III Facsimile System	Facsimile	76 sets	Facsimile	76 sets

3-3 Outline of the Plan

(1) Administrative Agency and Operating Agency for the Project

The Communications Division of the Royal Thai Police Department, the administrative agency for the project, consists of four sub-divisions and a maintenance centre.

The Division has about 730 members including about 210 engineers and technicians(1988). It assumes all the responsiblities for police communications facilities all over the country, including arrangement, planning, design, construction, maintenance planning, disposition of the necessary personnel, maintenance services and so on. In particular, the Communications Division has a maintenance centre, named Parusakawan Maintenance Centre that maintains the communications facilities of the Bangkok Metropolitan Police Bureau.

The operating agency is the Bangkok Metropolitan Police Bureau.

The Metropolitan Police Bureau which has about 13,500 policemen (1987) is in charge of maintenance of the public peace in the metropolitan area of Bangkok. The area

consists of Bangkok and Thonburi, a city on the other side of Bangkok.

The area is divided into 3 divisions (Northern Bangkok, Souther Bangkok and Thonburi). There are 69 police stations in the area.

The Metropolitan Police Bureau is made up of 6 divisions: General Staff Division, Metropolitan Patrol Special Operations Division, Traffic Police Division, and the Northern and Southern Bangkok and Thonburi Metropolitan Police Divisions. The 191 Centre is included in the Metropolitan Patrol Special Operation Division.

(2) The Basic Plan

This communications system of the 191 Centre is made up of the following system.

- o 191 Call System
- o Radio Communications System
- o Facsimile System

(3) The outline of the Equipment

The outline of the equipment for the project is shown in Table 3-2.

Table 3-2. The outline of the equipment

System	Equipment	Qty.	Specification
I 191 Emergency Call System	1. Map display processing unit	1 set	The processing unit is used for dispatching and leading patrol cars to the scene of an emergency. The consoles can search for the map of the particular area from the unit. The processing unit can transmit the map to the displays of the receiving console, radio patrol dispatching console, supervisory console and emergency operation control console. All these consoles are equipped with displays and operation boards.

I 191 Emergency Call System	2. Character display processing unit	1	This unit inputs and manages the records of emergency calls and then transmits the contents transmits the contents to radio patrol dispatching consoles and others. The emergency call receiving console, radio patrol dispatching console, supervising console and emergency operation control console are equipped with character displays.
	3. Emergency call receiving console	7	This console receives emergency calls from the public and manages them by using a digitizer, push buttons, and transmits the contents of the call to the radio patrol dispatching console. This console is equipped with a map display and a character display.
	4. Radio patrol dispatching console	3 sets 2 seats for 1 set	The dispatching console holds the radio communication system to send orders to patrol cars. This console is equipped with a map display, a character display

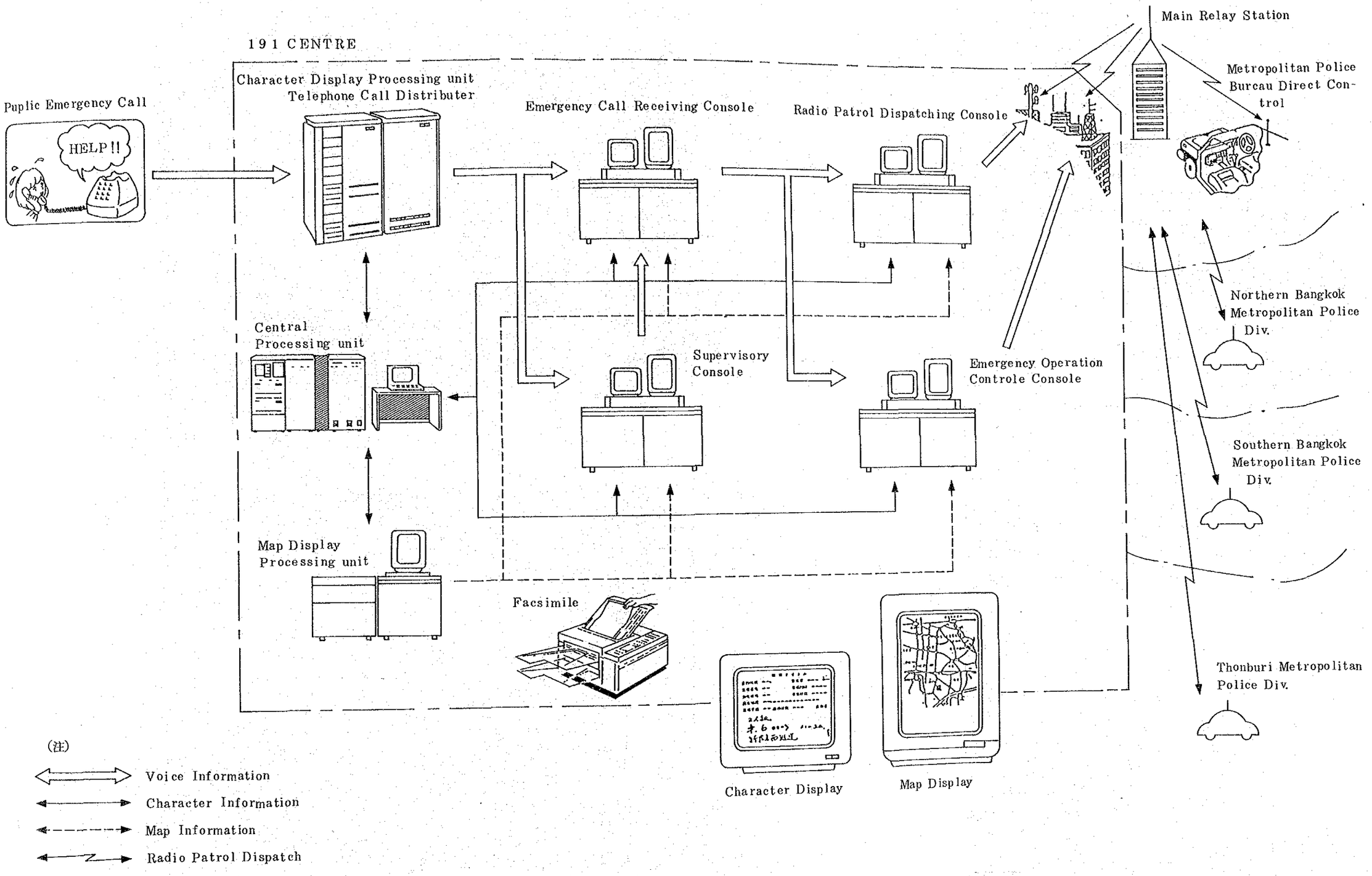
			and push button.
I 191 Emergency Call System	5. Supervisory console		This console manages all the emergency call consoles, and supervises the receiving console to be sure it works adequately. When a serious case happens, the managing staff member himself receives an emergency call directly. This console is equipped with a map display, and a character display.
	6. Emergency operation control console	1	This console completely manages the radio patrol dispatching console. When a serious case happens, the managing staff member himself can order patrol cars and others. This console is equipped with a map display and a character display.
	7. Fixed radio equipment	10	This equipment allows directions of the Metropolitan Police Divisions, police stations and patrol cars through the main or back-up relay stations.

I 191 Emergency Call System	8. Multichannel logging recorder		This is the recorder of emergency calls and radio communications.
	9. Emergency power supply	1	This equipment is an engine generator and storage battery that supplies electric power in case of a power failure.
	10. Police activity operation display	1	This equipment displays the details of emergencies within the area of the police station and the activities of patrol cars. The maps are to be prepared by the Thai side.
II Radio Communications System	1. Main relay station (1) Aerial equipment	1 set	Antenna, feeder, duplexer, and others
	(2) Relay equipment	5	This equipment is a VHF transmitter-receiver that repeats the communications between the 191 Centre and the police stations and patrol cars.
	(3) Control and monitoring equipment	1	This equipment monitors and controls the condition of the radio relay station and the

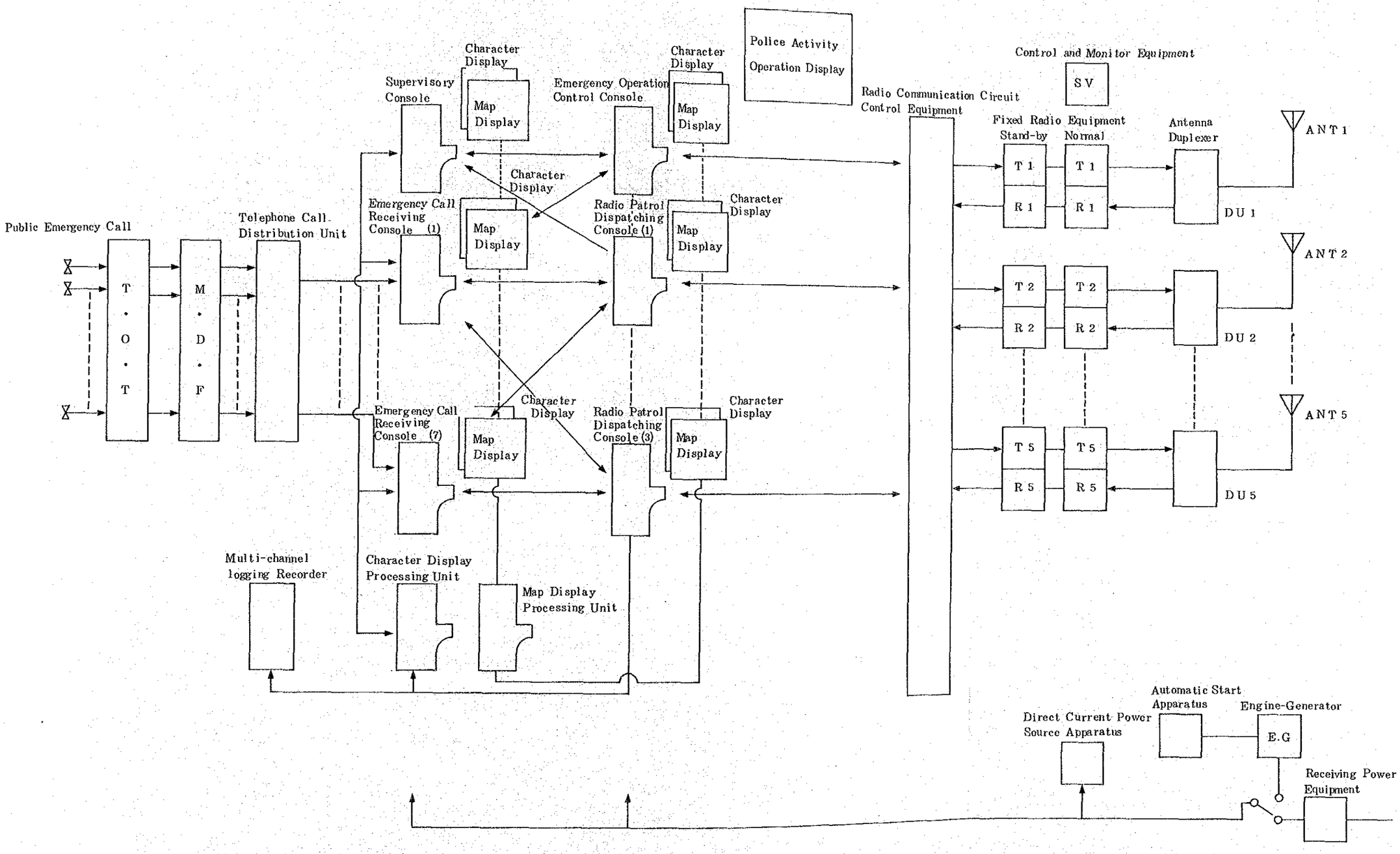
Ⅱ Radio Communi-cations System			action of the relay equipment.
	(4) Emergency power supply	1	An engine generator and a storage battery that supply electricity in case of a power failure.
	2. Back-up relay station (1) Aerial equipment	1	Antenna, feeder, duplexer, and others
	(2) Relay equipment	5	This equipment is a VHF trans-mitter-receiver that repeats the communications between the 191 Centre and the police stations and patrol cars.
	(3) Control and monitoring equipment	1	This equipment monitors and controls the condition of the radio relay station and the action of the relay equipment.
	(4) Emergency power supply	1	An engine generator that supplies an electric power in case of a power failure.

Ⅱ Radio Communi-cations System	3. Fixed radio equipment	75	VHF transmitter-receiver that is installed in the Metropolitan Police Divisions, police stations and others.
	4. Mobile radio equipment	250	VHF transmitter-receiver that is loaded onto patrol cars.
	5. Hand-held radio equipment	220	VHF transmitter-receiver that is carried by the policemen.
Ⅲ Facsimile System	Facsimile	76	The equipment that transmits documents in writing between the 191 Centre and the Metropolitan Police Divisions and police stations.

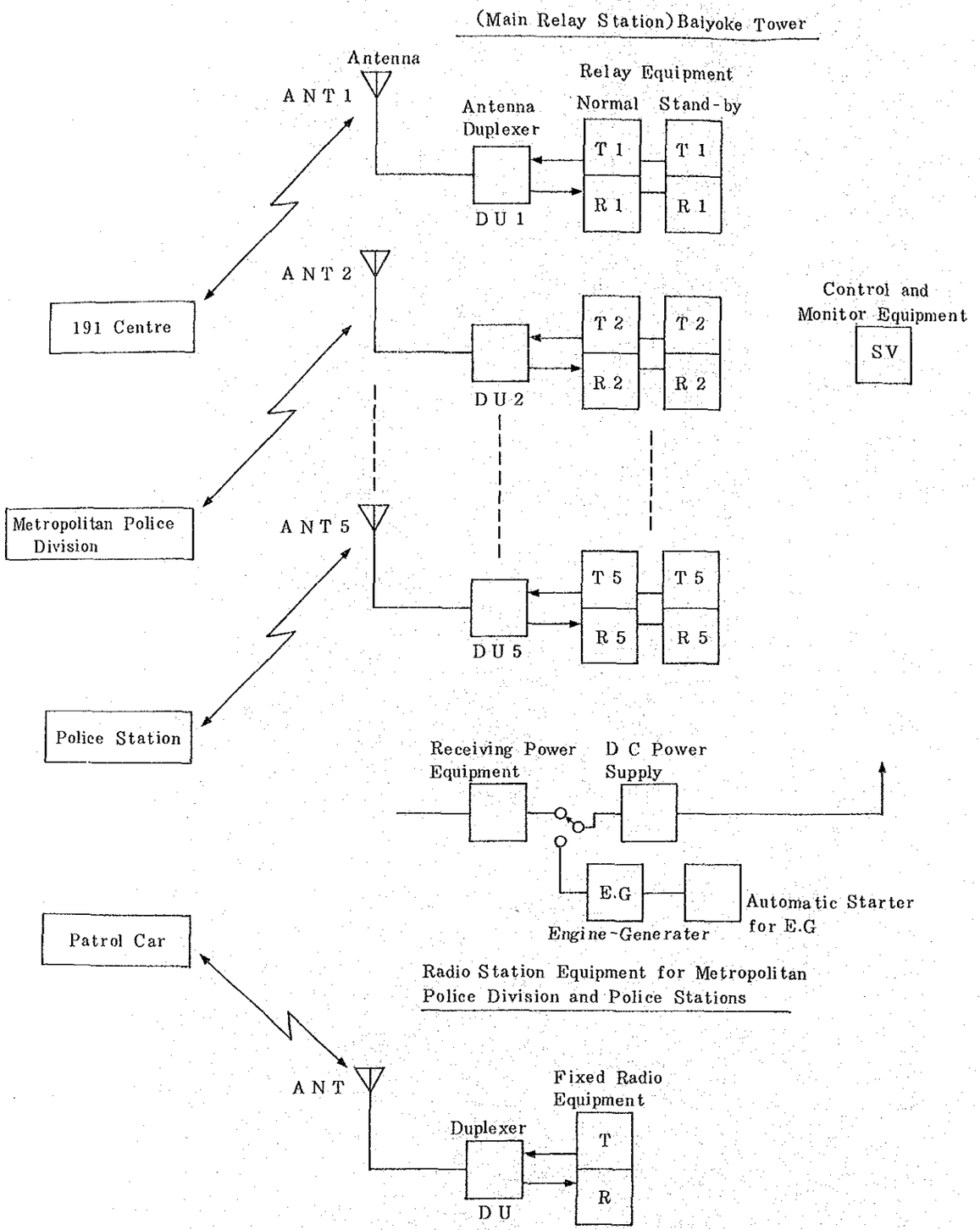
The outline of the Public Emergency Call Centre Communications System Modernization Project is shown in Fig. 3-3, and the system of the Public Emergency Call Centre (Communications System) Modernization Project is shown in Figs. 3-4-1 and 3-4-2.



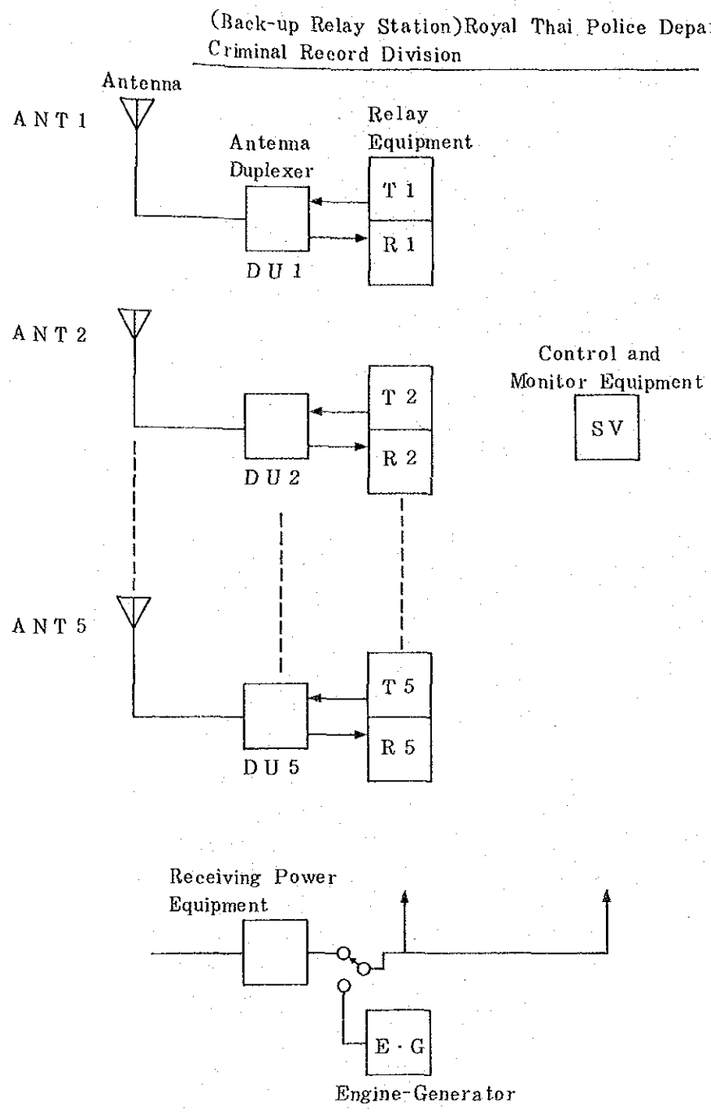
THE OUTLINE OF THE PUBLIC EMERGENCY CALL CENTRE COMMUNICATION MODERNIZATION PROJECT Fig. 3－3



THE SYSTEM OF THE PUBLIC EMERGENCY CALL CENTRE COMMUNICATION MODERNIZATION PROJECT Fig. 3－4－1



Radio Station Equipment for Metropolitan Police Division and Police Stations



(Back-up Relay Station Power Room) Royal Thai Police Department Communication Division

THE SYSTEM OF THE PUBLIC EMERGENCY CALL CENTRE COMMUNICATION MODERNIZATION PROJECT Fig. 3-4-2

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4-1 Object and Result of the Study in Bangkok

To gain data necessary for the basic design of the Public Emergency Call Centre (Communications System) Modernization Project of the Bangkok Metropolitan Police Bureau, the Basic Design Study Team carried out field surveys, the results of which are described below.

(1) Measuring of the 191 call traffic

To study the necessary quantity of the emergency call receiving consoles, the number of emergency calls received was counted.

- o Time: From 2 to 6 February, 1988
- o Place: The 191 Call Centre
- o Number of the lines tested: 18 call lines (Of the 20 existing lines, two were unused.)
- o Measurement equipment: Traffic measurement equipment
- o Results: See Table 4-1

For the distribution graphs of the numbers and the times of the calls, see the graphs in the appendix.

Table 4-1. The Results of Measurment of Call Traffic

Date	Busiest Time	Calling Seconds	Call Traffic (erl) (Note 1)
2 Feb. (Tue)	13:00-14:00	8,340	2.32
3 Feb. (Wed)	15:00-16:00	7,061	1.96
4 Feb. (Thu)	14:00-15:00	7,225	2.01
5 Feb. (Fri)	15:00-16:00	6,715	1.87
6 Feb. (Sat)	11:00-12:00	8,862	2.46

Table 4-1 shows the heaviest call traffic that the 191 Centre received from 2 to 6 February, 1988.

o Analysis of the results

Six emergency call receiving consoles are needed based on the heaviest call traffic (2.46 erl) on 6 February and 1/100 loss probability (Note 2)

Seven consoles will be needed in five years time (Note 3), because the traffic will increase to 3.15 erl

The Basic Design Study Team recommends that seven emergency call receiving consoles should be installed for future operation.

Note 1. Call traffic is the product of the number of calls in an hour multiplied by the average calling time, and is expressed in units called "erl."

Note 2. Loss probability is the probability of call being answered by a busy signal.

Note 3. The estimated call traffic of the busiest time in five years is calculated based on the ratio of 730,000 units of telephones (estimated number in five years) to the 570,000 units of telephones existing in Bangkok now.

(2) Field Intensity Measurement of Radio Communications System

To gather data for the planning of the radio communications system on the assumption that a main relay station is built on the Baiyoke tower, the Basic Design Study Team measured the electric field intensity at the tower, transmitting from a mobile radio station in Bangkok.

- o Time: from 1 to 3 February, 1988
- o Place: on the rooftop of Baiyoke Tower
- o Line: using a frequency in the 150 MHz band (transmitted from a mobile radio station and received on the Baiyoke Tower.)
- o Measurement equipment: field intensity measurement equipment
- o Results: see Table 4-1
- o Analysis of the results:

Shown in Table 4-1 is the distribution of the input levels to the distances on the measuring points around the borders of the service area. The line in the graph is the receiving input level derived from the mathematical formula

of CCIR recommendation (Note 1). The height of the relay station is 130 m. Approximately the distribution of the input levels coordinates with the line.

In these data, most of the input levels over 20 km are lower than 20dBμ, possibly making the call-merite (Note 2) below 3.

Therefore, it is necessary to improve the situation by discussing the ways shown below.

- o Use of high gain antennas
- o Increase of the emmission power, etc.

(Note 1) CCIR: Internatinal Radio Consultative Committee

(Note 2) Call merite (degree of clearness)

merite 5: very clear

merite 4: clear

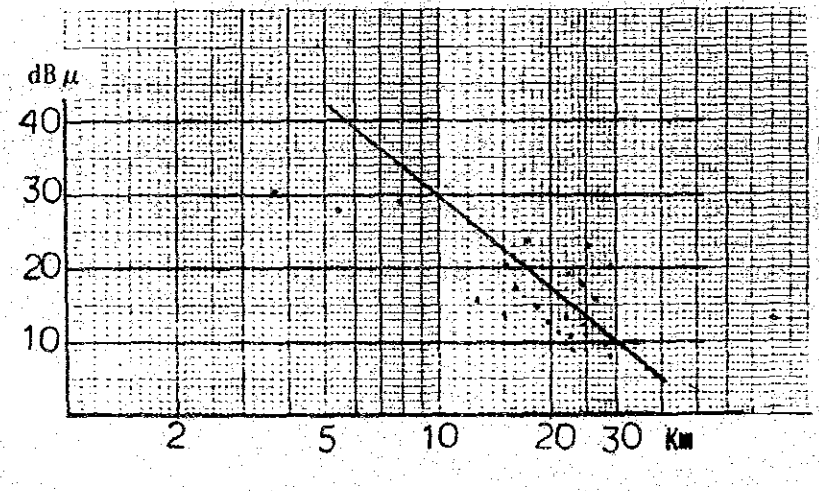
merite 3: noisy, but can receive

merite 2: noisy, but can receive with difficulty

merite 1: noisy, and cannot receive.

Fig. 4-1

The characteristic of the input level to the distance by field test (3 February, 1988)



(3) Measurement of the adjacent frequency to the assigned frequencies for use

To gather data for planning of the radio communications system related to crosstalk and jamming of the radio relay lines, and thereby to determine the transmitting frequency, the received waves around the frequencies to be used were measured on the Baiyoke Tower.

Frequency to be used is as follows:

1. 166.550 MHz - 171.550 MHz
2. 166.600 MHz - 171.600 MHz
3. 166.850 MHz - 171.850 MHz
4. 166.900 MHz - 171.900 MHz
5. 166.950 MHz - 171.950 MHz

- o Time: 4 February, 1988
- o Place: Baiyoke Tower
- o Measuring equipment: Spectrum analyzer
- o Results:

As the result of study on adjacent frequencies around the assigned frequencies, on the rooftop of the Baiyoke Tower, which is to be the site of the Main Relay Station, 79 waves were counted, without less than -75dBm waves which are removable by wave filter.

o Analysis:

Between the measured waves transmitted from other stations and the waves to be transmitted for this project,

the number of combinations which could give out the received waves for use because of mutual interference were computed as shown in Table 4-2.

Table 4-2 Analysis of the Measured Data.

Assigned frequency to be used for receiver	Combinations of jamming frequency made by mutual interference	Total combinations
171.550	270	
171.600	269	
171.850	268	1305
171.900	254	
171.950	244	
166.550	278	
166.600	295	
166.850	297	1477
166.900	299	
166.950	308	

o Study on the frequency to be used for the receiver of the relay station

The results mean the possiblity of being jammed by the other radio station is smaller in the 171 MHz band as Table 4-2 shows.

o Study on the frequency to be used for the transmitter of the Relay Station.

The number of combinations which will jam the existing radio station on the Baiyoke Tower is:

166 MHz band:96,

171 MHz band:53,

Then, the 171 MHz band should be assigned for the transmitter of the Relay Station, because it is very important to avoid interference with the existing radio station.

4-2 Situations of the Sites

The sites are to be set in three places: the buildings of the Bangkok Metropolitan Police Bureau for the new 191 Centre, the Baiyoke tower for the Main Relay Station, and the Royal Thai Police Department for the Back-up Relay Station.

The situations at each site are as follows:

(1) The Bangkok Metropolitan Police Bureau

The Bangkok Metropolitan Police Bureau is in the northern part of Bangkok, located at the corner of Sri Ayutthaya Road and Rama IV Road, sharing the place with the Bangkok Metropolitan Fire Bureau. The bulding of the Metropolitatn Police Bureau was built in 1971, at first for the use of Fire Bureau. After that, it was given to the Police Bureau, and has been improved with the addition of the top sixth floor. It is this additional floor that has the present 191 Centre, which is to be remodled into the new 191 Centre.

For the present situation of the Bangkok Metropolitan Police Bureau, see Table 4-2.

1) The 191 Centre (the sixth floor)

The space suggested by the Thai side is on the sixth floor of the Police Bureau, where is located the present 191 Centre (18m × 8m) with an office, a warehouse (12m × 8m) and the telephone-exchange room (12m × 8m). Ceiling height of these rooms is 2 m 44 cm from the floor level to the bottom beam of the roof slab. Although the building was built seventeen years ago, it has been kept clean without cracks or any architectural problems.

Based on the obtained plan of the building and the obtained concrete floor sample, the Basic Design Study Team asked the Department of Construction Technology at King Mongkut's Institute of Technology to make a strength study of it. With the results of this study and the one made in Japan, the compressive strength of the floor concrete was calculated. It is 166 kg/㎡ in the corridor and 350 kg/㎡ in the other rooms. Although there is no special need to reinforce the floor, it is necessary to avoid putting the heavy equipment in the corridor and to make arrangements in the other safer places. There is no need for reinforcement of the floor by the Thai side.

The electric power capacity which the Metropolitan

Police Bureau is now receiving is 100KVA. But in 1988 they have received budget for newly designed electric-power-receiving facilities capable of 500 KVA trans formation. The cable to receive the power can be put into the existing trough for the power cable in the building from the receiving transformer. There are also eight separate-type air conditioners with outdoor units.

2) Emergency power supply (1st floor)

From the Thai side, four places in and around the building of the Metropolitan Police Bureau were suggested for the emergency power supply.

Space A: on the first floor of the building, where there is a general store.

Space B: between the building and the stairway room

Space C: between the building and the another building on the north side, which is also owned by the police

Space D: in the 1st floor which is now used as a warehouse.

Having considered the compressive strength of the floor concrete, the Thai side share of the construction expenses and the sizes of the spaces, space D was chosen to be used as the room for the emergency power supply and the battery. For this equipment, space D has enough room (12m × 8m), with a ceiling 3.9 m high.

If D is used, there is no need for the Thai side to furnish the room at their expense. The Emergency Power Supply of the Bangkok Metropolitan Police Bureau is shown in Fig. 4-2.

3) Antenna (roof)

Just above the 191 Call Centre is the rooftop, with an iron pole for UHF, three poles for VHF and a pole for both UHF and VHF.

One of these is to be used to holding new aerial equipment. The rooftop is made of waterproof mortar on concrete slab, with a crack on the part. But the crack seems to be no problem because it allows no leaking of water and seems to be only on the surface. The roof of the Bangkok Metropolitan Police Bureau is shown in Fig. 4-2.

(2) Baiyoke Tower

The Baiyoke Tower stands about 1,400 m east-southeast from the Bangkok Metropolitan Police Bureau. It is the highest private building in Bangkok, 132m high with 43 floors above ground, built in 1987. Lower floors are rented as a shopping centre, parking area, etc. Upper floors are used as apartments and offices. A part of the building is to be rented to the Royal Thai Police Department for the use of the Main Relay Station of the 191 Emergency Call System.

For the present situation of the Baiyoke Tower, see Fig. 4-3.

1) Main Relay Station

The room suggested by the Thai side was on the level of the two floors above the topmost of the regular floors. But the space was 4.3 m x 1.7 m with a ceiling 2.5 m high, which was too small. And the room had no windows, which means probable high temperature in the hot, rainy season. And the passage to the room was limited to a gangway ladder, making the work inefficient. So the Station is to be moved to the space for the emergency power supply on the 11th floor. The feeder line to the antenna on the rooftop is to go through a piping shaft for the electricity.

2) Emergency power supply room

A room on the eleventh floor which is made for machinery is to be used for the emergency power supply. Because the room was made at first to be used as the transformer room of the Baiyoke Tower, it has enough compressive strength on the floor concrete and sufficient electric power capacity. But for installing the Main Relay Station, it will be necessary to supply the room with an air conditioner for control of the temperature and the humidity, some partitions, etc. It will also be necessary to add a door to the entrance which has been open, and to put a partition between

the open area and the room. The construction to build a partition should be done at the expense of the Thai side.

3) Rooftop

On the rooftop 132 m above ground, there is an iron frame for the roof truss. It might have been added there while the tower was being built, because it is not indicated in the plan.

There is no problem for installing the repeater-aerial equipment.

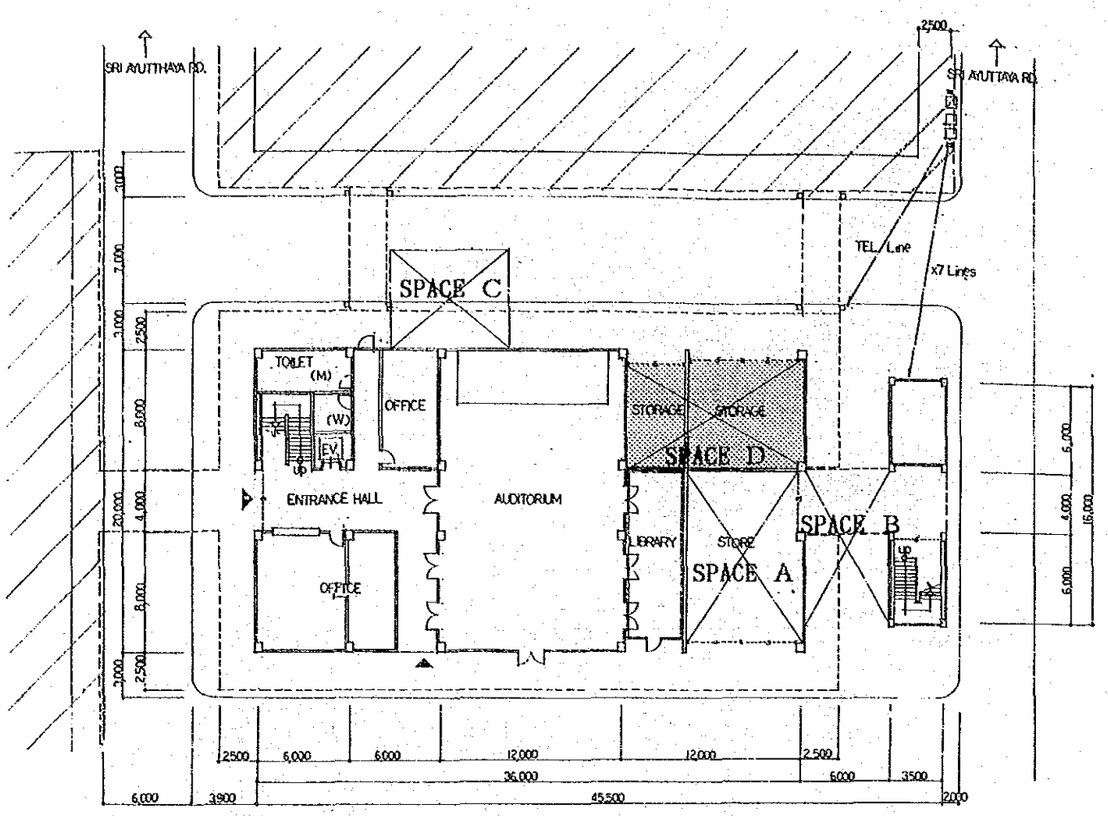
(3) The Royal Thai Police Department

The Royal Thai Police Department is about 1,850m southeast from the Bangkok Metropolitan Police Bureau, about 850m south of Baiyoke Tower, in the south of Rama IV Road and Henri Dunant Road.

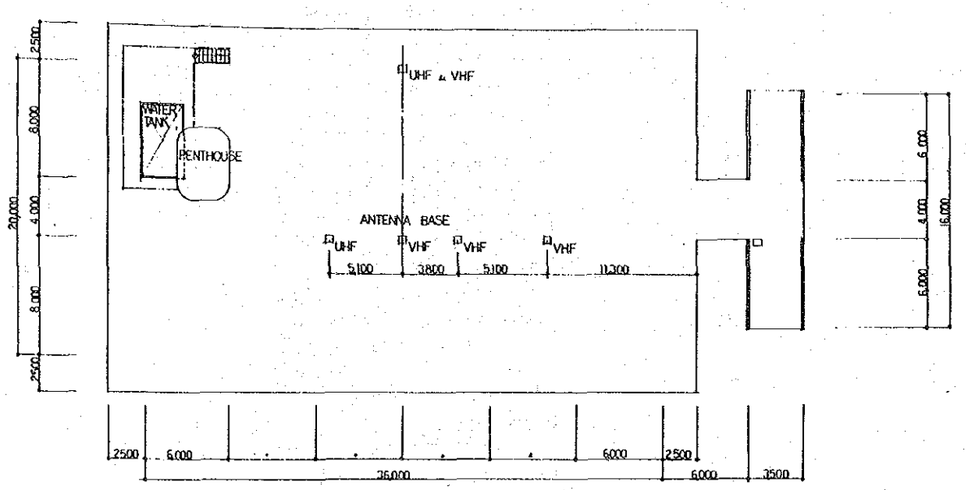
For the Back-up Relay Station, two places in the building of the Royal Thai Police Department were suggested by the Thai side. They are shown below. For the present situation of the Royal Thai Police Department, see Fig. 4-4.

1) The Machinery Room on the 5th floor of the Communications Division.

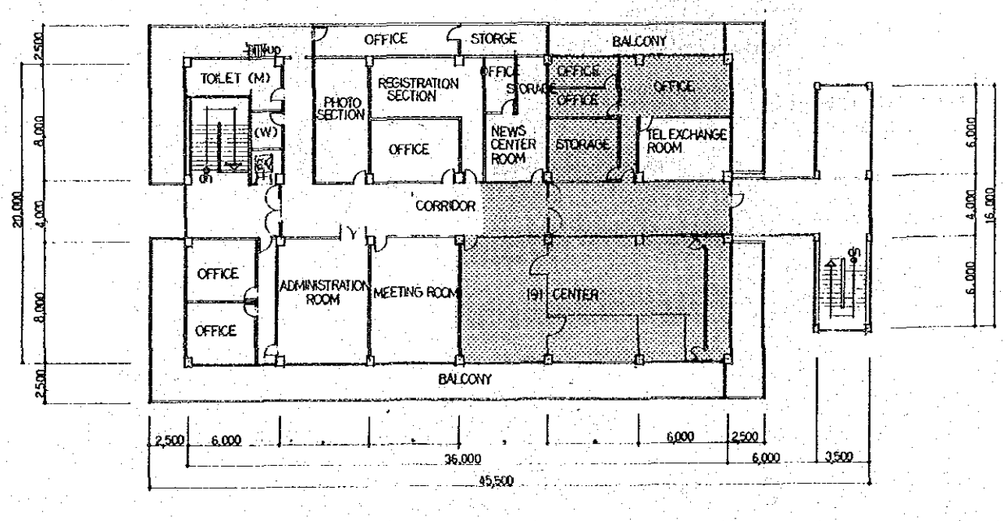
The Communications Division is in a five-storied structure built in 1977, where telephone, radio and telex are being managed. The suggested place is the machinery room on the fifth floor, 10.5 m × 10 m, with some equipment for radio communications and four air



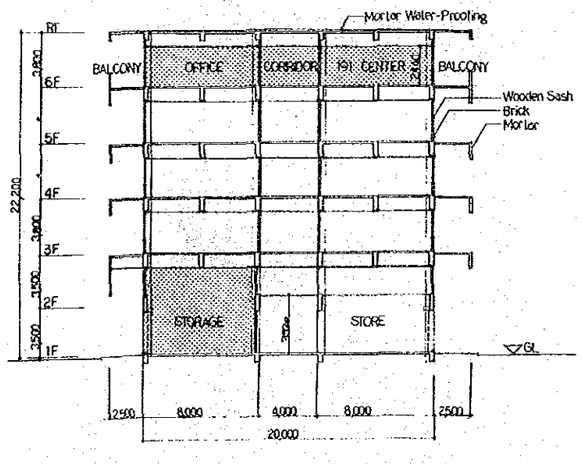
1st FLOOR PLAN
S = 1 : 400



ROOF PLAN
S = 1 : 400



6th FLOOR PLAN
S = 1 : 400

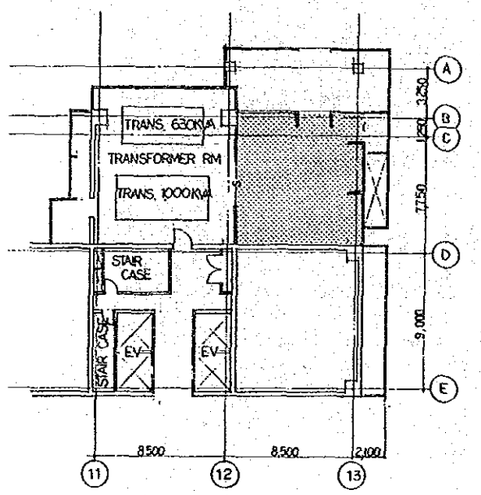


SECTION
S = 1 : 400

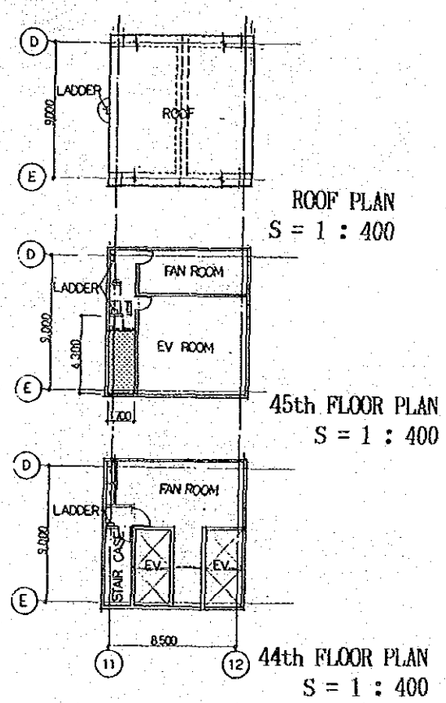
Surveyed area

N

METROPOLITAN POLICE BUREAU PRESENT CONDITION Fig. 4 – 2



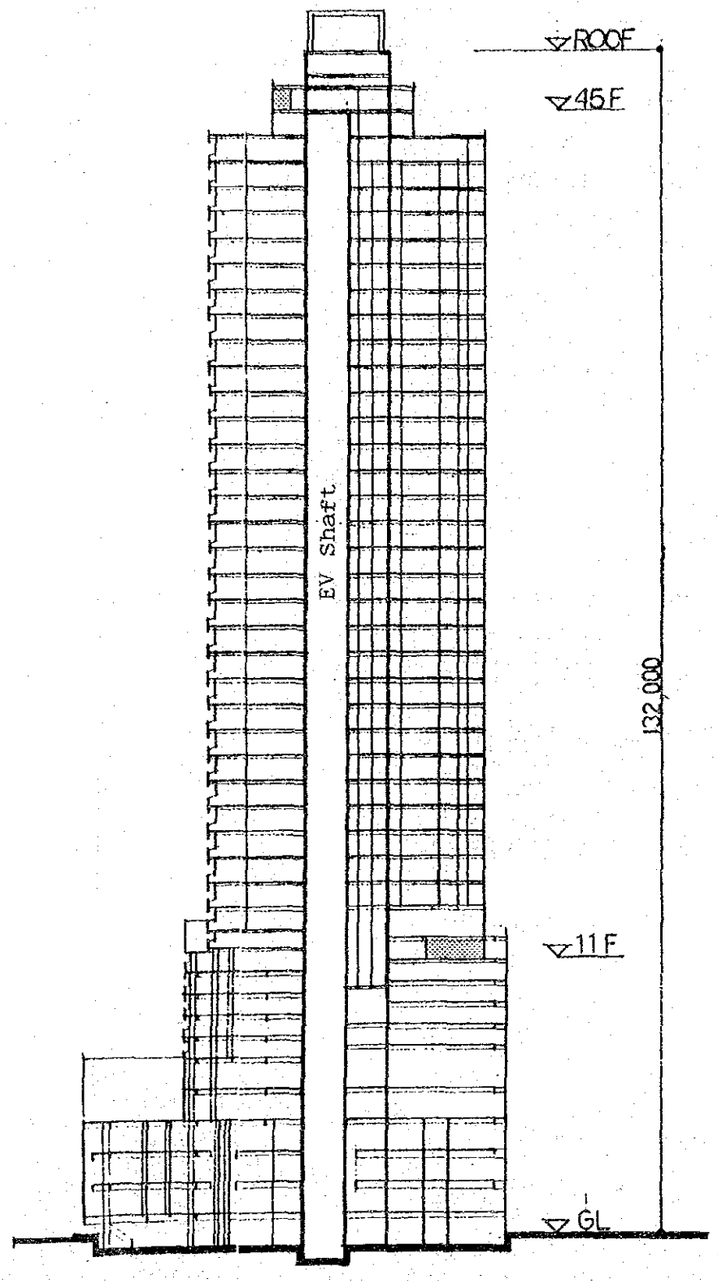
11th FLOOR PLAN
S = 1 : 400



ROOF PLAN
S = 1 : 400

45th FLOOR PLAN
S = 1 : 400

44th FLOOR PLAN
S = 1 : 400

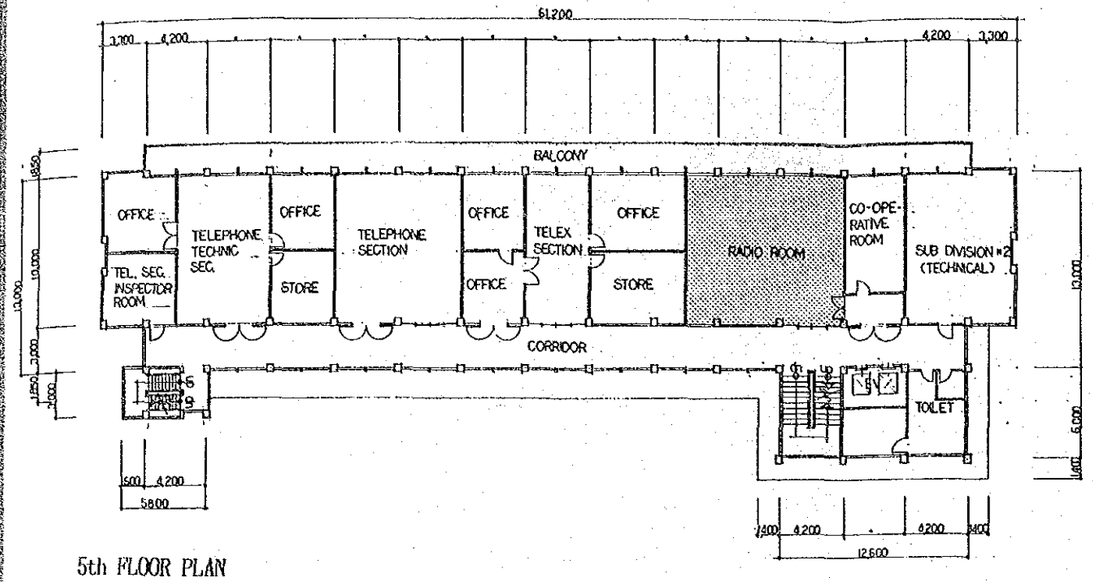


SECTION
S = 1 : 650

Surveyed area

N

BAIYOKE TOWER PRESENT CONDITION Fig. 4-3



5th FLOOR PLAN
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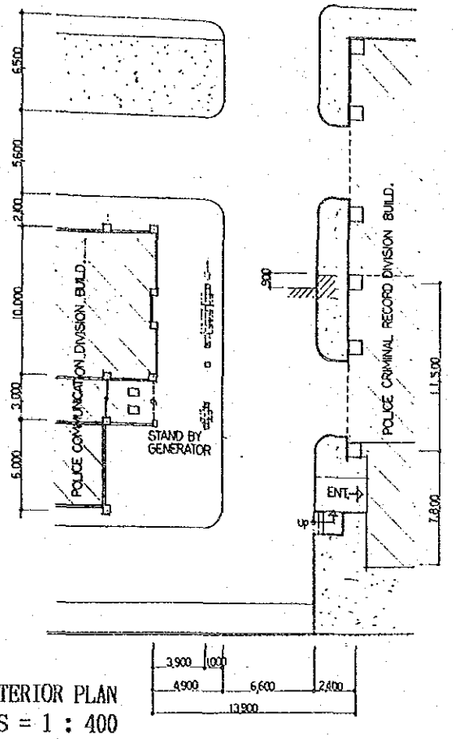

EXTERIOR PLAN
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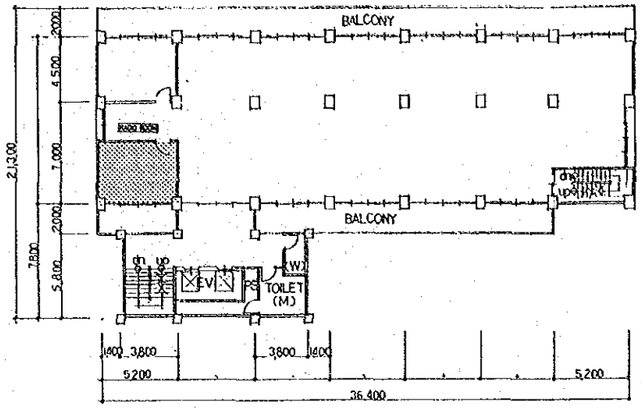
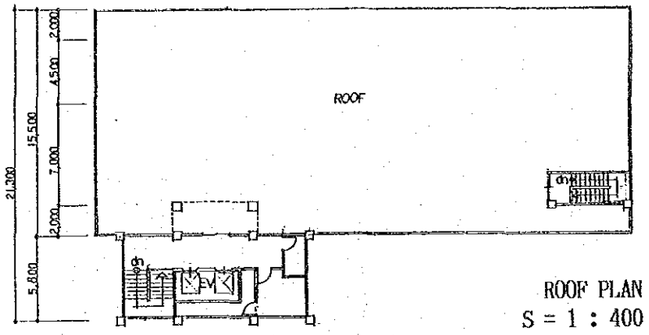
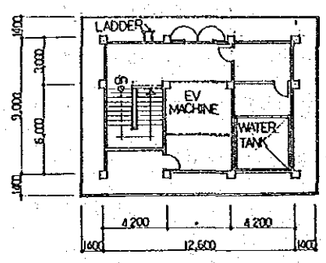


12th FLOOR PLAN
S = 1 : 400



ROOF PLAN
S = 1 : 400

POLICE CRIMINAL RECORD DIV. BLDG.



PENTHOUSE 1st FLOOR PLAN
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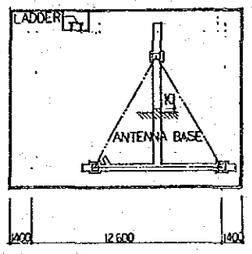
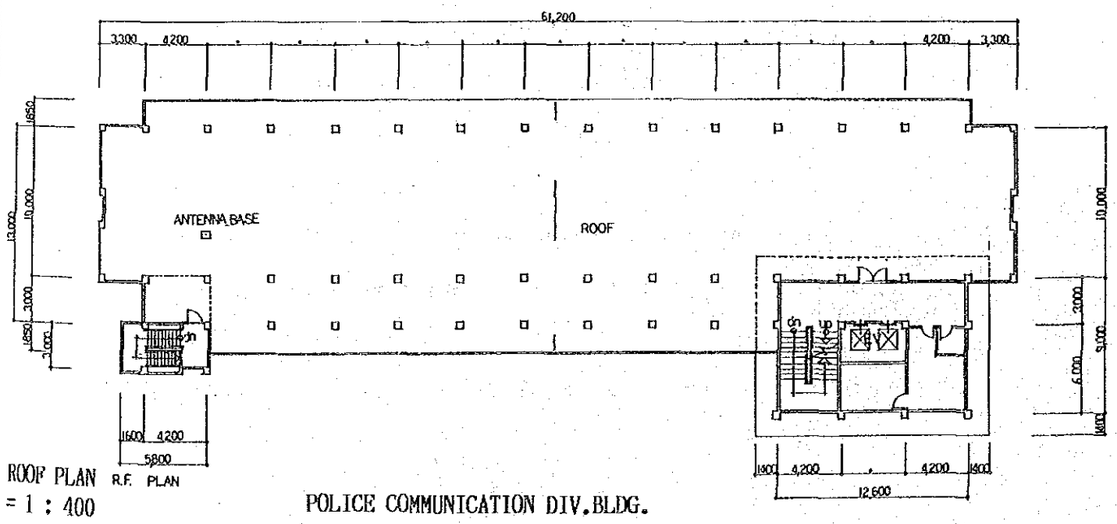


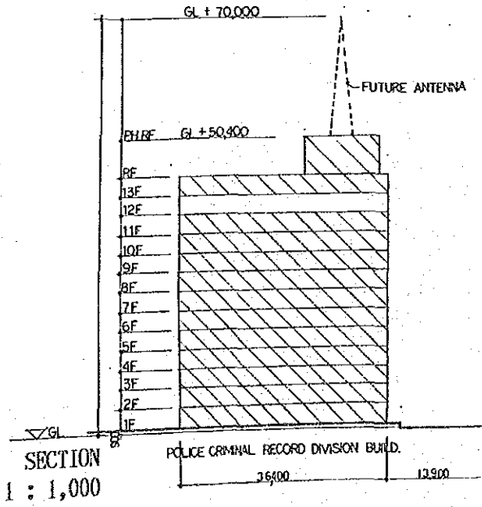
PENTHOUSE ROOF PLAN
S = 1 : 400

Surveyed area

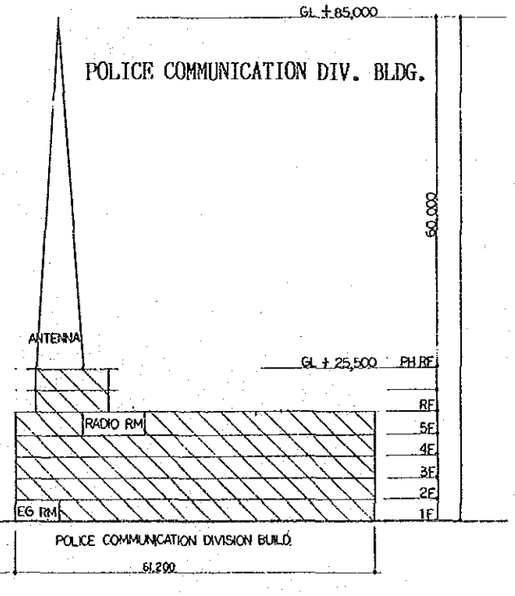


ROOF PLAN R.F. PLAN
S = 1 : 400

POLICE COMMUNICATION DIV.BLDG.



POLICE CRIMINAL RECORD DIV. BLDG.



POLICE COMMUNICATION DIV. BLDG.

SECTION
S = 1 : 1,000

N

ROYAL THAI POLICE DEPARTMENT PRESENT CONDITION Fig. 4 – 4

conditioners to control the temperature and the humidity. The receiving electric power capacity of the building is 100KVA and the building has an iron tower on the rooftop, about 85m above ground. It has two, though old, emergency power supplies of 12KVA in the power room on the 1st floor.

2) The Criminal Records Division on the 12th Floor

The Criminal Records Division is a 13-storied new building completed in 1987. Although the lower floors have been used, the suggested twelfth floor has not been used, with only some part of it partitioned.

Wiring work to the switchboard and an air conditioner are necessary. The receiving electric capacity of the building is 500 KVA. An antenna is going to be set on the rooftop in 1988. The emergency power supply has not yet been installed.

Considering these situations, the discussions with the Thai side resulted in the setting of the Back-up Relay Station on the 12th floor of the Criminal Record Division. The aerial equipment is to be put upon the tower on the rooftop. The feeder is to be connected to the Criminal Records Division with a messenger in the air.

For the emergency power supply, the one on the 1st floor of the Communications Division is to be used.

4-3 Design Policies

This project consists of three systems: the 191

Emergency Call System, the Radio Communications System, and the Facsimle System. Because they are all very important for public rescue activities, being used 24 hours a day without a second of operation loss is the essential condition.

Therefore, to prevent trouble, each system must consist of equipment which has perfect stability and reliability.

And it is necessary to keep the whole system's reliability. For this purpose, doubling and back-up of the main equipment are necessary.

(1) Economy and reliability of the equipment

Equipment with long records of past use in Japan should be chosen. And part of their specifications are to be changed to fit their use in Thailand.

(2) Countermeasures in the event the system is down

In the radio communications system, when the relay equipemnt of the main relay station has trouble, the communications of each police station and patrol car become unrelayable and break down. To prevent this, equipment for normal use and for stand-by use are installed. When the normal equipment has trouble, the stand-by automatically takes it place.

When the Main Relay Station has its whole system down triggered by some trouble, the Back-up Relay Station is to do the job of the Main Relay Station.

Even when the emergency call receiving and radio patrol

dispatching consoles have some trouble and become impossible to use, the basic function of receiving emergency calls from citizens and radio patrol dispatching of patrol cars should be kept working. To fulfill this duty, some technical work should be done.

(3) Countermeasures in the event of an electricity stoppage

Although the electric power supply is relatively stable in Bangkok, there is a possibility of an electricity stoppage with regard to the receiving facilities of the buildings.

In the 191 Centre and the Main and Back-up Relay Stations, emergency power supply is to be installed for long stoppage. In the 191 Centre and the Main Relay Station, a D.C. power supply is to be installed for short stoppage.

When the equipment is installed in the 191 Centre, the compressive strength of the floor should be taken into consideration. It is 166 kg/m^2 on the corridor and 350 kg/m^2 in the other rooms.

(4) Countermeasures for mutual interference of electric waves

Because there are already many waves used by other radio stations around the frequency band to be used for the Main Relay Station, and to prevent mutual interference of the waves with these stations, countermeasures should be taken.

And to keep interference with other stations as little

as possible, the transmission power is to be kept as low as necessary.

4-4 Design Conditions

The sites of this project are in the city of Bangkok, with the following climatic conditions.

Maximum temperature:	33℃
Minimum temperature:	24.4℃
Average temperature in a year:	28.7℃
Rainfall in a year:	1,785 mm
Average humidity in a year:	74.5%

Source: Royal Thai Statistics Department

Because it is hot and humid throughout the year in Bangkok, it is a very harsh environment for electric equipment compared to Japan.

Working conditions for this project's important equipment are mostly indoors under air conditioned circumstances.

But the equipment which can be directly influenced by outside air must be that whose use is suited to the environment of Thailand.

(2) Specifications setting

1) The 191 Emergency Call System

- o Input line: 20/128 (actually/capacity)
  (20 lines being used now)
- o Output line:
  Emergency call receiving line: 2

Transit line: 1

Extension line: 1

- o Method of input for the emergency call receiving console: handwriting digitizer or push button input, picture display.

Note: A digitizer is to be used for this design, because a digitizer has good specifications for transmitting the Thai language written by hand.

The input management for receiving data and number is to be done by operating the numbers on the push button.

- o Method of input for the radio patrol dispatching console: push button input

2) Radio communications system

- o Relay system by 2 waves simplex
- o Radio frequency

VHF band 5 pairs	transmission from relay station	reception at relay station
1	171.550 MHz	166.550 MHz
2	171.600 MHz	166.600 MHz
3	171.850 MHz	166.850 MHz
4	171.900 MHz	166.900 MHz
5	171.950 MHz	166.950 MHz

- o Frequency range of the radio: from 158 MHz to 178 MHz.
- o Power of transmission

for relay station: 50 W

fixed station: 25 W

mobile station: 25 W

hand-held station: 1 W

o Type of communications system: Analog

Table 4-3 shows comparisons of analog and digital radio in detail such as their merit, making, use and maintenance.

Although the digital system is better at functions of monitoring prevention and data transmission, Bangkok has no circumstances of third person monitoring, jamming and giving damage to the police radio communication, and also has no network-end to send digitalized information other than voice.

If a digital system is introduced, it will surely increase the expense of installing the communications system, through the equipment quantity in this project would be reduced.

And because the present system is analog, it cannot be used with a digital system.

Considering these points, better to use an analog system for the radio communications system of the Bangkok Metropolitan Police Bureau.

o System of modulation: Frequency modulation system

o Radio-frequency impedance: 50 Ohm

o Voice-frequency impedance(modulation): 40 Ohm

o Power source: AC220V 50Hz

3) Facsimile system:

Telephone auto-dial system of CCITT G Ⅲ standard.

Note: CCITT is Consultative Committee of International Telegraph and Telephone.

Table 4-3 The Comparative Table between an Analog Type Radio Communications System and Digital Type Radio Communications System

Classification	Items	Analog	Digital	Comparative Study
Fundamental characteristic	Secrecy of communication	×	○	Digital type system can keep the secrecy of commuications completely. An analog type system cannot keep secrecy of communication completely.
	Data transmission	×	○	A digital type system can transmit data more easily than analog type system.
	Adjustment of existing equipment to new system	○	×	Existing analog type radio equipment cannot be used in a digital type radio communications system.
	Occupied frequency band width	○	×	Digital type system needs wider band width than that of an analog type system.
	Power	○	×	Digital type radio equipment

	consumption Past record of use	○	×	uses more power consumption than an analog type. Digital type systems have been used less than analog type systems in the past and have not enough reliability and stability.
Pro-duction	Period of production	○	×	Digital type system needs a longer period for production than an analog type system, because a digital one has newly designed parts.
	Cost of production	○	×	A digital type system increases the cost of the radio communications system by about several tens tens percent, as a digital one has newly designed circuit.
Oper-ation	Radio jamming countermeasure	×	○	The extent of radio jamming of a digital type system is the same as that of an analog one, but a digital one can stop the relay of an analog type radio jamming.
	Quality of voice	○	×	Quality of voice of a digital type system is a little

				inferior to that of an analog type system.
	Handling of equipment	○	×	Fundamental handling of digital type equipment is the same as that of the analog type, but the digital type needs the management of a code.
Mainten-ance	Load of maintenance	○	×	A digital type system requires education and training for its maintenance. Efficiency of maintenance work would be decreased.
	Parts	○	×	Maintenance parts for digital type equipment are not enough yet. It is difficult to exchange the broken parts.
	Cost of maintenance	○	×	A digital type system needs very expensive circuit unit cards, measuring equipment, etc. so that the cost of the maintenance would be increased.

4-5 *Plan for Equipment Selection*

The equipment materials to be used in this project

(1) Use Japanese domestic products

In view of the quality, specifications, and economic efficiency of the equipment materials which compose each system, Japanese products shall be used in principale.

(2) Use products which have past records of use

For the purpose of maintenance, for their reliability and stablilty, products which have past records of use in Japan shall be used.

(3) Meeting the qualifications for use at the project sites

If the Japanese standards have any inconformities to those of the project sites, the specifications of the equipment may be modified and the actual qualifications for use must be met.

(4) Lightening the cost of production

The equipment which is already specified shall be used. Then the cost of production can be lightened and the production period shortened.

4-6 Equipment Installation Plan

About the installation of the equipment which composes each system in this project, we have properly planned in consideration of the rationality of the operation and maintenance and the strength of the floor. As a rule, the existing towers shall be used for the aerial equipent. Antennas must be newly established.

(1) Equipment Arrangement Plan for each project site

Equipment for each site, the quantity and main specifications are as shown in Table 4-4

Table 4-4 Equipment Arrangement Plan for Each Project Site

Site	Room	Equipment	Qty	Function (Specification)
Bangkok Metro-politan Police Bureau	191 Centre	Map display processing unit	1 set	Map processing unit 1 consist of: Map display 1 Map input 1 Printer 1 Optical disk 1 Map control unit 1 The processing unit is composed of more than 15 control channels. Power: AC 220V
		Character display processing unit	1 set	Central processing unit 1 consists of: Monitor console 1 Printer 1 Call distributor unit 1 Input line: 20/128 (actually/capacity) Connection circuit: 14/20 (actually/capacity) Power: AC 220V, DC 48 V.

Bangkok Metro-politan Police Bureau	191 Centre	Emergency call receiv-ing console	7	Stand alone console type 1 seat/ console consisting of: Character display 1 Map display 1 Digitizer 1 The receiving console is composed of two receiving lines, one extension line and one transit line. Power: AC 220V, DC 48 V.
		Radio patrol dispatching console	3	Stand alone console type 2 seat/ 1 console consisting of: Character display 2 Map display 2 The dispatching console is composed of 2 monitoring lines, two extension lines and four transmitting lines. Power: AC 220V, DC 48 V.
		Supervisory console	1	Stand alone console type 1 seat/ 1 console consisting of: Character display 1

Bangkok Metro-politan Police Bureau	191 Centre			Map display 1 Digitizer 1 The supervisory console is composed of two receiving lines, one extension line and one transit line. Power: AC 220V, DC 48 V.
		Emergency operation control console	1	Stand alone console type 1 seat/ 1 console consisting of: Character display 1 Map display 1 The control console is composed of one monitoring line, one extension line, and radio link equipment, and it can select six radio channels. Power: AC 220V, DC 48 V.
		Fixed radio equipment	10	Stand rack type 25 W Fixed radio rack 2 5 system/ rack The fixed radio rack includes radio line control distributor (10 distri-bution/ system).

Bangkok Metro-politan Police Bureau	191 Centre	Fixed radio equipment		Three elements Yagi antenna feeder and connector 5 Power: AC 220V, DC 48 V.
		Police activity operation display	1 set	The display consists of: Large map poster board 1 Mobile activity display 1 Emergency disposition display 1 Power: AC 220V, DC 48 V.
		Multi-channel logging recorder	1 set	Stand rack style, 24 hour continuance recording system (two tapes automatic change) Automatic time record system 14 voice channnel Time designated play equipment 1 Tape 10 Power: AC 220V, DC 48 V.
		Facsimile	3	CCITT G Ⅲ standardized ones including auto memory dial telephone. 10 exclusive papers. Power: AC 220V, DC 48 V.
		Control and monitoring	1 set	Stand rack style control and monitoring equipment

Bangkok Metro-politan Police Bureau	191 Centre	equipment		consists of: Monitoring panel 1 Control panel 1 Test panel 1 DC power supply 1 Power: AC 220V, DC 48V.
	Power room	Emergency power supply	1 set	Engine generator 1 (220V.50Hz.30KVA) Fuel tank 1 Automatic starter 1 Starter power supply 1 (charger, battery) 48V DC Power supply 1 (60 A) fitting: AC220V 100A Rectifier 1 48V, 300AH Battery 1 24V DC Power supply 1 fitting: AC 220V 60A Rectifier 1 24V, 400AH Battery 1 Switchboard 1 AC220V shield transformer 1

Bangkok Metro-politan Police Bureau	Patrol car centre	Mobile radio equipment	112	Four wheel mobile loading type, Tx : 25W consists of: Antenna, feeder, connector, power cable, Power: DC 12V
	Sub-Divisn	Hand-held radio equipment	82	Walkie-talkie type. Emission power: 1 W 2 storage batteries each Battery charger: one output type: 82
Baiyoke Tower Main Relay Station	Machine Room (11F)	Relay equipment	5 sets	Stand rack style Emission power: 50 W Input power: 24 V Automatic change of normal and standby setting Relay equipment rack 2 (5 system/ 1 rack) Duplexer 5 (5 radio system)
		Air conditioning	1 set	Air conditioner 1
		Control and monitoring equipment	1 set	Stand rack style Control and monitoring rack consist of: Monitor panel 1 Control panel 1

Baiyoke Tower				Test panel 1 Power: DC 24V
Main Relay Station	Power room (11F)	Emergency power supply	1 set	Engine generator 1 (220V, 50Hz, 10KVA) Fuel tank 1 Automatic starter 1 Starter power supply 1 (charger, battery) 24V DC power supply (60A) 1 fitting: AC 220V 100A Rectifier 1 DC 24V,300AH battery 1 Switchboard 1 220V shield transformer 1
	Rooftop	Aerial equipment	1 set	High gain antenna 5 Low loss feeder 5 sets Connector 5 sets
Criminal Record Division Back-up Relay Station	Machine room (12F)	Relay equipment	5 sets	Stand and rack style Emission power: 50 W Input power: DC 24 V Normal set operation Relay equipment rack 1 (5 system/ 1 rack) Duplexer 5 24 V DC power supply 1
		Air	1	Air conditioner 1 set

Criminal Record Division Back-up Relay Station	Machine room (12F)	conditioning	set	
		Control and monitoring equipment	1 set	Stand rack style Control and monitor rack 1 consisting of: Monitoring panel 1 Control panel 1 Test panel 1 Power: DC 24V Connection switchboard 1
Communi-cations Division Back-up Relay Station	Power room (1F)	Emergency power supply	1 set	Engine generator 1 (220V, 50Hz, 15KVA) Starter power supply 1 (charger, battery) 220V, shield transformer 1 Switchboard 1
	Rooftop	Aerial equipment	1 set	High gain antenna 5 Low loss feeder 5 Connector 5
Metro-politan Police Division	Northern Southern Thonburi Total 3 sites	Fixed radio equipment	3 sets	Console box type Emission power: 25 W Five element Yagi antenna: 1/equipment, Feeder, connector: 1/set Power: AC 220V
		Facsimile	3 sets	CCITT G standardized facsimiles, including auto

Metro-politan Police Division	Northern Southern Thonburi			memory dial telephone. 10 exclusive papers. Power: AC 220V
Police Station	North-ern 26 South-ern 16 Thon-buri 27	Fixed radio equipment	69 sets	Console box type Emission power: 25 W Five element Yagi antenna: 1 equipment Feeder, connector : 1/set Power: AV 220 V
		Mobile radio equipment	138 sets	mobile loading type Emission power: 25 W consisting of: Antenna, feeder, connector, power cable. Power: DC 12V
		Hand-held radio equipment	138 sets	Walkie-talkie type, Emission power: 1 W 2 storage batteries each Battery charger: one output type 138
		Facsimile	69 sets	CCITT G standardized ones, including auto memory dial telephone, 10 exclusive papers. Power: AC 220V

Patumwan		Fixed radio equipment	1 set	Console box type Emission power: 25 W Five element Yagi antenna: Feeder, connector 1 set Power: AC 220V
		Facsimile	1 set	CCITT G standardized facsimiles, including auto memory dial telephone, 10 exclusive papers. Power: AC 220V, DC 48V
Parusa-kawan Mainte-nance Centre		Fixed radio equipment	2 sets	Console box type Emission power: 25 W Fixed radio rack 1 consisting of: Fixed radio set 2 DC 24V power supply 1 Three element Yagi antenna : 1/set Feeder, connector : 1/set Power: AC 220V
		Contol and monitoring equipment	1 set	Stand rack style Control and monitoring rack 1 consisting of: Monitoring panel 1 Control panel 1

Parusa-kawan				Test panel Power : AC 220V	1
Mainte-nance Centre		Measuring/ test equip-ment	1 set	Linear detector Frequency counter Dummy Load Test oscillator Level meter Multi-meter	1 set 1 set 1 set 1 set 1 set 1 set
		Spare parts	1 set	Spare parts for each equipment	

(2) Equipment Installation Plan

The results of investigations regarding installation of each piece of equipment for each site are as follows:

The equipment installation for the Metropolitan Police Bureau 191 Centre is shown in Fig. 4-5

The power equipment installation of the Metropolitan Police Bureau 191 Centre is shown in Fig. 4-6.

The equipment installation of the Main Relay Station is shown in Fig. 4-7.

The equipment installation of the Back-Up Relay Station is shown in Fig. 4-8.

4-7 Remodeling Plan

For the purpose of installing the new communication equipment, some of the rooms in the existing facilities need to be remodeled. But the finishing of each room shall be of the same grade as at present. The place to be

remodeled are started in the following, and the remodel designs are shown in Figs. 4-9, 4-10.

The expenses for the remodeling, however, shall be borne by the Thai side.

(1) Bangkok Metropolitan Police Bureau

1) 191 Centre (6F)

The present 191 Centre shall be extended and the interior completion work of this room and the others shall be performed on the same order as that of the present 191 Centre: removal of the partition and the corridor-side wall in the 191 Centre, of the partition wall between the office and a warehouse accross the corridor, and of this side's corridor-wall. The interior shall be of the same grade as that of the present 191 Centre. The contents of the interior completion work are shown in the Table 4-5.

Table 4-5. Contents of the Interior Completion Work

	Floor	Baseboard	Wall	Ceiling	Others
191 Centre	carpet (conductive)	wooden EP	mortar	accoustical rockwool board	
	(The completion shall be done on the same order as at present and all shall be renewed.)				
Office Warehouse Corridor	will remove P-tile	wooden EP	the part of mortar VP	shall remove plywood EP	present window cases,

	and spread a conduc-tive carpet		the part of wood EP	and inst-all wooden acoustical rockwool board	door, and door cases EP

After the 191 Centre is extended, the doorway of the News Centre Room shall face the 191 Centre. Therefore, this door shall be moved to the side of the Registration Section.

As the lighting apparatus the same type of flourescent lights (20Wx2) as the present 191 Centre shall be installed (the ceiling-buried type). The leading in of power lines up to the power switch-board is included in the work of the Thai side scope of work.

2) Power Room

The Thai side shall undertake power supply from the receiving power switchboard on the 2nd floor to the power switchboard in the power room.

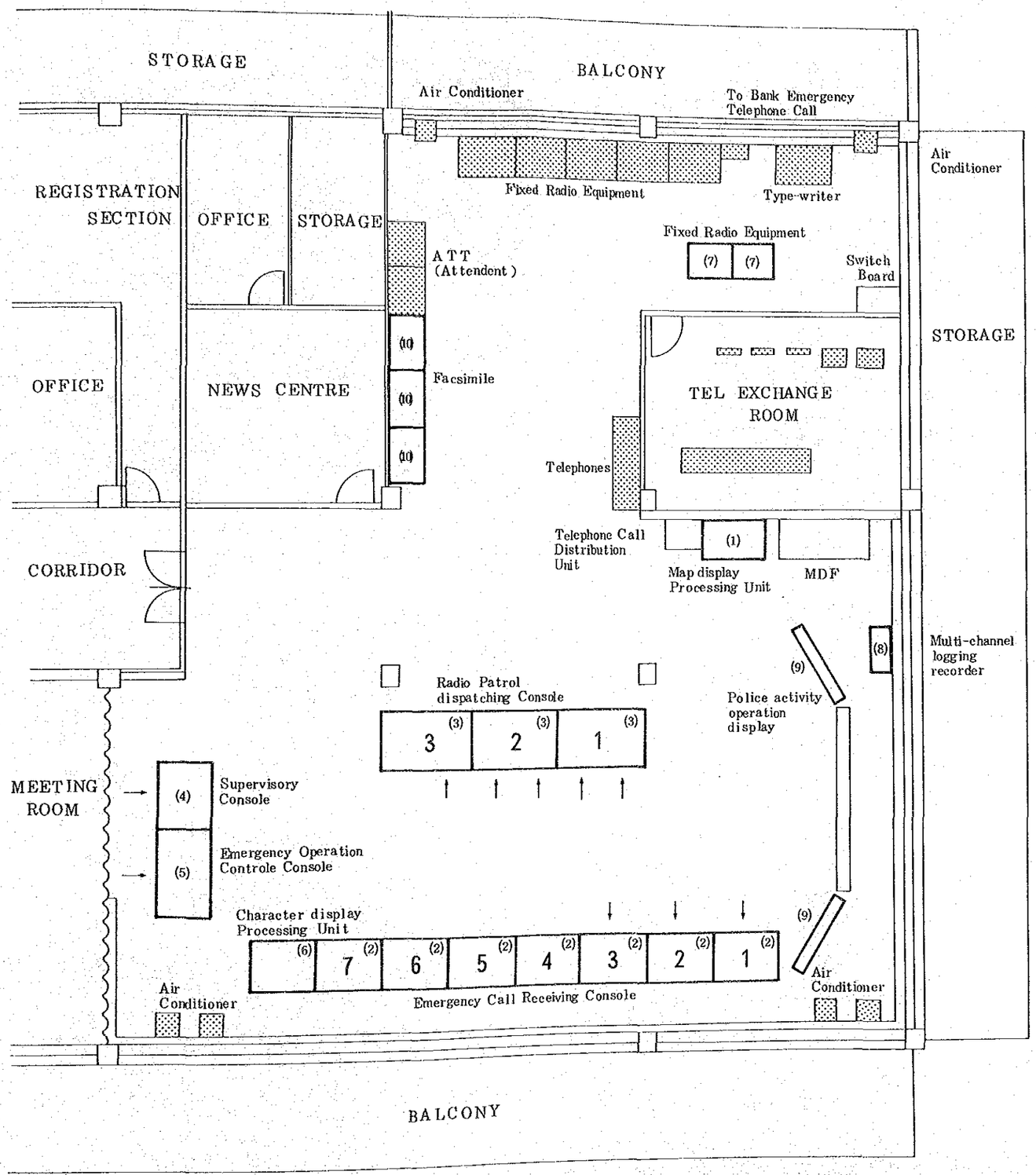
(2) Baiyoke Tower, Main Relay Station (11F)

Because it is to be a power equipment plant for the relay equipment and an emergency power supply, the room shall be divided into two parts with a separation wall (concrete blocks), which has a steel double-leaf door, (1800(W) x 2100 (H) OP completion). Also, on the sidewall which faces the outside, a similar door shall be set up.

No.	Name of Equipment
(1)	Map Display Processing Unit
(2)	Emergency Call Receiving Console
(3)	Radio Patrol Dispatching Console
(4)	Supervisory Console
(5)	Emergency Operation Control Console
(6)	Character Display Processing Unit
(7)	Fixed Radio Equipment
(8)	Multichannel Logging Recorder
(9)	Police Activity Operation Display
(10)	Facsimile

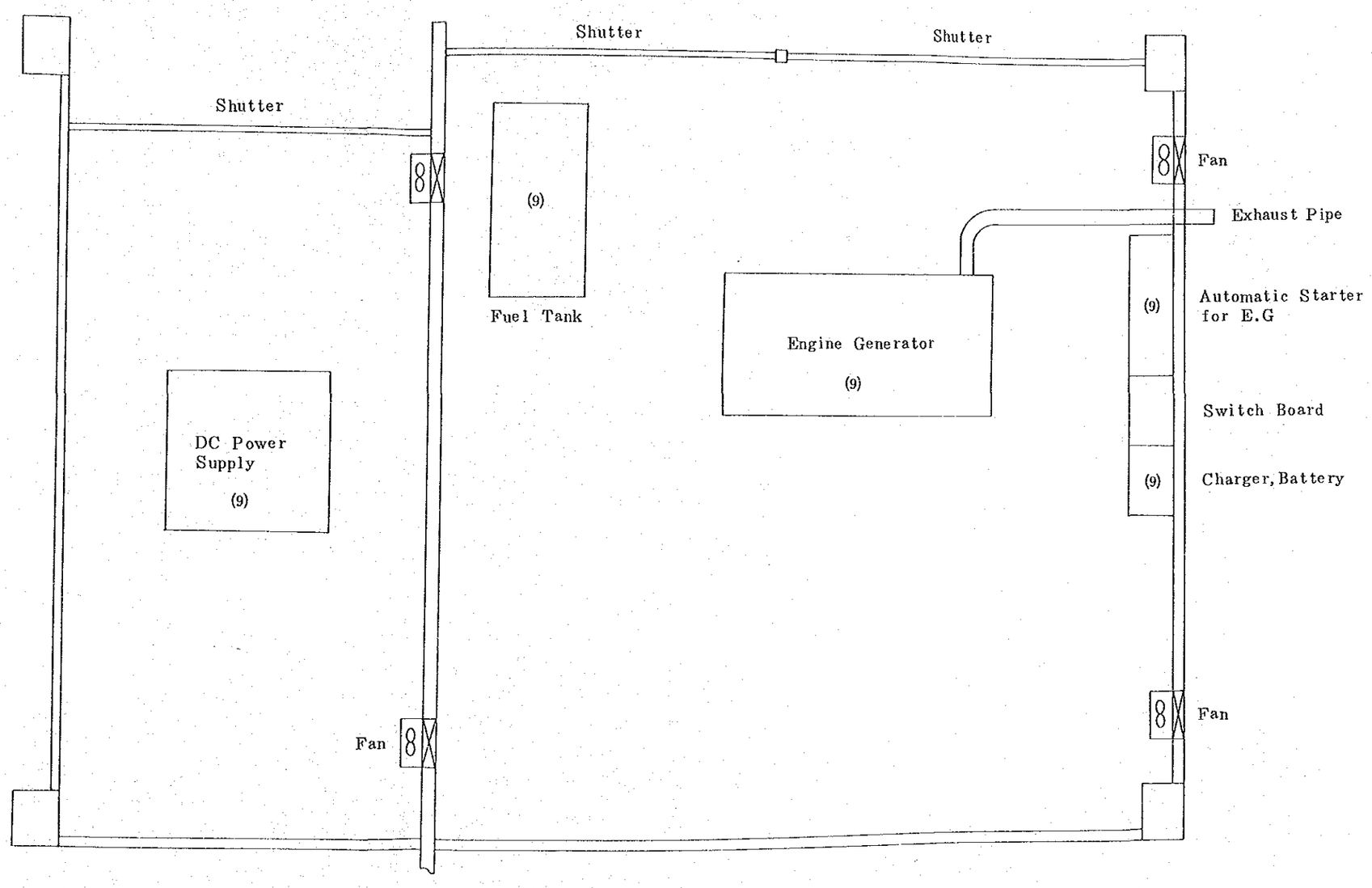
Note: ▨ shows existing Equipment

Note: Numbers shown in this drawing is the same number as the above table



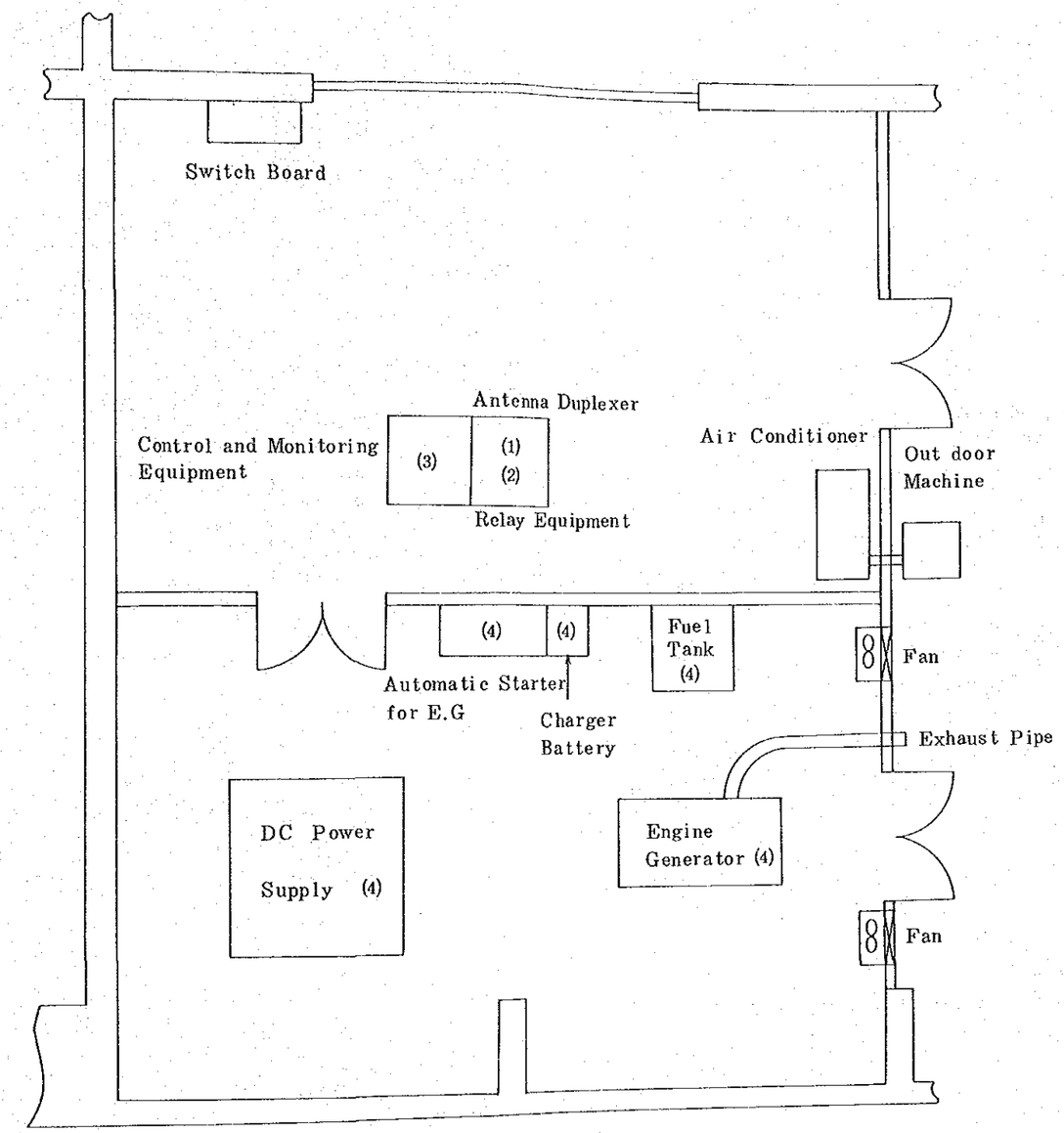
191 CENTRE LAYOUT OF EQUIPMENT Fig. 4 – 5

No.	Name of Equipment
(9)	Emergency Power Supply



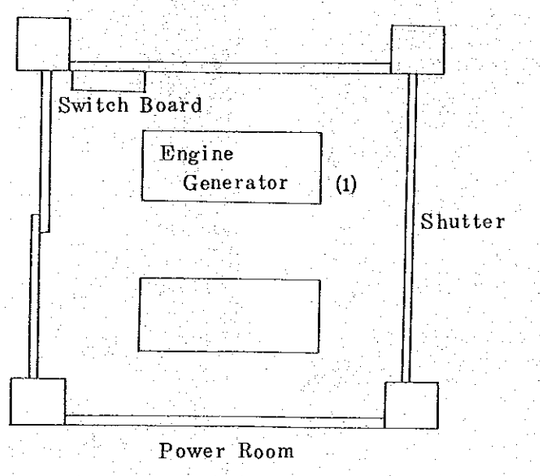
191 CENTRE POWER ROOM LAYOUT OF EQUIPMENT Fig. 4 – 6

No.	Name of Equipment
(1)	Antenna Duplexer
(2)	Relay Equipment
(3)	Control and Monitoring Equipment
(4)	Emergency power Supply



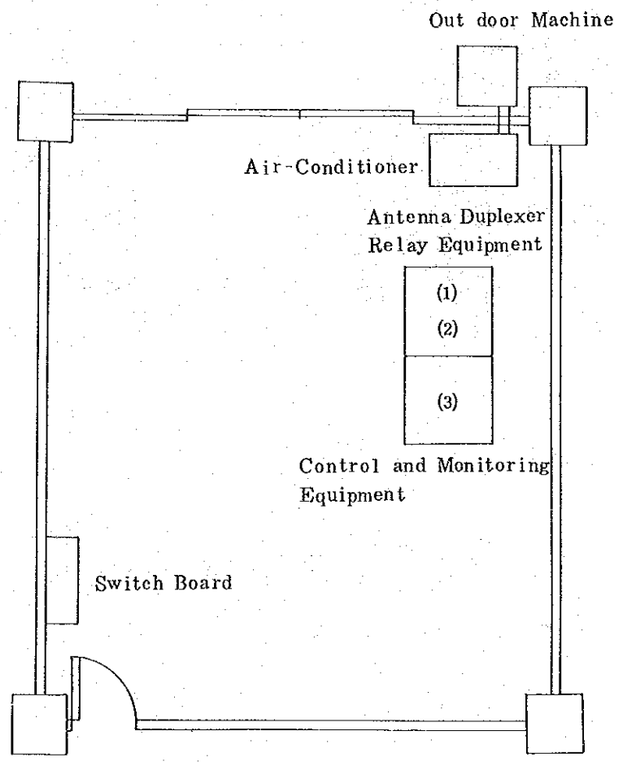
MAIN RELAY STATION LAYOUT OF EQUIPMENT Fig. 4 – 7

No.	Name of Equipment
(1)	Emergency power Supply



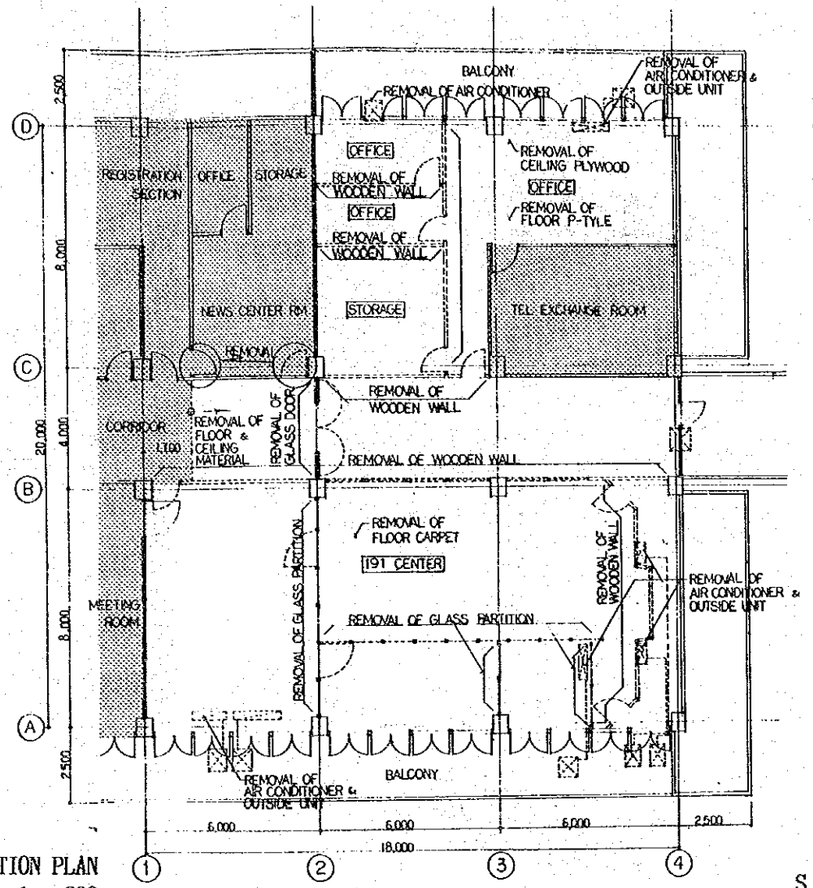
Royal Thai Police Department
Communication Division 1st floor

No.	Name of Equipment
(1)	Antenna Duplexer
(2)	Relay Equipment
(3)	Control and Monitor Equipment



Royal Thai Police Department Criminal
Record Division 12th floor

BACK-UP RELAY STATION LAYOUT OF EQUIPMENT Fig. 4－8



ALTERATION PLAN
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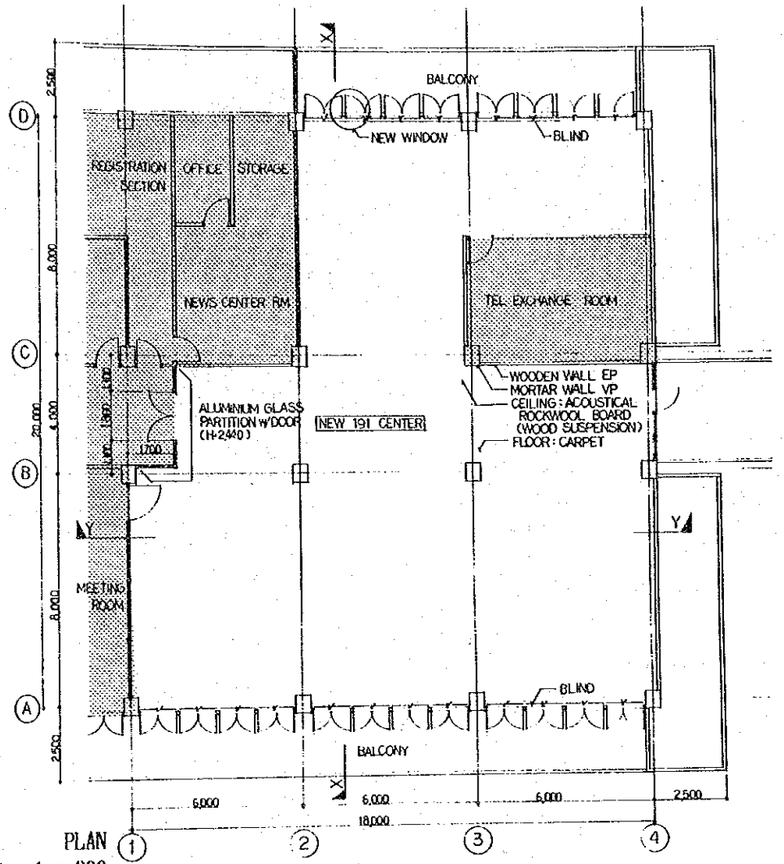

PLAN
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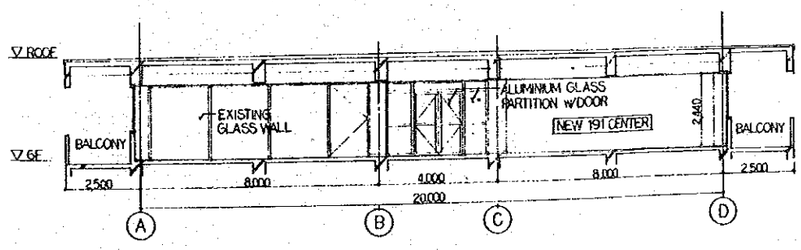

X-X SECTION
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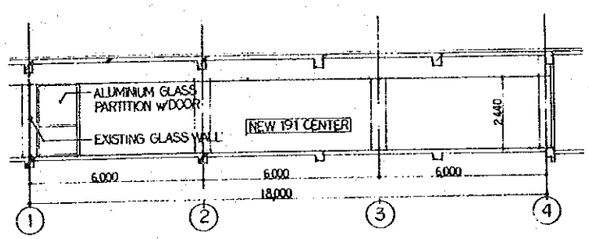

Y-Y SECTION
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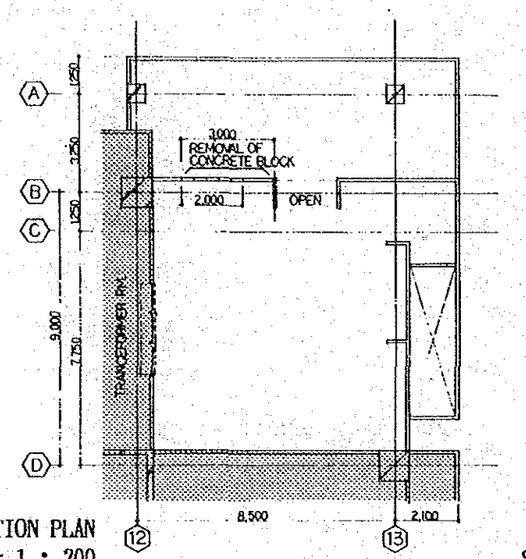
INTERIOR SCHEDULE

CEILING	: ACOUSTICAL ROCKWOOL BOARD (WOOD SUSPENSION)
WALL	: MORTAR WALL : VP WOODEN WALL : EP
SKARTING	: WOOD (H=100) EP
FLOOR	: CARPET ON MORTAR BED (conductive)
OTHER	: WOOD SURFACE : EP

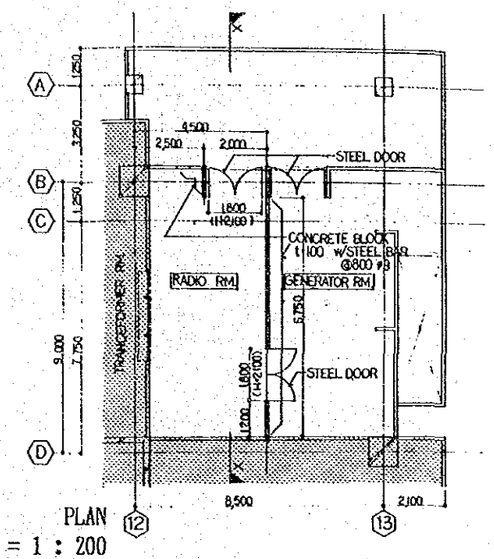
* VP : VINYL PAINT
EP : EMULSION PAINT

N

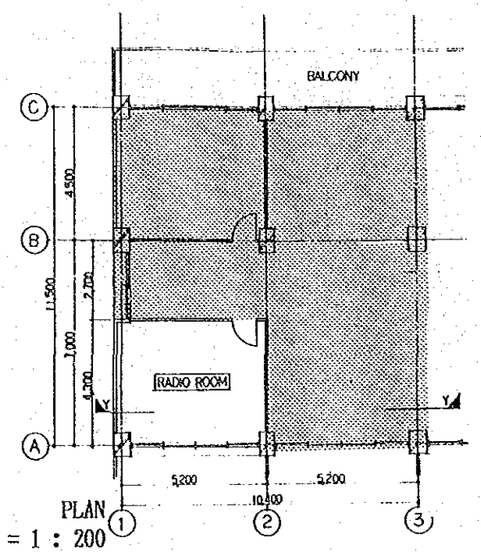
191 CENTRE ALTERATION DWG. Fig. 4 – 9



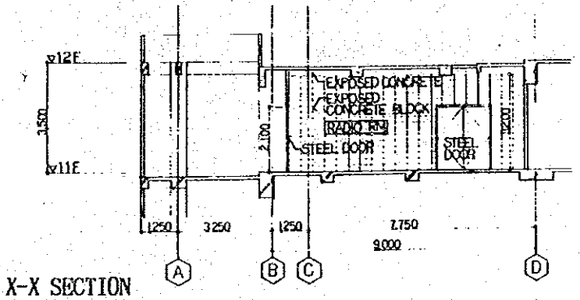
ALTERATION PLAN
S = 1 : 200



PLAN
S = 1 : 200



PLAN
S = 1 : 200



X-X SECTION
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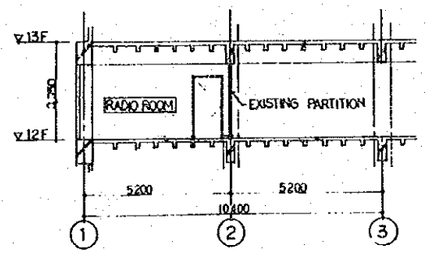

Y-Y SECTION
S = 1 : 200

MAIN RELAY STATION
(BAIYOKE TOWER)

BACK-UP RELAY STATION
(ROYAL THAI POLICE DEPARTMENT)

N

The interior shall be only of concrete or mortar: special interior completion work shall not be needed.

The Thai side shall be responsible for the power supply work from the receiving power switchboard on the 11th floor to the switchboard in the machine room.

(3) The Royal Police Department, Criminal Records Division, Back-up Relay Station (12 F)

Interior completion and partition work are already finished, so further interior completion work is not necessary. The Thai side shall be responsible for the power supply work from the receiving power switchboard on the 12th floor to the switchboard in the machine room.

4-8 Maintenance Plan

The following maintenance plan is made in order to maintain the funtion of each system properly, operate it smoothly, and accomplish the expected result after introducing this project.

(1) Operation Plan

Now the present 191 Centre is organized on a 24 hour a day work system (a three-shift system). But after the introduction of this system, it is desirable that the number and the dispositions of watchkeepers should be as follows.

Dispositions	Number of persons
Person in charge of watch	1
Emergency call receiver	7
Radio dispatcher	5

Facsimile system member	1
Maintenance	1
Total	15

In case of a serious disruption at the 191 Centre and the Main and Back-up Relay Stations, it is necessary that a stay duty system and an emergency dispatch system should be established in advance in the Maintenance Section of the Royal Thai Police Department or the Metropolitan Police Bureau.

Concerning the Radio Communication System, it is, moreover,desirable that the radio patrol dispatchers of the 191 emergency Call System should play a leading part in making an operation standard for continual maintenance of communication order, and in preparing for traffic increases in case of serious accidents.

(2) Maintenance Plan

Both the 191 Emergency Call System and the Radio Communications System are important systems for public rescue activities. In order to prevent an stoppage in operation because of an accident, it is desirable that the staff in charge of maintenance should make checklists of each piece of equipment, inspect them regularly, and ascertain whether the systems are operating normally. Especially, since the Radio Relay Station is automatically controlled, making periodic maintenance inspections is most important.

It is desirable that, by organizing a maintenance system to cope with possible accidents which may cause the system to be down, stoppage of operation due to accidents could be prevented.

The necessary spare parts and measuring/test equipment for maintenance operations should be reserved in the 191 Centre and the Main and the Back-up Relay Station for case of sudden need.

Spare parts and measuring/test equipment, shown in Table 4-4, shall be procured by the Japan side.

(3) Estimated Maintenance Cost.

After this project is completed, the maintenance cost for a year is to be about 5,000,000 BT (table 4-6), including expenses for lighting and fuel.

Table 4-6 Estimated Maintenance Costs for One Year

System	Contents of the Maintenance	Cost (BT)	Cost (BT)
191 emergency Call System	Consoles	190,000	900,000
	Fixed Radios	40,000	
	Processing unit	330,000	
	Operation display	100,000	
	Power supply	240,000	
Radio Communications System	Relay equipment	170,000	300,000
	Power supply	90,000	
	Fixed radios	660,000	
	Mobile radios	1,160,000	

	Hand-held radios 920,000	
Facsimile System	Papers and others	600,000
Systmes above mentioned	Expenses for light and fuel	500,000
Total		5,000,000

4-9 Project Implementation Plan

(1) Implementation System

It is important to ensure the acquisition of the local materials and the trnsportation of the equipment from Japan in line with the implementation schedule. It is necessary that the consultants from a Japanese consulting firm should be assigned to ensure the smooth progress of the project.

After the Exchange of Notes between the Governments of Thailand and Japan, the Japanese consulting firm shall conclude a consultant contract with the Royal Thai Police Department based on the procedures required for the Grant Aid Program.

The consulting services shall cover the following works.

1) Works in Japan,

- o Preparation of Detailed Design drawing, specifications and design documents for the equipment and the remodeling works of the 191 Centre and the other sites.
- o Work for selecting the firm to be supplied with the equipment
- o Inspection of the equipment manufactured in Japan

o Others

2) Works in Thailand

o Supervision of the remodeling works of the 191 Centre and the other sites

o Inspection of local materials

o Technical guidance concerning with the interfacing of each system of the Project

(2) Scope of work to be undertaken by the Japanese Side and the Thai Side.

1) Responsibilities to be taken by the Thai side:

o To remove the partitions, and other structures, implement interior work at the 191 Centre, construct related power facilities and to move air conditioners and presently operated equipments.

o To set the partitions for the Main Relay Station machine room and power room in Baiyoke Tower, and implement related power facility construction.

o To implement related power facility construction in the Back-up Relay Station machine room in the Criminal Records Division of the Royal Thai Police Department.

o To load the mobile radio equipment offered in this project onto vehicles.

o To maintain and use properly and effectively the equipment provided in the project.

o To bear commissions to the Japanese foreign

exchange bank for banking services based upon the Banking Arrangement.

- o To ensure prompt unloading, tax exemption at the port of disembarkation in Thailand and prompt internal transportation therein of the products purchased under the Grant.
- o To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Thailand with respect to the supply of the products and services under the verified contracts.
- o To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contracts, such facilities as may be necessary for the performance of their work.
- o To provide general furniture required for administrative purposes.
- o To bear all expenses necessary for the project other than those to be borne by the Japanese side.

2) Responsibility to be taken by the Japanese side:

- o To privide the equipment to be used in the 191 emergency Call System.

Equipment	Quantity
Map display processing unit	1 set
Character display processing unit	1 set
Emergency call receiving console	7
Radio patrol dispatching console	3 (2 seats/1 console)
Supervisory console	1
Emergency operation control console	1
Fixed radio equipment	10
Multi-channel logging recorder	1
Emergency power supply	1 set
Police activity operation display	1 set

o To provide the equipment to be used in the Radio Communication System.

Equipment	Quantity
Main Relay Station	
Aerial equipment	1 set
Relay equipment	5 sets
Control and monitor equipment	1 set
Emergency power supply	1 set
Air conditioner	1
Back-up Relay Station	
Aerial equipment	1 set
Relay equipment	5 sets
Control and monitor equipment	1 set

Emergency power supply	1 set
Air conditioner	1
Fixed radio equipment	75
Mobile radio equipment	250
Hand-held radio	220

o To provide the equipment to be used in the Facsimile system.

Equipment	Quantity
Facsimile	76

o To install the equipment mentioned above (except for loading of mobile radios onto vehicles)

o To offer a plan and supervise remodeling work to be undertaken by the Thai side.

(3) Equipment Procurement Plan

The communications equipment for the project shall be produced in Japan and the power cables and air conditioning equipment for the Relay Station are to be procured in Thailand.

(4) Implementation Schedule

The implementation schedule is shown in the Table 4-7.

4-10 The Estimated Project Cost on the Thai Side

The estimated project cost to be borne by the Thai side is as follows:

Total amount : approx. 1,725,000 BT

Breakdown :

o Removing work of the equipments 24,000 BT

which are operated presently in the 191 Centre:

o Remodeling of the 191 Centre:	1,554,000 BT
o Partition construction for machine and power rooms in Baiyoke Tower:	136,000 BT
o Power facility construction in the machine room of the Criminal Records Division, The Royal Thai Police Department	10,500 BT
Total	1,724,500 BT

Table 4-7. Implementation Schedule