

MINISTRY OF COMMUNICATIONS
PAPUA NEW GUINEA

NO. 1

**BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR REBUILDING OF
RADIO EAST NEW BRITAIN
IN
PAPUA NEW GUINEA**

DECEMBER 1996

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*Japan International Cooperation Agency
NHK Integrated Technology Inc.*

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PREFACE

In response to a request from the Government of Papua New Guinea, the Government of Japan decided to conduct a basic design study on the Project for Rebuilding of Radio East New Britain in Papua New Guinea and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Papua New Guinea a study team from June 30 to July 27, 1996.

The team held discussions with the officials concerned of the Government of Papua New Guinea, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Papua New Guinea in order to discuss a draft basic design, and as this result, the present report was finalized.

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

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

December 1996



Kimio Fujita

President

Japan International Cooperation Agency

December 1996

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Rebuilding of Radio East New Britain in Papua New Guinea.

This study was conducted by NHK Integrated Technology Inc., under a contract to JICA, during the period from June 24, 1996 to January 16, 1997. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Papua New Guinea and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

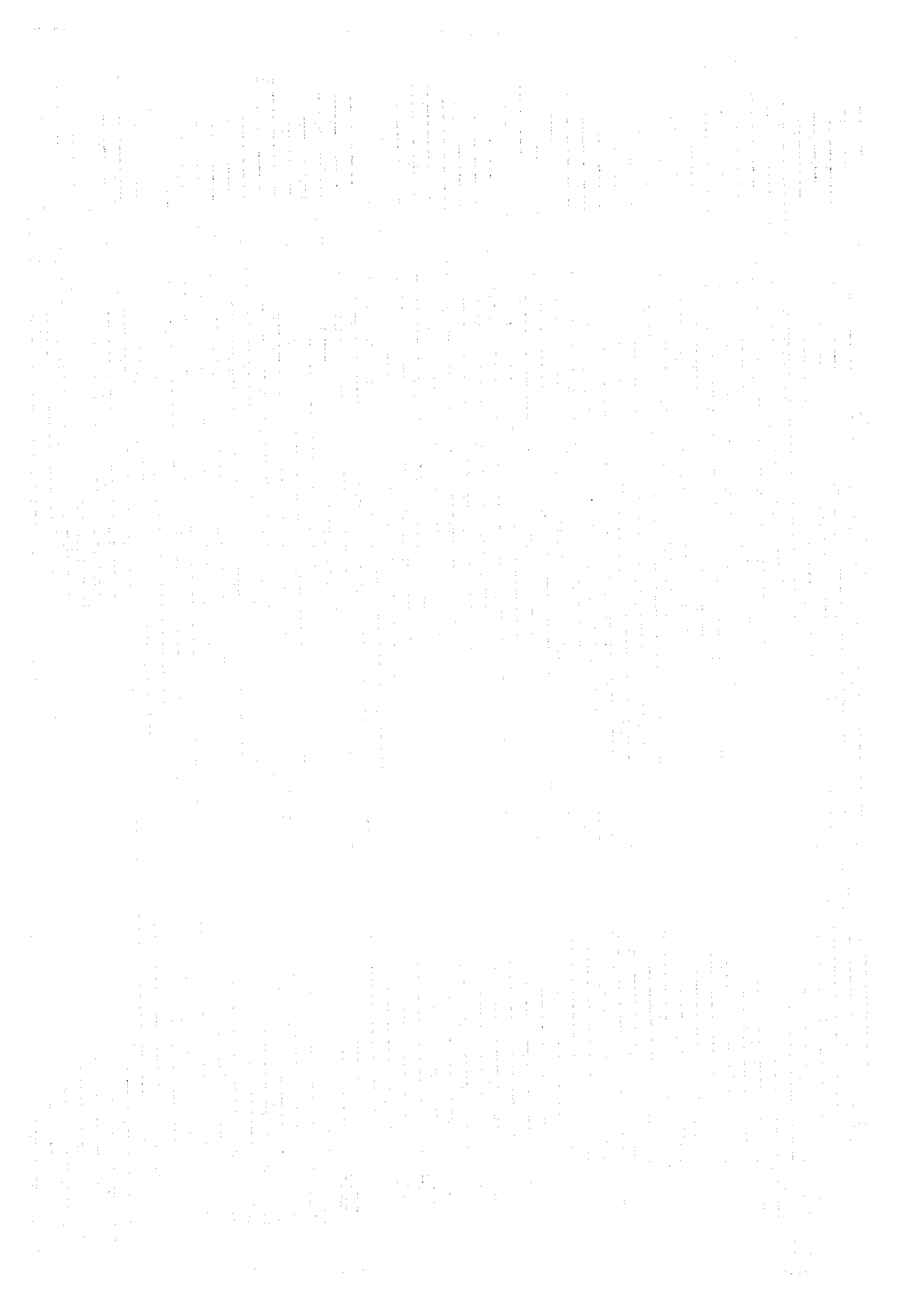
Very truly yours,

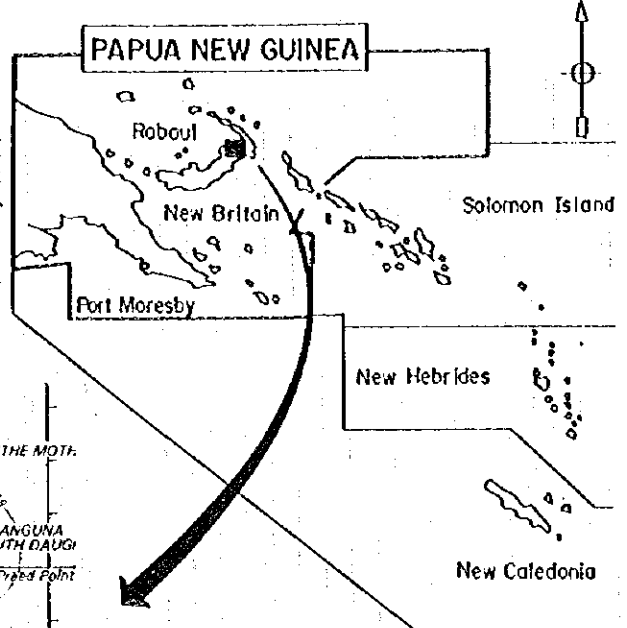
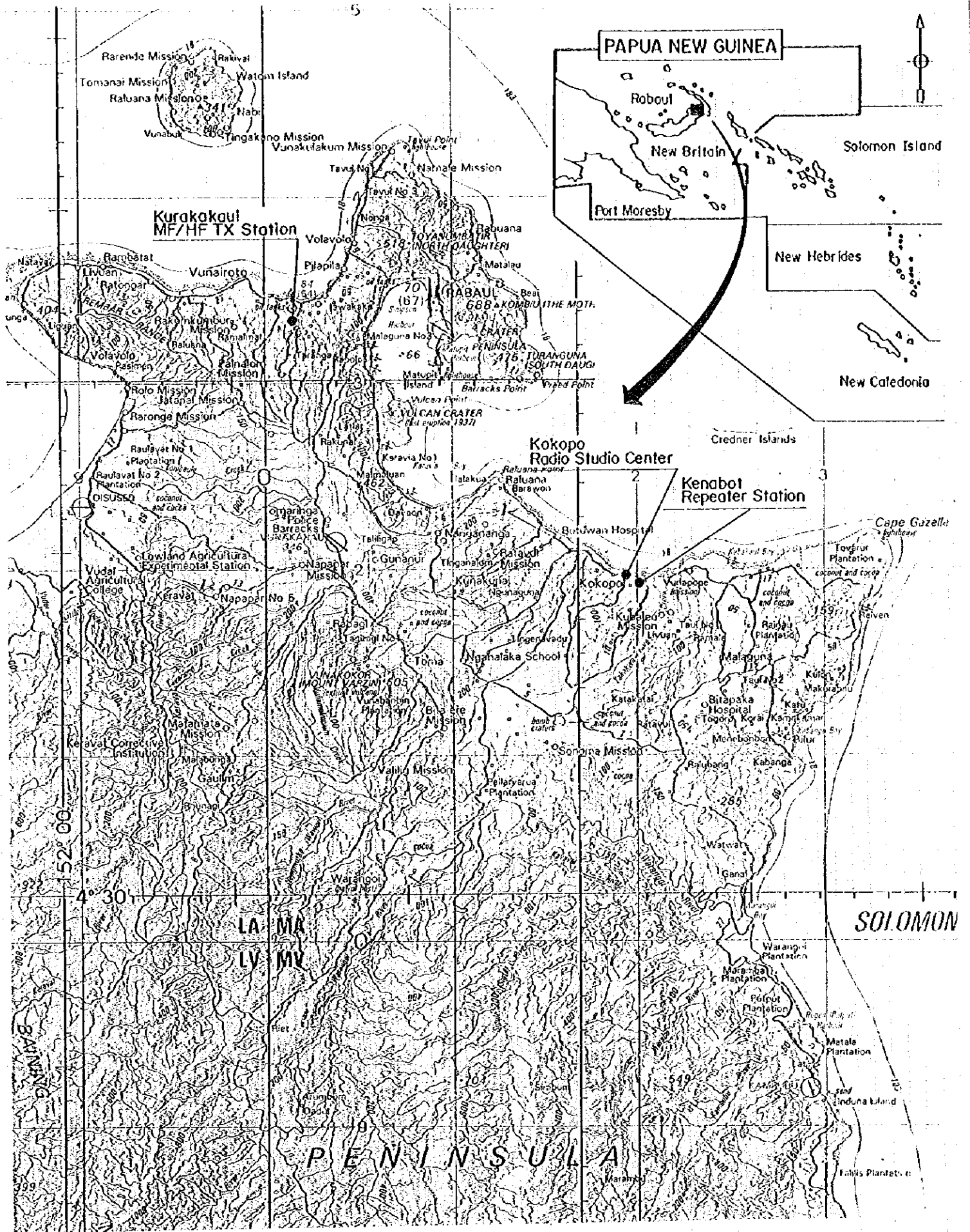


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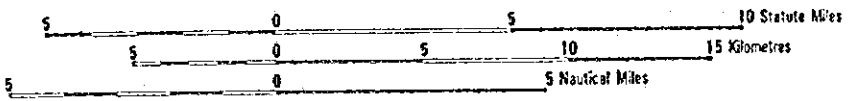
Project manager,

Basic design study team on
the Project for Rebuilding
of Radio East New Britain
NHK Integrated Technology
Inc.

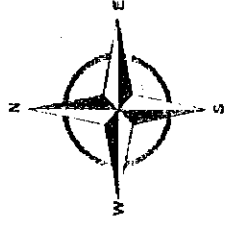




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PROJECT SITES



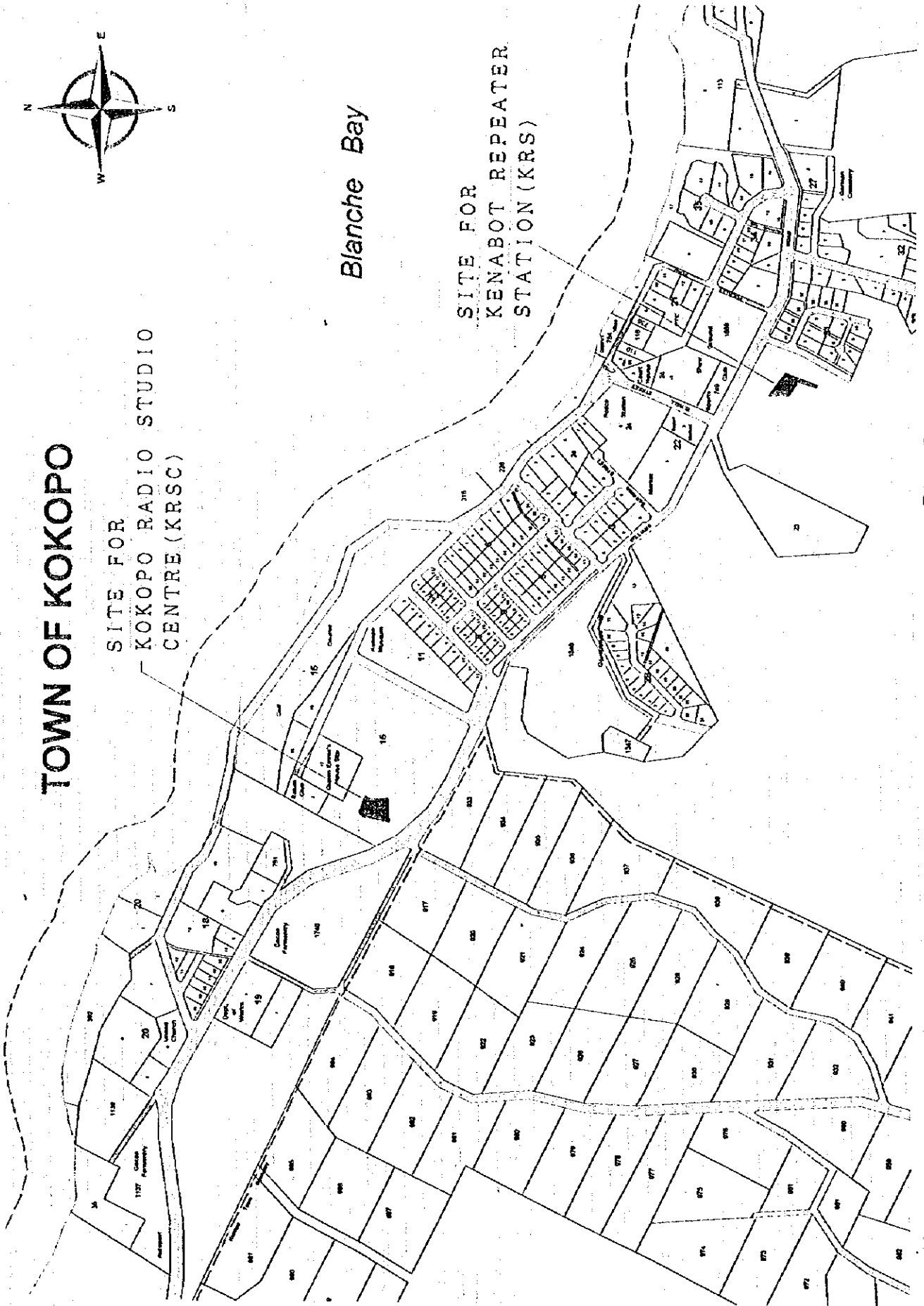
TOWN OF KOKOPO

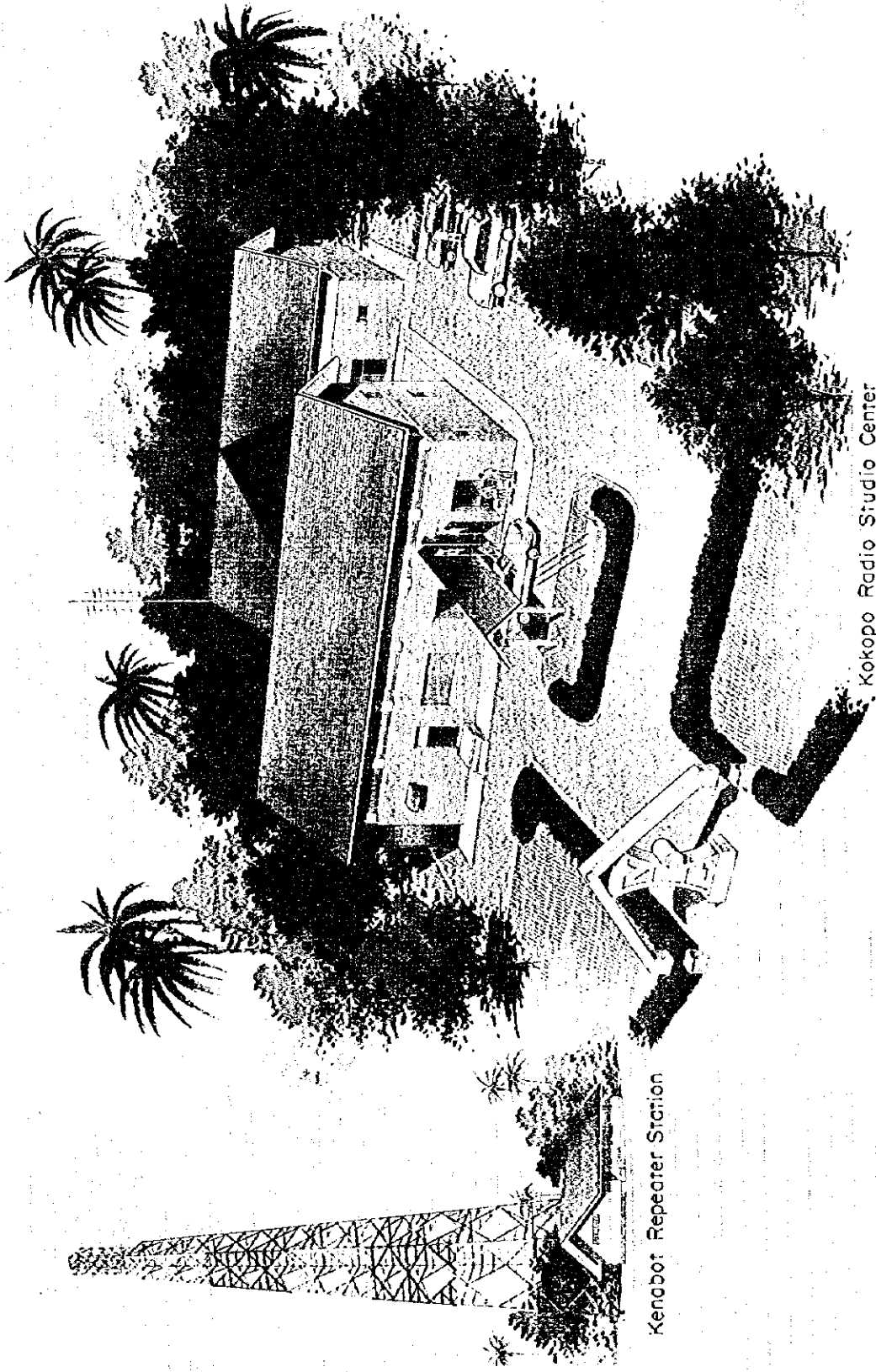
SITE FOR
KOKOPO RADIO STUDIO
CENTRE (KRSC)

Blanche Bay

SITE FOR
KENABOT REPEATER
STATION (KRS)

BUILDING LOCATION MAP S=1/11,400





Kenobot Repeater Station

Kokopo Radio Studio Center

PERSPECTIVE OF RENB NEW BUILDINGS

Abbreviation

GRA	Gazelle Restoration Authority
ICAO	International Civil Aviation Organization
ITU	International Telecommunication Union
KRS	Kenabot Repeater Station
KRSC	Kokopo Radio Studio Center
NBC	National Broadcasting Corporation
PNG	Papua New Guinea
PTC	Post & Communication Corporation
RENB	Radio East New Britain

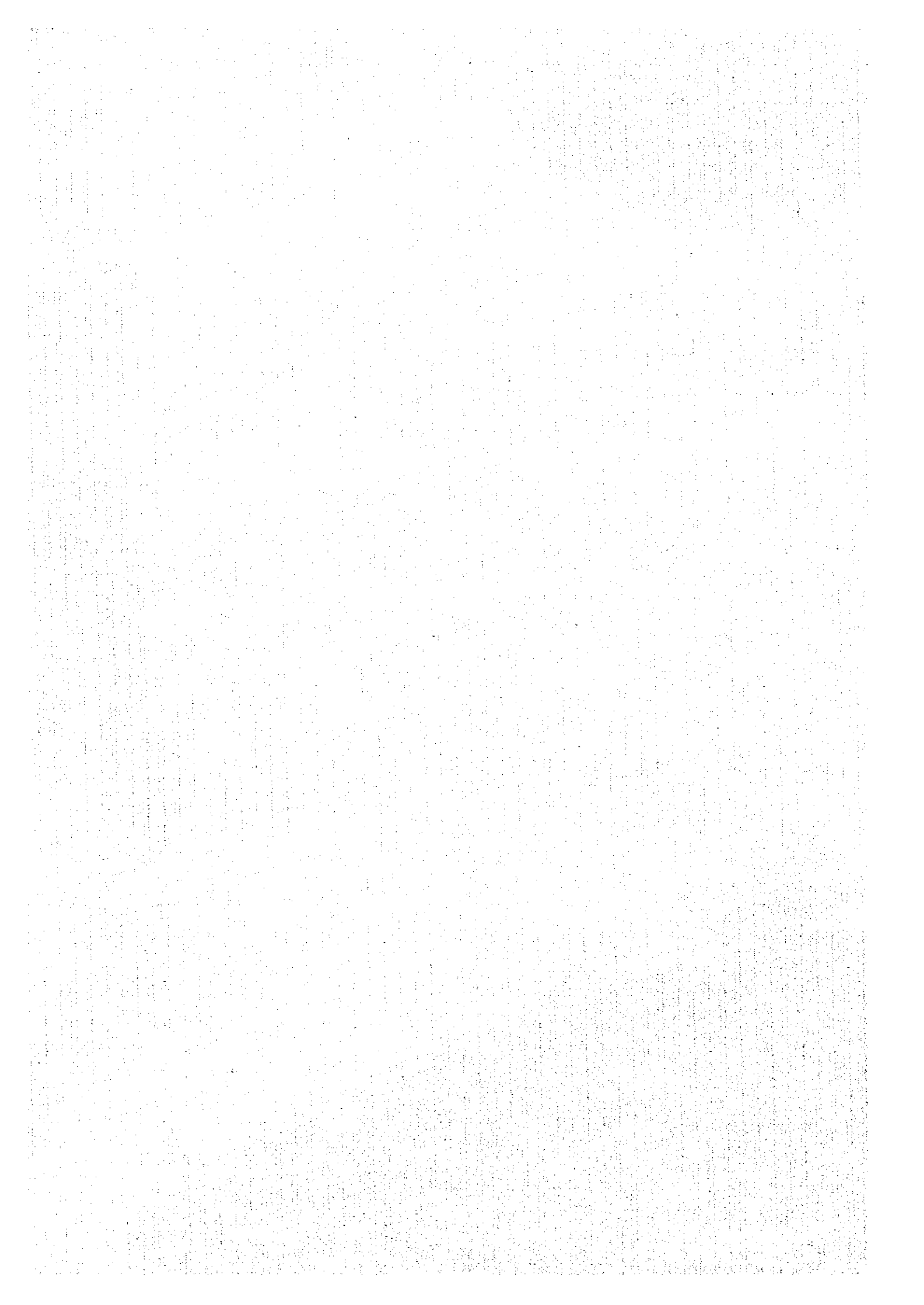
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Chapter 1 Background of the Project



Chapter 1 Background of the Project

1-1 Broadcasting Situation in Papua New Guinea

Papua New Guinea (PNG) is composed of more than 10,000 islands of varying sizes such as the eastern half of New Guinea island, Ireland, Bougainville and Manus; it has a population of 4,200,000, and it covers a national land area of 4,630,000 km². With most of the national land belonging to the Pan-Pacific orogenic belt, there are numerous mountain ranges of precipitous features that have been formed by volcanic activity, and the terrain is very complex. These natural conditions partly explain the complicated nature of society in Papua New Guinea, where there are more than 500 races who speak upwards of 830 different languages and dialects.

In a country like Papua New Guinea, which is faced with such severe natural conditions and is home to so many races and languages, radio broadcasting is an effective media for imparting information to the whole nation (indeed in the regions it is the most reliable media and in some areas the only media), and it fulfills a vital role in not only providing education, news and entertainment programmes but in spreading knowledge on health, sanitation and agriculture and passing on emergency information in the event of disasters.

The following paragraphs give an outline of the broadcasting sector in PNG.

(1) Public Broadcasting

The National Broadcasting Corporation (NBC) broadcasts two types of programmes: national programme (Karai service) and locally intended programme (Kundu service).

1) Karai Service

Karai service is broadcast to the whole nation in English and mainly consists of public information and education programmes. The broadcasts last for 18.5 hours every day (05.30-24.00) by 6 MF transmitters, 12 HF transmitters and one FM transmitter established in the country's major areas.

2) Kundu Service

Nine-and-a-half hours (0.5.30-08.00 and 17.00-24.00) of Kundu service in around 30 languages including Pidgin English and Motu were produced and broadcast every day in each province's radio station, however, due to damage caused by volcanic eruption, Radio East New Britain (RENB) is currently only broadcasting five hours of Kundu service a day.

(2) Commercial Broadcasting

1) Radio

There are two networks of FM Broadcasts; one is a NBC-owned network (Kalang Service) and the other is funded by companies in Fiji (NAUFM). These networks are centered around Port Moresby and broadcast mainly music programmes for 24 hours a day to the capital and other major cities.

2) Television

EMTV, which is owned by the Australian commercial television company Nine Network, broadcasts 48 hours of mainly entertainment programmes every week. Television set ownership reached 10,000 sets in 1992 and the service covers 30% of the country.

1-2 Outline of Request

In September 1994, two volcanoes on the outskirts of Rabaul in East New Britain Province erupted, resulting in almost complete destruction to the radio studio building of Radio East New Britain (RENB) and damage to studio equipment. After rescuing equipment from the ashes of the old radio studio center and repairing it, RENB managed to restore functions enough to now be able to broadcast five hours of programmes daily, compared with nine-and-a-half hours before the disaster. However, because RENB has no studios, it finds it almost impossible to produce local programmes and, as a result, the residents of East New Britain are unable to receive satisfactory news and information.

In response to this situation, the Government of Papua New Guinea requested the Government of Japan to provide grant aid for the rebuilding of the RENB radio studio center and office block and the provision of studio and other broadcast equipment.

Chapter 2 Contents of the Project

Chapter 2 Contents of the Project

2-1 Objective of the Project

The Project for the Rebuilding of Radio East New Britain (RENB) in Papua New Guinea (PNG) aims to restore the RENB, which suffered damage as a result of the volcanic eruption of September 1994. The targets of the restoration are the radio studio centre building, studio equipment, transmission equipment for transmitting programmes from the studio to the transmitting station, and the antenna system for HF transmitting equipment.

Implementation of the Project will increase the broadcasting hours of RENB from its current five hours to nine-and-a-half hours per day and also enhance the contents of broadcasts. In doing this, the Project aims to restore the service capability of RENB to pre-disaster levels so that it can contribute to the daily lives of citizens in East New Britain in the following ways.

- (1) Contribution to socioeconomic development
- (2) Unification of the multi-racial state
- (3) Diffusion of the official language
- (4) Maintenance of regional traditional culture
- (5) Diffusion of child education, literacy education, skills and technologies, and knowledge regarding public health and sanitation
- (6) Provision of weather and disaster reports and other necessary every day information

2-2 Basic Concept of the Project

(1) Facilities

The old radio studio center in East New Britain Province was located in central Rabaul but, as a result of the eruption of the volcano on the outskirts of Rabaul in September 1994, this was practically destroyed.

The Government of PNG established the Gazelle Restoration Authority (GRA) to take charge of the disaster restoration centering around the city of Rabaul (located on the Gazelle Peninsula). The GRA has been carrying out the removal of volcanic ash from Rabaul, the provision of housing support to people who suffered in the disaster, infrastructure preparation for the construction of Kokopo Airport, and also the compilation of a new city plan and further infrastructure building with the aim of transferring the state capital from Rabaul to Kokopo.

Damage to the old radio studio center in Rabaul is so extensive that restoration is impossible. The National Broadcasting Corporation (NBC) originally planned to construct the new radio studio center next to the Kenabot Hill in Kokopo, however, because this area has been designated as a commercial district within the city plans compiled by the GRA, it has decided to construct the new radio studio center in Kokopo on land that has been reserved for public works by the GRA.

One drawback to this site is that the type of building that can be constructed on it is limited according to the restrictions laid out within the city plans compiled by the GRA. As a result, the new radio studio center will have to satisfy these restrictions.

1) Kokopo Radio Studio Center (KRSC)

Prior to the volcanic eruption, the radio studio center of Radio East New Britain (RENB) and island regional headquarters in charge of RENB were located in different buildings in Rabaul. It has been requested, however, that these functions be combined within the same building in the case of the new Kokopo Radio Studio Center, so that the ground floor of the building contains the studio functions where the RENB staff will work and the first floor contains office space to be shared by the staff of both RENB and the regional headquarters.

Therefore, the basic concept of the Kokopo Radio Studio Center design shall be that it is of a scale that combines the sizes of the old radio studio center and the old regional headquarters. Furthermore, in order to prevent further damage caused by the still continuing volcanic ash fallout, facilities that are normally installed outdoors such as air conditioning and rainwater storage facilities, etc. shall be put indoors.

2) Kenabot Repeater Station (KRS)

As a result of the restrictions laid down within the GRA city plans, the construction of a tall structure such as a steel tower has been prohibited in the vicinity of the Kokopo Radio Studio Center because it may adversely affect the urban landscape.

However, in order to send out programmes produced at Kokopo Radio Studio Center to the existing HF transmitting station in Kurakakaul, a steel tower fitted with a transmission antenna is needed. For this reason, a self-supporting steel tower (80 m above ground) shall be constructed together with a repeater station building to house the programme transmission equipment on Kenabot Hill, which is located 1 km away from Kokopo Radio Studio Center.

The site for the steel tower and repeater station on Kenabot Hill had already been secured as NBC land, thus there is no problem concerning the land acquisition.

(2) Broadcast Equipment

1) Studio Equipment

The scale of the programme production equipment shall basically be the same as before the disaster, and the necessary facilities and equipment shall be determined according to the contents of programmes and length of broadcasting times that exist following completion of the Project.

NBC has studios in each of the country's 19 regions and central studios in Port Moresby, but as almost all these studios were established in the early 1970s and are more than 20 year's old, NBC has planned to renew them over the next 10 years within its long-term broadcasting development plan.

The fiscal 1996 phase of the said long-term broadcasting development plan has scheduled the installation of a programme editing and sending-out system for the studio of Radio West New Britain (Kimbe Station), and the installation of the same system in the studio at RENB has also been strongly requested.

However, because the above-mentioned renewal of the Kimbe Station has been delayed, in the case where a programme editing and sending-out system is introduced through implementation of the Project, this will first take place at RENB, meaning that RENB will become a model for subsequent renewal at other stations.

2) Programme Transmission Equipment

Programme transmitting equipment is needed to send programmes that have been produced in the studio from the radio studio center to the transmitter station. In view of the fact that radio equipment is said to be more advantageous than wired equipment in the event of disaster, radio equipment shall be adopted for the purposes of the Project. Because there are mountains between the Kokopo Radio Studio Center (KRSC) and the Kurakakaul MF and HF transmitter station (distance 23 km) which make it impossible to obtain a direct link, the local topography shall be studied before deciding the ideal position for the repeater station and the scale of the transmission equipment.

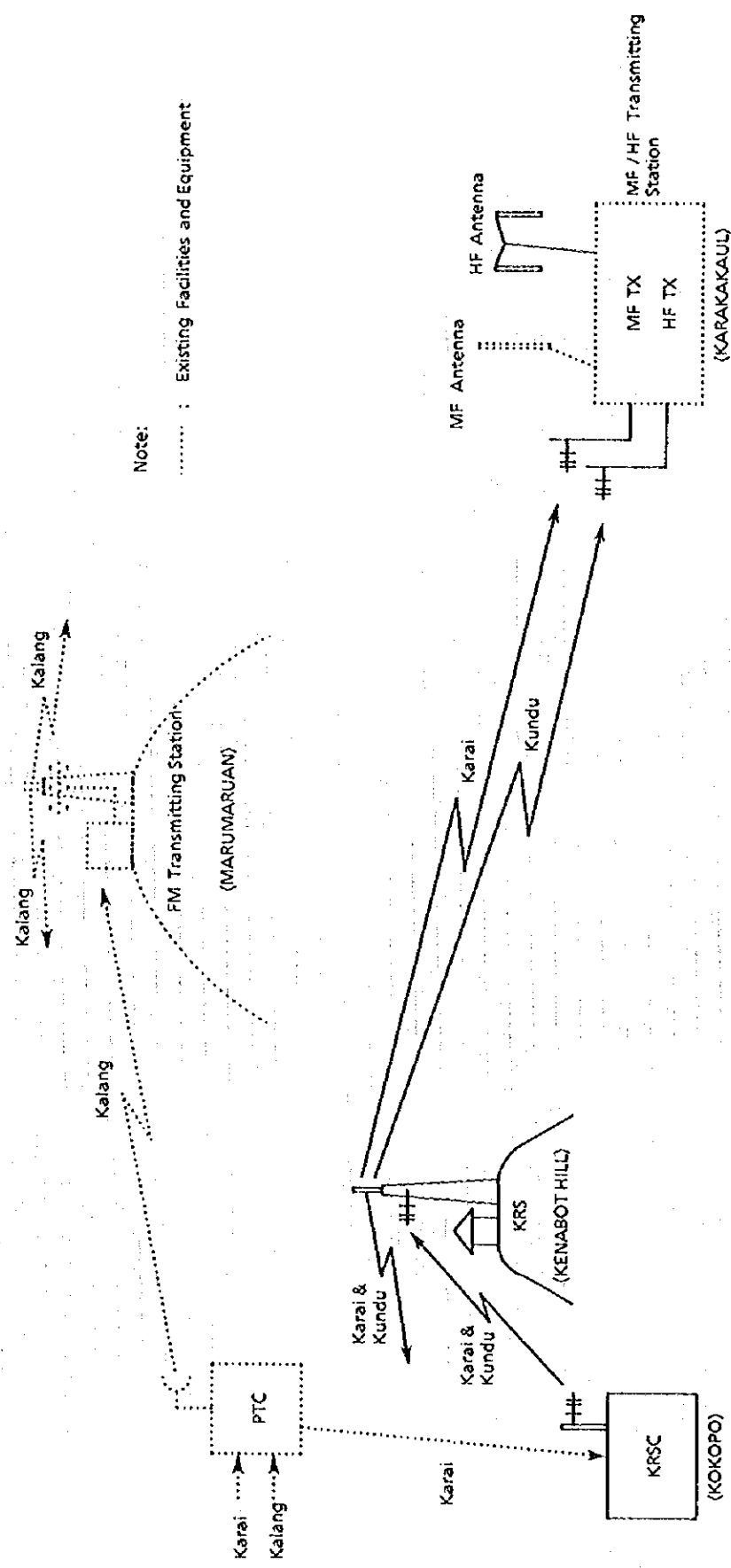
As a result of the site survey and discussions with the local side, it was decided to locate the repeater station of Kenabot Hill one kilometer away from the KRSC. Because there are no obstructions between the KRSC and Kenabot Hill, STL (studio to transmitter link) equipment of the UHF band, which is the authorized wavelength for sound broadcast programs in PNG, shall be used. Regarding transmission between Kenabot Hill and the MF and HF transmitter station in Kurakakaul, because there are mountains which make it impossible to get a clear link, an FM transmitter on the VHF wavelength shall be used to transmit programmes through the mountains.

Refer to: Figure 2-2-1 Outline of Programme Transmission
Link Equipment

(3) HF Transmitting Antenna

There are currently two HF antennas which transmit on the wavelengths of 3385 kHz and 5985 kHz, however, a common antenna for joint use over both wavelengths shall be used for the purposes of the Project and it shall be given enough capacity to cover the Kundu service broadcasts of the existing antennas.

The HF transmitter for Kundu service was established in 1988 through Japanese grant aid, however, the HF transmission antenna is now 35 year's old (established in 1961) and is in need of renewal. In particular, renewal is urgently required because the degradation has been accelerated by the effects of volcanic ash fallout containing chemical substances.



Note:
 : Existing Facilities and Equipment

Figure 2-2-1 Outline of Programme Transmission Link Equipment

2-3 Basic Design

2-3-1 Design Concept

(1) Facilities

It is required that the broadcasting facilities to be constructed under the Project are sturdy, reliable and able to function indefinitely. Moreover, the facilities must be able to respond to the need to expand functions in line with future development and changes in lifestyles. Thus, with regard to the buildings that will house the broadcasting equipment, they shall be designed with greater durability, safety and flexibility to respond to future changes than general buildings.

In carrying out the design of the facilities, careful attention shall be paid to the following items based on these basic principles.

1) Natural Conditions

The greatest emphasis shall be placed on minimizing building damage caused by volcanic ash fallout. Because volcanic ash mixes with rain to create acidic and alkaline solvents which erode metals and other building materials, the utmost care shall be taken in selecting roof shape and exterior facing materials. Moreover, outside units of air conditioners and pumps, etc. will need to be brought indoors to avoid the fallout, and the blocking out of volcanic ash shall also be planned through the adoption of anti-dust chambers and filters, etc. at openings that are used to introduce fresh air to the buildings.

2) Social Conditions

Because the Kokopo Radio Studio Centre is to be located in a city planning zone designated by the GRA, the facility shall be designed to comply with the city planning concept. The GRA guidelines shall be applied with regard to the building layout within the site, the roof shape and the design conditions, etc. However, because the GRA development plans have not yet reached the implementation stage and the plans for land use and approach road construction around the site are currently unclear, close

coordination will again need to be carried out in the detailed design stage.

3) Construction Circumstances

Not many materials are produced in PNG, so almost all construction materials are imported from Australia, New Zealand and other nearby countries. Such imported materials will need for the construction of the Project facilities, however, care shall be taken to ensure the easy operation and maintenance of facilities after construction through selecting materials and product suppliers that possess agents locally.

4) Use of Local Contractors

The technical levels and work progress management capabilities of local construction contractors cannot be described as sufficient, so such contractors shall be relied on mainly to provide labor. Japanese engineers and skilled workers from third countries shall be utilized during the construction work, and appropriate technical transfer shall be provided to the local contractors as the work progresses.

5) Grade of Facilities

Regarding the grade of facilities, it was previously stated that high durability and safety levels shall be aimed for, however, in consideration of the local conditions and maintenance setup, care shall be taken not to take this policy too far.

(2) Broadcast Equipment

1) Studio Equipment

The method of programme production can be said to almost totally comprise a series of manual operations, and the quality of the interface with the equipment used can greatly affect the efficiency of the work. In implementing the Project, the wishes of the NBC side shall be accurately grasped to adopt a programme sending-out system that makes it possible to perform multi-channel recording and play back, which has rapidly become the norm at radio stations in recent years.

2) Programme Transmission Equipment

The programme transmission equipment is intended to transmit the programmes produced at the Kokopo Radio Studio Centre to the existing transmitting station without lowering sound quality, through placing the programmes on the frequencies created by radio transmitters.

In carrying out the design, a backup system shall be built and the monitoring system improved in case the transmission equipment should break down.

3) HF Transmitting Antenna

There are currently two HF transmitting antennas operating on 3,385 kHz and 5,985 kHz, but these shall be replaced with one broad-band antenna capable of covering both frequencies.

2-3-2 Basic Design

(1) Facilities

1) Site and Building Layout Plan

(a) Site Conditions

a) Kokopo Radio Studio Centre (KRSC)

The KRSC construction site is located in the centre of Kokopo some 300m south of the coast on a plot (15 sections, 18 units) that faces onto William Road, which is the main road running east to west through the city centre. The site forms a sunken square shape and runs for an average of 50m in both the north-south and east-west directions (area approximately 2,500 m²), and it also has a level difference of approximately 3.5m between its northern and southern ends. Although the site area cannot be described as totally sufficient, the site itself presents no problems to the construction of facilities.

Commercial electricity is supplied up to the site,

however, because part of the electricity line runs across the site, it will be necessary to relocate the poles and line in question. There is no city water supply and drainage system, so the building shall adopt a rain utilization water supply system and system of internal waste water treatment through septic tanks and soak pits seen throughout all New Britain Island.

b) Kenabot Repeater Station (KRS)

The construction site for the repeater station is located on Kenabot Hill approximately 1 km to the east of the KRSC in the direction of Tokua, and this is also along the aforementioned William Road. The site is shaped like a trapezium (area approximately 2,055 m²) and has an approach road of approximately 5m in width and 50m in length. The site area is appropriate for constructing a repeater station and 80m self-supporting tower, however, because there is a gradient of more than 5m over the whole site, it will be necessary to carry out site formation through cutting and banking.

Because there is a level difference of roughly 20m between the front road and the site, access to the site is difficult. The CRA has announced that it will secure an access road to the top of the hill by September 1997.

The commercial electricity supply is fed to the frontal road, and line extension should not be a problem. The water supply and sewerage situation is the same as that described for the KRSC above, however, because the repeater station will normally be unmanned, the facility shall be provided with no water supply.

(b) Building Layout Plan

a) Kokopo Radio Studio Centre

The Kokopo 15 section zone containing the KRSC construction site is a zone known as the Ralum Civic Centre, an area that has been reserved for the

construction of various public facilities. There are plans to construct governmental offices, a courthouse, police station, museum and library, etc. here, and the KRSC site is a plot in the north-western corner facing onto William Road and on the west side of the planned Civic Centre car park.

The GRA is planning to turn William Road into a superhighway road linking Tokua and Rabaul and has prohibited direct entry to the KRSC site from this road. Therefore, the most appropriate approach route to the KRSC will involve passing through the car park from the Civic Centre main access road being planned on the south side of the site and then turning off the in-complex rotary being planned on the north side of the site.

As a result, the front garden and car approach shall be placed on the north side of the site, and the building itself shall be placed on the south side facing north. Moreover, in order to make sure the offices and other occupied rooms do not capture too much western sun, the long side of the building containing most of the openings shall be placed on the east-west axis.

The north side of the site is currently a coconut grove, while there is a path on the west side leading to a golf course to the north of the site. In the light of total landscaping around the site, the site access road could either directly enter through the site perimeter on the north side. In case that the Civic Centre construction plans fell far behind schedule, the access to the site may be made using the existing path on the west side.

b) Kenabot Repeater Station

Because the site has an overall gradient of more than 5m, land on the south side in the centre of the site close to the planned approach road where the ground is comparatively flat shall be utilized as the space for construction of the building and tower.

The self-supporting tower shall be built on the planned access road side (highest level spot within the site), and it shall be angled approximately 50 degrees from the north to west to ensure that the antenna attached to the top of the tower faces in the direction of the existing transmitting station at Kurakakaul.

The building shall be placed parallel and to the north of the tower to ensure that the feeder laid between the two is of minimum length and that the feeder inlets in the centre of the tower and inside the transmitting room respectively are on the same line.

(c) External Work Plan

a) Kokopo Radio Studio Centre

The Ralum Civic Centre construction plans are still only in the basic concept stage, and even the ground design level of the KRSC construction site has yet to be decided. Upon making inquiries to the GRA about this point, the GRA gave instructions to make the fullest possible use of the existing ground conditions when designing the building. Thus, assuming a ground level that will fit well with the exterior plans of the overall Civic Centre, the KRSC shall be designed to utilize the existing gradient (level difference over the whole site is approximately 3.0m).

The in-complex road shall, in consideration of the building layout, circle the front entrance on the north side of the site and have enough space on the west side to allow the entry and exit of tank lorries and other service vehicles. The road shall be concrete paved.

Kokopo City has no waste water and rain drainage system and, because it is imagined that it will be many years before such a system is put in place in the city, it is most appropriate to adopt a method whereby as much rain as possible is treated on the site. Thus, the rain drainage system shall consist of an approximately 2m gravel scarcement around the building and infiltration rain inlets around the site, all designed to ensure that rain is percolated into the ground as fast as possible.

The area of lowest ground in the north-east part of the site shall be used as a service yard containing a septic tank, soak pit and oil tank for holding generator oil.

Regarding fencing, because the GRA plans to construct a boundary fence around the whole Civic Centre development zone, the independent fencing of the KRSC alone is not allowed. However, in the event where the Civic Centre construction is delayed far beyond the end of Project implementation, the NBC would like the temporary works fence (the establishment of which is the responsibility of the Japan side) to be used for as long as may be necessary following construction for security reasons.

b) Kenabot Repeater Station

The exterior plan of the repeater station will be largely affected by the GRA plans for construction of the access road to Kenabot Hill and the site formation on top of the hill. In this basic design the existing ground conditions have been used in the building and tower layout plan, however, it may be necessary to review this layout plan at the time when the GRA plans become more specific.

Construction of the in-site road cannot be started until the access road construction level and the overall land formation plans for the top of the hill have been finalized. For this reason, the exterior

plan at the basic design stage shall be limited to the ground preparation around the building and shall not consider connection of the in-site road and access road and the boundary fencing, etc.

2) Building Plan

(a) Floor Plan

a) Kokopo Radio Studio Centre(KRSC)

The points given special consideration and items set as basic conditions in compiling the floor plan of the KRSC are described below.

* In order to enable the rooms that comprise the KRSC to be arranged into the following zones, the plan was compiled to secure the clear zoning of the rooms and to achieve a positional relationship between zones that allows them to mutually function and perform effectively.

- Studio zone : Studios, Control Rooms (2), Tape Library

- Staff zone : Waiting Room, Offices, Conference Room and other occupied rooms

- Service zone : Generator Room, Electricity Room, Pump/Tank Room, etc.

* The plan was compiled to allow the shape and level differences of the existing ground to be utilized to the full.

* In order to secure a building area that matches with the overall site area and external work plan, the staff zone (offices, conference room, etc.) shall be placed on the first floor.

* Care shall be taken to have outside-looking windows in the staff zone not directly facing the west.

* Traffic lines in the service zone (mainly the building equipment rooms) shall be secured to allow the easy carrying in and maintenance of large items of equipment.

* The noisy generator room shall be placed as far away as possible from the studios.

The plan shown in the basic design drawing is the combined result of giving overall consideration to the above-mentioned factors. The comparatively low-lying area on the north side of the site shall be used to construct a two story block containing the service zone and staff zone on top of one another, while the highest level area on the south side shall be used to build an independent single story block containing the studio zone. The two blocks shall be placed parallel to one another and shall be connected by a common-use space containing a corridor, staircase and toilets, etc.

By making the studio zone into an independent block, it will be possible to carry out expansion of up to two spans in the future. Moreover, by placing the staff zone (offices, conference room, etc.) on the first floor of the north block, a pleasant environment for occupants will be secured in that there will be a good view of the sea to the north and it will be possible to minimize the amount of western sunlight coming in.

b) Kenabot Repeater Station

The existing NBC transmitting stations have almost identical floor plans, with maintenance engineer rooms (offices or control rooms) and equipment repair workshops placed next to the transmitter rooms, and storerooms, generator rooms (combining electricity room functions) and pump rooms, etc. also included.

The floor plan of the Project repeater station complies with this standard plan for NBC transmitter stations but, in view of the fact that it will normally be unmanned and is located on Kenabot Hill in the middle of the city, water supply facilities and toilets shall not be provided.

The table showing the functions and basis for area

calculation of each of the rooms in the KRSC and the repeater station is shown on a subsequent page.

Refer to: Table 2-3-1 Rooms Required with their Functions and Areas

(b) Sectional Plan

a) Kokopo Radio Studio Centre

The GRA, taking a serious view of the volcanic ash fallout that has continued since the eruption in 1994, is attempting to establish a new building code for buildings scheduled to be built in the Kokopo city planning district, based on the assumption that the worst fallout at any one time is approximately 100 mm (ranging between 4-100 hours, but 40 hours on average). The Recommended Additional Building Code Requirements (ABC proposal) were compiled in May 1996 and contain specific recommendations concerning the quality of appropriate building materials, ash load, roof shape, the treating of openings, and so on.

The one item contained in the ABC proposal which most greatly affects the sectional plan of the KRSC building is that which states that roof gradient should be set at a value within the range of 35° minimum and 45° maximum. Even though the ABC proposal has yet to become written law and contains some contradictory parts, this recommended requirement concerning roof gradient can be said to be quite appropriate in view of the fact that buildings with steep roofs in the central disaster area of Rabaul have received no major damage.

Therefore, in compliance with this recommended requirement, the KRSC shall be given a gable end roof, however, in view of the special nature of the building as a broadcasting facility, the studio zone of the building shall be covered in concrete slabs to ensure noise insulation, and the roof shall be given a wooden truss frame. This double roofing method will not only secure attic space for air conditioning ducts, but will

also be effective in terms of strengthening the water proofing of the building and the heat insulation performance of the air conditioning system. Regarding the programme production studio capable of staging small musical performances, its ceiling height shall be set at 4m (the same as in existing NBC studios) in consideration of the studio size and functions. In consideration of the necessary noise absorbing double ceilings, space for air conditioning ducts behind ceilings, and beam heights, an appropriate floor height for the studio block is 6.5m. Moreover, the floor heights of the ground floor service zone and first floor staff zone in the north side block shall be 4m and 3.7m respectively, giving a combined floor height of 7.7m. By utilizing the level difference on the site, the ground floor ground slabs of both blocks shall be given a level difference of 1.2m, and the roofs of both blocks shall be put at the same height.

b) Kenabot Repeater Station

The repeater station shall be a small single story building of around 100 m² in floor area. In view of the equipment to be housed in the station, the beam height shall be 3.5m and the floor height 4m. The roof shall be the same wooden truss framed sleepy roof to be adopted in the KRSC building.

3) Structural Plan

(a) Foundation Structure

From the sub-soil investigation, the geological makeup was found to be similar in both sites, with ground being composed of a silty sand layer covered with a topsoil of over 1m containing tree roots and gravel. Because this silty sand layer has medium density and is not likely to expand and contract according to water content, it shall be adopted as the bearing layer for the Project buildings and self supporting tower.

As a result of standard penetration testing carried out at the sites, an allowable soil bearing capacity of 150 kPa (approximately 15 tons/m²) is considered to be appropriate for both sites, and spread foundations shall be adopted for the buildings and self-supporting tower.

(b) Structural Framing

The KRSC building shall be a rigid frame reinforced concrete structure in view of the fact that a relatively long span (9m) has been adopted for the floor plan and because its two stories mean that a seismic load equivalent to Japanese levels needs to be considered.

As for the repeater station, because this is a small single story building, a reinforced masonry structure shall be adopted.

(c) Setting of Design Loads and External Forces

Because there is a building standard law in place in PNG and detailed standards relating to structural calculation methods do exist, these standards shall be complied with.

a) Live Loads

According to the Papua New Guinea Standard (PNGS) 1001-1982 Part 2, the live loads for main rooms are given as follows.

* Broadcasting studios : 4.0 kPa

- * Studio-related rooms : Actual loads to be determined,
(equipment rooms) but they must be 5.0 kPa
minimum
 - * Offices : 3.0 kPa
 - * Building equipment rooms
: Actual loads to be determined,
but they must be 5.0 kPa
minimum
 - * Corridors : 3.0 kPa
 - * Toilets : 2.0 kPa
- Note) 1 kPa \approx 102 kg/m²

b) Wind Resistance

Detailed standards regarding design for wind resistance are given in PNGS 1001-1982 Part 3. The wind load is calculated by setting facility purpose of use-separate return periods and district-separate wind speeds and by considering a multiplier for additional standard wind velocity according to the terrain conditions (terrain categories) around the construction site and the heights of buildings in each terrain category.

The standards relating to buildings are given below, and these shall be complied with when setting the wind loads.

- * Building purpose of use : Communications facilities -
return period 50 years
- * Standard wind velocity : Return period 50 years -
26 m/sec (10m above ground)
- * Terrain category : Kokopo zone - Zone 2

Regarding the self-supporting tower, the result of the above calculation or the most widely applied American EIA (Electronic Industries Association) Standard RS-222-C A District setting, whichever is the highest value, shall be adopted.

c) Seismic Load

In the standard regarding design for seismic resistance in PNGS 1001-1982 Part 4, the seismic load is calculated according to the level of seismic activity in the area concerned. In the standard, the whole area of the country are classified four zones according to the level of seismic activities and the project area of Kokopo has the maximum level and is thus designated as Zone-1, which is nearly same as that in Japan.

The seismic resistance design of buildings is performed by means of static analysis and dynamic analysis, but dynamic analysis is only applied in cases of buildings in excess of 40m in height or buildings of extreme non-symmetrical form. Because the maximum building height here is only two stories, the following static analysis-based seismic load has been applied. The lateral shearing force applied in the seismic resistant design of the buildings is computed by means of the following expression.

$$V = C I K Wt$$

Where:

V : Lateral shearing force

K : Structural type multiplier (ranging between 1.0-4.0 depending on structure, detailed structure and height of building; 1.0 is usually adopted)

Wt : Combination of fixed load and live load (there are three calculation methods depending on the live load)

C : Standard shearing force coefficient (calculated as 0.25 according to the geological conditions and the Zone 1 coefficient sheet)

4) Electrical Installations Plan

The electrical installations plan for the KRSC is outlined below. Electric equipment in the repeater station shall also comply with this plan.

(a) Power Source Facilities and Main Feeder System

Power source facilities shall be installed outside the site. The power supply shall pass through a power transformer for stepping down and the resulting secondary (low voltage) three-phase four-wire system 415/240V 50 Hz power shall be supplied to facilities along underground cable (work to be carried out by the PNG side).

A low voltage main distribution switchboard shall be installed in the Electricity Room and electricity shall be supplied along use-separate feeders to the broadcast equipment, general lighting fixtures and socket outlets, water supply and drainage pumps and air conditioning equipment, etc.

The switchboard shall be the cubicle type totally enclosed in order to secure higher reliability and safety.

The feeders shall basically be steel conduit installation according to each use classification. Care shall be taken in the design and execution of this wiring to ensure that no electromagnetic interference occurs in the broadcasting equipment.

(b) Lighting Fixtures and Socket Outlets

Mainly fluorescent lamps, which are superior in terms of color rendition and economy of power consumption, shall be used as light sources. However, incandescent lamps shall also be adopted for appearance reasons. Levels of illumination for main rooms shall be as follows;

<u>Room</u>	<u>Illumination</u> <u>(lux)</u>
* <u>Production Studio, Network Studio,</u> <u>Sub-Control Room, Offices, Conference Room</u>	: 300-500
* <u>Waiting Room, Electricity Room, Tape Library,</u> <u>Air Conditioning Machine Room, Generator Room</u>	: 200-300
* <u>Entrance Hall, Tank/Pump Room, Toilets,</u> <u>Tea Kitchens</u>	: 100-200

In order to secure light for disaster prevention and safety reasons during cuts in the commercial power supply, emergency lighting fixtures with storage batteries shall be installed at appropriate intervals in the rooms underlined above and along corridors, etc.

General socket outlets shall be provided in appropriate numbers in each room. The socket types most generally adopted in PNG shall be used.

(c) Fire Alarm System

In view of the importance of radio broadcasting facilities and in line with local regulations, the designated automatic fire alarm system shall be installed. In addition to installing smoke and heat detectors in appropriate places, the manual fire alarm stations, bells and indication lamps, etc. shall be provided in the relevant rooms.

(d) Telephone Conduits

In addition to laying conduits for telephone lines between telephones and the private branch exchange, the required terminal boards and outlets shall be installed. (Installation of the private branch exchange and telephone sets and the wiring works are the responsibility of the PNG side).

(e) Earthing System

The following earthing system shall be provided for low-voltage equipment and broadcasting equipment purposes.

<u>Purpose of Use</u>	<u>Earth Resistance</u>
Low voltage equipment	Not more than 2Ω
Lightning arrester	Not more than 10Ω
Telephone conduits	Not more than 100Ω
Broadcasting equipment	Not more than 5Ω

(f) Ceiling Fans

Ceiling fans shall be installed in General Office, Waiting Room, Maintenance Room and other rooms that are not fitted with air conditioning.

(g) Lightning Protection

Lightning arresters shall be fitted to tower sections to prevent lightning striking radio antennas, towers and buildings, etc. The technical guidelines for the lightning arresters shall be in accordance with the standards in PNG.

(h) Special Facilities

a) Power Distribution Equipment for Broadcasting Equipment

Exclusive use feeders, distribution boards and sockets, etc. shall be installed in order to supply power to the various broadcasting equipment installed in the Studios and Sub-Control Room, etc.

b) Emergency Engine Generator

A diesel engine-driven generator (three-phase four-wire system 415/240V 50 Hz) with automatic battery starter system shall be installed. The power supply from the generator shall cover all loads, and a fuel tank with enough capacity to allow continuous operation at 80% load for three days shall be provided. Output from the generator shall be 150 kVA at the KRSC and 30 kVA at the repeater station, and the KRSC generator shall be a soundproof type.

c) Automatic Voltage Regulator

The supply of power to broadcast equipment, lighting fixtures and socket outlets in the main rooms shall be performed via a 10 kVA static-type automatic voltage regulator in a three-phase four-wire 415/240V 50 Hz system. The regulating range shall be $\pm 2\%$ on

the output side to fluctuations of $\pm 20\%$ on the input side.

d) Special Conduits

Conduits required to interphone wiring between rooms on the equipment side and the wiring of speakers and electric clocks, etc. shall be laid appropriately together with wiring ducts and cable ladder based on the equipment design requirements.

e) Security Access Control

In order to monitor and control entry and exit to and from the building, an automatic locking system linked to the main entrance door shall be installed so as to allow the control of entry and exit and the locking and unlocking of doors to be controlled from the designated room indoors. Locking and unlocking can be carried out by means of ID cards or ID numbers, etc. Incidentally, this system shall be procured locally in PNG to make its future maintenance easier.

f) Obstruction Lights

Obstruction lights shall be fitted to 80m towers. The installation guidelines shall be in accordance with standards laid down by the International Civil Aviation Organization (ICAO) and authorities in PNG.

g) Outdoor Lighting Fixtures

Appropriate lighting equipment shall be set up on roads inside the site and around facilities for security reasons, and this equipment shall be operated by automatic switch timers.

Refer to : Figure 2-3-1 KRSC/Schematic Diagram of
Electrical Facilities

5) Water Supply and Drainage System (KRSC)

(a) Water Supply System

As there are no city water supply mains in the Project area, rain shall be led into storage tanks, where it will undergo dust elimination; after that it shall be stored in a water storage tank in the building, and then be supplied to each necessary area in the building by means of pressurized feed pumps.

To secure convenience for maintenance, two water tanks shall be provided and used in parallel at all times.

The water supply shall be limited to use for non-potable purposes only. It is estimated that a staff of 30 people will benefit from the water supply and that 100 liters per day will be required.

(b) Sanitary Fixtures

The toilets shall be fitted with low tank Western style closet bowls, urinals, washbasins and sinks for cleaning, and accessories such as paper rollers, etc. shall be fitted.

Showers shall be cold water only. Drainage shall be installed in those areas where it is planned to install water coolers.

(c) Drainage System

Indoor wastewater and soil water piping and the drainage piping on each floor shall form separate systems until they join up outdoors and lead into septic tanks and infiltration tanks that are installed outside.

Vent pipes shall be installed appropriately in the necessary areas.

(d) Fire Extinguishers

Fire extinguishers shall be provided at necessary indoor and outdoor areas according to the properties of fire causes and the room conditions.

6) Air Conditioning and Ventilation Systems (KRSC)

(a) Air Conditioning System

In order to secure the quality and reliability of radio programme production and broadcast equipment, it is vitally important to maintain the surrounding environment at appropriate levels.

Because it is necessary to minimize the entry of noise and vibration to the studio-related rooms (Production Studio, Network Studio, Sub-Control Room), a low-noise single duct air conditioning system shall be adopted and self-contained packaged-type air conditioners that are easy to maintain shall be installed.

Multiple air conditioners shall be installed to ensure that functions are not totally lost during breakdowns.

In the other rooms requiring air conditioning apart from the studio-related rooms, split-type self-contained packaged air conditioners shall be installed appropriately. The rooms requiring air conditioning are as follows.

<u>Room</u>	<u>Personnel Density (people/m²)</u>	<u>Heat Dissipation From Equipment (kW)</u>	<u>Target NC Value</u>
Programme Production Studio	0.15	2	15-20
Sub-Control Room	0.15	2.4	30-35
Network Studio	0.15	1.2	15-20
Master Control Room	0.15	3.5	40-45
Tape Store	0.1		40-45
Offices (not including General Office)	0.2		40-45

The design outdoor temperature and humidity conditions shall be set based on past meteorological data at 35 °C (dry bulb temperature) and 78% (relative humidity) respectively, while the indoor temperature and humidity conditions shall be set at 26 °C (dry bulb temperature) and 50% (relative humidity) respectively.

Total heat exchangers shall be adopted for the intake of outside air in order to ensure energy saving. Filters shall be used in the case of air intake to the broadcasting studios in order to ensure dust prevention.

(b) Ventilation System

Ventilation shall be carried out in the generator room and other rooms where heat, dust, moisture and odor, etc. may be generated.

7) Facilities for Kenabot Repeater Station

In order to maintain the quality and reliability of the programme repeater equipment, floor-mounted self-contained packaged-type air conditioners that are easy to maintain shall be installed to carry out cooling in Repeater Room. Multiple air conditioners shall be installed to ensure that functions are not totally lost during breakdowns. The design temperature and humidity conditions shall be the same as those set for the KRSC.

Ventilation equipment shall be provided in the Generator Room and Electricity Room.

The Office and Maintenance Room shall be fitted with fixed ceiling fans. Fire extinguishers shall be fitted appropriately in the necessary indoor and outdoor areas.

8) Building Finish Plan

(a) Exterior Finish

In order to minimize the damage caused to buildings by the chemical nature of the volcanic ash fallout, external finishing materials with high weather resistance shall be selected. The use of metal shall be avoided as much as possible, and any metal that is used shall be given a weather resistant coating. Reports of severe damage to aluminum materials have been received from the Electricity Commission at Kokopo, so these shall not be adopted.

Openings on the ground floor service zone and studio zone of the KRSC shall be kept to a minimum because these areas will contain mechanical equipment and high precision broadcasting instruments and computers, etc.

The main external finishing material specifications are as follows.

- * Roof : Cement slate or ribbed metal sheet with anti-corrosive special paint
- * External walls : Synthetic resin epoxy paint spray finish, porcelain tiles partially used
- * External doors : Stainless steel
- * External windows : Stainless steel (triple glazed soundproof windows)
Wooden jalousie windows (general occupied rooms)

(b) Interior Finish

Ample noise reduction and sound absorption materials shall be utilized in the interior finishing of the studio-related rooms in consideration of the acoustic target values that constitute design conditions. The finishing of main rooms in the studio zone is outlined below.

(Production Studio, Network Studio)

Floor : Vinyl sheet (Production Studio), tile carpet (Network Studio)

Ceiling : (Upper) double-layered plaster board, glass wool laying backside the ceiling
(Lower) Plaster board + rock wool boards, glass wool laying backside the ceiling

Surrounding walls : (Outer) Concrete blocks + mortar
(Inner) Light gauge steel framed double walls filled with glass wool, veneer EP coating

Door : Soundproof steel door

(Sub-Control Room)

Floor : Tile carpet

Ceiling : Plaster board + rock wool boards, glass wool laying backside the ceiling

Surrounding walls : Concrete blocks + mortar + glass wool + veneer EP coating

Doors : Soundproof steel doors (Main Control Room, Tape Library)

Floor : Tile carpet (Main Control Room), vinyl sheet (Tape Library)

Ceiling : Plaster board + rock wool boards

Surrounding walls : Mortar EP coating

Door : Steel door

In general rooms other than studio zone, floors shall be vinyl sheet, inner walls shall be mortar EP coating, and

ceilings shall be rock wool boards. The Entrance Hall shall be given a stone floor in consideration of the fact that rain on shoes will be brought in. In the Generator Room and Air Conditioning Machine Room, etc., floors shall be given a highly dust and acid resistant coating and walls shall be given sound absorption finishing to deal with the noise generated by the machinery. The Water Closets, Tea Kitchens and Shower Rooms, etc. shall be finished in a manner appropriate to the respective purpose of use of each.

(2) Broadcast Equipment

1) Studio Equipment

The basic related equipment consists of network studio equipment, production studio equipment and master control room equipment, and shall produce and send out Kundu programme for East New Britain Province. The national broadcast Karai programme shall also be sent out using this equipment.

The scale of the programme production equipment and facilities shall be set based on the contents of programmes and length of broadcasting time following completion of the Project.

Refer to: Figure 2-3-2 Outline of Programme Production and Sending-out Equipment

Figure 2-3-3 Reference Materials for Setting Equipment Scale

(a) Network Studio Equipment

Equipment to allow the following work shall be provided.

- * Production of news and talk programmes and sending-out of all Kundu programme
- * Announcements at start and end of out door relayed programmes, complementing through theme music, etc., support discontinued programme, etc.

- * Measures to counter the delayed start or early finish of sent out programmes, and disposition in cases of relay programme breakdowns

The operation of this equipment (plus announcements) shall be carried out by one staff member, and the necessary equipment shall be housed on the studio floor.

(b) Production Studio Equipment

Equipment to allow the following work shall be provided.

- * Recording, editing and final production of talk, lecture and small music programmes, etc.
- * Substitute studio functions for use during breakdowns to the network studio equipment

A medium-size independent sound studio and programme production sub-control room shall be provided in order to enable the recording of these programmes.

(c) Master Control Room Equipment

Equipment to allow the following work shall be provided.

- * Sending out of Kundu programme
Scheduled programmes shall be sent out on the days and at the times given in the broadcast programme schedule.
- * Sending out of Karai programme
Karai programmes shall be sent from the central studio in Port Moresby to this master control room along PTC lines, and shall thus be sent out to the transmitting station.
In cases where damage to the PTC lines occurs the Karai programme shall be directly received through the HF broadcast from Port Moresby.
Moreover, news of this Karai programme shall be inserted into Kundu programme broadcast.
- * Reception of outdoor relayed programmes
Reception and delivery to studios of programmes that are sent along relay lines from outside the station

* Monitoring of broadcasting radio waves

Monitoring through the reception of broadcasting radio waves at the Kurakakaul transmitting station and Kenabot repeater station

Refer to: Figure 2-3-4 Monitoring of Broadcasting Radio Waves

* Monitoring of broadcast programmes

Karai and Kundu programmes being broadcast shall be sent to each area and shall be listened to by staff through speakers at all times.

Refer to: Figure 2-3-5 Monitoring of Broadcast Programmes

* Communications between Rooms

Central role in conducting communications between rooms related to broadcasting

Refer to: Figure 2-3-6 Block Diagram of Communications between Rooms

* Master clock

The standard time signals vital to sending-out programmes shall be sent to the clocks in each related room.

Refer to: Figure 2-3-7 Block Diagram of Broadcasting Clock Facilities

(d) Programme Editing and Sending-out System

The basic concept of the programme editing and sending-out system is illustrated in Figure 2-3-8.

In this system, sounds that have been concentrated and recorded are played back where necessary to produce programmes, and these programmes are then sent out.

Once the sound software has been recorded in the system, it is no longer necessary to install recorders and play-back equipment separately in the related rooms, and the sound can be incorporated into the programme production and sending-out through simple operation.

Moreover, because the sound software can be recorded and stored on hard disc, the broadcasting raw materials storage space can be reduced and the trouble of storing recorded tapes and handing over tapes for broadcast, and so on, is removed.

The programme editing and sending-out system is composed of an audio server and multiple Personal Computers.

Refer to: Figure 2-3-8 Programme Editing & Sending-out System

Figure 2-3-9 Conception of Programme Editing & Sending-out System

* Storage capacity

The capacity of the hard disc to be used in the audio server shall initially be set at 360 hours of sound software (equivalent to 6,000 songs), but it shall be possible to add to this hard disc capacity depending on future demand.

As the life of the hard disc is considered to be around five years, a backup system shall be built to ensure that valuable sound data is not lost in the event of breakdown.

* Personal Computers

Personal Computer (PC1, PC2, PC3)

: One work station each shall be installed in the network studio, production studio and broadcast staff room and used for programme production.

Personal Computer (PC4)

: This shall be used for preparing news drafts.

News shall be broadcast for 10 hours 25 minutes per week, and of this five hours 50 minutes shall be produced at KRSC. The independently made news shall consist of local and provincial news, the latter of which especially will involve the use of English, Pidgin and Kuanua. As these programmes will be broadcast together in a 70 minute slot between 18.50 and 20.10, it will be necessary to produce and record four types of news programme including provincial news within a limited amount of time.

For this reason, the fourth work station shall be installed to enable the fast preparation of news drafts and immediate delivery of drafts to the news production areas.

Personal Computer (PC5) : This shall be used for preparing programme schedules. This shall be used exclusively for this purpose in order to avoid confusion in operation with the other Personal Computer.

Refer to: Figure 2-3-10 RENB News Broadcasting Times

2) Programme Transmission Equipment

(a) KRSC to Kenabot Repeater Station

Because the distance between the KRSC and Kenabot repeater station is only 1 km and this space is unobstructed, an STL (studio to transmitter link) system that uses the UHF 1.6 GHz band shall be used to transmit Karai programme (mono) and Kundu programme (mono).

The effective radiated power on the transmitting side shall be set to the field strength of -40 dBm or better at the receiving point.

The STL transmitter and receiver shall both be the auxiliary standby changeover type. The STL transmitter shall be installed in the master control room in the KRSC, and the transmission antenna shall be set up on the roof of the building. The STL receiver shall be installed inside the Kenabot repeater station, and the receiving antenna shall be mounted on the 80m tower at the station.

(b) Kenabot Repeater Station to MF/HF Transmitter Station

Because the Kenabot repeater station and the MF/HF transmitting station are separated by approximately 23 km and there is a mountain in front of the transmitting station on the receiving side that obstructs the two, VHF radio waves that allow refraction in the mountain shadow shall be used and FM transmitters and receivers shall be installed.

The frequencies used shall be 103.7 MHz and 105.1 MHz, and the transmission power level and antenna shall be set to the field strength of 60 dBuV/m or better (note 1) at the

receiving point.

The FM transmitters shall both be solid state units and the drive sections shall be the auxiliary standby type. The transmission antenna shall be used to transmit both Karai and Kundu programmes, so it shall be fitted with a channel combiner at transmitter outputs.

The FM transmitters shall be installed inside the Kenabot repeater station, and the transmitting antenna shall be mounted on the 80m self-supporting tower at the station.

In the event where the Kurakakaul transmitting station becomes inoperable due to volcanic eruption, etc., elliptical transmitting antenna directivity pattern shall be incorporated to allow the use of a standby transmitter station.

As the Kenabot repeater station will be unattended, the equipment shall be operated using time control. The monitoring of broadcasting radio waves from the repeater station shall be carried out at the KRSC.

One FM receiver each shall be installed inside the existing MF/HF transmitting station building for receiving Karai programme and Kundu programme respectively, and a joint-use standby receiver shall also be provided. The FM receiving antenna shall also be for joint use and installed inside the transmitter station.

Refer to: Figure 2-3-11

Repeater Station - MF/HF Transmitting Station
Topographical Profile

Note 1) According to CCIR Rec. 412-3, the recommended minimum usable field strengths in the case of FM broadcasting are as follows.

	Monophonic	Stereophonic
Rural area	48 dB μ V/m	54 dB μ V/m
Urban area	60 dB μ V/m	66 dB μ V/m
Large cities	70 dB μ V/m	74 dB μ V/m

3) HF Transmitting Antenna

The coverage of service provided by the RENB HF transmitters

shall target all of East New Britain Province and cover a maximum distance of 300 km radius measured from the transmitter station (note 2).

Refer to: Table 2-3-2 Predicted Field Strength at Distance of 300 km Radius

Note 2) The minimum usable field strength varies depending on the level of interference and external noise in the service area and the performance of the receiver, etc., but a level of 50 dBuV/m is generally adopted.

Table 2-3-1 Rooms Required with their Functions and Areas

Room	Function	Design Area (m ²)	Basis for Area Calculation	
KRSC				
Ground Floor	Production Studio	Production and recording of programmes including musical performances	64	Standard value set according to the contents of programmes produced
	Network Studio	Production and recording of talk and news programmes	32	Based on the equipment layout (see Equipment Layout Plan)
	Sub-Control Room	Sound adjustments during programme production	23	Based on the equipment layout (see Equipment Layout Plan)
	Sound Lock	Sound insulation when entering or leaving the studio	9	Minimum area required for sound insulation
	Master Control Room	Sending-out of broadcast programmes	41	Based on the equipment layout (see Equipment Layout Plan)
	Tape Library	Storage of recording tapes and other programme materials	41	Standard area (64 m ²) has been reduced due to adoption of new system
	Maintenance Room	Repair of equipment and storage of spare parts	32	According to existing standard area at RENB
	Equipment Store (1)	Storage of studio equipment and spare parts	14	According to existing standard area (30 m ²) at RENB; divided according to types of equipment
	Equipment Store (2)	Storage of outdoor recording equipment and spare parts	16	
	Diesel Engine Generator Room	Housing of generator equipment	25	Set according to standard dimensions of equipment to be housed
	Electricity Room	Housing of main switchboard, AVR and other power supply equipment	21	Same as above
	Tank/pump Room	Housing of tanks, pumps and water treatment equipment	32	Same as above
	Air Conditioning Machine Room	Housing of studio packaged-type air conditioners	32	Same as above
	Reception	Monitoring of visitors and lock control of entrance doors	8	Set as the appropriate minimum value
	Waiting Room	Waiting area for performers and reception of visitors	8	Same as above
	Shower Room	Cleaning of ash fallout, etc.	5	Same as above
	Tea Kitchen	Housing of water boiler, crockery and refrigerator, etc.	8	Same as above
First Floor	Manager's Room (1)	Work and reception office of provincial administrator	21	Work space 10 m ² , guest receiving space 10 m ²
	Manager's Room (2)	Work and reception office of station manager	21	Same as above
	General Office	General administration and engineers' office	81	5 m ² x 16 staff = 80 m ²
	Offices (1)-(6)	Private offices of senior programme officers	11x6	Set as the appropriate minimum value for private offices
	Conference Room	For programme editing meetings and provincial station conferences	40	Set at the minimum value (2 m ² /person) to hold a maximum of 20 people
	Tea Kitchen and Rest Room	Small kitchen and rest room for female staff	15	Water boiling space 8 m ² + (3.5 m ² /person x 2 people)
	All Floors	Water Closet (Male)	(On each floor)	14 x 2
Water Closet (Female)		(On each floor)	11 x 2	2 closet bowls, 2 washbasins, cleaning utensils storage
Corridors, Staircase, etc.		Connecting rooms and floors	206	According to the optimum room plan for functioning of the facility
KRSC Total Floor Area			911	
Kenabot Repeater Station				
Repeater Room	Housing of transmitter equipment	36	Based on the equipment layout (see Equipment Layout Plan)	
Office	For work of maintenance staff who visit occasionally	13	According to existing standard area at RENB	
Maintenance Room	Repair of equipment and storage of spare parts	13	Same as above	
Repeater Room	Housing of generator equipment	24	Set according to the standard dimensions of the equipment to be housed	
Electricity Room	Housing of main switchboard, AVR and other power supply equipment	6	Same as above	
A/C Outdoor Units Space	Protection of air conditioning outdoor units from ash fallout	6	Same as above	
Kenabot Repeater Station Total Floor Area			98	

Table 2-3-2 Predicted field Strength at Distance of 300 km Radius

Local Time	Field Strength (dB μ V/m)				Remarks
	June		December		
	3 MHz	6 MHz	3 MHz	6 MHz	
1	51	48	51	52	
2	52	41	51	52	
3	52	23	51	52	
4	52	-28	51	52	
5	52	-28	51	52	} Morning Broadcasting hours for Kundu Programme
6	52	23	49	52	
7	43	51	39	48	
8	35	47	31	45	
9	28	35	25	43	
10	23	45	19	37	
11	20	42	16	36	
12	18	42	14	35	
13	19	42	15	39	
14	21	43	17	36	
15	26	44	22	42	
16	32	47	28	44	
17	40	49	36	47	} Evening Broadcasting hours for Kundu Programme
18	50	52	44	50	
19	52	54	49	51	
20	52	53	50	55	
21	52	53	50	52	
22	51	53	50	52	
23	51	53	51	52	
24	51	52	51	52	

Note) Transmitter's output power : 10 kW
 Antenna Gain : 9 dBi
 Directivity : Omnidirectional
 Sunspot Number : 50

3PHASE 4WIRES 415/240V 50Hz

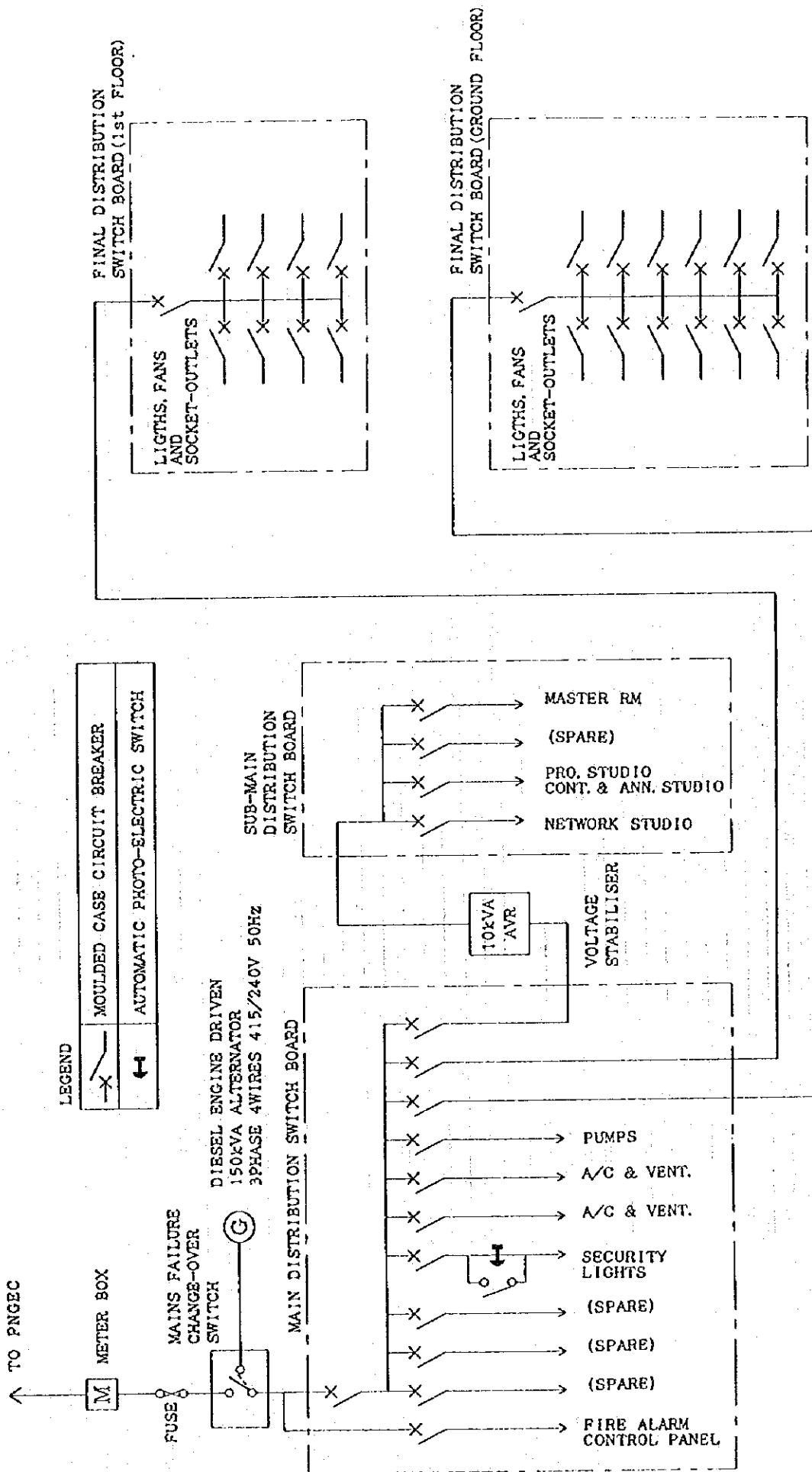


Figure 2-3-1 KRSC / Schematic Diagram of Electrical Facilities

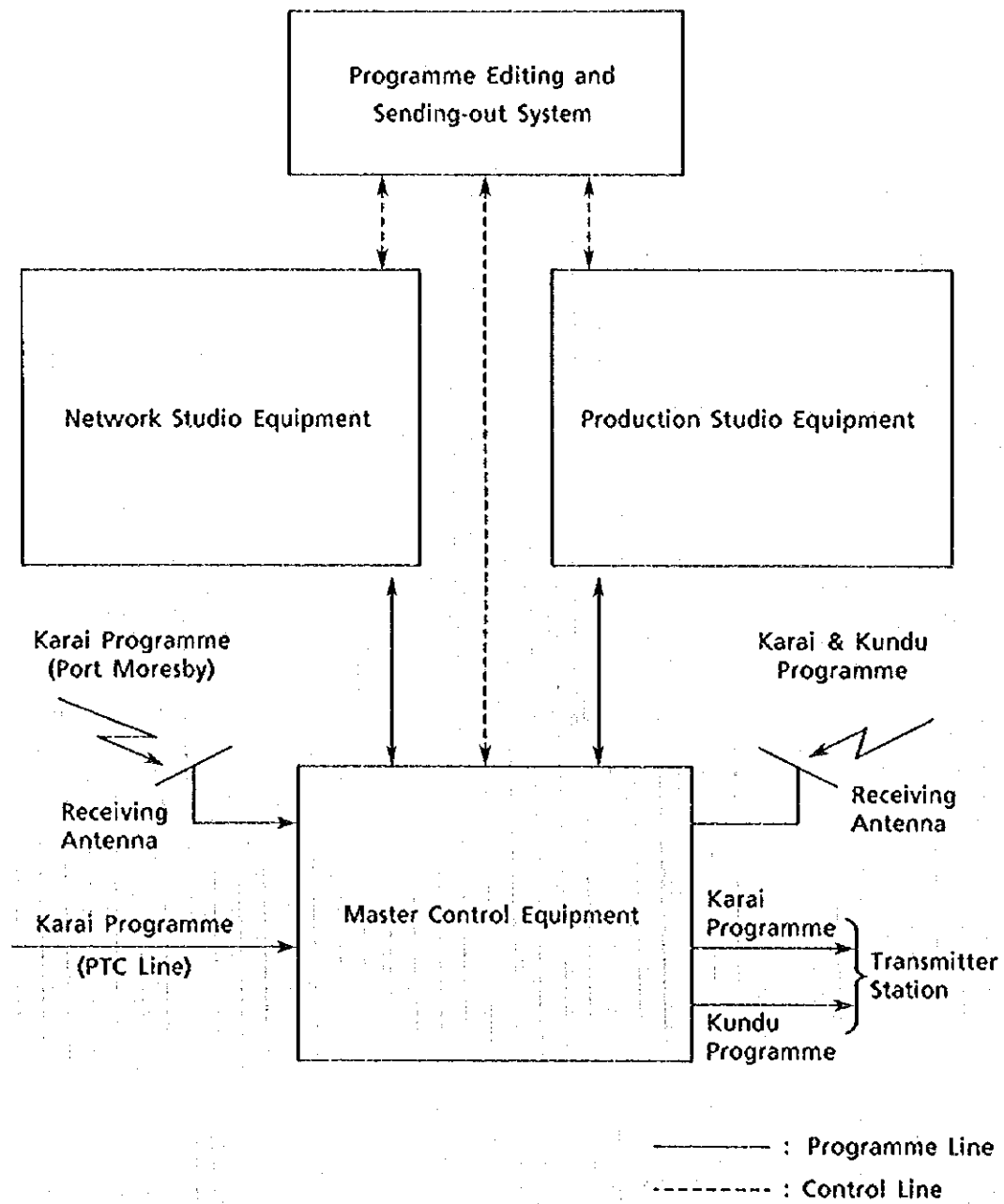


Figure 2-3-2 Outline of Programme Production and Sending-out Equipment

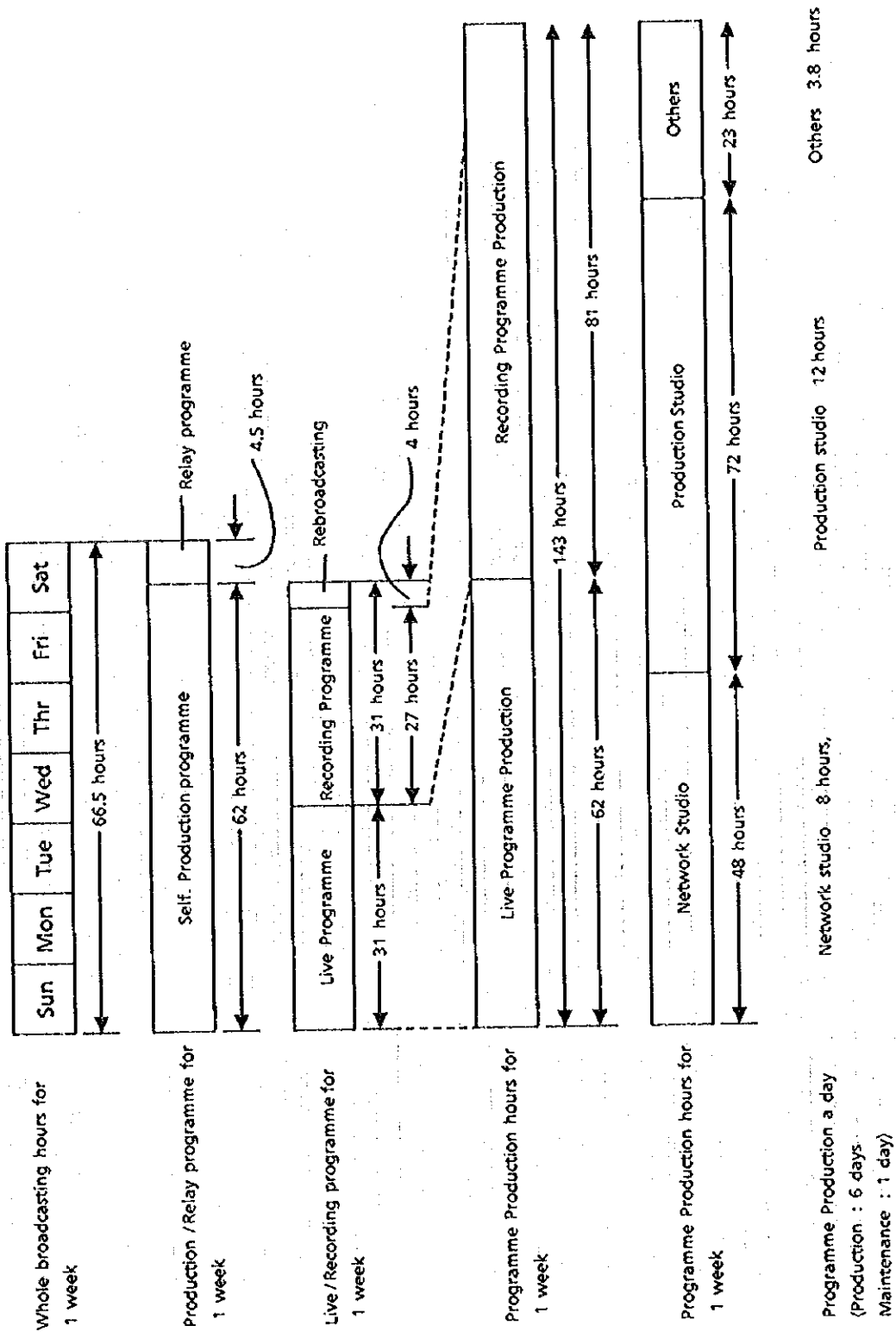
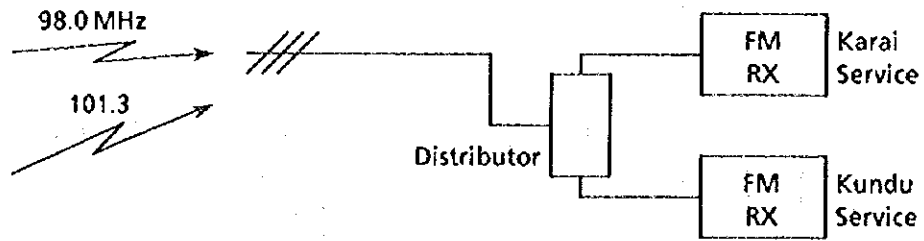


Figure 2-3-3 Reference Materials for Setting Equipment Scale

(1) Kenabot Hill



(2) Kurakakaul MF/HF Transmitter

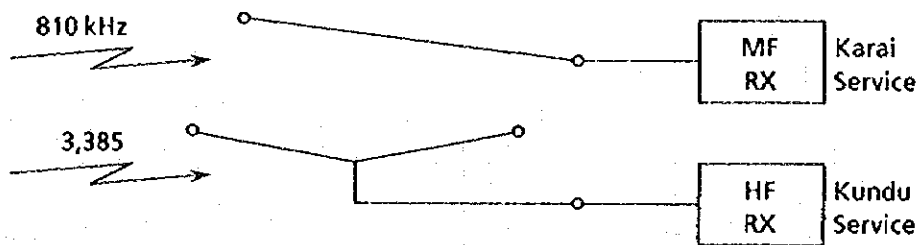


Figure 2-3-4 Monitoring of Broadcasting Radio Waves

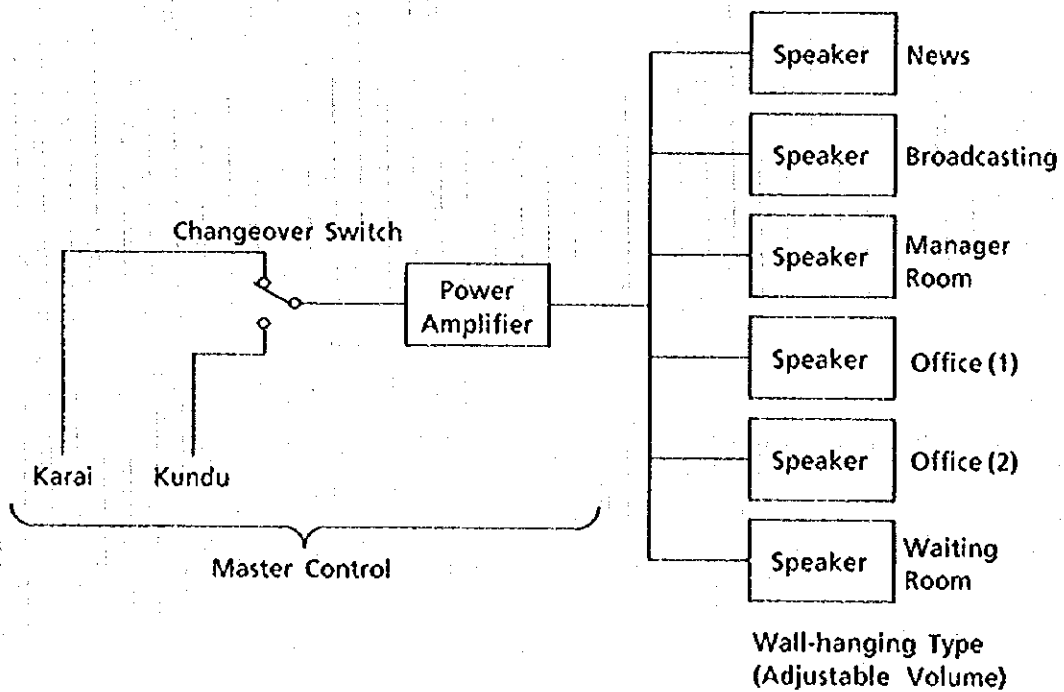


Figure 2-3-5 Monitoring of Broadcast Programmes

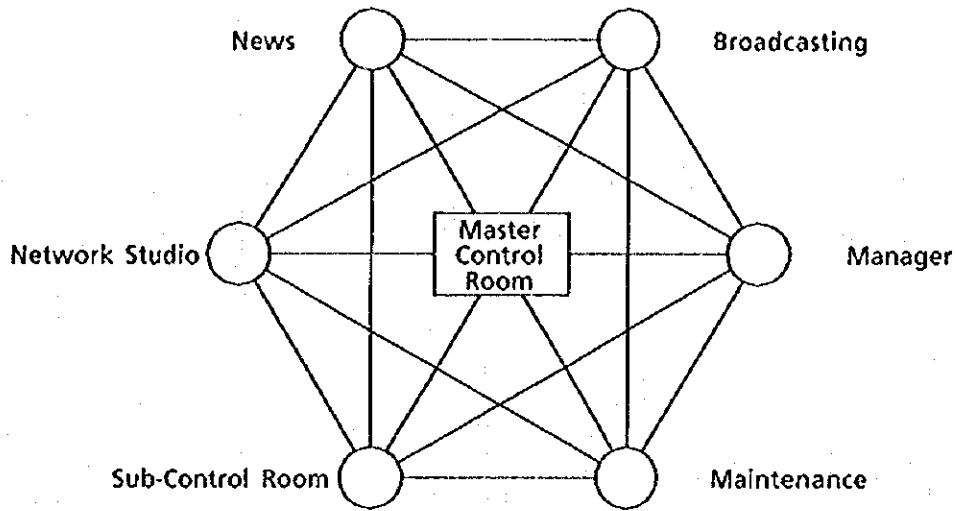


Figure 2-3-6 Block Diagram of Communications between Rooms

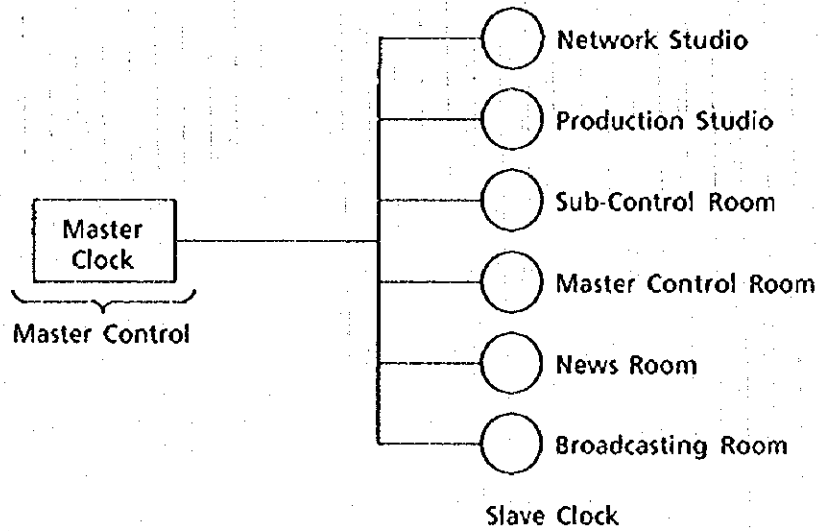
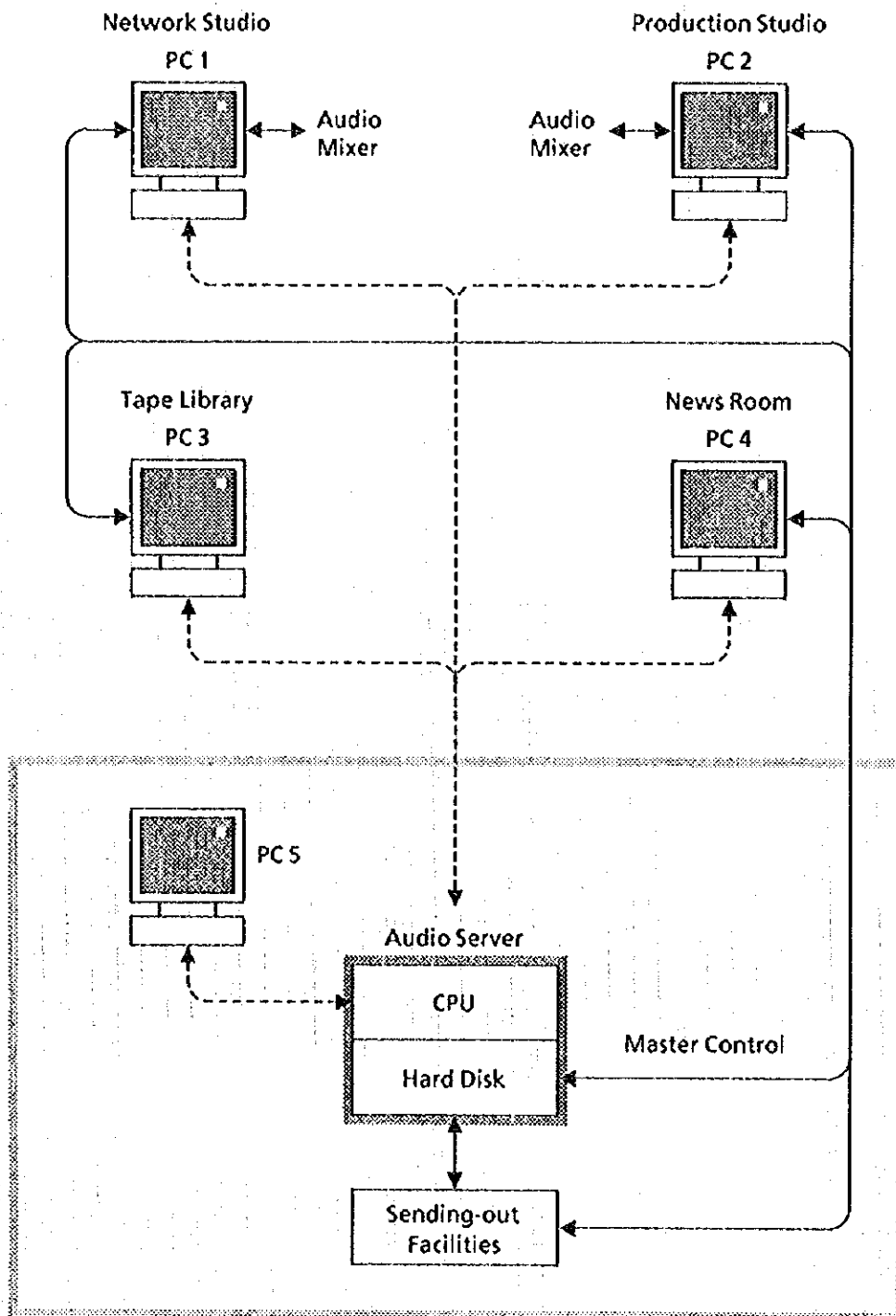


Figure 2-3-7 Block Diagram of Broadcasting Clock Facilities



CPU : Host Computer
 PC : Personal Computer
 — : Programme Line
 - - - : Control Line

Figure 2-3-8 Programme Editing & Sending-out System

Programme Production

Programme Sending-out

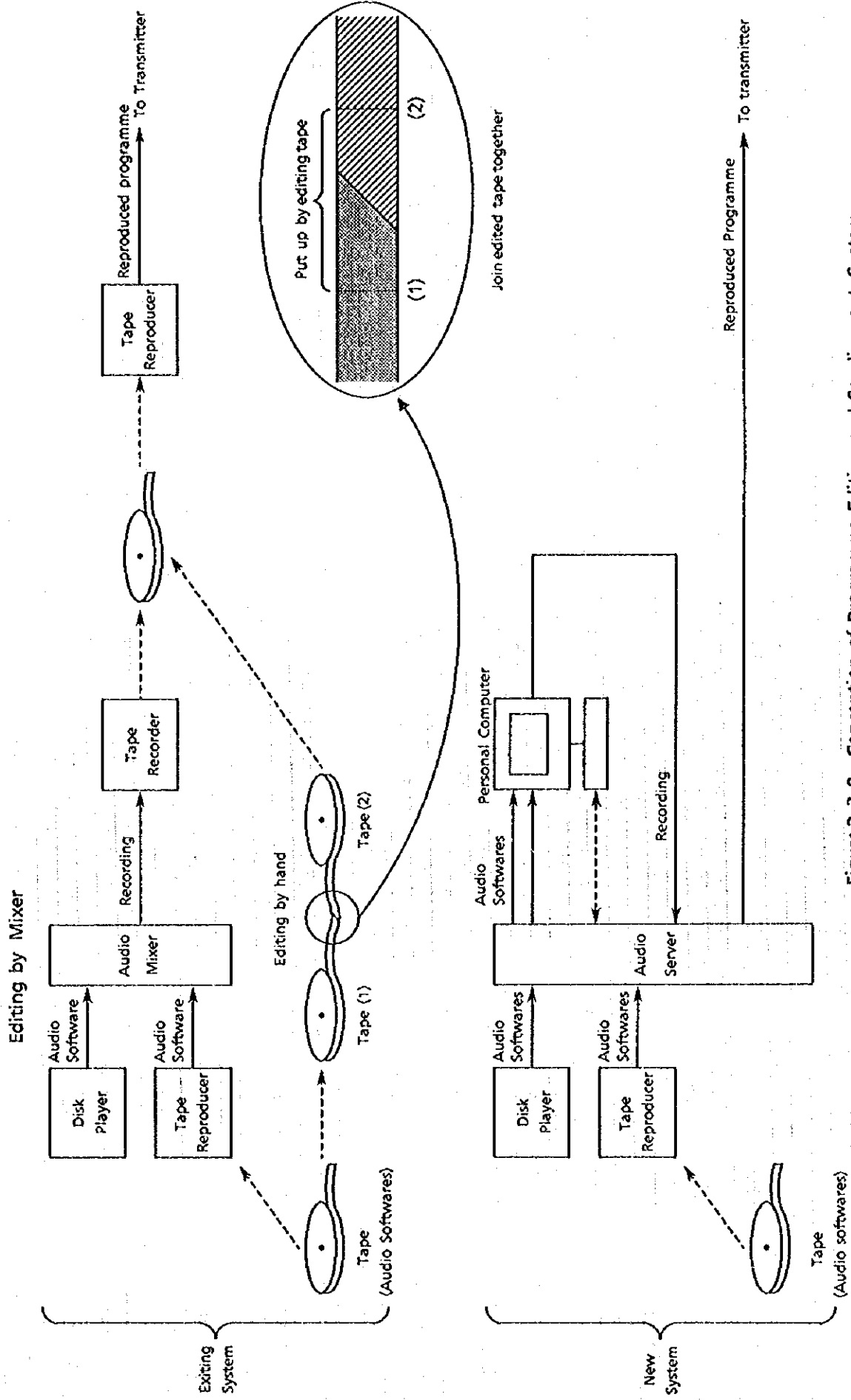


Figure 2-3-9 Conception of Programme Editing and Sending-out System

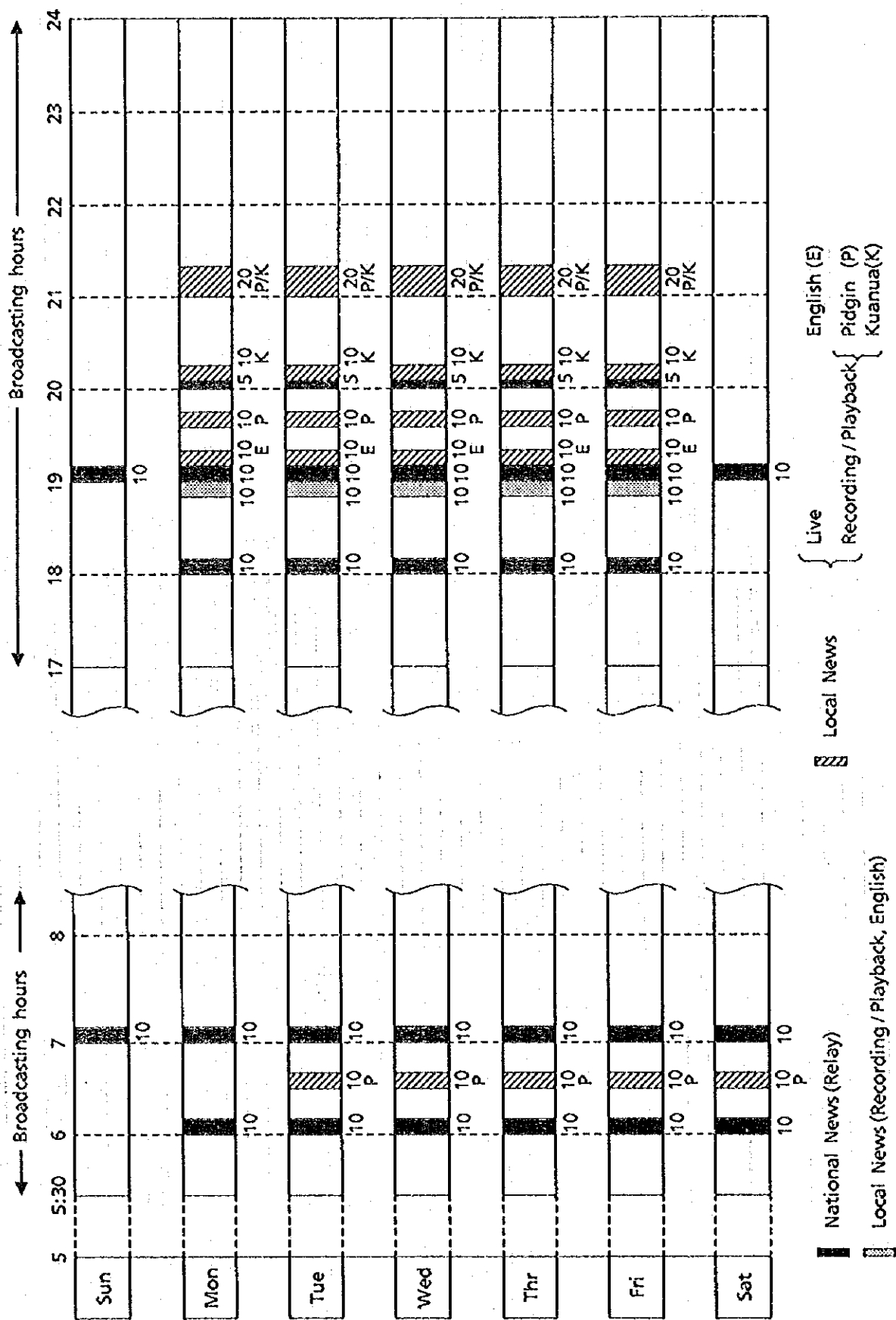


Figure 2-3-10 RENB News Broadcasting Times

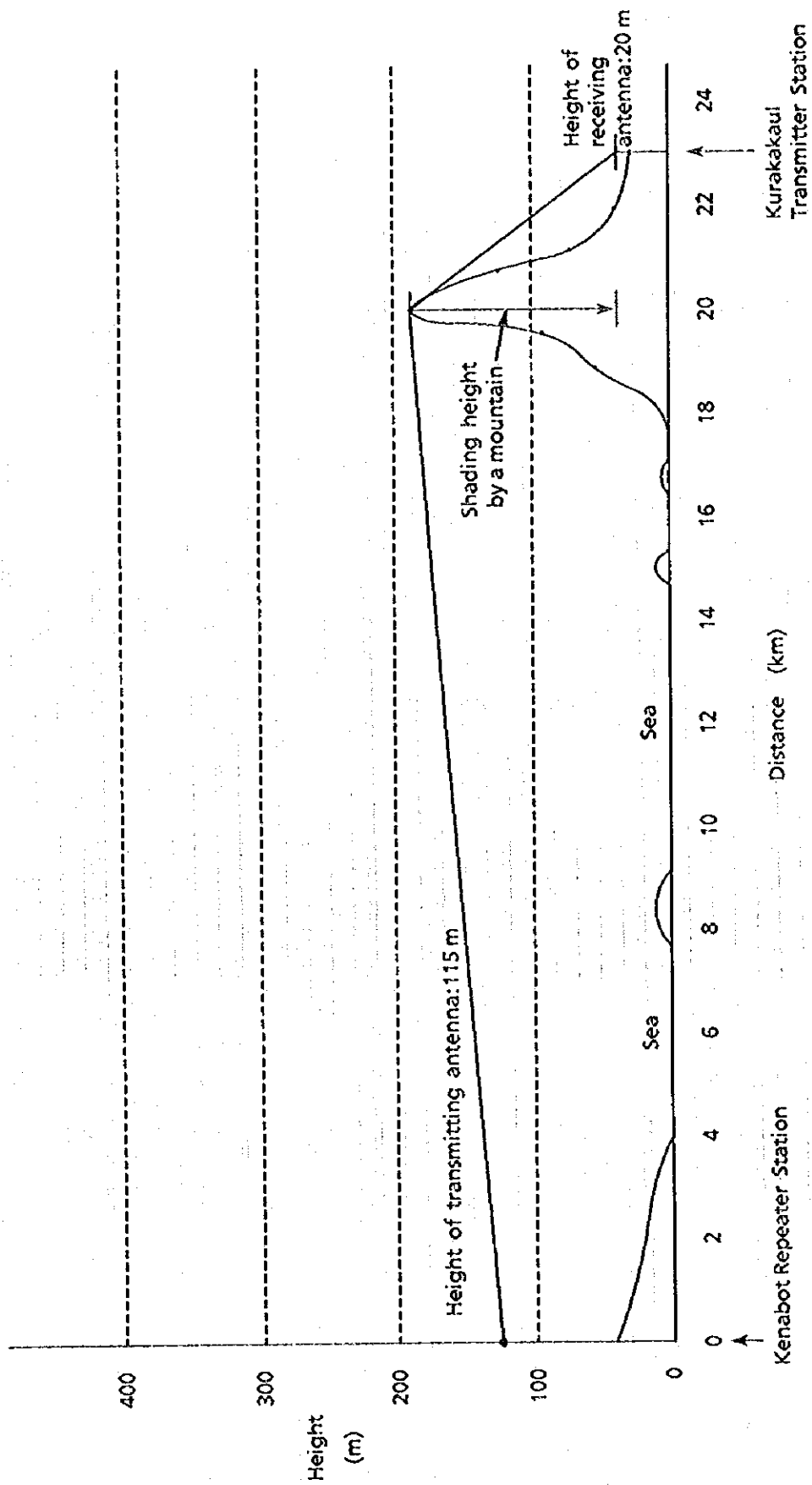


Figure 2-3-11 Repeater Station - MF/HF Transmitting Station Topographical Profile

2-3-3 Outline of Planned Facilities and Equipment

(1) Facilities

1) Kokopo Radio Studio Centre

Functions : Facilities with RENB functions and an administrative regional centre of Islands Regional

Location : 15 Section, 18 Unit of Kokopo city

Site Area : Approx. 2,500 sq.m

Building : reinforced concrete structure for studio, two stories, total floor area of 911 sq.m.

2) Kenabot Repeater Station

Functions : Unattended repeater station for programme transmission

Location : On Kenabot Hill, Kokopo city

Site Area : Approx. 2,055 sq.m.

Building : Wooden structure, single story, total floor area of 98 sq.m.

(2) Broadcasting Equipment

1) Studio Equipment

(a) Network Studio

a) Audio Mixer	1 set
b) Digital Audio Tape Rec/Rep	2 sets
c) Reverberatory Unit	1 set
d) Telephone Hybrid	1 set
e) Audio Monitor Speaker	1 set
Production	2
On-air	1
f) Headphone	2 sets
g) Audio Distribution board	1 lot
h) Audio Jack Panel	1 lot
i) Patch Cord	1 set
30cm (5 cable Bounded)	4
60cm (5 cable Bounded)	4
j) Equipment Rack	1 set

k) Equipment Wagon	1 set	
l) Microphone	1 set	
Dynamic Uni Directional	2	
Condenser Uni Directional	1	
m) Microphone stand	1 set	
DJ Type	1	
Desk type	1	
Boom Stand	1	
n) Cough Box	1 set	
o) Earphone	2 sets	
p) Microphone Cable	1 set	5m×3
q) Mic Connector Panel W/Box	1 set	
r) On-air Lamp	2 set	
s) Guest Table	1 set	
t) Chair for Operation	3 sets	

(b) Production Studio

(b-1) Sub Control Room

a) Audio Mixer	1 set	
b) Compact Cassette Tape		
Rec/Rep	1 set	
c) Digital Audio Tape Rec/Rep	2 sets	
d) Compact Disc Player	2 sets	
e) Disc Player	1 set	
f) Open Reel Tape Rec/Rep	1 set	
g) Min disc Rec/Rep	2 sets	
h) Sound Effect Equipment		
Reverberatory Unit	1	
Delay	1	
Graphic Equalizer	2	
Limiter/Compressor	1	
i) Telephone Hybrid	1 set	
j) Audio Monitor Speaker		
Production	2	With Power Amplifier
On-air	1	With Power Amplifier
k) Headphone	2 sets	
l) Audio Distribution board	1 lot	

m) Audio Patch panel	1 lot	
n) Patch Cord		
30cm (5 cable Bounded)	4	
60cm (5 Cable Bounded)	4	
o) Equipment Rack	1 set	
p) Equipment Wagon	1 set	
q) Chair for Operator	3 sets	

(b-2) Studio Floor

a) Microphone	1 set	
Dynamic Uni Directional	4	
Condenser Uni Directional	2	
b) Microphone Stand		
Disk	2	
Floor	2	
Boom	2	
c) Cough Box	2 sets	
d) Earphone	2 sets	
e) Microphone Cable	1 set	5m×6, 10m×4
f) Connector Panel W/box	1 lot	
g) Audio Monitor Speaker	1 set	
Fold Back	2	
h) Headphone	3 sets	
i) On-air Lamp	2 set	
j) Guest Table	1 set	
k) Chair for Operator	3 sets	

(c) Master Control Room

a) Sending-out Switch	1 set	
b) Line Equalizing Amplifier	3 sets	
c) Audio Distribution Amplifier	1 set	
d) Line amplifier	4 sets	
e) Limiting Amplifier	3 sets	
f) Audio Patch Panel	1 set	
g) Patch Cord	1 set	
40cm (5 Cable Bounded)	4	
60cm (5 Cable Bounded)	4	

h) Audio Monitor speaker	1 set	
Audio Software	2	
Sending-out	2	
Input Selection Switcher	1	
i) Level Meter	5 sets	VU Meter(L,R)
j) H.F. Receiver	1 set	With Check Speaker, Receiving Antenna and Feeder
k) Equipment Rack	4 sets	
l) Chair for Operator	3 sets	
m) Room to Room communication	1 set	
Interphone	7	
n) Building Monitor System	1 set	
Power Amplifier	1	
Wall type Speaker	6	
o) Clock System	1 set	
Master Clock	1	
Slave Clock	6	
(d) Programme Editing Sending-out system		
a) Personal Computer 1	1 set	Network Studio
b) Personal Computer 2	1 set	Production Studio
c) Personal Computer 3	1 set	Tape Library Room
d) Personal Computer 4	1 set	News Room
e) Personal Computer 5	1 set	Master Control Room
f) Audio Server	1 set	With Server Control, Master Control Room
g) Uninterrupted Power supply	7 set	
h) Network Hub	1 sets	
i) Equipment Rack	1 set	
j) Equipment Table	4 sets	
k) Analog Equipment for Personal Computer	1 set	
e) Accessories	1 set	

2) Programme Transmission Link

(a) Radio Studio Center to Repeater Station

- a) UHF Transmitter 2 sets 1W 1.6GH₂ Band
- b) Cannel Encoder 1 set
- c) Transmitter Change
over Switch 1 set
- d) Transmitting Antenna
and Feeder 1 set 1.2 m ϕ Parabolic
Antenna
- e) UHF Receiver 2 sets
- f) Channel Recorder 1 set
- g) Antenna Power Divider 1 set
- h) Receiving Antenna
and Feeder 1 set 1.2 m ϕ Parabolic
Antenna
- i) Equipment Rack and Assembly 2 sets

(b) Repeater Station to MF/HF Transmitting Station

- a) FM Transmitter 2 sets 1 kW VHF Band
including Dual Exciters, lightning Transformers
- b) Output Equipment 1 set
including 2 channel combiner, U-Link, Dummy Load
- c) Input and Monitoring
Equipment 2 sets
- d) Transmitting Antenna and
Feeder 1 set 2-dipole Antenna
(3.2.2.2)
- e) FM RECEIVER 3 Sets
- f) Antenna Power Divider 1 set
- g) Receiving Antenna and
Feeder 1 set Yagi Antenna
- h) Equipment and Assembly 2 sets

3) HF Band Transmitting Antenna

- a) Broad Band Dipole antenna 1 set
- b) Earth Mat 1 set
- c) Coaxial Feeder 1 set
- d) Inlet of Coaxial Feeder 1 set

- 4) Receiver for Supervision
- a) FM Receiver
(for Repeater Station) 2 sets With Level Meter
including Antenna, Divider, Feeder
 - b) MF Receiver
(for Transmitting Station) 1 set With Level Meter
including Antenna Feeder
 - c) HF Receiver
(for Transmitting Station) 1 set With Level Meter
including antenna Feeder
- 5) Measuring Equipment
- a) Audio Frequency
Measurement meter 1 set
 - b) Oscilloscope 1 set
 - c) Measuring Cable 1 set
 - d) VHF Electric Field
Strength Meter 1 set FM Band
 - e) Frequency Counter 1 set Upto 2 MHz
 - f) Circuit Tester 3 set
 - g) FM Liner Detector 1 set
 - h) FM Demodulator 1 set
 - i) Oscillator 1 set
- 6) Spare Components 1 lot
- 7) Installation Material 1 lot

2-3-4 Basic Design Drawings

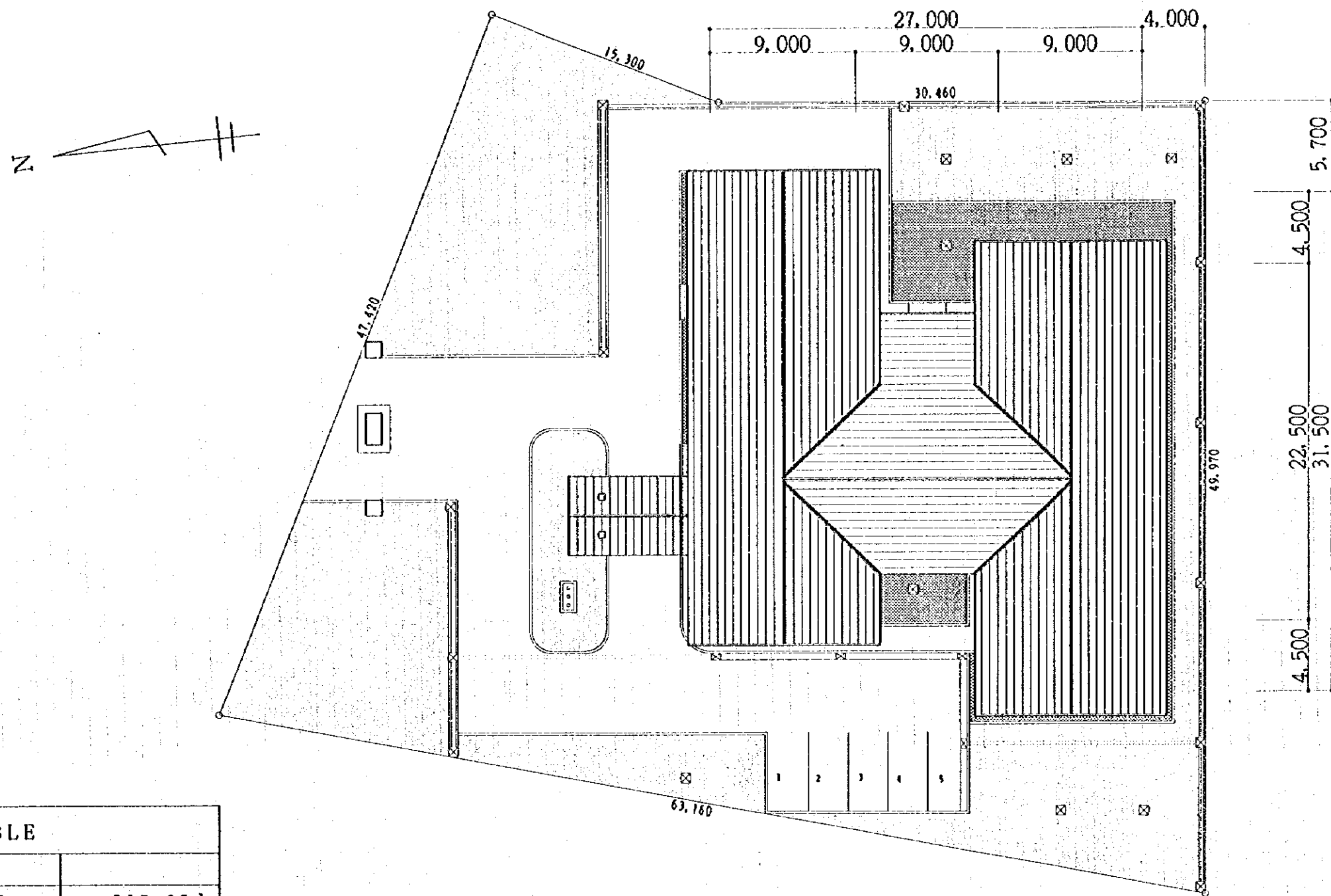
(1) Buildings

- 1) Figure 2-3-12 KRSC/Site Layout Plan 2-55
- 2) Figure 2-3-13 KRSC/Grand Floor Plan 2-57
- 3) Figure 2-3-14 KRSC/First Floor Plan 2-59
- 4) Figure 2-3-15 KRSC/Elevation 2-61
- 5) Figure 2-3-16 KRSC/Section 2-63
- 6) Figure 2-3-17 KRS/Site Layout Plan 2-65
- 7) Figure 2-3-18 KRS/Plan · Elevation · Section 2-67
- 8) Figure 2-3-19 KRS/Elevation of Steel Tower 2-69

(2) Broadcasting Equipment

- 1) Figure 2-3-20 Block Diagram of Studio System 2-71
- 2) Figure 2-3-21 (1/2) Block Diagram of Programme
Transmission Link 2-72
- 3) Figure 2-3-21 (2/2) Block Diagram of Programme
Transmission Link 2-73
- 4) Figure 2-3-22 Layout of Studio Equipment in
Kokopo Radio Studio Centre 2-74
- 5) Figure 2-3-23 Layout of Repeater Room
in Kenabot Hill 2-75
- 6) Figure 2-3-24 Layout of Transmitting
Room in Kurakakaul 2-76
- 7) Figure 2-3-25 Layout of New Antenna in Kurakakaul 2-77

(1) Buildings



AREAS TABLE	
FLOOR AREA	
GROUND FLOOR	587.25 ^m
FIRST FLOOR	324.00 ^m
TOTAL	911.25 ^m
CONSTRUCTION AREA	706.75 ^m

Figure 2-3-12 KRSC/Site Layout Plan S=1/300

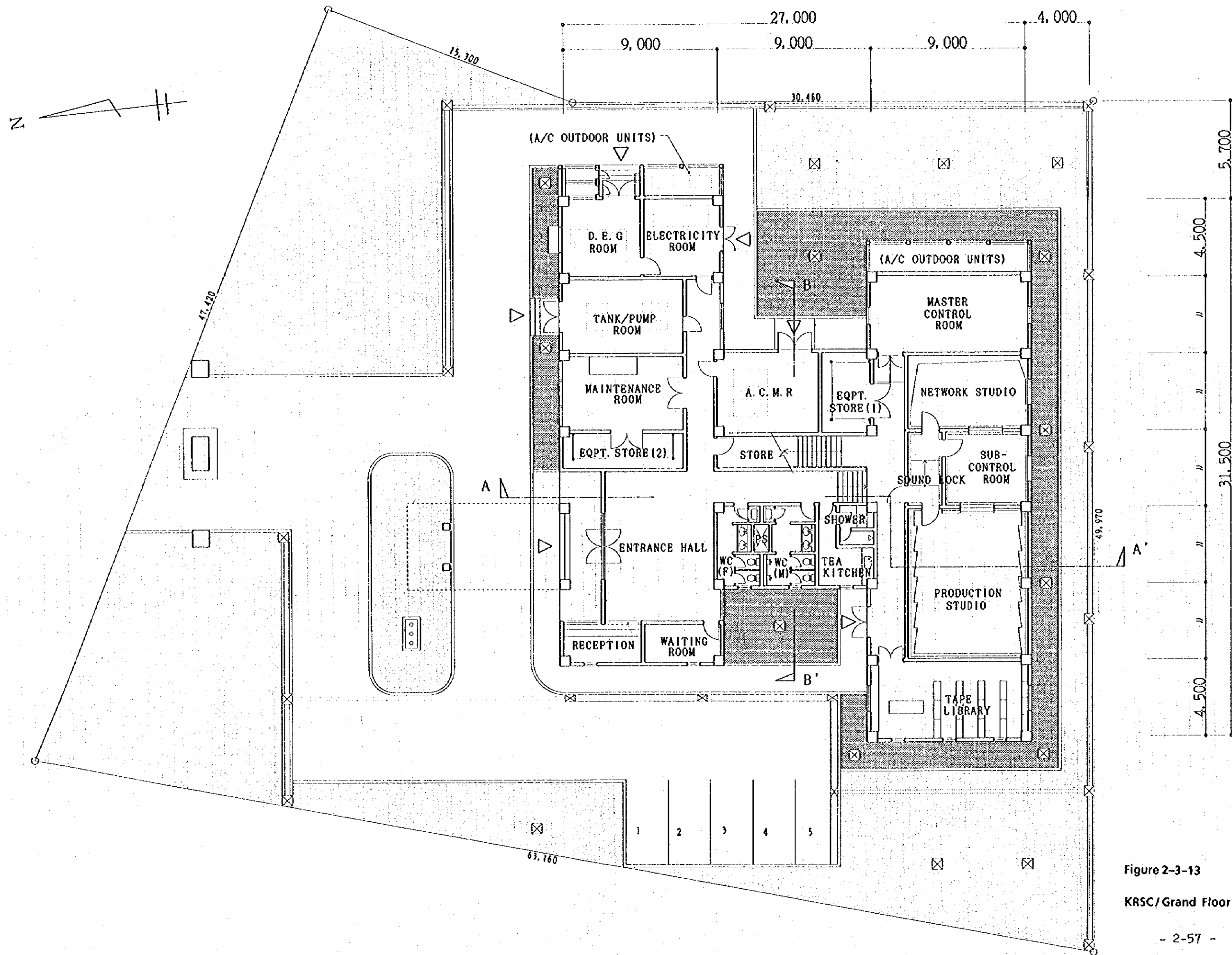


Figure 2-3-13

KRSC/Grand Floor Plan S=1/200





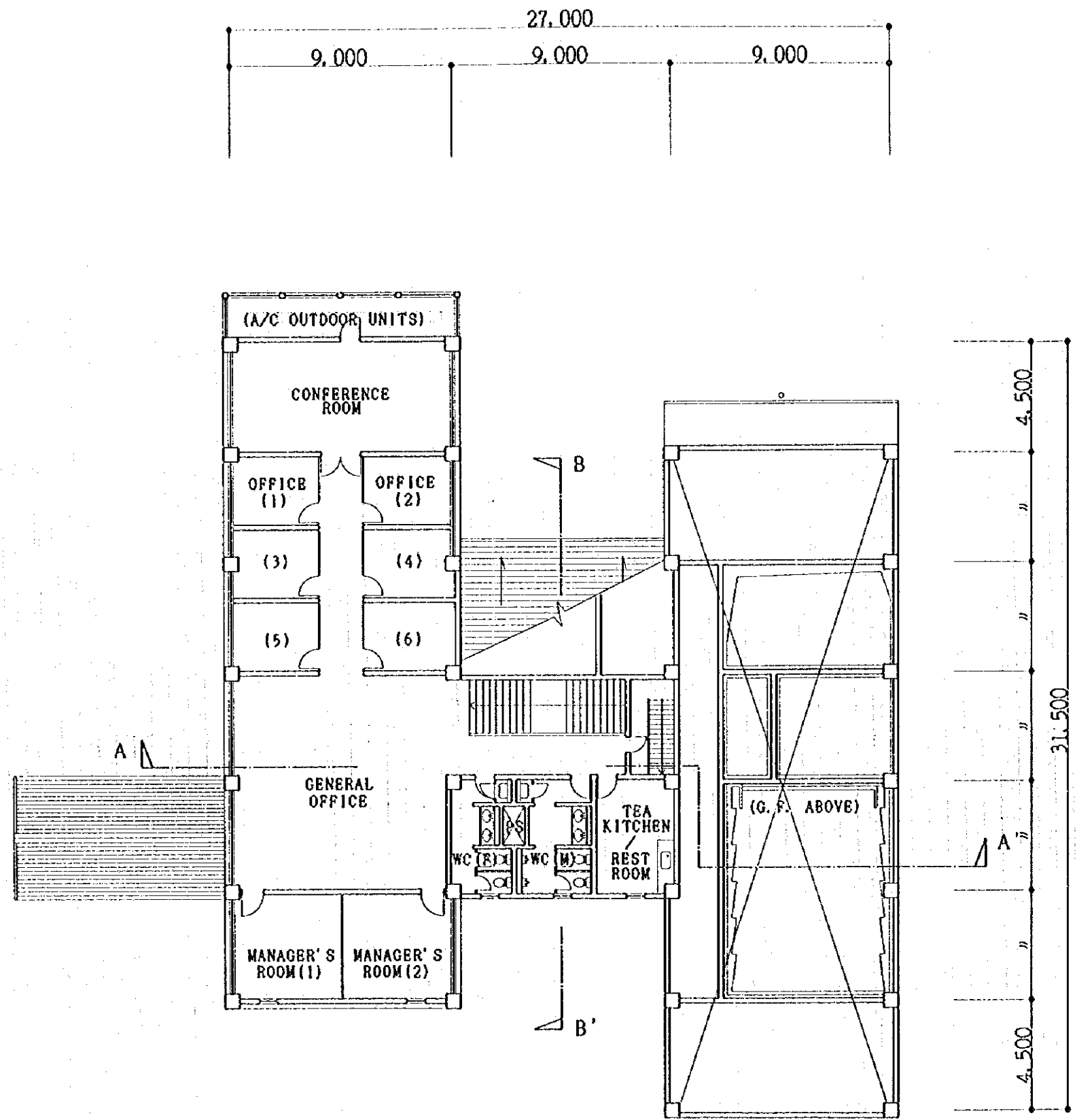
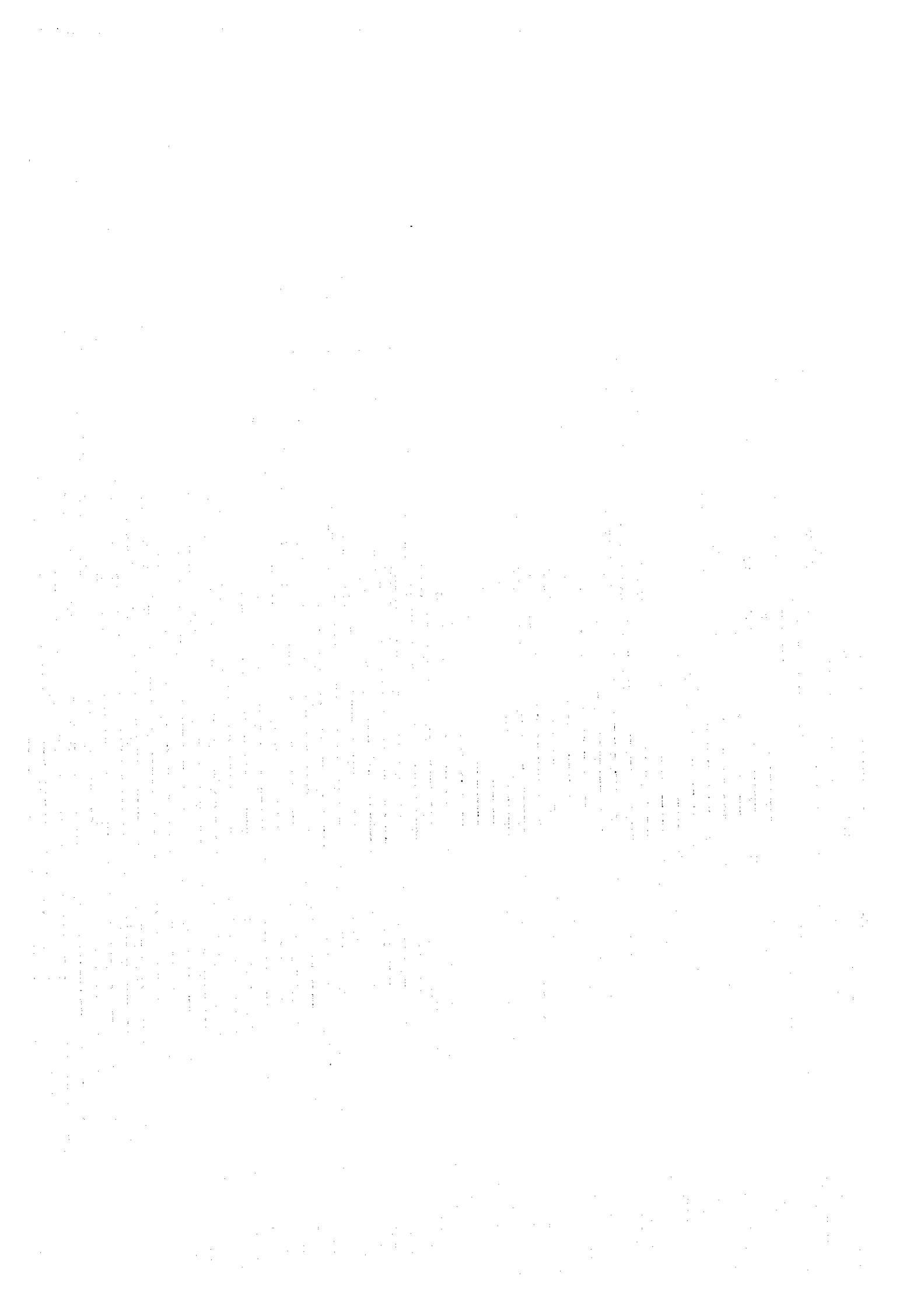
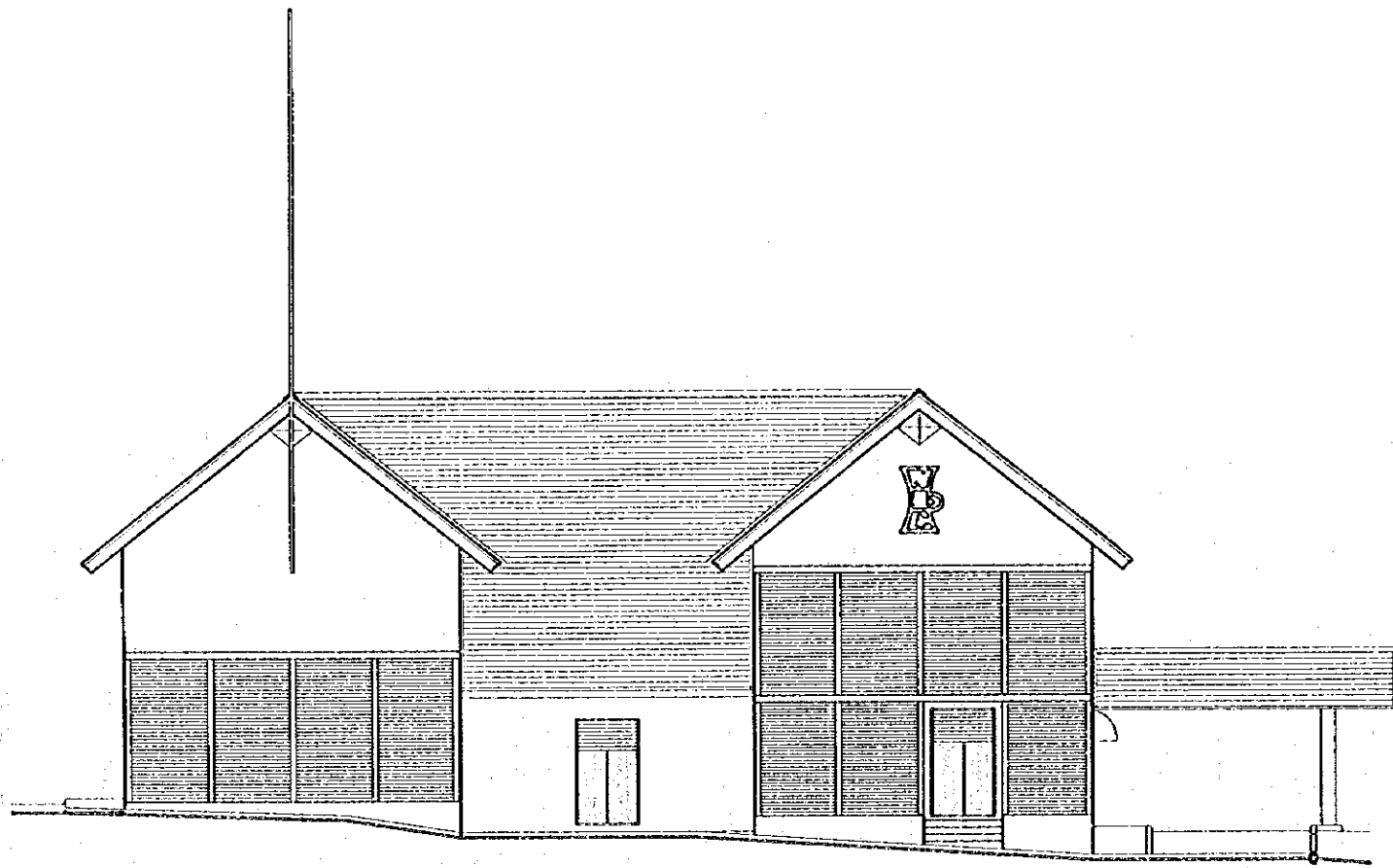


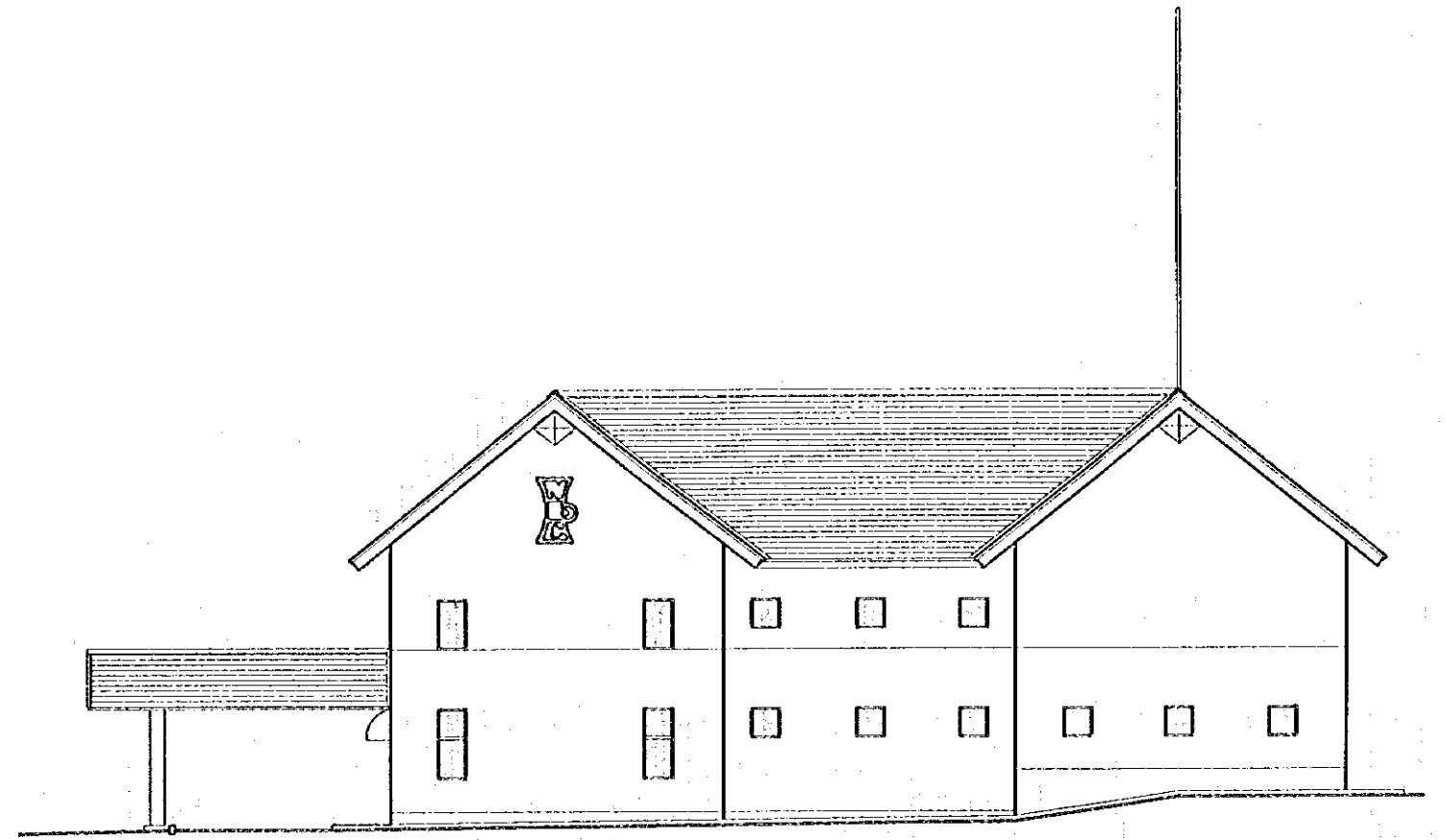
Figure 2-3-14 KRSC/First Floor Plan S=1/200



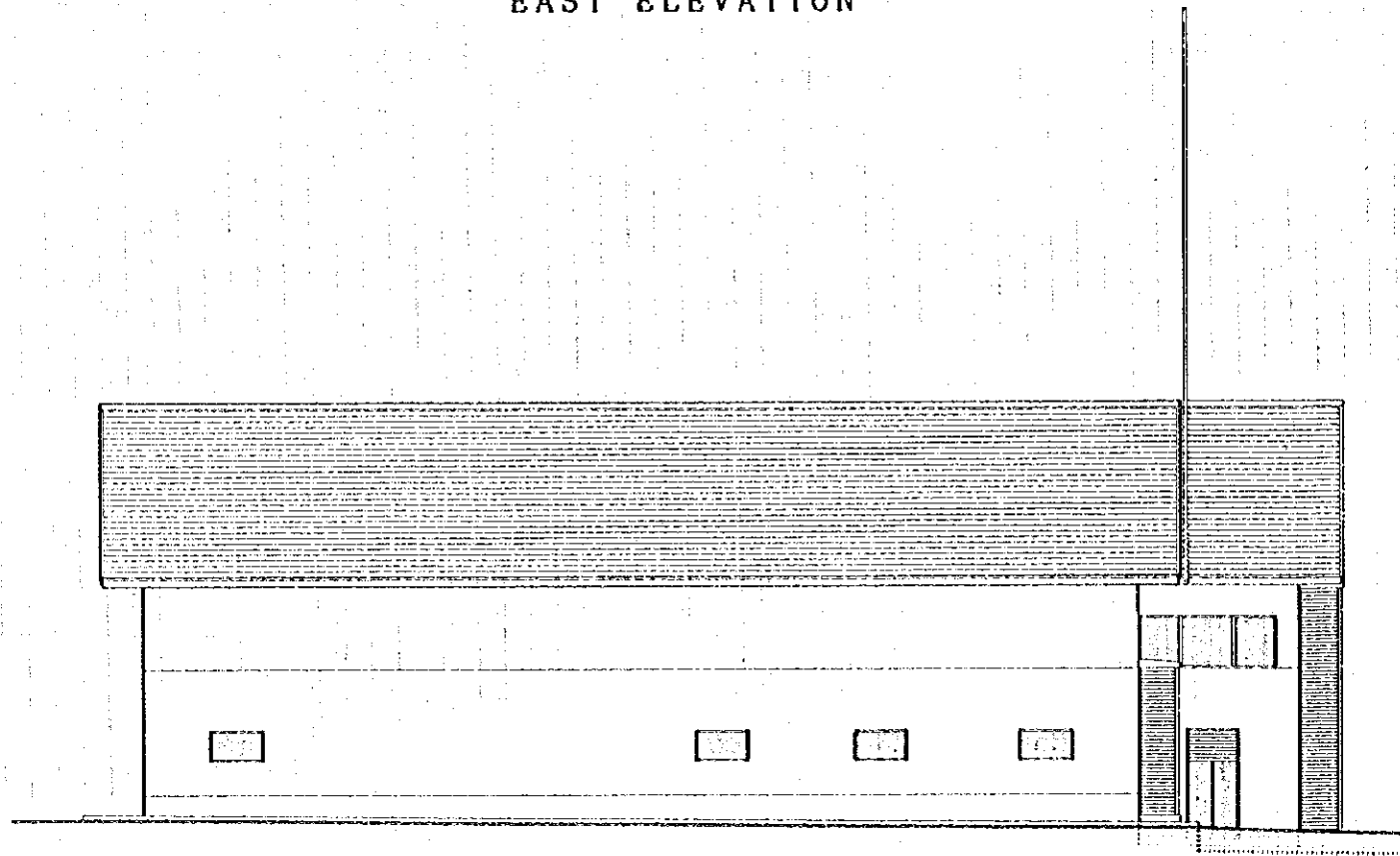




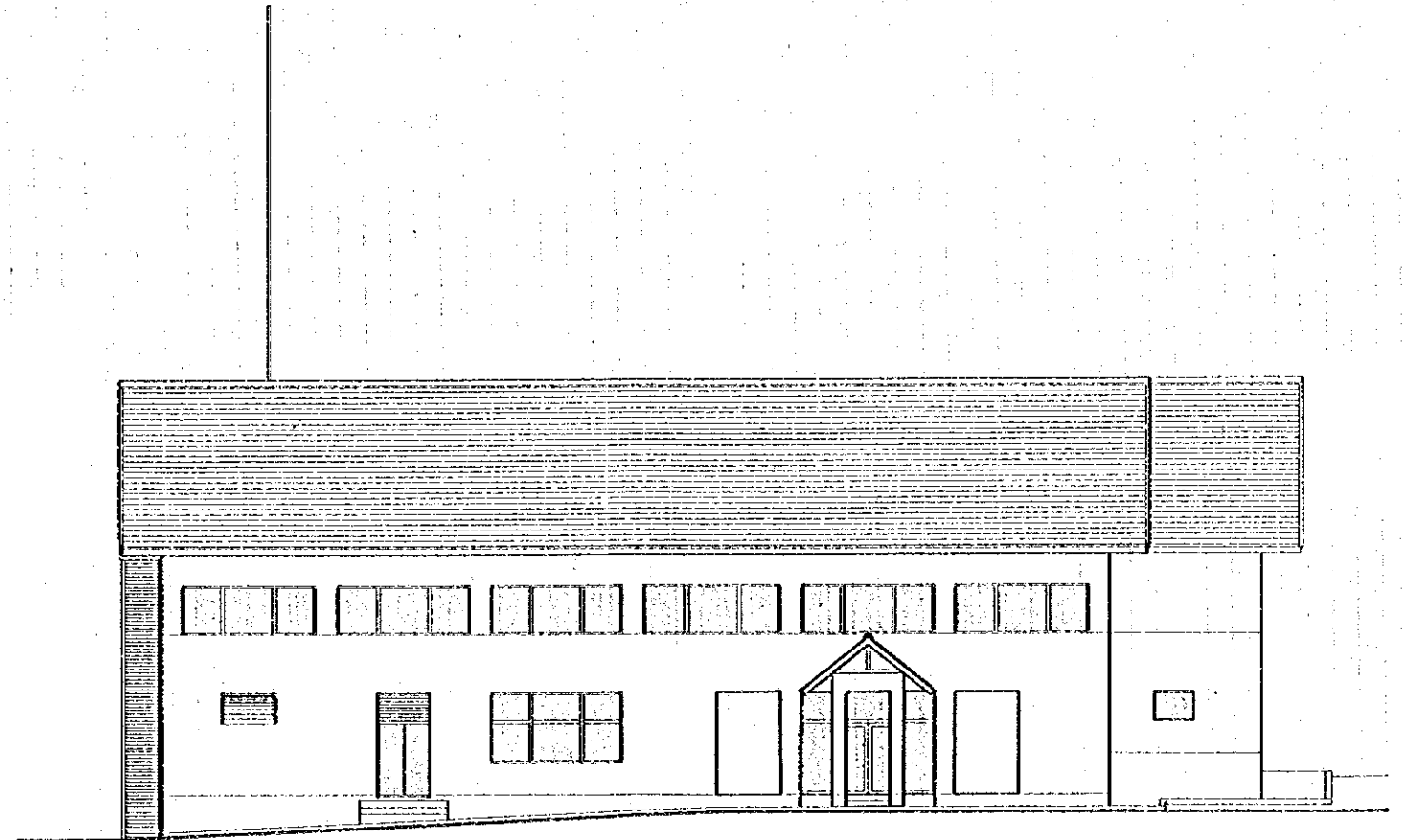
EAST ELEVATION



WEST ELEVATION

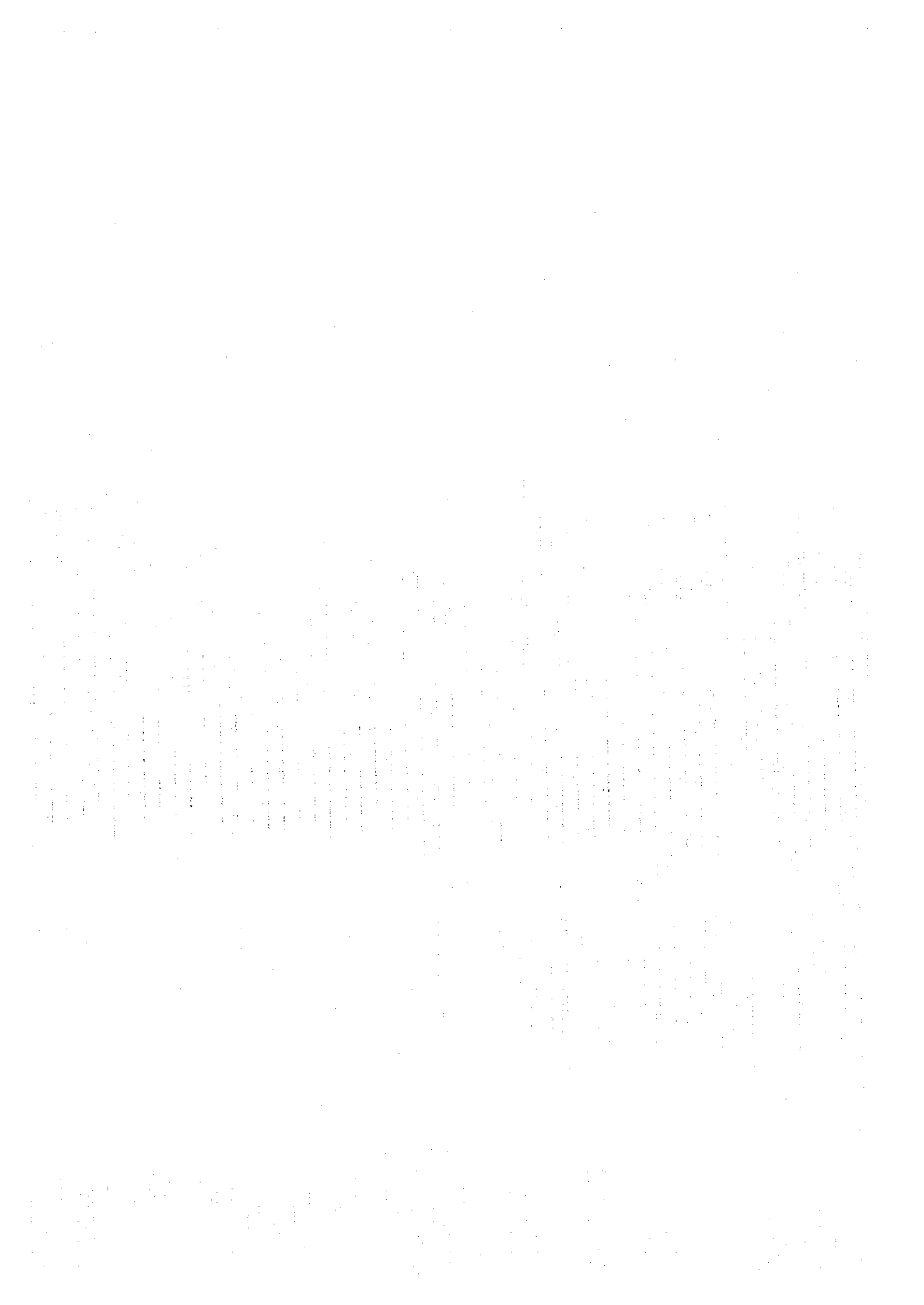


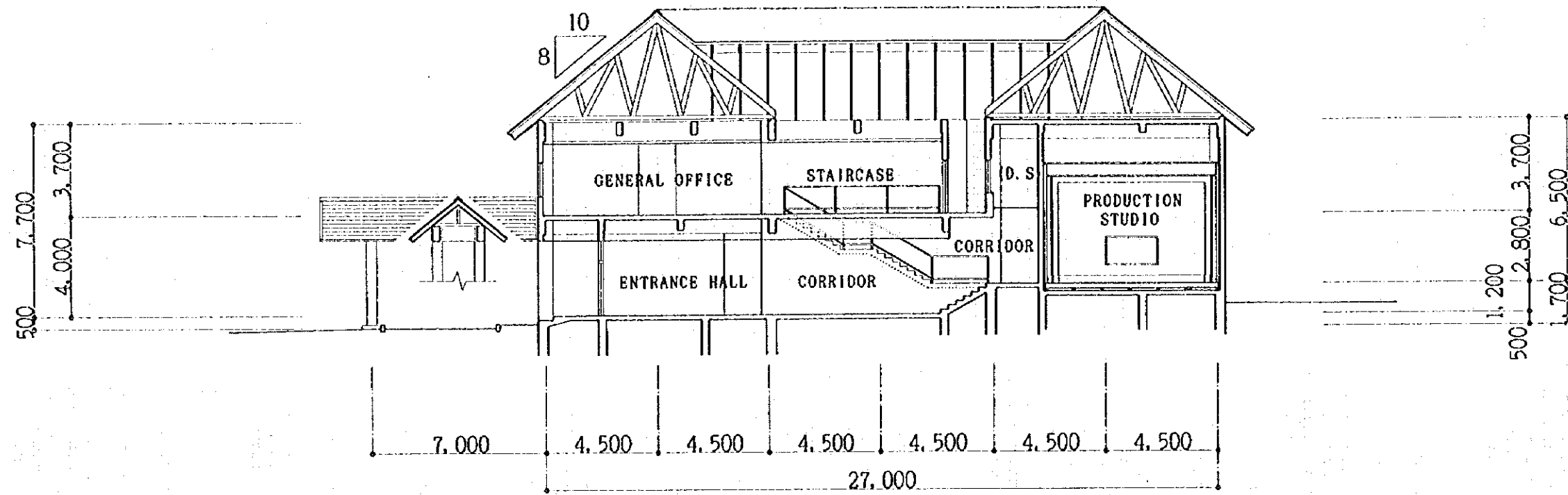
SOUTH ELEVATION



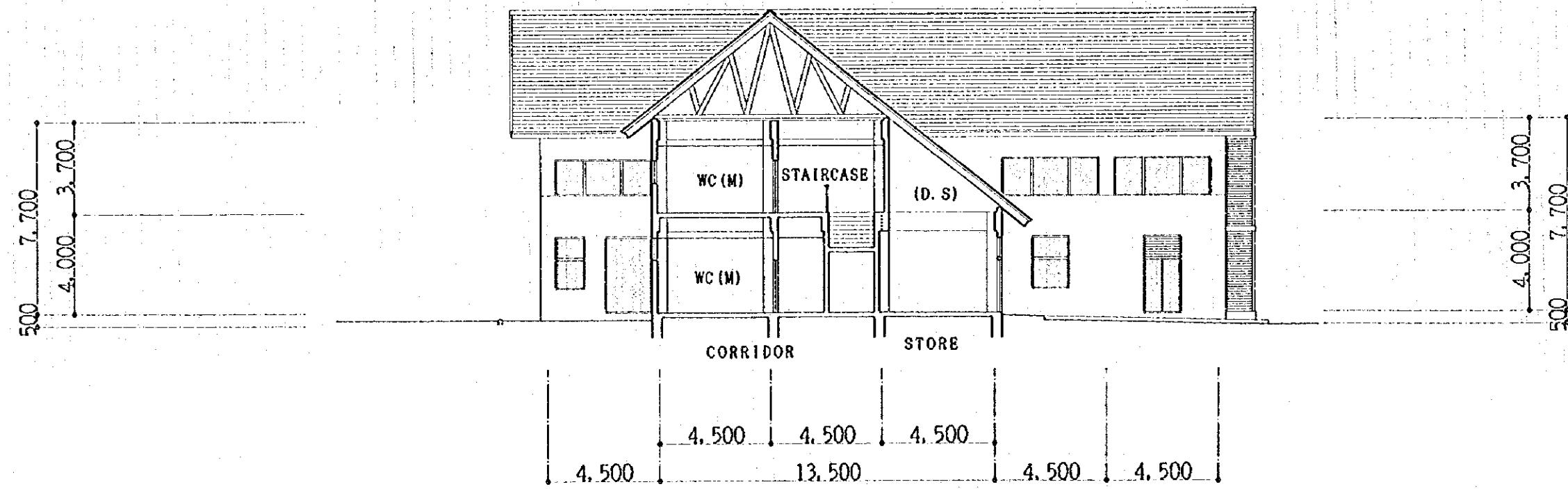
NORTH ELEVATION







A-A' SECTION



B-B' SECTION

Figure 2-3-16 KRSC/Section S=1/200

AREAS TABLE	
BUILDING	
FLOOR AREA	97.56 m ²
CONSTRUCTION AREA	137.76 m ²
SELF SUPPORTING STEEL TOWER	
CONSTRUCTION AREA	100.00 m ²
(HEIGHT)	(80.00m)

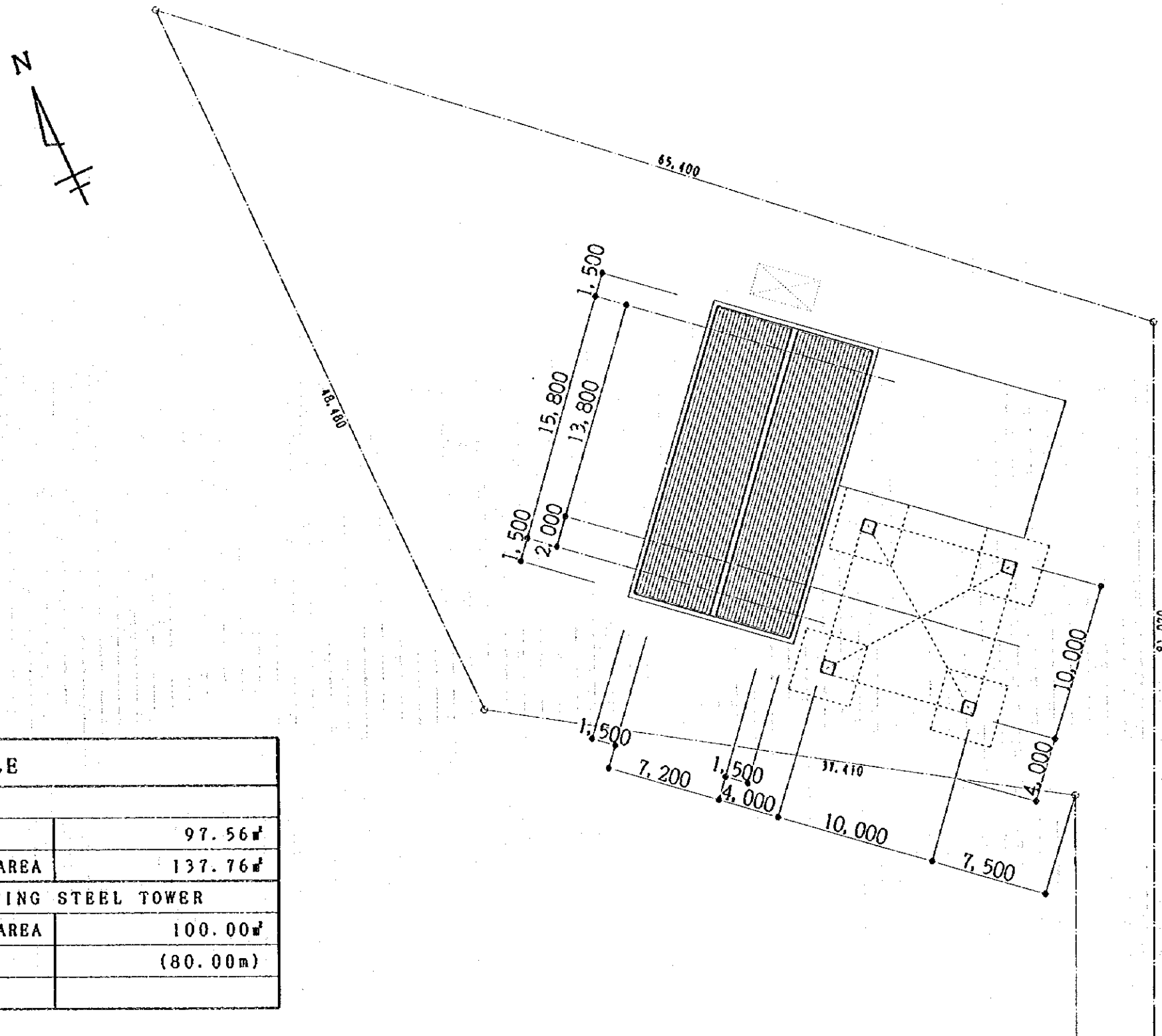
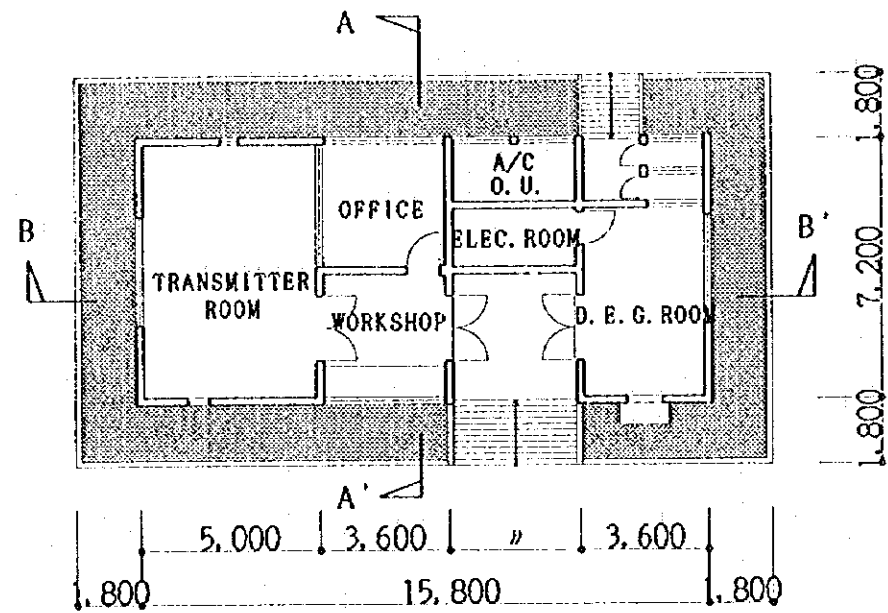
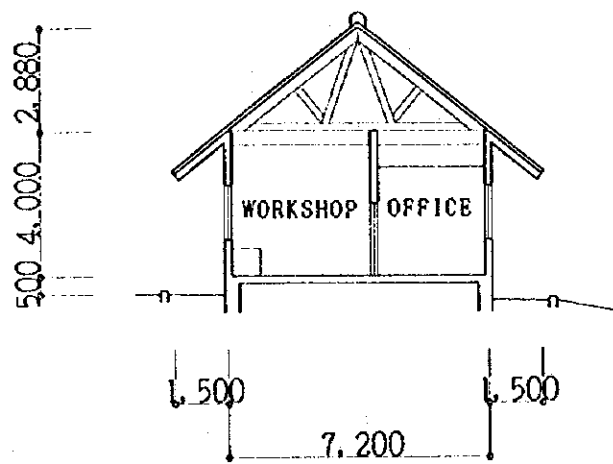
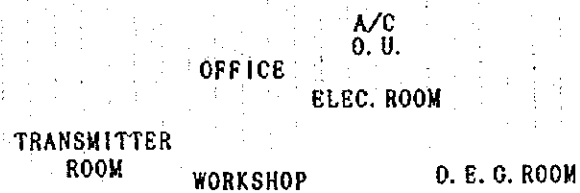
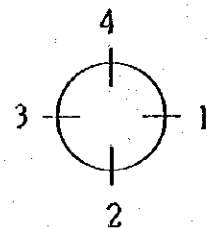


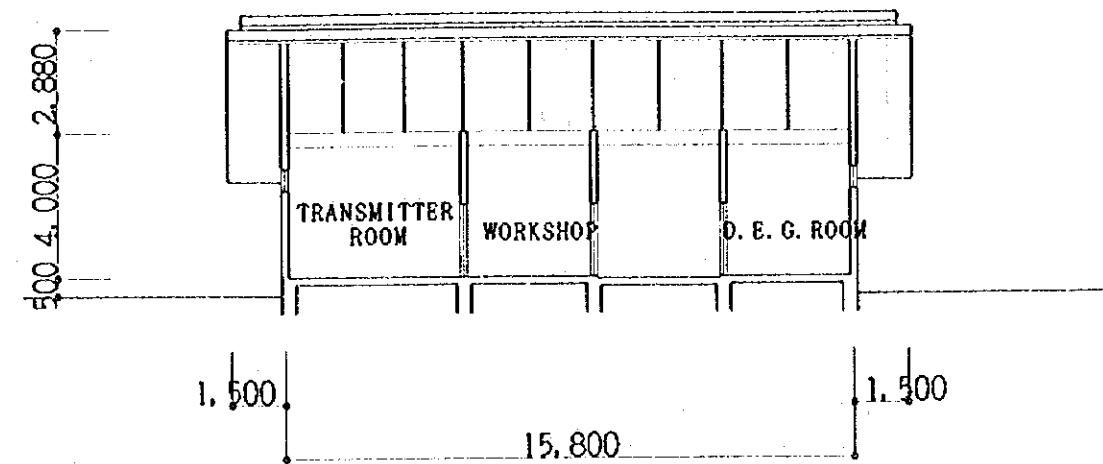
Figure 2-3-17 KRS / Site Layout Plan S = 1/300



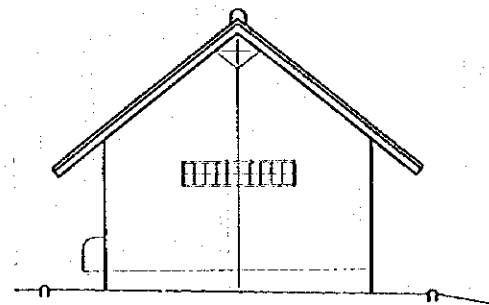
GROUND FLOOR PLAN



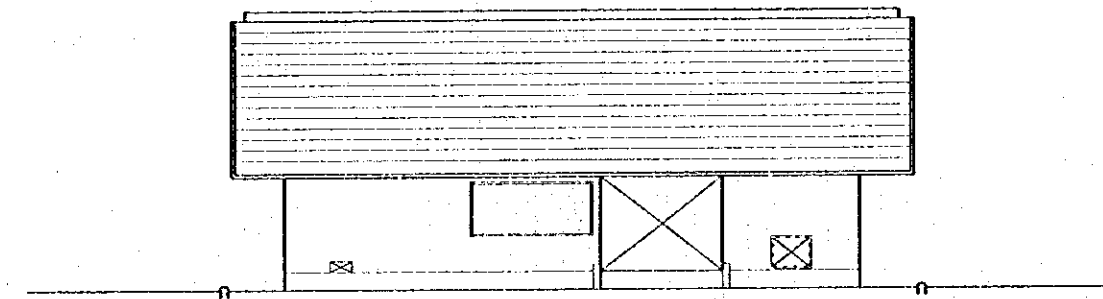
A-A' SECTION



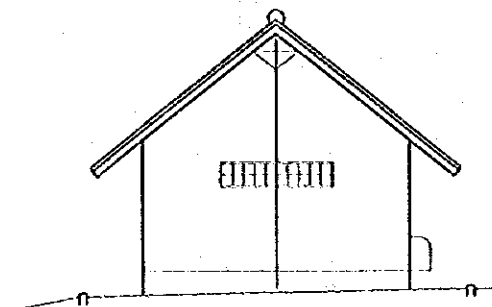
B-B' SECTION



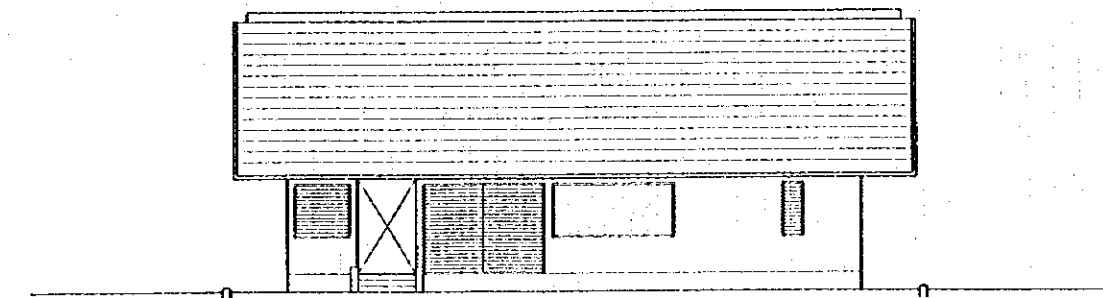
ELEVATION (1)



ELEVATION (2)

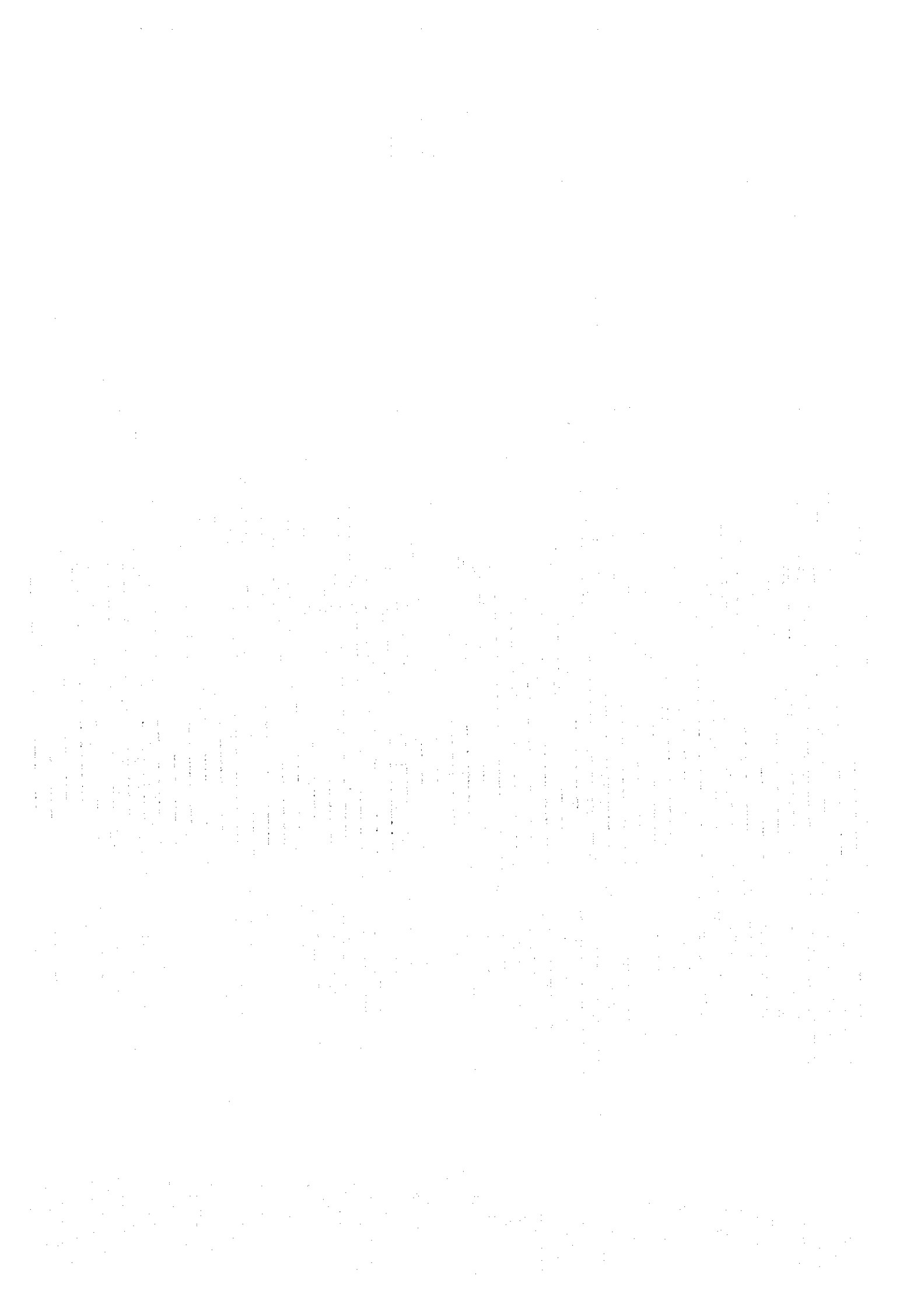


ELEVATION (3)



ELEVATION (4)

Figure 2-3-18 KRS/Plan • Elevation • Section S=1/200



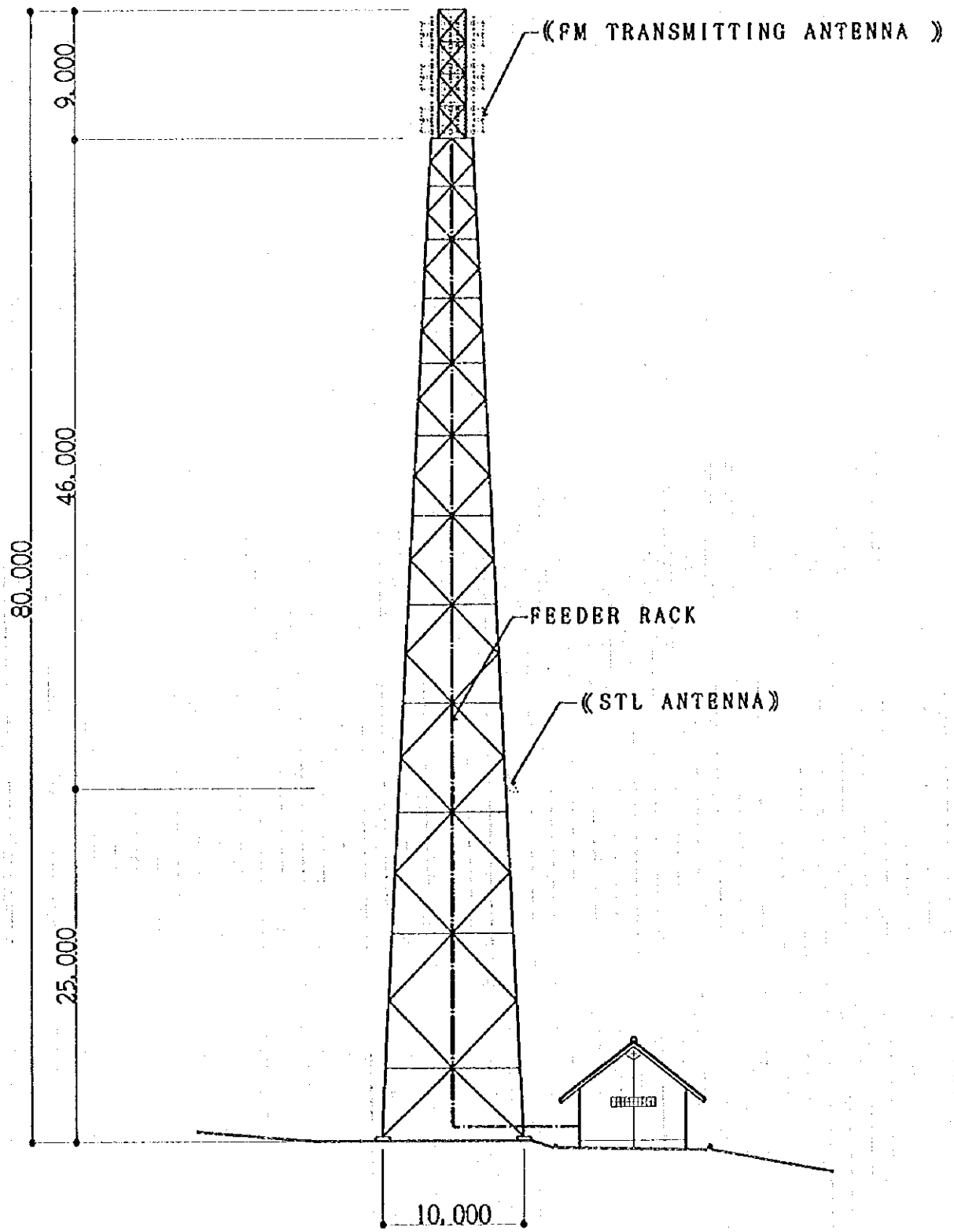
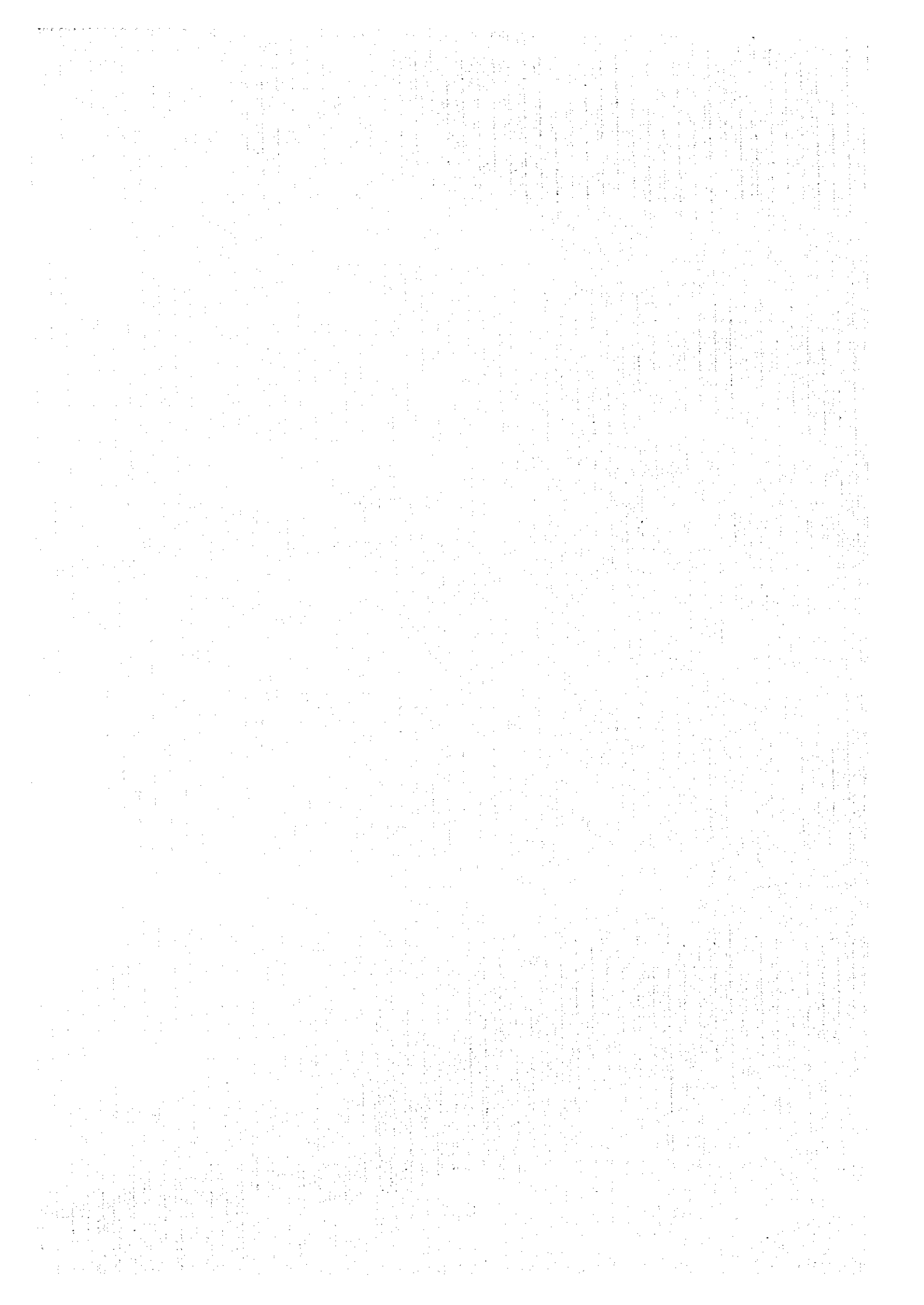
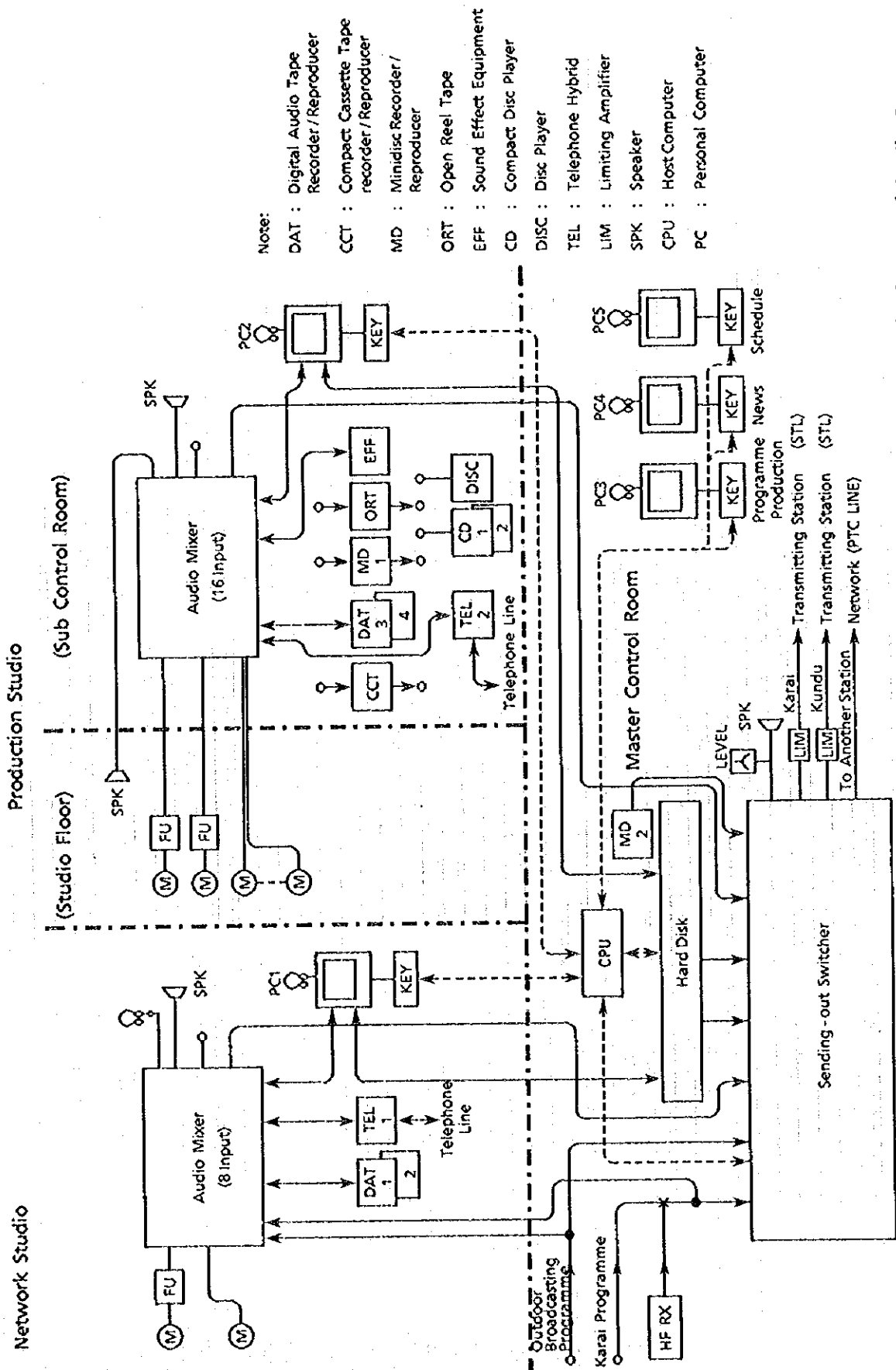


Figure 2-3-19 KRS/Elevation of Steel Tower S = 1/400

(2) Broadcasting Equipment





Note:

- DAT : Digital Audio Tape Recorder / Reproducer
- CCT : Compact Cassette Tape recorder / Reproducer
- MD : Minidisc Recorder / Reproducer
- ORT : Open Reel Tape
- EFF : Sound Effect Equipment
- CD : Compact Disc Player
- DISC : Disc Player
- TEL : Telephone Hybrid
- LIM : Limiting Amplifier
- SPK : Speaker
- CPU : Host Computer
- PC : Personal Computer

Figure 2-3-20 Block Diagram of Studio System

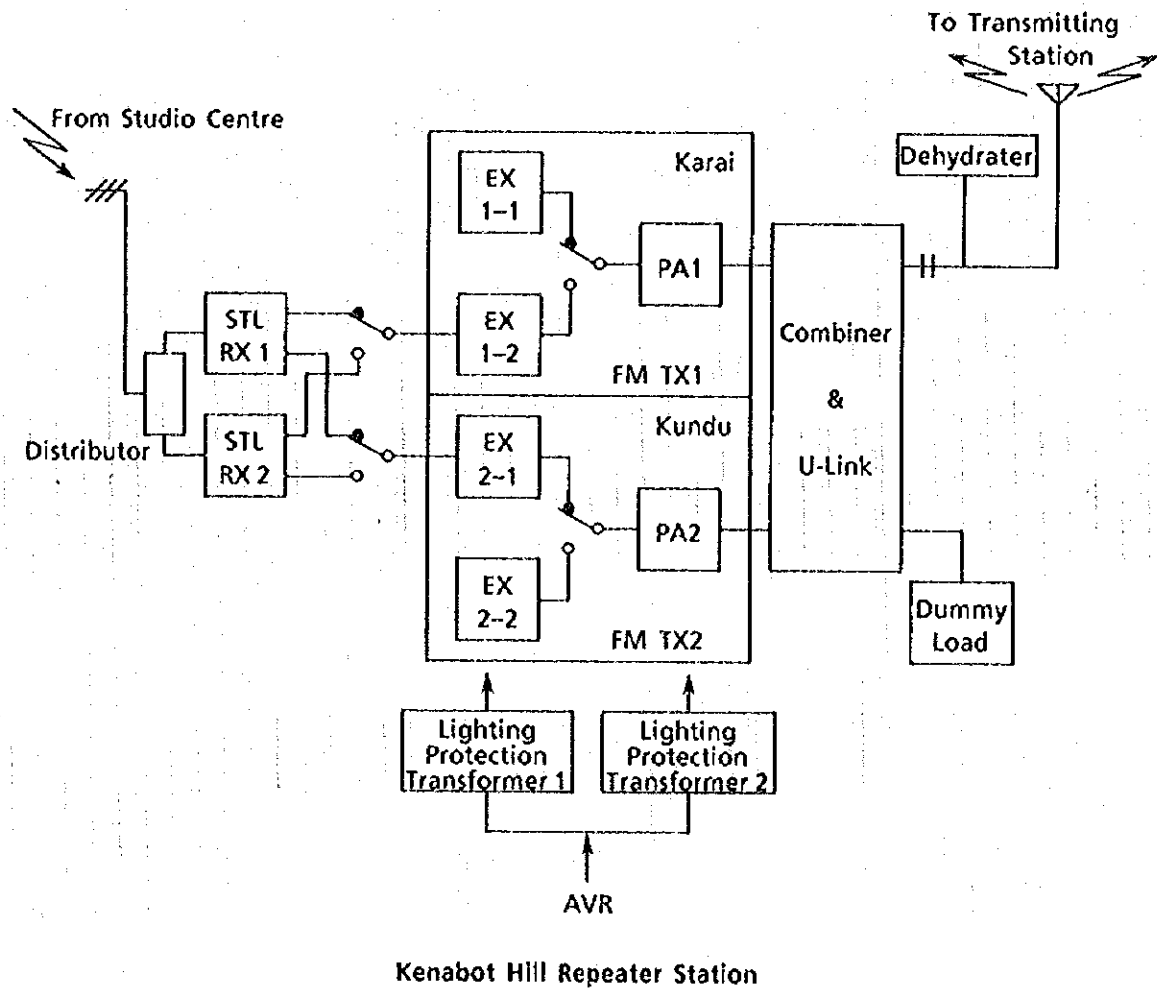
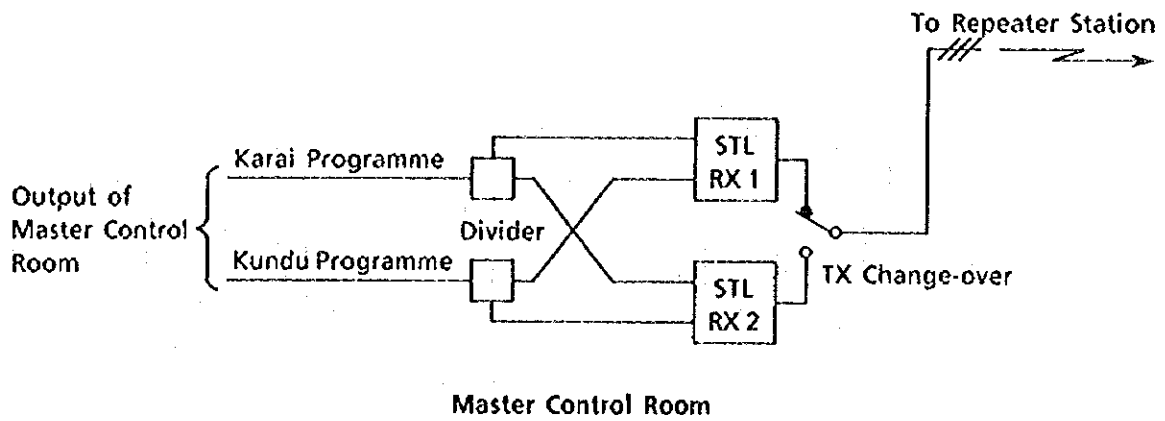
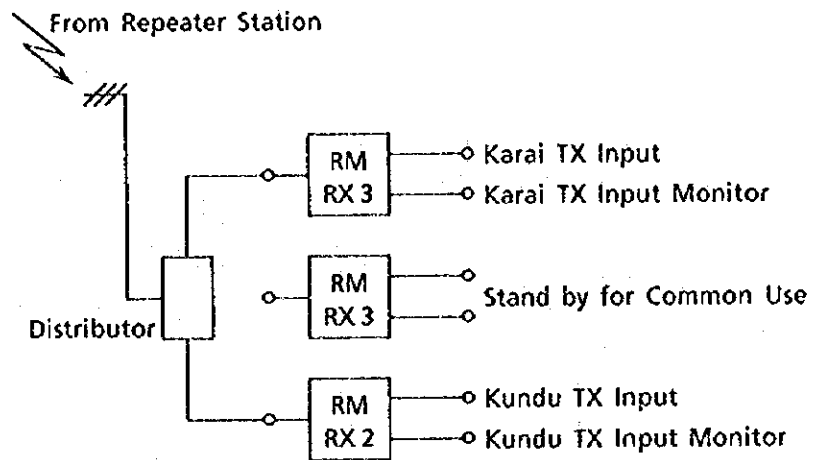
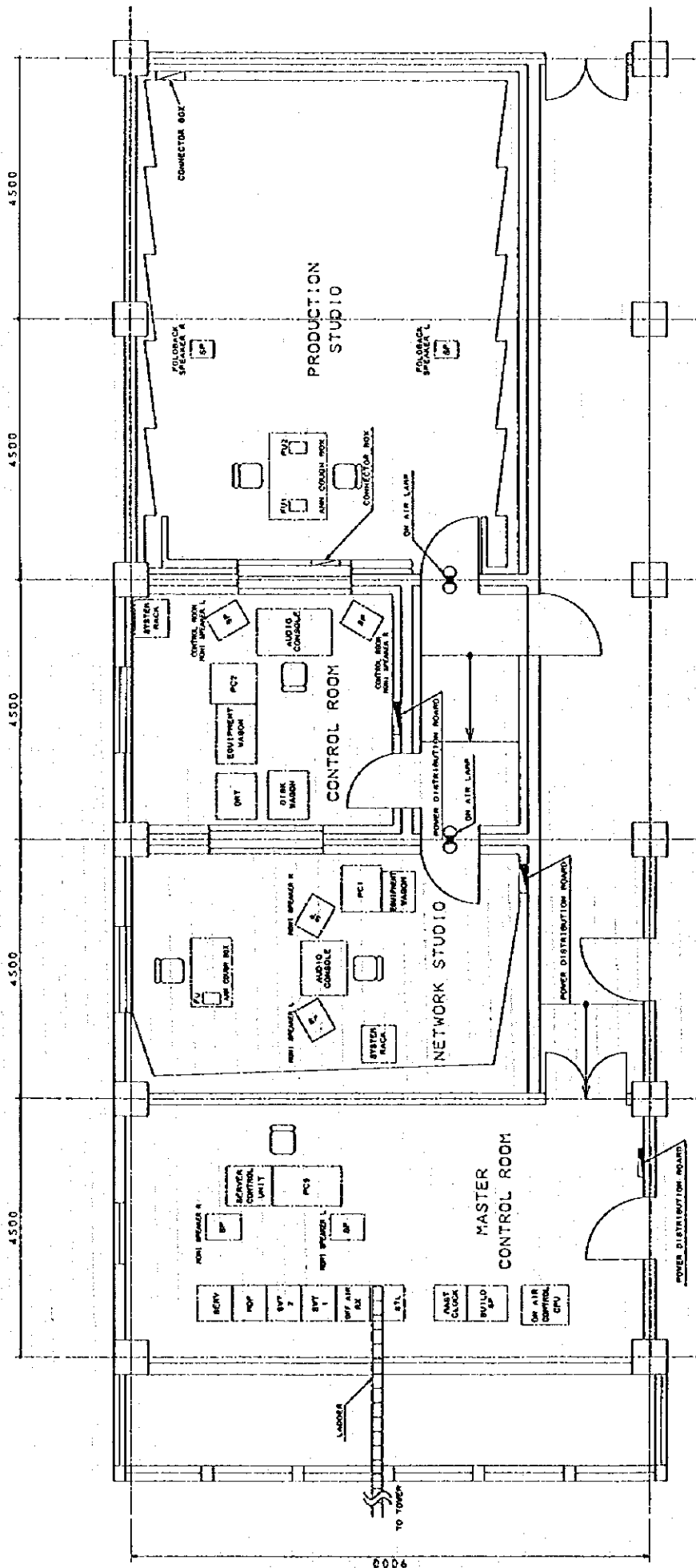


Figure 2-3-21 (1/2) Block Diagram of Programme Transmission Link



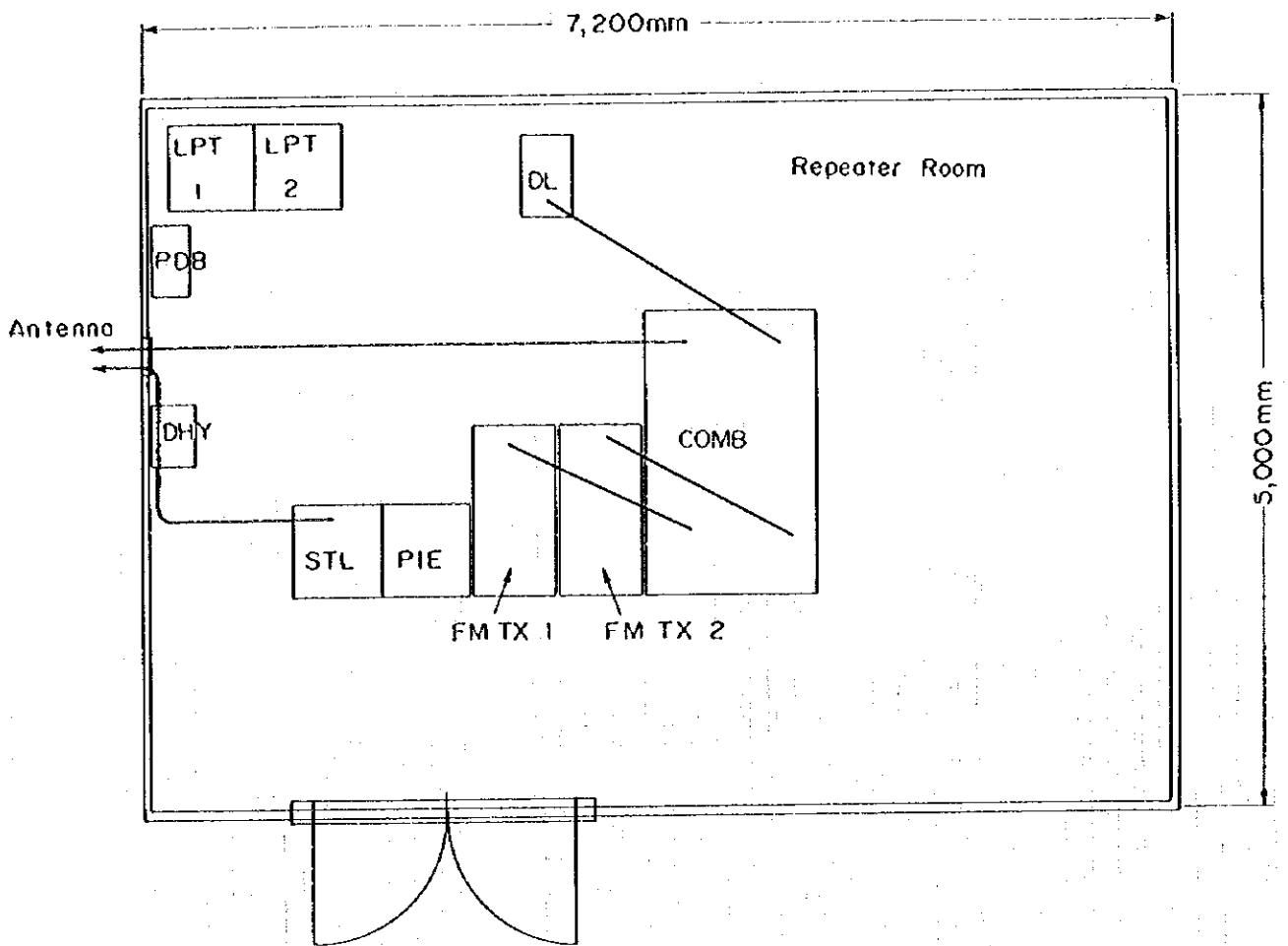
Kurakakaul MF-HF Transmitting Station

Figure 2-3-21 (2/2) Block Diagram of Programme Transmission Link



Abbreviation:
 Serv:Server
 MDF:Main Distributing Frame
 SWT:Sending-out Switch Board
 RX:Receiver
 SP:Speaker
 FU:Fader Unit
 CPU:Computer
 L:Left
 R:Right

Figure 2-3-22 Layout of Studio Equipment in Kokopo Radio Studio Centre



- PDB : Power Distribution Board
- LPT : Lightning Protection Transformer
- PIE : Programme Input & Monitoring Equipment
- COMB : Channel Combiner
- DL : Dummy Load
- DHY : Dehydrator
- FM TX : FM Transmitter

Figure 2-3-23 Layout of Repeater Room in Kenabot Hill

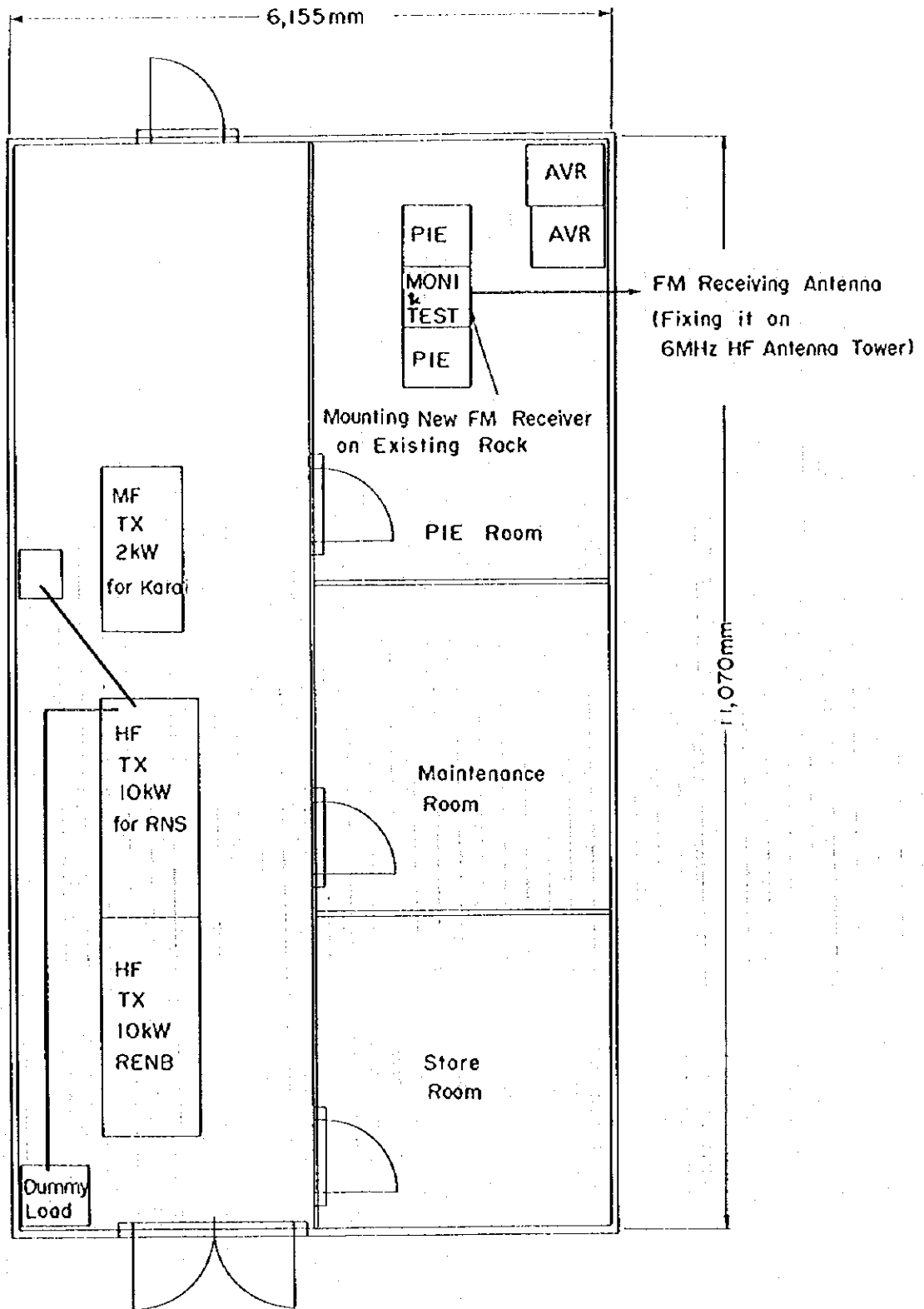


Figure 2-3-24 Layout of Transmitting Room in Kurakakaul

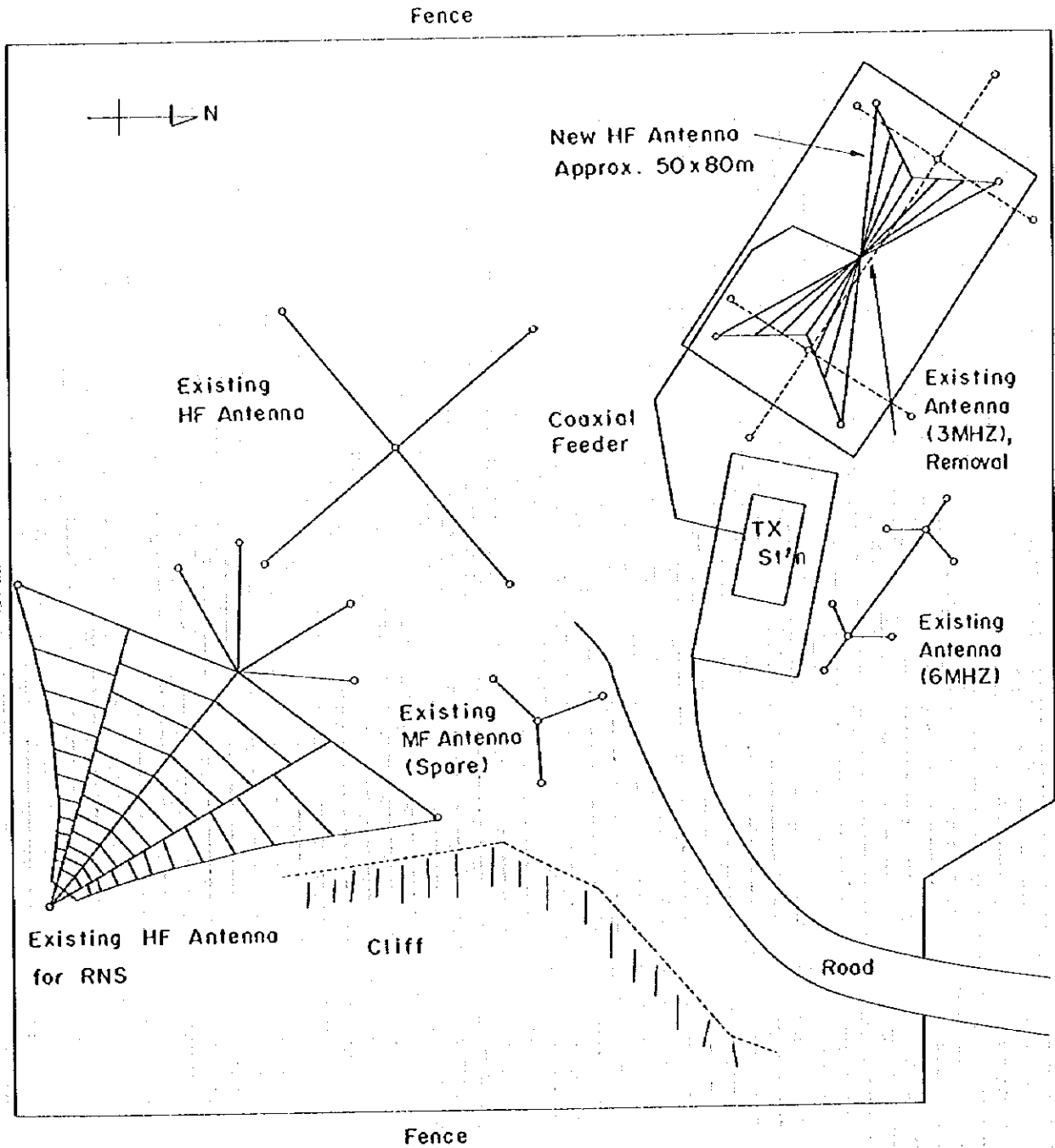


Figure 2-3-25 Layout of New Antenna in Kurakakaul

Chapter 3 Implementation Plan

Chapter 3 Implementation Plan

3-1 Implementation Plan

3-1-1 Implementation Concept

(1) Project Implementation Set-up

1) PNG Parties Concerned

The related agencies in PNG that will be involved in the implementation of the Project under the grant aid system of the Government of Japan are described below together with their respective roles.

(a) National Planning Office

This is the executive agency on the PNG side in the grant aid Project.

(b) National Broadcasting Corporation (NBC)

This is the main implementing agency in the Project and will get in touch with the Japanese consultant and contractors.

(c) Provincial Land and Physical Planning Board

This is the authority for giving approval on utilization of the land in the Province. The assessment is mainly made in the light of effect to the environmental conditions by construction of the building. Without getting approval by the authority, nobody can apply the subsequent building permit.

(d) Provincial Building Board

This is the final agency for authorizing the construction of buildings in the Province. The board examines design documents submitted by the applicants referring to the architectural and mechanical laws and regulations in PNG and issue the building permit.

(e) Gazelle Restoration Authority

The GRA, in addition to reviewing and approving the Project building plan from the standpoint of city development planning, will also prepare the urban infrastructure around the Project sites. With regard to the approval of the facilities plan, the GRA has independent authority separate from the approval procedure of the above (c) and (d).

2) Project Implementation Procedure

The Project shall commence with conclusion of the Exchange of Notes (E/N) between the Government of PNG and the Government of Japan. After conclusion of the E/N, the NBC, acting as the main implementing agency for the Project, shall sign an agreement with a Japanese consultant, and the said consultant shall start the detailed design work immediately after verification of the said agreement by the Government of Japan.

The tender shall be carried out after completion of the tender documents (detailed design drawings, specifications, etc.) for the building construction and supply and installation of broadcasting equipment. Design drawings for construction will require the prior approval by the Provincial Building Board and the GRA.

Regarding the documentation to be presented to the related ministries and agencies, PNG standards request not only the calculation method of structures and building equipment but also the order and method of expression of drawings. Structural design needs to be checked by an engineer with PNG qualifications. Therefore, part of the detailed design work shall be consigned to a local consultant.

The tender shall be carried out according to the stipulations laid down in the E/N and shall only target contractors of Japanese nationality. Because the Project involves two differing areas, namely building construction and the supply and installation of broadcasting equipment, tenders shall be carried out separately. The tender for building construction shall target registered construction companies, and

a pre-qualification procedure shall be conducted prior to the tender. With regard to the equipment supply, because the Project equipment is made up of various types of equipment (studio broadcasting equipment, programme transmission equipment, etc.) made by separate manufacturers, the tender shall target general trading companies that are capable of supplying all the necessary items together.

Work in both areas shall start after the contracts between the successful bidders and NBC and verified by the Government of Japan.

3) Management Set-up of NBC

The NBC, the main implementing agency for the Project, will need to pay attention to the building permit application procedure and the city development plans of the GRA when advancing the Project.

The procedure for building permit application in PNG is extremely complex and this may cause a big delay on the implementation schedule. It is compulsory for the application documentation presented to the Provincial Building Board to first be inspected and signed for approval by a total of seven inspectors, i.e. the Provincial Lands Officer, the Physical Planner, the Provincial Health Inspector, the Electricity Commission, the Water Board, a structural engineer registered with the Ministry of Construction, and the Fire Prevention Officer. Furthermore, because these approval signatures have to be put on the same sheet of paper, it is necessary to carry around these inspectors to expedite, and still it may take more than two months.

To ensure the smooth and timely execution of the Project, the NBC should select its management staff in charge of the building plans as early as possible, without waiting for the official commitment by the Government of Japan to the Project. The selected management staff, in addition to putting the basic plans for the Project facilities across to the GRA, should maintain a constant grasp on the GRA city planning situation and strive to persuade the GRA to carry out the exterior plan in line with the Project and urban infrastructure development

around the Project area. Moreover, with respect to building permit application, the management staff should conduct ample prior negotiations in order to work out ways to minimize the time required for this procedure.

In the case where additional approval from other ministries or agencies is required with respect to the tower construction and broadcasting equipment procurement, the management staff in charge of equipment should similarly be appointed at an early stage and made to handle the necessary work. The respective management staff in charge of construction and equipment should make the utmost effort to ensure smooth Project implementation through cooperating with the consultant during implementation and resolving any foreseeable problems in advance.

(2) Essential Points on Work Management Plan

1) Consideration for Complex Work

Many of the design conditions of a radio studio centre, by no means an ordinary type of building, are determined by the broadcasting equipment housed in the building. The heat dissipation values, required power supply, installation methods and wiring systems, etc. of such equipment tend to vary according to the equipment manufacturer's specifications. Therefore, with respect to such detailed conditions as the equipment layout, electricity, air conditioning wiring ducts and conduits, positions and dimensions of floor or wall opening etc., it is vitally important that the consultant hold close coordination among all the parties concerned including the construction contractor and equipment contractor with detailed discussions for demarcation of responsibility.

2) Securing Studio Quality

Any errors in the installation of studio walls, floors and fittings, etc., which need to have excellent sound insulation, can have a critical effect on the quality of programme production. When building the studios and studio-related rooms, the utmost care must be taken to ensure that acoustic requirements are met.

3) Use of Local Contractors

Because there have been few construction works in Kokopo and the rest of East New Britain in the past, there are unfortunately no local contractors able to independently carry out the Project works to the level of quality required, and it is also extremely difficult to find skilled workers. As a result, the construction work shall be contracted out to major local construction companies based in Port Moresby.

4) Dispatch of Specialist Technicians

There are practically no specialists in PNG expert in those areas of the Project that require special skills, i.e. installation of broadcasting equipment, noise insulation and sound absorption finishing of studios, fitting of sound proof doors, construction of self-supporting tower, and so on. Therefore, specialists from either Japan or Australia shall be dispatched as appropriate during the implementation of the above works, and technical transfer to the local workers will be carried out in the form of on-the-job training.

3-1-2 Implementation Conditions

(1) Consideration for Natural Conditions

The average rainfall in Kokopo, the Project area, is 100-200 mm per month and around 2,000 mm per year, and there is occasionally torrential rain. The highest annual rainfall on record is 3,873 mm in 1930, the highest monthly rainfall is 1,148 mm recorded in 1980, and the record rainfall in one day is 151 mm in 1993. It is forecast underground that the water level in the Project area during the works implementation period will be relatively high, and there is concern that difficulty encountered in excavation due to much water in the ground may have a serious effect on the implementation schedule. For this reason, all possible measures should be taken to ensure the drainage of the site during the works period. Also, the foundation works for the self-supporting tower on Kenabot Hill should be implemented during the dry season from May to November.

From December to April the monsoon will blow from the west to north-west direction, and it is expected that the rain will fall

together with ash fallout from the still active volcano in Rabaul. Ample consideration will need to be given to weather conditions to ensure that the rain and ash containing all sorts of acidic compounds do not mix with concrete being placed.

(2) Preparation of Construction Materials and Labor

As it is only possible to procure foundation materials in Kokopo, almost all the construction heavy machinery and finishing materials shall be procured in Port Moresby, and some of the broadcasting equipment and special building materials shall be imported from Japan and Australia. Consequently, the building construction contractors should collect the necessary information concerning import procedures and transportation periods, etc. as early as possible to make sure that the work schedules are not adversely affected.

Regarding the procurement of labor, it is thought that skilled workers for the finishing and equipment installation works will need to be found in New Guinea island. Because there are no accommodation facilities in Kokopo, it will be necessary to examine methods for setting up the sites and accommodating the site management staff and skilled workers well in advance.

(3) Cares for Building Inspections by Authorities

As was mentioned earlier, the legal procedure regarding construction in PNG is strict, and this applies not only to building permit but also during the works period. It is required that interim inspections and completion inspections be carried out by the Electricity Board, the Water Board, the Fire Department, and so on. Because these inspections, like the building permit procedure, tend to take time, it is vitally important to notify the authorities concerned as early as possible.

(4) Points to Consider in Equipment Procurement and Installation

1) Regarding the site for erection of the HF transmission antenna, because the existing site is somewhat limited, the existing 3,385 kHz HF transmission antenna shall be removed and the new antenna built in its place. Because it will not be

possible to carry out broadcasts over 3,385 kHz until the new HF antenna starts operating, broadcasts shall be sent out using the 5,985 kHz antenna during this period.

2) Removal of the existing 3,385 kHz HF transmission antenna shall be the responsibility of the NBC.

3-1-3 Scope of Works

(1) Scope of Works by Both Governments

In the case where the Project is implemented under the grant aid system of the Government of Japan, it is considered appropriate to divide the work responsibilities of the Government of Japan and the Government of PNG as follows.

- 1) Works to be Conducted by the Japan Side
 - a) Construction of Kokopo Radio Studio Centre
 - b) Construction of Kenabot Repeater Station and self-supporting tower
 - c) Supply and installation of broadcasting and transmission equipment for the above facilities
 - d) Supply of a HF transmission antenna for the existing MF and HF transmitting station

- 2) Works to be Conducted by the PNG Side
 - a) Securing of sites for the Kokopo Radio Studio Centre and Kenabot Repeater Station
 - b) Removal of obstacles from the Kokopo Radio Studio Centre site and leveling of site land
 - c) Exterior work including construction of an access road to the Kokopo Radio Studio Centre site (GRA)
 - d) Construction of an approach road to Kenabot Repeater Station (GRA; by September, 1997)
 - e) Laying of necessary power lines to both sites (GRA)
 - f) Preparation of water supply and sewerage system around both sites (GRA), and connection of system to the sites
 - g) Free provision of work space necessary for construction

- h) Supply of facilities including telephones, furniture, utensils, plants, and so on
- i) Transfer of existing equipment to the new Radio Studio Centre
- j) Removal of existing HF transmission antennas
- k) Acquisition of all legal authorizations required in PNG for Project execution
- l) Exemption of tariffs which may otherwise be applied to imported equipment and construction materials necessary for the works to be conducted by the Japan side
- m) Issue of an authorization to pay (A/P) and paying of bank commission charged for its amendment
- n) Appropriate and efficient maintenance and operation of Project facilities and equipment
- o) Execution of all other recipient country duties specified in the E/N

3-1-4 Consultant Supervision

(1) Basic Concept of Supervision

The consultant shall form a project team to carry out the detailed design and implementation supervision based on the purport of the basic design, and shall coordinate opinions with the related agencies and aim for the smooth completion of the Project.

The basic concept of the supervision is described below.

1) The consultant shall coordinate closely with the respective agencies in charge of facilities construction and equipment installation, and shall make the utmost effort to ensure that the works are completed without delay.

2) The consultant shall maintain close communications with the related agencies and officers in both countries, and shall strive to realize the smooth progress of the works by giving appropriate and timely advice to contractors.

3) The consultant shall aim technology transfer with regard to execution methods and technologies, etc. and thus enable the Project to realize its effect as a grant aid concern.

(2) Details of Supervision Work

The work contents of the consultant supervision are described below.

1) Work Relating to Contracts

Preparation of design drawings and tender documents, etc., prequalification of contractors, implementation and evaluation of tender, selection of contractor, preparation of contract agreement, witnessing of the signing of contract, etc.

2) Review of Items Presented by Contractors

Review and approval of shop drawings, working drawings and samples, etc. presented by contractor and manufacturers

3) Guidance of Works

Examination and guidance to contractor with respect to work plans and time schedule, and periodical reporting to the client on the progress of the works

4) Cooperation Relating to Procedure for Payment Approval

Review of the contents of bills presented by contractors and cooperation relating to the payment of contract fees to be paid during or at the end of the works

5) Witnessing of Inspections

Witnessing and approval of tests and inspections performed during the works; implementation of payment procedures; reporting of necessary items to the Government of Japan relating to completion and handing over; verification of the completion of works and witnessing of handing over to the client

(3) Supervision Staff Set-up

1) Facilities Construction Works

The Project is to be implemented in part of the GRA city development zone, and it is forecast that the development plans will enter the implementation stage in unison with the Project works. Thus, the consultant shall maintain close contact with the GRA during the period of works to ensure that disparity does not arise between the two sets of plans. Moreover, the issue of securing the high quality of the broadcasting facilities must be respected together with the subsequent equipment installation schedule.

Thus, it is essential to dispatch a permanent supervisor in charge of building construction, and this shall be planned together with the dispatch of an occasional supervisor in charge of building equipment. Conditions for the selected supervisors shall be that they possess ample experience and appropriate technical judgment, have a broad outlook and are able to coordinate affairs.

2) Equipment Installation Work

In carrying out the installation of equipment a permanent supervisor in charge of broadcast equipment and appropriate staffs shall be dispatched.

3-1-5 Procurement Plan

(1) Construction Materials Procurement Plan

The building materials produced domestically in PNG are limited to such basic items as sand, aggregate, cement, forms, concrete blocks and wood, etc. Reinforcing bars, steel frames, doors and windows, interior finishing materials and equipment are almost totally imported from nearby countries such as Australia and New Zealand, etc., however, except for special specification items, just about all materials can be procured in Lae and the capital Port Moresby.

The construction materials to be used in the Project shall basically be procured locally.

Refer to: Table 3-1-1 List of Procurement Sources of Main Construction Equipment and Materials

(2) Equipment Procurement Plan

Equipment that can be procured in Japan shall as a rule be selected, but third country procurement may be considered for HF Transmitting Antenna from viewpoint of price and other conditions. In this case, the antenna equipment and materials shall be directly transported to the site from the third country, because there will be no need to carry out assembling in Japan.

(3) Equipment and Materials Transportation Plan

1) Items Procured on New Guinea Island

The only cities on New Guinea island that possess port facilities are the capital Port Moresby and Lae in Morobe Province. At Lae reinforcing bars, metal products, roof materials, wood and paint, etc. can be procured, however, because there are few dealers of interior finishing materials and mechanical equipment, these items shall be procured from Port Moresby.

The landing port in East New Britain Province is Rabaul, however, because the port facilities here are insufficient and there are problems with safety, all goods from New Guinea island are transported by container ship. One container ship per week operates between Port Moresby, Lae and Rabaul, but the time taken traveling between ports is six days from Lae to Rabaul and 10 days from Port Moresby to Rabaul.

From Rabaul the equipment materials shall be transported overland to Kokopo by truck.

Incidentally, because the poor state of roads between Port Moresby and Lae means that overland transportation is far more expensive than marine transportation, inland transportation is not actually carried out.

2) Items Procured in Japan

There is no regular service operating from Japan directly to Rabaul, but one ship per month does sail to Lae. Thus, the equipment and materials that are procured in Japan shall be shipped to Lae and then reloaded onto the weekly ship that sails to Rabaul. For the reasons described above, it is desirable that the equipment and materials from Japan be shipped in containers.

The total period required to transport the equipment and materials as far as Rabaul (including reloading at Lae) is approximately 30 days.