DC signalling
- b) Régister signals

DC signalling consisting of a combination of polarities of A and B wires. It includes forward signal and backward signal.

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### 1.1.2 Mayangon Exchange Office after the Completion of World Bank Project

(1) Outline

The Government of Burma plans to realize a large scale exchange system improvement with a World Bank loan under the schedule of its completion in the fiscal year of 1979. The completion of this project will materialize not only the improvement of automatic telephone switching network in the city of Rangoon but also the automatization of local call service in other major cities of Burma and the subscriber trunk dialling (STD) service among those major cities.

The World Bank Project initially included the new Mayangon Exchange Office. However, the Government of Burma subsequently decided to install C2 type automatic exchange at Mayangon Exchange Office so that the plan was eliminated from the World Bank Project. PTC, anxious to minimize the influence of this decision on the World Bank Project, desires to have the C2 type automatic exchange specifications comply with those under the World Bank Project. As the result of consultation between PTC and the survey team it was so decided that the specifications under the World Bank Project be applied if possible.

The numbering plan, charging system, number of junction circuits and signalling system after the completion of the World Bank Project are as follows:

### (2) Numbering Plan

Rangoon local telephone network numbering plan will be as follows:

a)	Local call	5 digits
	Maungtaulay Exchange Office	70000 - 82599
	Hanthawaddy Exchange Office	30000 33999
	Insein Exchange Office	40000 - 40999
	Mingaladon Exchange Office	45000 – 45999
	Tamwe Exchange Office	50000 - 52999
	Thingangyun Exchange Office	55000 – 59999
	Mayangon Exchange Office	60000 - 61999

These 5-digit numbers are scheduled to be changed to the 6-digit numbers in the future.

### b) Trunk call

	Area code	0 + 1 digit or $0 + 2$ digits
	Subscriber number	5 digits
c)	Special service call	3 digits (1XY)
		X: One of 0–9
		Y: One of 0–9

### (3) Charging

Charging will be made by the following method:

a) Local call

Unit fee, untimed.

When the called subscriber answers the individual metering by message register is made.

b) Trunk call

For STD charging the following two plans are drawn up. It is not yet decided which of the two will be adopted.

i) Charging by periodic pulse

Charged by periodic pulse determined by distance between calling and called parties and call duration.

ii) Toll ticketing

Charged by CAMA (centralized automatic message accounting) System using MFC signal.

(4) Routing and Number of Junction Circuits

Traffic flow diagram including C2 type automatic exchange before and after the completion of the World Bank Project is shown in Fig. II.1.1.2.

### (5) Signalling System

The signalling system to be used is as follows:

- a) Line signals DC loop signalling
- b) Register signals MFC-R2 signalling

### 1.1.3 C2 Type Automatic Exchange

In regard to the installation of C2 type automatic exchange at Mayangon Exchange Office, PTC desires to have the following points satisfied:

a) Before the completion of the World Bank Project Mayangon Exchange Office belongs to the existing local exchange network of Rangoon.

b) After the completion of the World Bank Project Mayangon Exchange Office belongs to the telephone network under the World Bank Project.

It is impossible to comply with all the World Bank Project specifications. The survey team proposed that the World Bank Project plan be taken into consideration in the design of such basic items as numbering plan, charging system, routing and signalling system. PTC approved this proposal.

The outline of C2 type automatic exchange design is as follows:

(1) Numbering Plan

The numbering plan shall be so designed that both the numbering plan used in the existing telephone network and that in the World Bank Project are applicable, and that the numbering plan alteration can be realized by simple means such as jumpering.

(2) Charging

Local call charging by unit fee and exchange ticket by the operator will be continued because nothing impractical is expected with them. Concerning the STD charging after the World Bank Project completion it is not yet decided which of the aforementioned two plans will be adopted; however, as the result of consultation with PTC, it was decided to adopt the charging by periodic pulse from the higher ranked exchange office which is the standard system of C2 type automatic exchange.

Meanwhile, should the toll ticketing system be adopted in the World Bank Project, the ANI (automatic number identification of calling subscriber) facility becomes necessary. Design shall be made so that the equipment to perform the ANI facility can be mounted in the future. Such equipment, when required, is to be procured by PTC.

### (3) Trunking Diagram

The trunking diagram for C2 type automatic exchange to be installed at Mayangon Exchange Office is shown in Fig. II.1.1.3. In this figure, MDF is installed inside C2 type automatic exchange; however, since the outside plant work is carried out first, another MDF shall be installed in the existing exchange office building. Fig. II.1.1.4 shows the layout of existing MDF room of Mayangon Exchange Office.

(4) Signalling System

In the existing telephone network the DC signalling system is adopted whereas in the World Bank Project the MFC signalling system shall be adopted. Therefore, C2 type automatic exchange shall be designed to operate with whichever of the two signalling systems. Design shall also be made so that the signalling system alteration can be realized by simple means such as jumpering.

(5) Traffic

Provided that two C2 type automatic exchanges be installed at Mayangon Exchange Office to accommodate 2,000 subscriber lines, it was decided after the consultation with PTC that the traffic estimate shall be based on the traffic data used in the World Bank Project.

### 1.1.4 Modification of C2 Type Automatic Exchange

(1) Exchange Equipment

C2 type automatic exchange to be installed this time features a good operating record in Japan till now. However, since it continues to be used in Burma for a long time, it shall be cleaned and inspected carefully, and with aged parts renewed. Furthermore, in order that it can operate in the telephone exchange network of Burma its specifications by Japanese standard, such as traffic capacity, subscriber accommodation capacity and signalling system, have to be modified on a large scale. Main items that require modification are as follows:

a) Traffic Capacity

Traffic per subscriber terminal of 0.083 Erl/L shall be increased to 0.16 Erl/L.

b) Subscriber Line Capacity

Line capacity for individual subscribers shall be increased from 800 terminals to 1,000 terminals (including miscellaneous circuits to be accommodated on subscriber terminals, such as AAT and NUT).

c) Signalling System

Line signals and register signals shall be changed to DC signalling and MFC signalling systems, respectively, and at the same time the required equipment shall be additionally installed. d) Temperature and Humidity Conditions

Since the temperature and humidity levels in Burma are higher than in Japan, the exchange shall be equipped with the air conditioner, and at the same time the working temperature range of electronic equipment shall be expanded.

e) Container

The C2 type automatic exchange container cannot contain additional equipment required by increased traffic capacity and subscriber line capacity. Therefore, the container shall be enlarged and at the same time it shall be so arranged that the power supply equipment can be mounted in the container.

f) Numbering Plan

It shall be so arranged that both the existing numbering plan of Burma and World Bank Project can be used.

- g) Maintenance Drawings and Descriptions
   Maintenance drawings and descriptions in English shall be attached.
- h) Maintenance Tools, Tester and Spare Parts

Maintenance tools, tester and spare parts shall be attached.

(2) Power Supply Equipment

Power supply equipment for C2 type automatic exchange receives AC 3-phase 200 V (phase to phase) for rectifying equipment and single phase 100 V for lighting, outlets, etc. However, AC main power supplied in the city of Rangoon is 3-phase 230 V (phase to neutral) and single phase 230 V. Therefore, the modification of rectifying equipment and the insertion of step-down transformer are necessary.

Furthermore, the power supply stability in Burma is not exactly good so that in case of receiving voltage variation by 15% or more and unbalance between phases it is necessary to cut off the input by the phase control circuit, and supply DC power by battery discharge.

The standard C2 type automatic exchange is not provided with an emergency engine generator. However, in consideration of the power supply situation and the desire of PTC and to avoid overdischarge of storage battery at the time of protracted power failure it was decided to install the diesel engine generator.

In regard to 100V wiring for fluorescent lamps, outlets, etc., the step-down transformer shall be used.

Storage battery shall be replaced in consideration of its aging. The battery to be supplied shall have the current supply capacity for eight busy hours.

### 1.1.5 Other Facilities

### (1) Distribution Frame

Distribution Frame (MDF) has been installed inside the C2 type automatic exchange container. In view of the fact that the outside plant work shall be carried out ahead of the installation of exchange another MDF shall be installed in the existing Mayangon Exchange Office building. The outside plant installation work shall be carried out, starting from this MDF. When C2 type automatic exchange is installed, this MDF and that in C2 type automatic exchange shall be connected with tie cables. Fig. II.1.1.4 shows the floor layout of MDF room in the existing exchange office.

### (2) Remote Test Equipment

The subscriber line test for the existing telephone exchanges in the city of Rangoon can be performed not only by the subscriber line test equipment installed at each exchange office, but also by the centralized test equipment installed at Maungtaulay Exchange Office. However, since the interface connection between this centralized test equipment and the subscriber line test equipment of C2 type automatic exchange is extremely difficult, the remote test equipment for C2 type automatic exchange shall be installed at Maungtaulay Exchange Office.

(3) VD Coil

Impedance of C2 type automatic exchange equipment is 600 ohms. For the insertion of loading coil into junction circuit the equipment-line matching is necessary. For this reason, VD coil for impedance matching shall be provided in the existing Mayangon Exchange Office building and Hanthawaddy Exchange Office building.

### 1.1.6 Others

(1) Site plan of C2 Type Automatic Exchange

Site plan of C2 type automatic exchange at Mayangon Exchange Office is shown in Fig. II.1.1.5. The location of C2 type automatic exchange was decided after consultation with PTC by taking the following points into consideration:

a) To be convenient for connection to MDF to be installed in MDF room in the existing exchange office building.

b) To be away from road from the viewpoint of security.

c) To be the place not to exert a serious influence on the construction of building scheduled to be newly built in the future.

d) To be in the direction wherein the influence of temperature rise in the container due to exposure to sunshine can be minimized. Furthermore, to avoid temperature rise in the exchange room during power failure, etc., the sunshine shelter covering the exchange container shall be provided. PTC is to procure necessary materials and carry out the installation.

In order to provide new distribution frame in MDF room of the existing exchange office building the survey of available space was made to confirm the feasibility of its provision.

### (2) Transportation

As the result of consultation with PTC it was decided that the Government of Burma should take care of unloading of equipment and materials procured in Japan at port of Rangoon and their storage and transportation in Burma, as well as procurement of related equipment required. Findings in the survey concerning unloading and transportation availability, etc., are as follows:

a) Unloading

Port of Rangoon unloading facilities are considered to be in no wise problematical. A 40-ton crane is equipped and a enough space for the work is available.

### b) Inland Transportation Facilities

For inland transportation can be used large trailers of the Machinery Department, Ministry of Agriculture and Forestry, which are used for transportation of dam construction equipment and materials. These large trailers include those endure 30 tons or more weight.

They can therefore transport C2 type automatic exchange after modification with an estimated weight of 20 tons. However, their carrier bed length measures 9.6 meters (32 feet) at a maximum so that it is insufficient to cover the estimated length of 12 meters (40 feet) of C2 type automatic exchange after modification. Therefore, it is considered especially careful handling such as fixing the exchange container on the carrier bed of trailer, etc. are necessary.

### c) Unloading at Installation Site

For unloading at the installation site an approximately 40-ton crane is necessary. The movable 40-ton to 50-ton crane is owned by the Machinery Department of Ministry of Agriculture and Forestry, and unloading can be done without any problem by using this crane.

### d) Transportation Route

The survey of transportation route by traveling on it by car proves that the whole route is paved. Road is one lane wide on either side at the narrowest part, and when the unpaved portion is taken into account, the road is generally two lanes wide on either side. No problem is thus found with the road condition of transportation route. There exists no structure, such as tunnel or bridge, throughout the transportation route, which may interrupt the passage of exchange because of its height and weight. However, there are many overhead power lines and telephone lines that traverse the transportation route, and some of them are not likely to have sufficient ground clearance so that at the time of transportation it is desirable to use a guide car to make sure of required ground clearance on the road. For transportation from the road into the exchange site it is necessary to fill up ditches temporarily.

### (3) Power Reception

Initial charging of storage battery installed inside C2 type automatic exchange has to be done after the unloading of exchange at the site. Inter-equipment wiring of C2 type automatic exchange has already been finished so that immediately after the unloading the connection test is made. Therefore, rectifying equipment has to be put into operation without delay and this requires AC input connection.

AC power supply to C2 type automatic exchange is required for each unit separately. Power requirement per unit is 40 kVA in 3-phase AC 230 V (phase to neutral).

Power reception work is to be carried out by PTC as part of construction work. It is important to complete full prior arrangements with Electric Power Corporation so that there shall be no mismanagement in the distribution wire and service wire work, and the connection to service wire can be realized immediately after the completion of exchange unloading at site.

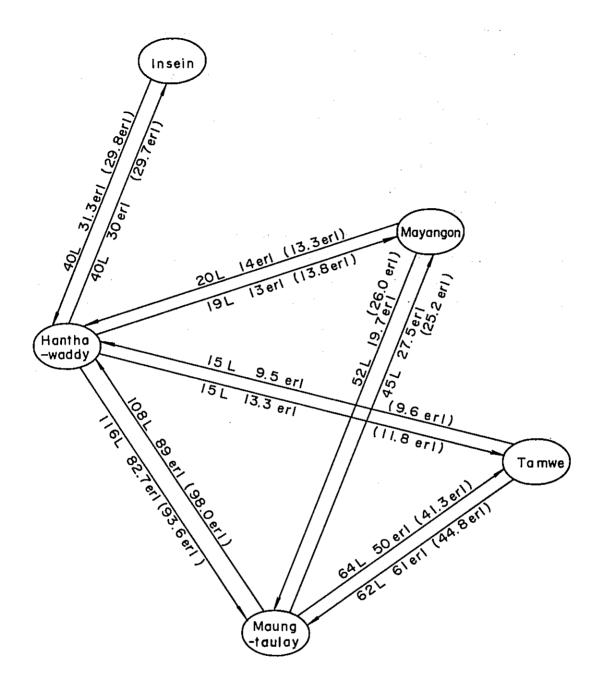


Fig. II. I. I. I Junction Traffic Flow Diagram of Rangoon Network. (Present)

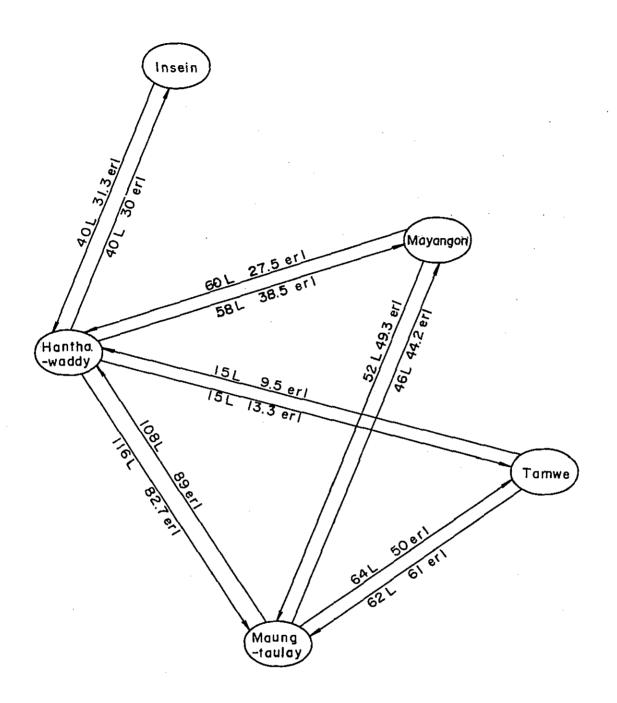


Fig. I.I.I.2.(1/2) Junction Traffic Flow Diagram of Rangoon Network (Before World Bank Project)

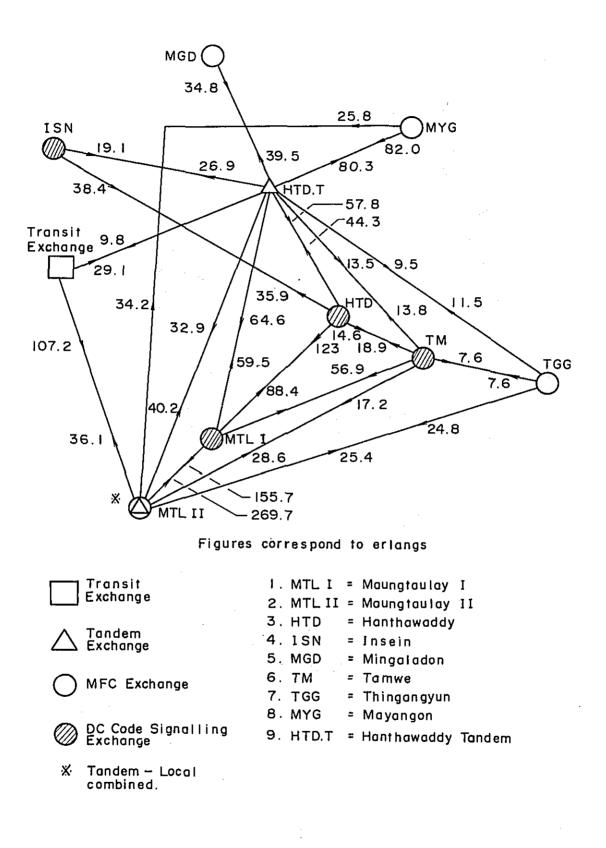
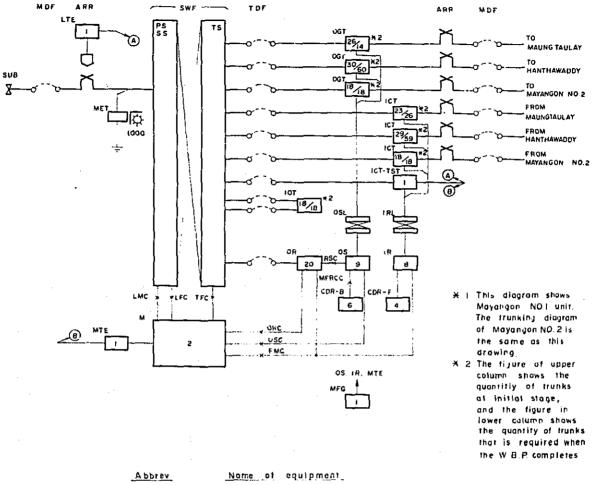
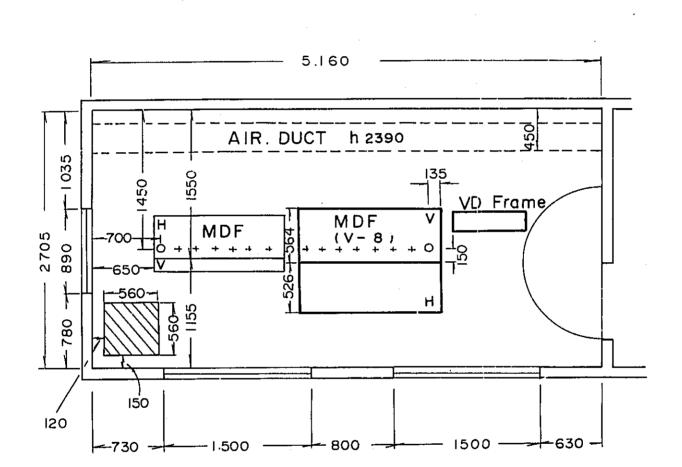


Fig. II. I. 2 (<sup>2</sup>/2) Junction Traffic Flow Diagram of Rangoon Network (After World Bank Project)



ARR	Arrester
CDR-B	Code recolver for backward signal (MFC Signal recoiver)
C D R - F	Code receiver for forward signal (MFC Signal receiver)
107	Incoming trunk
ICT-TST	Incoming trunk for test
107	Intra-office trunk
1 R	In coming register
IRL	Incoming register link
LFC	Line frame connector
LMC	Line marker connector
LTE	Line test equipment
M	Marker
MDF	Main distribution frame
MET	Subscriber meter
MFG	MFC signal generator
MFRCC	MFC signal receiver connecter
MTE	Master test equipment
OGT	Outgoing trunk
OR	Originating register
ORC	Originating register connecter
0 S	Outgoing sender
OSC	Outgoing sender connecter
OSL	Outgoing sender link
PS	Primary switch
RMC	Register marker connector
RSC	Register sender connector
S 5	Secondary switch
SWF	Switch frame
TDF	Trunk distribution frame
TFC	Trunk link connector
TS	Tertiory switch

Fig.II.1.1.3. Trunking Diagram of Mayangon Exchange



Unit : mm

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## Fig. II.I.4 Floor Layout of Mayangon MDF Room

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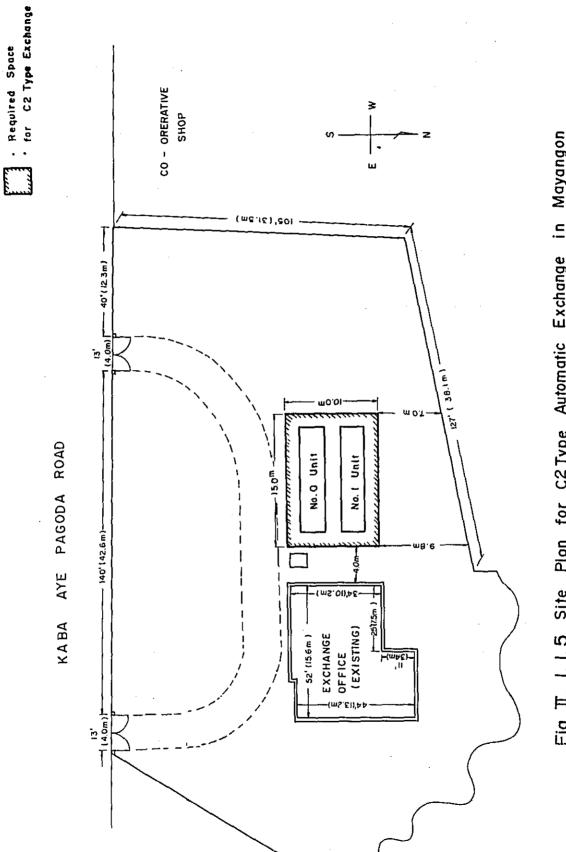


Fig. TL. I. I. 5 Site Plan for C2Type Automatic Exchange in Mayangon

### 1.2 Maymyo Exchange Office

### 1.2.1 Status Quo

The exchange system of Maymyo Exchange Office is the common-battery exchange system. The existing exchange facilities are as follows:

(1) Exchange System

	Common-battery cord switchboard	2 boards 4 positions (capacity: 300 lines)
	PBX	l subscriber
	Public coin box telephone	2 lines
	Trunk circuit	7 circuits
(2)	Police leased-circuit Power Supply Equipment Rectifying equipment:	1 circuit
	48 V, 25 A rectifier	1 set

Storage battery:

### 200 AH enclosed type battery 24 cells

(3) Carrier Equipment

Carrier equipment:

4 CH open-wire carrier equipment 1 system

The exchange system is approximately 30 years old. It had been used at other places before it was transferred to Maymyo Exchange Office and was modified when it began to be used there so that the superannuation is conspicuous.

The power supply equipment was renewed in 1974 so that it is in good condition. It will allow the continued use in the future.

Trunk circuits comprise seven including the circuit to Mandalay, etc. plus one police leased-circuit. All are composed of the open-wire carrier system using both-way trunk equipment (BWT) and the physical circuit. For the signalling system the AC signalling system is used. The police leased-circuit uses magneto telephone set for terminal equipment and is composed of single wire earthed. Routes of trunk circuits are shown in Table II.1.2.1.

Facilities mentioned above have been installed in the switch room and switchboard room on the ground floor of the two-storied wooden exchange office building.

### 1.2.2 C1 Type Automatic Exchange

(1) Exchange Capacity

The number of subscriber lines of Maymyo Exchange Office as of February 1976 is 115 (including public coin box telephones). The calling rate is 0.023 Erl.\*

Because of no plan of Maymyo Exchange Office to be included in the subscriber trunk dialling (STD) network even after the introduction of the automatic system, any rapid increase in the calling rate cannot be expected. The existing waiting applications total 56 so that even considering the increase from now on the two-unit (BSC unit + EXT unit) C1 type automatic exchange capacity\*\* is considered to be sufficient to satisfy the demand.

\* Based on PTC data.

\*\* Traffic capacity: 31.6 Erl.Terminal capacity: 384 terminals.

### (2) Numbering Plan

Maymyo Exchange trunking after its automatization shall not immediately be incorporated in the STD network so that all trunk calls are handled by means of the delay system via manual trunk switchboard. Types of calls handled by the manual trunk switchboard include long distance information and local information besides trunk booking calls. Judging from the traffic of C1 type automatic exchange, there is no specific need for separate numbering for each kind of call so that the common number "109" shall be used for all calls to the manual trunk switchboard.

The subscriber numbers shall comprise four digits (2XYZ), considering the terminal capacity and function of C1 type automatic exchange. A-code "0" shall be reserved since it is required when STD comes into practice and "1" shall be used for special service code.

For emergency calls the Japanese standard system shall be used in view of the function of the exchange. That is to say, "110" shall be applied to police and "119" to fire service. Meanwhile, both "110" and "119" shall have the hold function and moreover the re-ringing shall also be possible with earth sending function added to terminal equipment.

The numbering plan for Maymyo Exchange Office is shown in Table II.1.2.2.

(3) Subscriber Accommodation

The kinds of subscribers to be accommodated shall be limited to ordinary subscribers (including pilot numbers for PBX) and local public coin box telephones. Two-party line and toll public coin box telephone with STD facilities will not be accommodated because these were found not necessary as the result of consultation with PTC. For free of charge terminating lines, "2100" (enquiry, complaint, etc.) and "2200" (fault complaint) shall be prepared. The former shall terminate at the telephone set and the latter at the line test equipment. Terminating calls only can access to these lines mentioned above. As for test equipment, automatic answer trunk equipment (AAT) and trouble indication trunk equipment (TIT) shall also be accommodated onto subscriber terminals and each shall be given a particular subscriber number.

### (4) Charging

Charging shall be of message rate system by means of subscriber message register. The charging system is as follows:

a) Local call

Unit charge shall apply to one local call. One metering is made when the called party has answered. Answer signal can be obtained by polarity reversal and at the same time the register advances one step. With the terminating calls to the free-of-charge lines those operations shall not take place.

b) Trunk call

The trunk call shall be charged, based on the speech time record on exchange ticket made by the manual trunk switchboard operator. Trunk booking, long distance information call and local information call which are handled by "109" shall not be charged. For these calls the polarity reversal at the time of answer shall not take place. When the STD service comes into practice in the future the multi-metering by receiving of periodic pulse from automatic trunk exchange system also becomes possible.

(5) Trunking Diagram

The trunking diagram for C1 type automatic exchange at Maymyo Exchange Office is shown in Fig. II.1.2.1. C1 type automatic exchange is designed based on the traffic capacity of 31.6 Erl. and, when used at Maymyo Exchange Office, the maximum traffic is estimated to be in the neighborhood of 10 Erl. Therefore, two units of exchanges shall be applied on the basis of standard type (BSC unit plus EXT unit). (6) Ringing Signal and Tone

At present, in Burma, the automatic exchange equipment is established in Rangoon City only. Various signal tones used at the time of connection, e.g., busy tone and ringing tone differ from those used in C1 type automatic exchange. After the consultation with PTC it was concluded that the difference would cause no trouble because Maymyo Exchange Office is not included in the nationwide STD network. As the result, it was decided to use ringing signal and tones as they are used in C1 type automatic exchange. Tones and signal to be used are as follows:

Dial tone (DT):	400 Hz ± 20 Hz. Continuous.
Busy tone (BT):	400 Hz ± 20 Hz. 0.5 sec. on; 0.5 sec. off.
Ringing tone (RBT):	400 Hz $\pm$ 20 Hz modulated by 18 Hz $\pm$ 2 Hz.
	1 sec. on; 2 sec. off.
Interrupted ringing (IR):	$18 \text{ Hz} \pm 2 \text{ Hz}$ . $60 \text{V} \pm 15 \text{V}$ .
	l sec. on; 2 sec. off.

### 1.2.3 Modification of C1 Type Automatic Exchange

(1) Exchange Equipment

Since C1 type automatic exchange is to be used as transportable type the inside equipment is designed to be universal. It can perform the requirement of the exchange office concerned by jumpering in it. Therefore, in case the location of installation is changed the jumpering has also to be changed. As it is to be installed at Maymyo Exchange Office this time its jumpering shall be altered.

C1 type automatic exchange to be provided this time features a good operating record in Japan till now. However, since it continues to be used in Burma for a long time it shall be cleaned and inspected carefully, and with aged parts renewed.

This exchange, when used in Japan, receives forced ventilation by the attached ventilation fan while the temperature and humidity of the room in which it is installed are kept at the optimum by the aid of dehumidifier. However, since the temperature and humidity levels in Burma are higher than in Japan, the exchange shall be equipped with the air conditioner.

(2) Power Supply Equipment

Power supply equipment for C1 type automatic exchange receives AC 3-phase 200V (phase to phase) for rectifying equipment, and single phase 100V for lighting, outlets, etc.

However, AC main power supplied in Maymyo is 3-phase 230V (phase to neutral) and single phase 230V. Hence, the modification of rectifying equipment and the insertion of step-down transformer are necessary.

Furthermore the power supply stability in Burma is not exactly good so that in the case of receiving voltage variation of 10% or more and unbalance between phases, it is necessary to cut off the input by the phase control circuit and supply DC power by battery discharge.

The standard C1 type automatic exchange is not provided with an emergency engine generator. However, considering the desire of PTC and the power supply situation it was decided to install two transportable type petrol engine generators for the purpose of avoiding overdischarge of storage battery at the time of protracted power failure.

In order to cope with 100V for lighting in the container and outlets voltage is lowered by the step-down transformer inserted in the low-tension circuit.

Storage battery shall be replaced in consideration of its aging. The new battery shall be 108 AH enclosed type battery having the current supply capacity for eight busy hours.

### 1.2.4 Manual Trunk Exchange System

The existing manual switchboard at Maymyo Exchange Office has subscriber jacks and trunk circuits accommodated in common-battery switchboard. Relay circuits for subscriber jacks and trunk circuits have been installed in the MDF room. After the introduction of the automatic system, trunk circuits shall continue to be used but subscriber jacks shall become unnecessary, and on the other hand the trunk booking, outgoing trunks and dial circuits shall be necessary. As the result of survey it was found that the mounting of dial circuits was impossible and the modification of existing equipment to keep the interface with C1 type automatic exchange was also impossible. For these reasons, instead of utilizing the existing equipment, a manual trunk switchboard shall newly be installed. At present, two boards with four positions of manual trunk switchboards have been installed; however, after the automatic system is coming into practice, the subscriber exchange service of the existing manual switchboard becomes unnecessary and consequently the load of it reduces. Then one manual trunk switchboard with two positions shall be newly provided.

The new manual trunk switchboard and the associated trunk circuit equipment shall be installed in part of the existing linemen's room partitioned and modified into an approximately  $36 \text{ m}^2$  exchange room since the existing exchange room has no surplus space to do so. This plan was approved in the consultation with PTC. Meanwhile, it was decided that the above modification be undertaken by PTC and be finished before the target date.

The manual trunk switchboard to be newly installed is the cord type of Japanese standard (operation voltage: -48V; mainly using parts in crossbar system). It shall take care of both recording and information service so that it shall be provided with the telephone directory shelf. Charging meter and position clock shall not be provided because they are not specifically needed since the number of switchboard and of calls handled is small. This decision was made in the consultation with PTC.

The MDF room layout is shown in Fig. I.1.2.2.

Trunk circuit equipment shall be mainly composed of parts used in the crossbar exchange. This is to facilitate the use of common parts to those of C1 type automatic exchange equipment and manual trunk switchboard.

Of various kinds of power supply for manual trunk switchboard and trunk circuit equipment the main power of -48V shall be supplied from the existing power equipment. +50V booster power, ringing signal and tones shall be supplied from C1 type automatic exchange.

### 1.2.5 Other Facilities

### (1) Distribution Frame

Main distribution frame (MDF) is provided in C1 type automatic exchange and outside cables are, as a rule, directly terminated onto MDF inside C1 type automatic exchange. This time, however, C1 type automatic exchange requires modification and this modification requires a long time so that the installation of exchange becomes possible shortly before the completion of outside plant work.

In the outside plant work, the conductor number checkup from MDF is necessary; however, MDF cannot be used before the completion of C1 type automatic exchange installation. This retards the progress of cable work and, to cope with it, an additional MDF shall be installed in the existing exchange office building. Meanwhile, in the existing exchange office building the manual switchboard is to be installed so that intermediate distribution frame (IDF) becomes necessary. However, both MDF and IDF are small in scale so that they shall not be installed separately and, in their stead, combined distribution frame (CDF) shall be used.

The tie cable shall be used for connecting between CDF and C1 type automatic exchange. This tie cable shall be installed by outside plant work.

(2) Line Test Equipment

C1 type automatic exchange is designed to be installed as an unattended exchange so that it is not provided with line test equipment. It is so designed that the line test trunk of the exchange is operated by remote control from line test equipment in the master exchange office.

However, Maymyo Exchange Office is an attended exchange office so that it has to carry out line test by itself. Therefore, it shall be provided with line test equipment (portable type) of its own. The desk for line test equipment is to be procured in advance by PTC.

(3) Supervisory Equipment

Supervisory equipment, like line test equipment, is also designed for use at an unattended exchange office so that it is to be supervised by remote supervisory equipment of the master exchange office. Since Maymyo Exchange Office is an attended office, supervisory equipment shall be installed in the exchange room in order that the supervising of C1 type automatic exchange, manual switchboard and trunk equipment can be carried out independently. Alarm shall be indicated with lamps and bell.

### 1.2.6 Others

(1) Site Plan of C1 Type Automatic Exchange

Site plan of C1 type automatic exchange is shown in Fig. II.1.2.3. Consideration is made so as to reduce sunshine hours on the longer side of container in order to

minimize the influence of temperature rise in the container due to exposure to sunshine. Although the air-conditioner is to be mounted in Cl type automatic exchange, it is further desired that the sunshine shelter also be provided so as to avoid temperature rise in the exchange room during power failure, etc. PTC is to procure necessary materials and carry out the installation.

(2) Transportation in Burma

As the result of consultation with PTC it was decided that PTC would undertake the unloading and storage of equipment and materials of C1 type automatic exchange after their arrival at Port of Rangoon and transportation to the installation site. Findings in the survey in regard to transportation route and transportation facilities are given below.

a) Unloading at Port of Rangoon

Cranes with more than 10-ton capacity are available so that there is nothing to be questioned with regard to unloading.

b) Crane Truck

Crane truck with more than 10-ton lifting capacity is required; however, the procurement of such crane truck in Burma is possible.

c) Truck

Truck with more than 5-ton capacity is required and it is possible to procure such truck in Burma.

d) Railway Transportation

Railway transportation is necessary between Rangoon and Maymyo. It is considered that by use of low floor wagon the transportation over bridges and through tunnels without trouble is possible.

e) Transportation Route

No specific inconvenience is foreseen in regard to road width and bridge strength on the road between Port of Rangoon and Rangoon Station and between Maymyo Station and the installation site. However, power and telephone lines traversing the road lack overhead clearance in some cases. Arrangement was made that PTC should take necessary action to secure sufficient overhead clearance.

(3) Power Reception

C1 type automatic exchange rectifying equipment for -48V main power supply is capable of floating charge, as well as supplementary charge for storage battery, but is devoid of initial charge facility toward storage battery. Therefore, fully charged storage battery is to be supplied; however, due to long period of transportation, the storage battery will have suffered self-discharge at the time of its arrival at the installation site so that it requires supplementary charge without delay. (Three months after charge are the time limit of effectivity.) Hence C1 type automatic exchange must have its power circuit restored and the rectifying equipment must be put into operation.

C1 type automatic exchange requires two kinds of AC power: 3-phase 230 V (phase to neutral) and single phase 230 V. AC power 3 kVA (3-phase) and 7.5 kVA (single phase) are required per two units (BSC unit + EXT unit). Power reception work is to be carried out by PTC as part of construction work. It is important to complete full prior arrangement with Electric Power Corporation so that there shall be no mismanagement in the distribution wire and service wire work, and the connection to service wire can be realized immediately after the completion of exchange installing.

1

Number of Name of Distant End Remarks Trunk Circuits I Open-wire Carrier Circuit Rangoon Mandalay 3 Open-wire Carrier Circuit t Physical 2-wire Circuit Mandalay Naunghkio L Physical 2-wire Circuit Hsipaw L Physical 2-wire Circuit (Police) Physical Single-wireCircuit Pyinsa I.

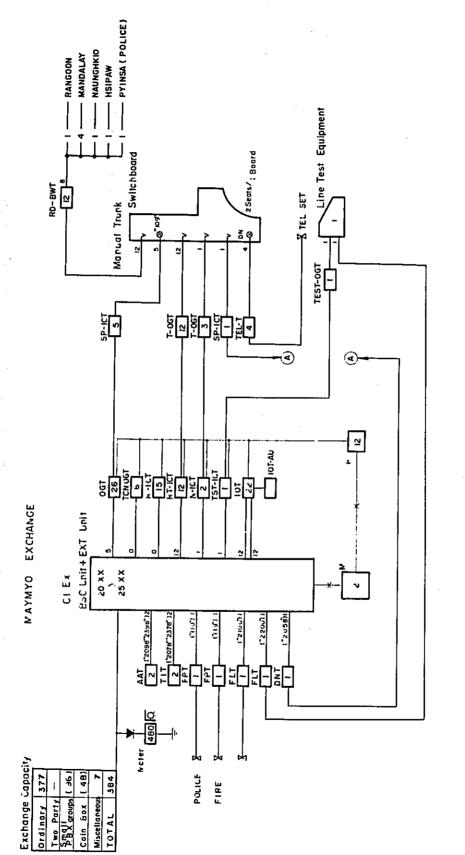
Table II. I. 2. I. Name of Distant End

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Table II. 1.2.2. Numbering Plan

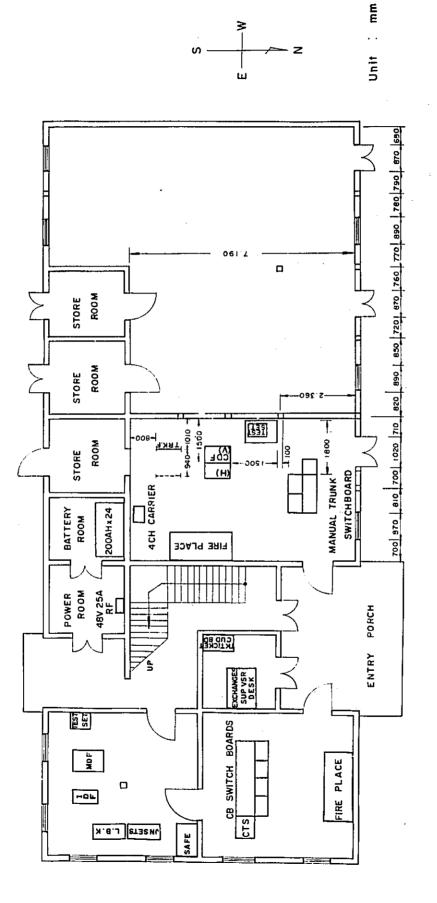
Items	Numbering	Remarks
Subscriber	2 X Y Z	X: 0 ~ 5 Y: 0 ~ 5 · 8 · 9 Z: 0 ~ 3 · 5 ~ 8
Special Service	109	Trunk Booking Long DistanceInformation Local Information
Local Special Service (Emergency)	<u> </u>	Police Fire



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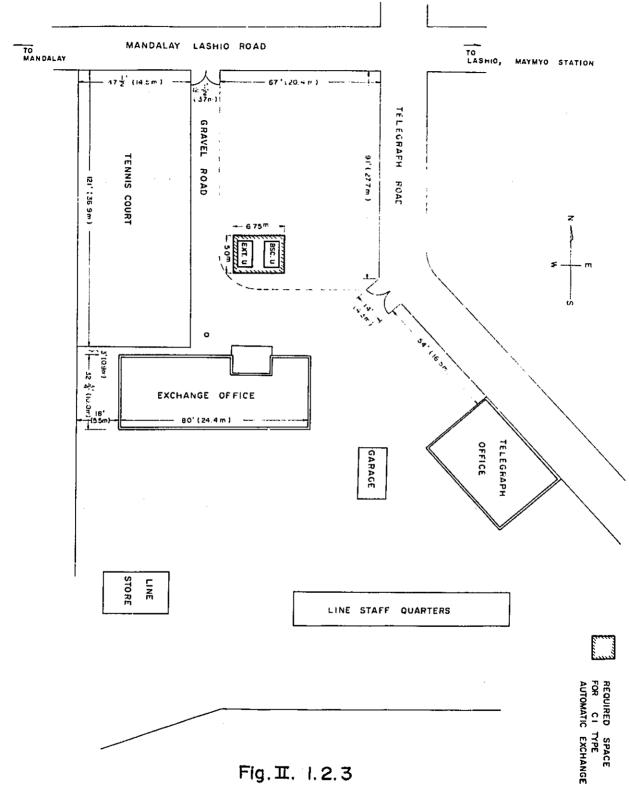
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Fig. II. L. 2. I Trunking Diagram of Maymyo Exchange





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Site Plan for Cl Type Automatic Exchane in Maymyo

#### CHAPTER 2 OUTLINE OF OUTSIDE PLANT DESIGN

#### 2.1 Junction Line

#### 2.1.1 Junction Network Plan in Rangoon City.

The Junction Network Plan in Rangoon City is shown in Fig. II.2.1.1.

This design envisages the laying of 0.9 mm - 400 pair cable as junction cable between Mayangon and Hanthawaddy Exchange Offices as seen in the above figure.

#### 2.1.2 Existing Loading Systems

At present, in the Rangoon City, six kinds of loading systems exist. They are:

a) Between Mayangon and Hanthawaddy Exchange Offices

-		<i>y u</i>
	Mean coil spacing	1,579 m – 100 mH
	Cable conductor diameter	0.8 mm
		R = 70.0 ohms/loop km
		C = 40.0  nF/km
	Impedance at 800 Hz	Z = 1,291.5 ohms
b)	Between Insein and Hanthawaddy	Exchange Offices
	Mean coil spacing	1,852 m – 120 mH
	Cable conductor diameter	0.8 mm
		R = 70.0 ohms/loop km
		C = 40.0  nF/km
	Impedance at 800 Hz	Z = 1,317.5 ohms
c)	Between Hanthawaddy and Maung	taulay Exchange Offices
	In this section the following two k	inds of loading systems exist:
	• Mean coil spacing	1,722 m – 120 mH
	Cable conductor diameter	0.8 mm
		R = 70.0 ohms/loop km
		C = 40.0  nF/km
	Impedance at 800 Hz	Z = 1,362.9 ohms
	• Mean coil spacing	1,060 m – 100 mH
	Cable conductor diameter	0.8 mm
		R = 70.0 ohms/loop km
		C = 40.0  nF/km
	Impedance at 800 Hz	Z = 1,562.6 ohms
d)	Between Maungtaulay and Tamwe	Exchange Offices
	In this section the following two k	inds of loading systems exist:
	• Mean coil spacing	1,408 m - 120 mH
	Cable conductor diameter	0.8 mm
		R = 70.0 ohms/loop km
		C = 40.0  nF/km

	Impedance at 800 Hz	Z = 1,498.3 ohms
0	Mean coil spacing	1,408 m – 100 mH
	Cable conductor diameter	0.8 mm
		R = 70.0 ohms/loop km
·		C = 40.0  nF/km
	Impedance at 800 Hz	Z = 1,364.8 ohms

### 2.1.3 Loading System to be Applied between Mayangon and Hanthawaddy Exchange Offices

As stated in the foregoing, many kinds of loading systems are used in the city of Rangoon. This time, the survey team, by taking the following points into consideration, decided to adopt the H type 88 mH (1,830 m - 88 mH) loading system for the junction cable between Mayangon and Hanthawaddy Exchange Offices and, at Mayangon Exchange Office, to use VD coil for the required junction circuit and, at Hanthawaddy Exchange Office, to use VD coil except for the circuit to be directly connected to Maungtaulay Exchange Office.

a) Impedance mismatching will occur between the existing ARF-101 exchange and the line side, even if whichever loading system previously mentioned is adopted.

b) Impedance of C2 type automatic exchange to be installed at Mayangon Exchange Office is 600 ohms.

c) To realize impedance matching between the line side and the machine side the insertion of impedance matching coil is unavoidable.

d) The H type 88 mH loading system is commonly adopted in foreign countries.

e) As seen in the preceding Paragraph 2.1.2, Items b) and c), the loading system equivalent to the H type is used between Insein and Hanthawaddy Exchange Offices and between Hanthawaddy and Maungtaulay Exchange Offices.

Note: When the H type 88 mH loading system is applied to 0.9 mm PEF-LAP cable, impedance at 800 Hz is 1,014.3 ohms.

#### 2.1.4 Line Structure

The underground line structure shall be adopted for the whole section. That is to say, for approximately 3.9 km from Hanthawaddy Exchange Office to Cabinet No. 108 (No. 655 manhole) the conduit system shall be adopted and for approximately 2.9 km from No. 655 manhole to Mayangon Exchange Office the buried system shall be adopted.

Buried cable shall be laid under the walkway and protected with bricks, for instance. When traversing the roadway or crossing the river alongside the bridge the cable shall be protected with the steel pipe. Two loading coils to be inserted in the buried section shall be installed in the manhole to be newly built. (Refer to Fig. II.2.1.2.)

For junction cable PEF-LAP cable (foamed polyethylene insulated and laminated aluminum and polyethylene with moisture barrier sheathed unit quad cable) will be used. The structure of this PEF-LAP cable is as follows:

Type of Cable	Standard Cable Core Diameter (mm)	Minimum Laminated Sheath Thickness (mm)	Outer Diameter of Cable (mm)
0.9 mm 400 pair unit junction PEF-LAP Cable (Non-armoured)	54	3.4	62
0.9 mm 400 pair unit iunction PEF-LAP Cable (Armoured)	54	3.4	74

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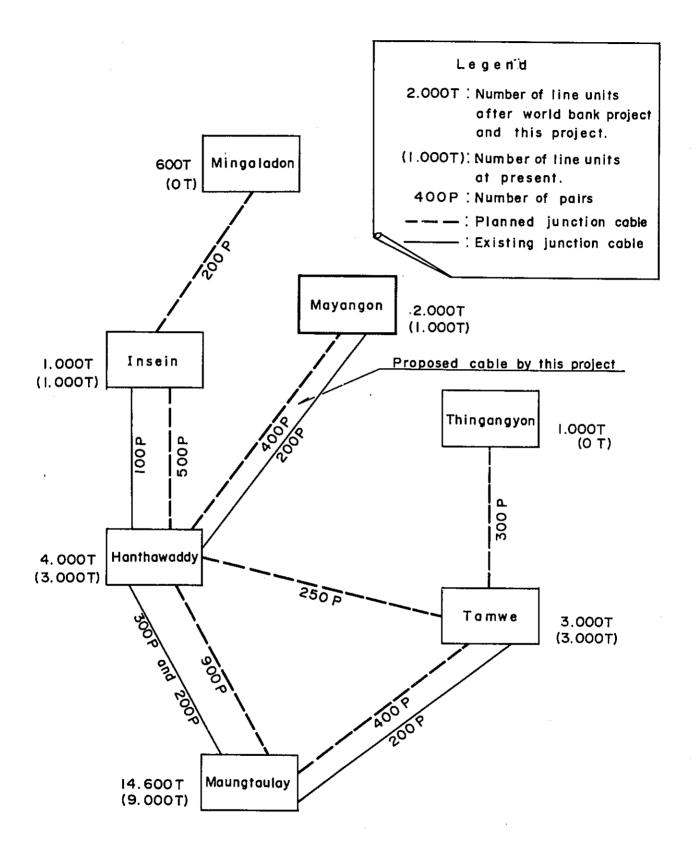
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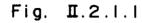
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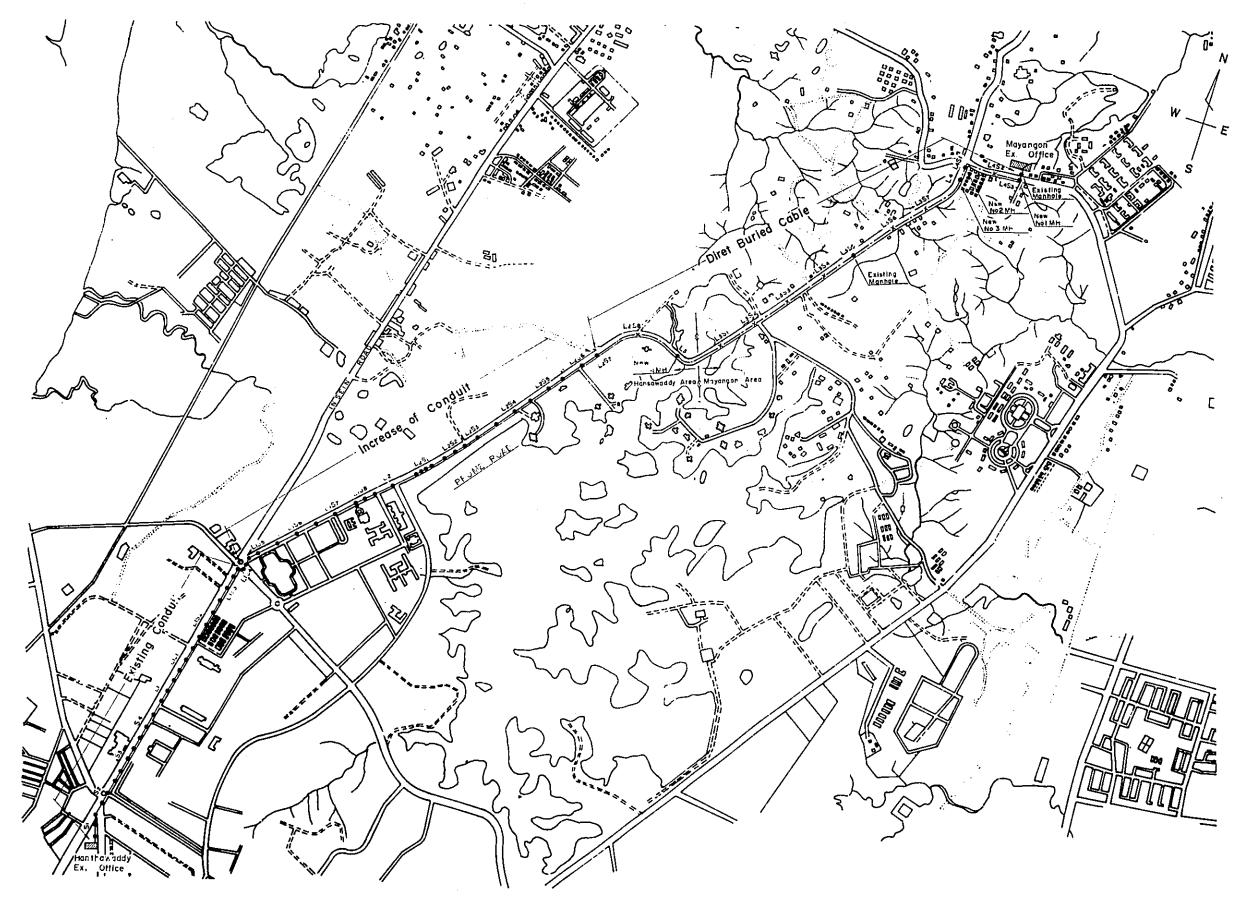




Junction Cable Network in Rangoon after World Bank Project

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Fig. II. 2. I. 2 Guide Map of Junction Cable Route

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2.2 Subscriber's Line

2.2.1 Limit of DC Resistance and Sending Reference Equivalent (excluding telephone set)

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In due consideration of the World Bank's tender specifications, as well as the conditions of operation of C1 and C2 type automatic exchanges, the limit of DC resistance and the sending reference equivalent of subscriber's line have been determined as follows:

Exchange Office	DC Resistance (ohm)	Sending Reference Equivalent (dB at 800 Hz)
Mayangon	1,500	7.0
Maymyo	1,000	7.0

The cable conductor diameter is so designed that 95% of the number of subscriber lines will not exceed the abovementioned sending reference equivalent.

Shown below are the values for each conductor diameter used in the calculation.

Cable Conductor Diameter (mm)	DC Resistance (ohm/loop km)	Electrostatic Capacity (nF/km)	Sending Reference Equivalent (dB/km)
0.4	278.0	50	1.79
0.5	177.4	50	1,35
0.65	105.0	50	0.98
0.9	54.8	50	0.65

#### 2.2.2 Installation of New MDF

In order to reduce the work period it is so designed that MDF will be newly installed in Mayangon and Maymyo Exchange Offices, respectively, in the existing exchange office buildings.

In the case of Maymyo Exchange Office, part of the exchange office building will be remodelled not only for the installation of MDF but for the installation of manual switchboard and related equipments also. (Refer to Fig. I.3.3.3.)

The number of frames of MDF to be newly installed is as follows:

Exchange Office	Number of Frames of MDF	Remarks
Mayangon	8	Including 400 pair junction cable
Maymyo	4	

#### 2.2.3 Lead-in Cable

Lead-in cables of Mayangon and Maymyo Exchange Offices are as follows:

Exchange Office	Total Number of Pairs	Remarks
Mayangon	3,400 (including 400 pair junction cable)	Underground cable Subscriber cable: 2x1,000-pair cables 1x600-pair cable 1x400-pair cable Junction cable: 1x400-pair cable
Maymyo	600	Aerial cable only. 3x200-pair cables

## 2.2.4 Tie Cable between C1/C2 Type Automatic Exchange and MDF to be Newly Installed in Existing Exchange Office Building

Tie cables of Mayangon and Maymyo Exchange Offices are as follows:

Exchange Office	Number of Pairs of Tie Cable	Remarks
Mayangon	2,800	2x1,400-pair cables (aerial system)
Maymyo	600	3x200-pair cables (aerial system)

#### 2.2.5 Distribution Method

In this design the free distribution method using the readyaccess terminal (refer to Fig. II.2.2.1) will be adopted, utilizing CCP-AP-SS cable (color-coded polyethylene insulated and LAP sheathed self-supporting cable) for earial cable.

Cabinet shall not be used. For small branch lines SD wire shall be used.

#### 2.2.6 Line Structure

a) Aerial Line and Underground Line

For aerial line CCP-AP-SS cable and SD wire will be used. The number of cable lines to be strung on the same pole shall be limited to two as a rule.

In the case of Maymyo Exchange Office, aerial cable only shall be used in the whole area. In the case of Mayangon Exchange Office, more than 400 pairs cables shall be installed as buried cables.

For underground line and tie cable of Mayangon Exchange Office PEF-LAP cable shall be used. The classification of cables to be used this time is as follows:

• PEF-LAP cable

Conductor Diameter (mm)		Nur	nber o	of Pairs	
0.4	400	600	800	1.000	1,400
0.5	400	600	—		
0.9	400				

• CCP-AP-SS cable

Conductor Diameter (mm)	Number of Pairs		Pairs	
0.4	30	50	100	200
0.5	30	50	100	200
0.65	30		100	
0.9	30	50		

SD wire

Conductor Diameter (mm)	Number of Pairs
0.65	6
0.9	2

#### b) Laying and Protection of Buried Cable

Buried cable shall in principle be laid under the walkway, and shall be protected with adequate protectors, for instance bricks, as is actually the case with underground cables in Burma.

It is so designed that buried cable, when traversing the roadway or crossing the river either independently or alongside the bridge, shall be protected with steel pipe. c) Riser Cable

For riser cable 0.4 mm - 400 pair CCP-insulated stalpeth sheathed with gas dam and valve shall be used. For the rising portion the protector pipe of Burmese standard shall be used.

#### d) Pole

Poles to be used for earial lines include the Japanese standard poles, Burmese standard poles (spliced poles) and rail poles.

The Japanese standard poles shall be used on the newly designed main route.

According to the survey, the existing Burmese standard poles (spliced poles) can continue to be used. It is so designed therefore that they will be used. However, to avoid confusion of maintenance due to the mixed use of different standard poles, the Burmese standard poles (spliced poles) shall be used as interposal poles in the long span sections of the existing lines and on small branch lines from the existing main lines. Spans between poles on aerial cable lines are designed to be:

Standard span	40-45 m
Maximum span	Nearly 60 m

Туре	Length (m)	*Design Load (kg)	Top Diameter (mm)	Bottom Diameter (mm)
7.0-2	7.0	200	80	173
7.5-2	7,5	200	80	180
7.5-4	7.5	430	150	250
8.0-2	8.5	200	80	187
8.0-4	8.0	430	150	257
9.0-2	9.0	200	80	200

The Japanese standard steel tubular poles to be used are as follows:

\* Safety factor is set at 2.

In the upper part of Japanese standard steel tubular poles five pole steps shall be mounted.

e) Ground Clearance of Aerial Line

Ground clearance of aerial line traversing the main road is designed to be 5 m in principle.

#### f) Stay

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Steel stranded wire shall be used for upper stay and anchor for lower stay. The classification of steel stranded wire and anchor is as follows:

• Upper Stay

Kind of Stranded Wire	*Design Load (kg)				
30 W	1,635				
35 W	2,090				
45 W	2,600				

Lower Stay

Kind of Anchor	*Design Load (kg)
S	2,600
M	3,750

\* Based on safety factor of 2.

#### g) Separation from Power Line

In case the power line is an uninsulated wire the aerial cable line is designed to be separated from such power line by more than 60 cm. The remodelling of power. line for this purpose, including the lift of its height and the replacement of open wire lead-in with insulated wire, is indicated in the aerial cable plan drawing.

Power line remodelling is required at 59 places in the Mayangon Exchange Office area and at 24 places in the Maymyo Exchange Office area.

h) Others

• When in the existing line section where SD wire, etc., is to be newly installed, the existing lower stay is in good condition and can endure the continued use, it is so designed that such lower stay shall be used intact.

• The undermentioned two routes in the Maymyo Exchange Office area exceeds the limit of sending reference equivalent so that the existing open wire shall be used intact. In this case, the pole mounted protector shall be used between SD wire to be newly installed and the existing open wire.

> Terminal portion of Ye chain route (1 circuit: approximately 4.0 km) Terminal portion of Mandalay route (3 circuits: approximately 9.0 km)

#### 2.2.7 Routes Investigated and Measured by PTC

The undermentioned routes in the Mayangon Exchange Office area have been designed, based on drawings made by PTC, for reason of security.

- a) Ady route
- b) Konemyint Yeiktha route
- c) Branch route of Prome No. 3 route
- d) Branch route of Dubern route
- e) Lead-in cable of Trade Corporation No. 19

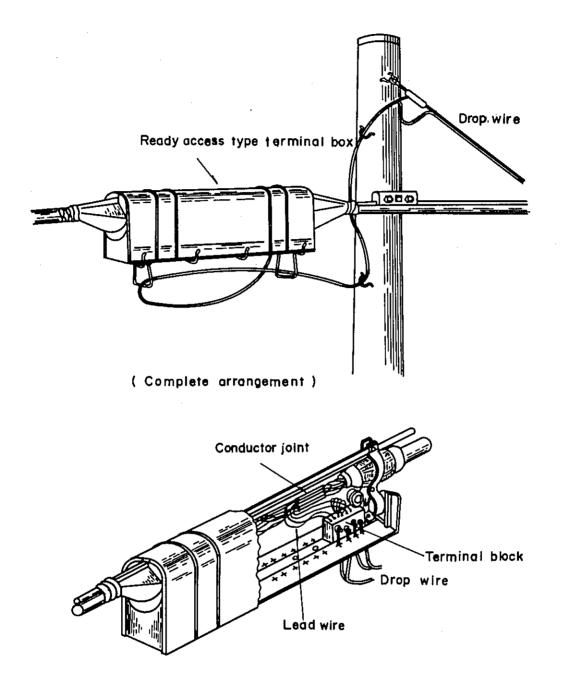
#### 2.2.8 Routes Temporarily Accommodated in Mayangon Exchange Office

In regard to each of the undermentioned routes which belong to other exchange office areas but are to be accommodated in Mayangon Exchange Office temporarily until the completion of the World Bank Project, terminal boxes shall be mounted, at a pole on the boundary between exchange office areas, on both cables from Mayangon Exchange Office and the existing cable of such route, and these terminal boxes shall be connected with a drop wire. Terminal boxes to be mounted on the existing cables are of Burmese standard.

Route	Number of Terminal boxes of Burmese Standard to be Mounted
Kaba Aye route	2.
Parami route	3

### 2.2.9 Line Names and Pole Numbers Used in The Drawing

Line names and pole numbers used in the drawing are determined in the consultation with PTC.



Arrangement inside ready access terminal box (Example of drop:wire from aerial cable ready access terminal box)

Fig. II.2.2.1 Ready Access Terminal Box (Copied from CCITT Local Telephone Network)

#### 2.3 Gas Equipment

As stated in the preceding Paragraphs 2.1 and 2.2, multi-pair underground cables for both junction cable and subscriber's cables shall be laid in the Mayangon Exchange Office area. Gas system to supply dry air to these multi-pair underground cables shall be established at Mayangon Exchange Office. Main equipments of gas system are dry air supply equipment and distribution equipment.

#### 2.3.1 Dry Air Supply Equipment

Dry air supply equipment supplies dry air automatically and continuously. Dehumidifier system adopts non-heating desiccant recycling.

#### 2.3.2 Distribution Equipment

Distribution equipment is used to distribute the dry air supplied by dry air supply equipment to each cable. Distribution equipment is provided with monitor device to check the flow rate of dry air to each cable. When the flow rate (which can be adjusted) exceeds the fixed level, alarm is issued.

#### 2.4 Subscriber's Premises Plant

Subscriber's permises plant is from the terminal box of aerial cable to the subscriber's telephone set. It is composed of self supporting type drop wire, indoor wire and telephone set.

In the case of Mayangon Exchange Office the rosette shall be used between drop wire and indoor wire and in the case of Maymyo Exchange Office the subscriber's telephone protector shall be used in the same way.

#### 2.4.1 Self Supporting Type Drop Wire

For drop wire the self-supporting PVC insulated drop wire shall be used.

Conductor diameter	0.65 mm
Supporting wire diameter	1.2 mm
Supporting wire strength	71 kg

#### 2.4.2 Rosette

Rosette is a terminal which is used for connection of drop wire and indoor wire in Mayangon Exchange Office area.

#### 2.4.3 Subscriber's Telephone Protector

Subscriber's telephone protector is installed at the connection point of drop wire and indoor wire in Maymyo Exchange Office area. It is furnished with fuse and arrester. Earth bar is used for it.

#### 2.4.4 Indoor Wire

Indoor wire is PVC insulated with conductor diameter of 0.65 mm. It is used for indoor wiring.

### 2.4.5 Indoor Terminal Block

In the case of cable or SD wire is led-in PBX, indoor terminal block is used in the building.

#### 2.4.6 Telephone Set

Telephone set to be used this time is 630 type telephone set so far used in Japan. Since it shall continue to be used for a long time in Burma, inspection of parts should be carried out and aged parts should be replaced.

Telephone set shall be remodelled to suit the conditions of operation of C1 and C2 type automatic exchanges.

#### 2.5 Others

#### 2.5.1 Keeping in Order of Aerial Cable Records

As stated in Part II, Paragraph 2.2.9, the survey team indicated the pole route names and pole numbers in the aerial cable plan drawings. This is as decided in the consultation with PTC from the viewpoint of keeping plant records in good order after the completion of the project.

To cite the existing case with Mayangon Exchange Office, the DP number is indicated at each distribution point but no indication is given on ordinary poles. This is the case with Maymyo Exchange Office also.

However, considering that the number of plants will be increased considerably in this project, it is desired that the plant records be kept in good order after the completion of the project. To begin with, the pole route names and pole numbers should be indicated on the poles and in the drawings concerned.

Keeping of plant records in good order is necessary and useful from the following viewpoints:

a) From Viewpoint of Maintenance

Outside plant lies extensively in the exchange office area concerned. To cite an example, when a trouble has occurred, and if the plant records are kept in good order, the exchange of information among maintenance personnel can be easily and accurately carried out.

b) From Viewpoint of Construction

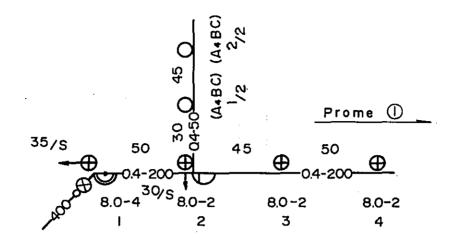
In case a new construction work is to be done years after the completion of this project or in case more subscribers are to be newly accommodated, if the pole

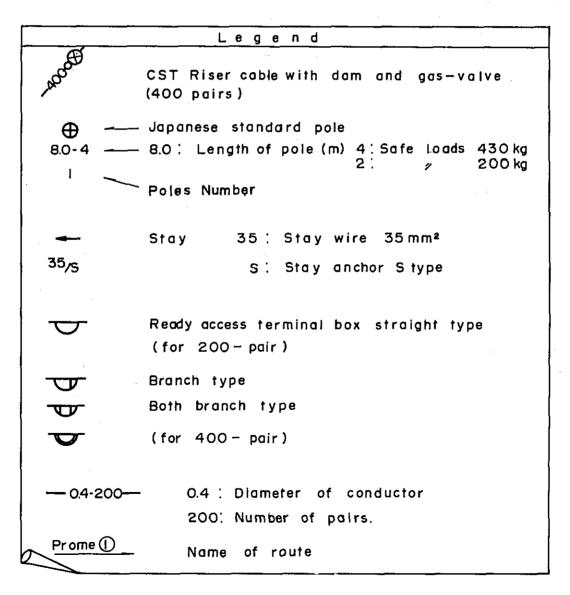
numbers are available and each pole can be identified, it is possible to proceed with the construction work speedily and correctly. One typical example is given in Fig. II.2.5.1.

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#### 2.5.2 Indication of Connection Points of Underground Cable

For the same reasons as in the preceding paragraph it is desired that the connection points of underground cable be indicated at the location where the cable is buried and, at the same time, be indicated with an offset in the drawing concerned. One typical example is given in Fig. II.2.5.2.





# Fig. II.2.5.1 Example of Aerial Cable Plant Record

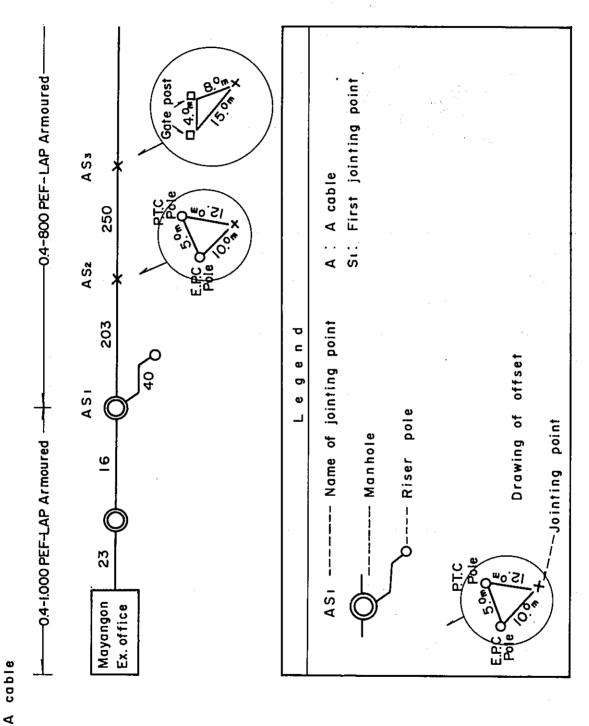


Fig. II.2.5.2 Example of Underground Cable Plant Record

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#### CHAPTER 3 AMOUNT OF ESSENTIAL WORKS OF THIS PROJECT

#### 3.1 Amount of Essential Works for Inside Plant

The amount of essential works for inside plant is given in Table II.3.1.1 and Table II.3.1.2.

and and the second

#### 3.2 Amount of Essential Works for Outside Plant

The amount of essential works for outside plant is given in Table II.3.2.1, Table II.3.2.2 and Table II.3.2.3.

### 3.3 Amount of Essential Works for Gas Equipment

The amount of essential works for gas equipment to be established in Mayangon Exchange Office is given in Table II.3.3.1.

### 3.4 Amount of Essential Works for Subscriber's Premises Plant

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The amount of essential works for subscriber's permises Plant is given in Table II.3.4.1 and Table II.3.4.2.

Table	I.3.1.1	1. Series de la composition de la compo	
List of Essential Work			

Items	Quantity	Remarks
C2 Type Automatic Exchange (Modification)	2 units	An
C2 Type Automatic Exchange	2 units	
Remot <b>e Test Equi</b> pment (in Maun <b>y</b> taulay)	lset	Including Alarm Receiver
Main Distribution Frame	8 verticals	
Frame for VD coil (in Mayangon)	set	VD coils 320 pieces
Frame for VD coil ( <del>in</del> Hanthawaddy)	l set	VD coils 240 pieces
Cable Platform	l set	
Tie - bar	l set	·····
Construction of Foundation	l set	Including grounding
Roofing	l set	
A.C. Power Reception	l set	

Table I.3.1.2.

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# List of Essential Works for Maymyo Exchange

ltems	Quanitity	Remarks
C   Type Automatic Exchange (Modification )	2 units	
C   Type Automatic Exchange	2 units	
Manual Trunk Switchboard	2 seats, Iboard	
Line Test Equipment	lset	
Trunk Frome	l frame	
Toll Outgoing Trunk Equipment	lācir:cuits	
Special Service Code Incoming Trunk Equipment	6 circuits	
Telephone Trunk Equipment	4 circuits	
kile Line Indication Equipment	l set	
Test Outgoing Trunk Equipment	l circuit	
Ringdawn Bothway Trunk Equipment	12 cir cults	
Supervisory Equipment	l set	· · · · · · · · · · · · · · · · · · ·
Combined Distribution Frame	4 verticals	
Cable Platform	l set	
Tie - bar	iset	
Remodeling of Building	36 s quaremeters	
Construction of Foundation	l set	Including grounding
AC Power Reception	l set	3 phase and single phase
Roofing	iset	

Amount of Essential Works for Junction Cable

	Item	Unit	Amount
5	0.9-400 PEF-LAP (conduit cable)	m	3,891.0
Cable Installation	0.9-400 PEF-LAP (direct buried cable)	y	2,873.9
Cable Instal	Total	M	6,764.9
	llation of loading (88 mH – 400pair)	pcs	4
	Cable termination	pc s	2
] F - LAP)	Jointing ( manhole )	"	22
jolnting 400 PEI	-ditto - (direct buried section)	"	8
Cable ( 0.9 - 4	Jointing of loading coll (manhole)	"	4
	Total	"	36

T - 1.	- 177	, .	.2.(
Tabl	e 11	Z	

2.(1/2) Amount of Essential Works for Outside Plant in Mayangon

	•		Item	Unit	Amount	Remarks		<u>.</u>	Iter			Vi.it	Amount	Remarks					
	ŀ		0.4 - 30	m	230	CCP-JF Coble		I	ndoor	İOpa	ıir	205	34						
ļ	Į –	ļţ	- 400		1,832	PEF-LAP Cable	ľ	i		Stralg Type	ht	pcs	568						
		e	600		1,673			box	pair	Branch	Ťуре		49						
	cable	cable	800		1,203	· ·			200 p	Both b			2						
ļ	ĺ	۲.	1 000	<u> </u>	407	•	рох	terminal	8	Type Total			619	·					
	Underground	buried	0.5 - 400		2,730	*		access		Strolg	ht	pcs							
	e rg r	e c t	600	·	368		Termina)	900	pair	Type Branct	Туре		8						
	puŋ	ā	0.9 - 400		4,654	•	Tern	Ready	400	Both I		~							
			Total		13,097			æ		Type Total	- <b>4</b>		17	 					
		PEF-	0.4 -1 400		27	Tie coble IMDF ~ C2 type)		s	ئــــــــــــــــــــــــــــــــــــ	rminal	box	pcs	272						
			0.4 - 30	-	14,162	(mb) ~ 02 ()per	4	pair	teri	minal b	lock	pcs	416						
			50	1.	9,467				0	.4 - 1	000	pcs	2	· · · · · · · · · · · · · · · · · · ·					
			100	•	6.872			ation	<u> </u>	1		-	4	Tie cable (MDF ~ C 2 type)					
ion		υ	200	<u>†-</u> .	4,296			termination	0	.5 -	600		1	INDI CETTE					
alla		cable	0.5 - 30		4,135				0	.9 ~	400	•	1						
installation		s	50	1.	2,071			Cable		Tota		•	8	[					
		ŝ	~ - 100	1.	2,130				0	4 -	400	pcs	2	М.Н.					
Cable	coble	- -	200	1.	3,273							<b>—</b>	•	600	•	1	•		
0	0		0.65 - 30	•	2,826														• - 1
	_	- -	- 100		3,999			<u>e</u>	0	.5 -	600	•		•					
	A erial	ບ ບ	0.9 - 30		1,470				0	.4 -	4 00	pcs	5	Direct buried section					
			50	·	2,409			cable		• _	600	-	6						
	ļ		Total		57,137			g		• •	800		5	4					
			2 S D	m	2,053		fing	gro und		1	000	•	I	*					
		wire	6 S D	-	23,581		join	nder	0	.5 -	400	•	12	•					
		sD	Total		25,634			5		• -	600	-		•					
R	ise	r	0.4 - 400	pcs	17	CST cable	a b l e		0	.9 –	400		19						
c	abl	e		(m)	(4194	5	ິວ			Tota	1	-	56						
	D	rop	wire	m	7,061				0	.4 ~	30	pcs	34	Including one jointin of SS cable and JF coble					
											50	-	36						
					cable		-	100		42									
										• -	200	-	31						
			•					lerial	0	.5 -	30	~	8						
							1	4			50	•	7						

50

100

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Table 0.3.2.2.(2/2) Amount of Essential Works for Outside Plant in Mayangon

	•	tem	Unit	Amount	Remarks		•	• • •	Unit	Amount	Remarks
<u> </u>	<b>۱</b>				remui KS			tem		Amount 52	Remarks For reference
		0.5 - 200	pcs	13			- V	Vooden pole	pcs -		I.AI LAISLANCO
2	cable	0.65 - 30	•	6		1. ja	stay	30 S W	pcs	674	· · ·
jointing	cat	- 100	•	13	1			35 SW	•	26	N 1
	Aerial	0.9 - 30	•	4		х	Upper	45 S W	•	53	
Cable	Aei	- 50	·	6		; t a		Total	•	753	
	ļ	Total	•	206		S	stay	'S type	pcs	739	
		7.0 - 200	pcs	1 1 5				М туре	•	3	
. •	puq	7.5 - 200	•	483			Lower	Total	•	742	
· .	s tandand	#	•	4 .		Wir	e :	suspension	m	9 63	Including over road stay
		8.0 - 200	•	196		Gas pre-	system	Dry air supply egulpment	se t	1	
	nes	+	•	5		G ds	sys	Dry air distribution equipment		. 1	
	Japanese	9.0 - 200		17			•				
lion		Total	•	820				· ·			
ins tallation		А. В.	pcs	108							
ins t		B. C.	•	26							
	ard	A4B C	•	170							
Pole	standar	A B C	•	4 7	1						
<u>a</u>		B4C D	•	11							
	nese	вср	•	13							
·	Burmes	Total		375							
		5 A	pcs	8							
		Rartial Installation V V I	1.	30	· ·						
		2 5 Total	•	38				•			
		T A	pcs	2	For reference						
		А В —	•	99	•	1			•		
		вс		43	•						
		т А.В	•	1	•			·			
5	ord	ABC	•	68	+	1				· .	
r e m o v a l	standar d	АВС		100	•						
<sup>2</sup>	۳ I	вср	-	5	•				•		
<u>ه</u>	ese		•	-		1					
Pole	Burmese	BCD Total	•	334	· · · · · ·	1					
				·	1						
		Dismonting Total	pcs.	2	•	1					
				2	•						
		Rail pole	,	3		]					

		Item	Unit	Amount	Remaks			Item	Unit	Amount	Remarks
Aerial cable	CCP - AP - SS cable	0.4 - 30	m	10,224				7.0 - 200	pcs	10	:
		- 50	4	5,109	· · · · · · · · · · · · · · · · · · ·		standard	7.5 - 200		224	
		4 -100		1,908				+ - 430		5	
		-200	"	3,121	Including tie cable		apanese	8.0 - 200		1,61	
		05 - 30	•	6,348			Japo	9.0 - 200	7	4	:
		r - 50	•	1,981		L o	-	Total	+	404	
		Total	•	28,691		stallation		A B	pcs	77	
	SD wire	2 S D	m	1,904		stal	τ	вс	•	6	
		6 S D		9,959		1	standard	A4 B C		100	
		Total		11,863	· · ·	Pole star	ABC	•	9		
Drop wire m			m	3,571		ă	e Se	вср	,	3	
	1	ndoor 10 pair	pcs	3		n 	urmese	Total	•	195	
XOQ	<ul> <li>Ready access</li> <li>terminal box</li> </ul>	Straigh ≿ type	pcs	167			8	το 10 10 10 10 10 10 10 10 10 10 10 10 10	*	3	
		Bronch type		24	•			Partioi Installation Lotal Lotal	"	3	
lerm ind i		N Total	•	191			_	ŤΑ	pcs	3	For reference
-		terminal box	pcs	76				G A	"	68	
4 pair terminal block pcs 99					вс	*	4				
Pole mounted protector pcs 3 2 p		2 pair			ТАВ		6	, ,			
	сб	ble termination 0.4 - 200	pcs	9	Including tie cable	1070	standard	A+ BC	•	85	· ·
	CCP - AP - SS Cable	0.4 - 30	pcs	21		Pole Removal	Burmese sta	АВС	4	17	"
ğ		+ - 50		16				B4 C D	•	17	"
Jointing		+ <del>-</del> 100	~	7				вср	4	14 :	*
ple		* - 200	"	20				CDE	•	2	•
		0.5 - 30	4	14				Tatal	•	216	,
		<i>*</i> 50	•	6				, Rail, Pole	pcs	21	ů
		Total	4	84				Wooden pole	pcs	20	\$
							۵y	30 SW	pcs	328	
							Upper st	35 SW	•	41	
							dc'U	Total		369	
						Stay	ň	S type	pcs	313	
	:						Lower stay	M type	•	5	
							Low	Total		318	
						<b></b>	Vire	suspension	m	398	Including over road sti

# Table I.3.2.3 Amount of Essential Works for Outside Plant in Maymyo

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# Table II.3.3.1 Amount of Essential Works for Gas Equipment in Mayangon

Item	Unit	Amount	Remarks
Dryair supply equipment	set	I	
Dry air distribution equipment	set I		
Gas pipe	set	ł	

# Table I.3.4.1Amount of Essential Works for Subscriber'sPremisesPlant in Mayangon

Item		Unit	Installation	Total	Remarks
	ephone	pcs	I,500 (858) <b>米</b>	1,500	Including spare tele -phone for applications
	Public coin box telephone		15	15	
d- in (wire)	Cable	*	12	12	
Lead- in able (wir	SD wire	•	11	1.1	
Leac cable	Dropwire	"	1,393	1,393	

st This figure shows number of the existing subscriber lines.

# Table II.3.4.2 Amount of Essential Works for Subscriber's Premises Plant in Maymyo

Item		Unit	Installation	Total	Remarks
Teleph	one	pcs	300 (1 15) <b>≭</b>	300	Including spare tele -phone for applications
	coin box ephone	"	6	6	
	Subscrber's telephone protector		308	308	
Lead-in cable (wir.e)	Cable	η	J	1	
Cal cal (wi	Drop wire	7	307	307	

\* This figure shows number of the existing subscriber lines.

