CHAPTER 3 CONTENTS OF THE PROJECT

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3-1 Objectives

This project is the third stage in a long-term development plan for a medium-wave radio broadcasting network which the government of Tanzania has commissioned. Through Japan's Grant Aids, in 1988 the government completed construction of the second stage, two 100kW medium-wave radio broadcasting stations at both Dodoma and Kigoma.

Following on from the second stage, the Government plans to install two 100kW medium-wave broadcasting stations at Nachingwea (Lindi) and Songea. The purpose of these stations is to broadcast necessary information about national development programs to people living in 3 regions along the southeastern border of the country--Ruvuma, Lindi, and Mtwara--which are important granary areas.

3-2 Study of the Request

3-2-1 Proposed Sites for Stations

A radio broadcasting station generally consists of a transmitting station, from which the broadcasting signal is transmitted, and a studio, where the programs are produced.

Transmitting stations should be located in flat rural areas, where humidity is high from the standpoint of radiant efficiency of radio waves. Studios, by contrast, should be located in urban centers, where communications and transportation facilities provide easy access to news gathering and performers. In addition, electricity, water, telephones, and other modern-day conveniences are needed at a minimum to construct stations.

Regarding stations for the two areas requested by the Government of Tanzania, based upon the conditions of installation mentioned above and the conclusions of site survey, the primary conditions of each station are shown as Table 3-2-1.

For the Nachingwea (Lindi) Station, RTD planned as follows.

A studio will be constructed in Lindi City, which is the capital city of the Lindi Region, and a transmitting station will be constructed in Nachingwea town, 150km from the studio in a straight line. A program transmission link between the studio and transmitting station will be installed through the nearest Masasi TPTC from the transmitting station. The results of site survey have clarified the practicality of this plan.

(1) Broadcasting Service Area

The service area of the stations under this project will cover two regions of Lindi and Mtwara, which are an important granary zone along Tanzania's southeastern border. These areas combined cover 880,000km^2 and have a population of about 1.54 million.

(2) Selection of Site for the Transmitting Station

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Some proposed sites which satisfy the condition of location for installing the transmitting station can be found inside of Lindi City, Mtwara City, Masasi town and Nachingwea town where infrastructure is well-developed.

1) Installation in Lindi City or Mtwara City is unsuitable for following reasons.

(a) Both cities are at the eastern edges of the target service area, therefore it would be necessary to install a transmitter with higher output power to cover the whole service area concerned. (For instance a 100kW station would cover only half of the targeted service area. An additional station would be necessary.)

(b) Given the present situation of electric power supply, the expenses for local work to construct a new electric power plant so as to satisfy the new large-scale demands would be too great for Tanzania to bear.

(c) Even if a site for new transmitting station is obtained, the location, transmitting power, and transmitting frequency used must all be newly registered at the IFRB. It takes a long time to receive approval.

2) Masasi Town and Nachingwea Town

(a) These towns are located near the center of the target service area. By installing a 100kW transmitting station there, it can be covered completely.

(b) There is no problem with the electric power supply since there is a new power station, and an existing electric power line (33kV).

(c) Even if a site for installing a transmitting station is obtained in Masasi Town, it belongs to Mtwara Region. The

administrative jurisdiction is not same as that of Lindi studio (Lindi Region). In addition,there is the same problem as sub-paragraph (c) above.

(d) Nachingwea Town is located about 50km north of Masasi Town. It is superior to Masasi from the standpoint of efficient radio broadcasting. The site has already been obtained by Tanzania. Location, transmitting power, and transmitting frequency have already been registered at IFRB. Consequently, Nachingwea Town is the most suitable place for installing the station.

(3) Selection of the Site for the Studio

The target of this project is an important granary zone in the southeastern part of Tanzania. The government of Tanzania wants the Nachingwea (Lindi) broadcasting station to be the key station of the zone.

Lindi City is connected to Mtwara City by a 100km paved road. The two cities together have about 37% of the population of the two regions. Mtwara City has the second international harbor in Tanzania,and there is also a port in Lindi City. Therefore they are the two largest marketing bases in the zone. They are the economic center of the southern part of Tanzania, and because both cities are regional capitals, the regional government offices are there. Lindi City is the primary capital in southeastern region, both historically and sectionally. Because of this it is easy to obtain program material. Besides, the conditions for installing a studio have been met and the site has been obtained by RTD. Therefore, we judge that it is reasonable to construct a transmitting station in Nachingwea together with a studio in Lindi City, which falls under the same administrative jurisdiction.

(4) Installation of a Relay Station for Program Transmission Link

If the sites for the transmitting station and the studio are decided in the locations mentioned above,the distance in a straight

line between the two is about 150km. We have studied this distance as the basis for installing an own program transmission link as follows.

1) For program transmission from the studio to the transmitting station, direct program transmission by an own radio transmission link would be best. But since the distance between Lindi City and Nachingwea is long for direct transmission, expenses would be 3~4 times more than usual. The possibility of installing a repeater station between the two points were investigated but a suitable place with clear line-of-sight between studio and transmitting station was not found.

2) Fortunately, there is already a 150km TPTC telephone line network circuit between Lindi City and Masasi Town, 45km from Nachingwea transmitting station. If this network is used for a part of program transmission line an own program transmission link has only to be installed for remaining 45km distance.

   But since there is a rock mountain in front of TPTC in Masasi City blocking transmission, a relay station should be installed at the location 2km away from Masasi TPTC. However, this plan is more economical, and installation would be simpler, than plan(1).

Table 3-2-1 Table of selection criteria for the proposed locations

	Name of Station Established	Nachingwea transmitting station	Masasi repeater station	Lindi studio	Songea transmitting station	Songea studio
1	Location (latitude/ longitude)	38E46/10S24	38E47.30 /10S42.30	39E43.25 /10S00.10	35E39.30 /10S37	35E39.34 /10S39.43
2	Primary industry	Maize, cashew-nuts. agricultural products.		Commercial city	Tea, coffee agricultural products.	
3	Broadcasting service area	Lindi and Mtwara Regions			Ruvuma Region.	
4	Population of the service area	1,536,044 (336,796 Households).			783,327 (146,874 Households).	
5	Receiving status in the area	Impossible to receive domestic medium-wave broadcasting.			Impossible to receive medium-wave broadcasting.	
6	Number of radio receivers	142,000 sets (Rate 50%/household).			78,000 sets (Rate 40%/household).	
7	Construction conditions	No problems.			No problems.	
8	Transporting for *construction materials	By ship (Dar es Salaam~Mtwara) + by truck (Mtwara~Nachingwea).			By truck (Dar es Salaam~ Songea).	
9	Road conditions	Repairs necessary in the rainy season at several locations between Masasi and Nachingwea.			No need for repairs.	
10	Electricity supply	No problems.			No problems.	
11	Programs Transmission Link Network	Dar es Salaam HQ~Lindi studio: TPTC telephone line network. Lini studio~Masasi Repeater station: TPTC Telephone line network. Masasi Repeater Station~Nachingwea Transmitting station: Own radio transmission link.			Dar es Salaam~Songea Studio: TPTC telephone line network. Studio~Transmitting Station: own radio transmission link.	
12	Weather conditions	Anti-lightning measures are necessary			Anti-lightning measures are necessary.	
13	Obtainable materials	Sand, gravel, block stone, cement, concrete blocks and bricks			Sand, gravel, block stone, cement, concrete blocks & bricks	
14	Available Labor	Construction workers, carpenters for provisional frames, plumbers, Iron workers, and others				
15	Status of site	Obtained.	Proceeding.	Obtained.	Obtained.	Obtained.

* (Refer to Appendix VIII for details.)

3-2-2 Frequencies and Power of the Transmitting Station

Radio waves in the medium-wave band used for radio broadcasting may travel long distances, especially at night, and thus, may interfere with stations in neighboring countries, and by contrary, may be interrupted by broadcasting stations in foreign countries.

Generally, radio waves are effective means for broadcasting and telecommunications, but if their use is not coordinated, interference may occur and good quality reception and transmission may not be possible. For this reason, frequencies and output powers for medium-wave radio broadcasting stations are regulated by an international agreement concluded at the Regional Administrative LF/MF Broadcasting Conference held twice, in 1974 and 1975, by the International Telecommunications Union (ITU). All frequencies and transmission powers of the existing and planned stations in Tanzania were registered at the International Frequency Registration Board (IFRB). The frequencies and transmitting powers of the stations in this project were registered as follows:

- Nachingwea 648kHz/100kW
- Songea 990kHz/100kW

Accordingly, the development project for medium-wave radio network in Tanzania will be executed effectively by using these above mentioned frequencies and output powers in Tanzania.

3-2-3 Program Production Equipment in the Studio Building

By giving program production equipment the functions of producing and sending programs such as news, culture and entertainment to meet the wide-ranging needs of listeners, it will be possible to produce and broadcast local programs concerning the zone-oriented news, living information, agriculture practices and health care and sanitation appropriate to the weather and climate, thus enabling the benefits of the development of the radio broadcasting network to be further enhanced.

Taking the above into consideration, the program production equipment with essential minimum functions necessary for producing the above mentioned programs should be provided for studios in the capital cities of

both Lindi and Ruvuma Regions. Buildings be constructed by the Government of Tanzania will be used.

3-2-4 Set Values in Service Area

Considering the population is uniformly scattered over the target area of this project (Figure 2-4-10 of 2-4-6), the Government of Tanzania intends to install a transmitting station in Nachingwea as the center of the service area covering Lindi and Mtwara Regions, and also to install another transmitting station in Songea for Ruvuma Region. Thus, these transmitting stations are expected to deliver informative programs effectively to people living in each region.

Transmitting power for radio broadcasting services should be the irreducible minimum of the requirement. The reason is that if transmission power is increased in a service area, better reception may be obtained within the area but that causes interference with other radio stations and brings undesirable results against public welfare from the viewpoint of fair use of radio waves.

Taking distribution of the population in the proposed area into account, each station has a service area with a radius of about 150km, and an output power of 100kW is the minimum necessary to secure the service area.

On the other hand, there are two methods to cover a wide service area : one is to install a high power transmitting station at one place, and the other is to install low power transmitting stations at many places. Naturally, many low power transmitting stations are required to cover the same size of service area as the one obtained by one high power transmitting station. Thus, many sites where infrastructure such as telephone line for the transmission of radio programs, roads, provision for power supply etc, is in order are required for installing transmitting stations.

Places meeting the above mentioned conditions, and therefore suitable for the installation of transmitting stations are limited to Nachingwea

and Songea sites, which are already registered with the International Frequency Registration Board (IFRB).
In addition to the situation described above, taking into account the fact that, based on the results of the survey, radiation caused by a transmitting power of 100kW does not interfere with any existing stations, the transmitting power of both Nachingwea and Songea will be 100kW, as requested by the Government of Tanzania. The decision was also made after considering maintenance cost as well as construction cost.

Moreover, in this project, by referring to the receiver's sensitivities by type in Japan and through actual listening results at each proposed sites, the service area where quality of sound in broadcasting can be evaluated as good quality is set to be within the range of 60dBμV/m field strength, and also the larger area where it can be evaluated as fair quality, that is, it is possible to hear the information, is set to be within the range of 54dBμV/m field strength (dB: This is a unit to represent the ratio of electric power, voltage and so on in terms of 10 (or 20) times the common logarithm of the ratio to the reference value. In the case of electric field strength, the reference value is based on the case that the voltage induced on the antenna with an unit length of 1 meter is 1μV.)

Fig. 3-2-1 are shown receiver sensitivities by type.

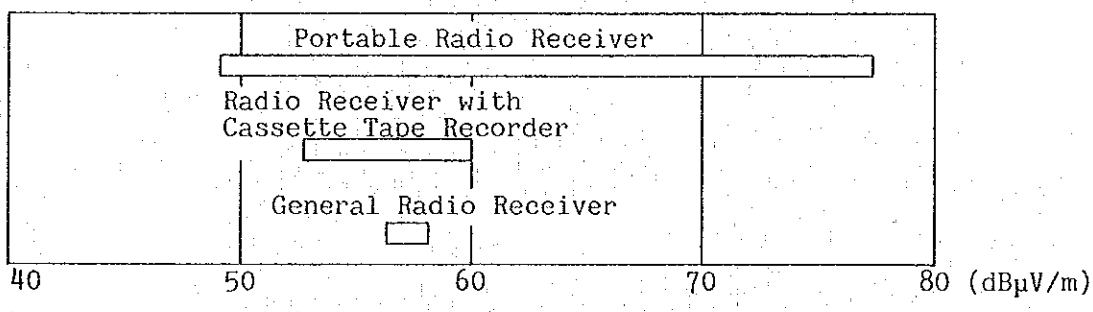


Fig. 3-2-1 Sensitivity of Radio Receiver

This was made based on the Receiver's Performance Survey for Standard Broadcasting (Radio Engineering and Electronics Association, Survey Committee, May 1977). The minimum field strength is shown when the ratio of audio signal (50mW output) to noise is 30dB (practically available value), meaning the lower the number, the better the sensitivity.

According to the calculation based on the target service areas, after the completion of Nachingwea and Songea transmitting stations, 61% of the total population of Tanzania will be able to enjoy medium-wave radio broadcasting at the field strength of more than 60dBμV/m (79% of the population will be covered within 54dBμV/m area). Compared with only 52% of the population (about 11.7 millions) at present, an additional 9% of the population (about 2.31 million more people) will be able to listen to the radio after the execution of this project. Estimated service area is shown in Fig. 3-2-2.

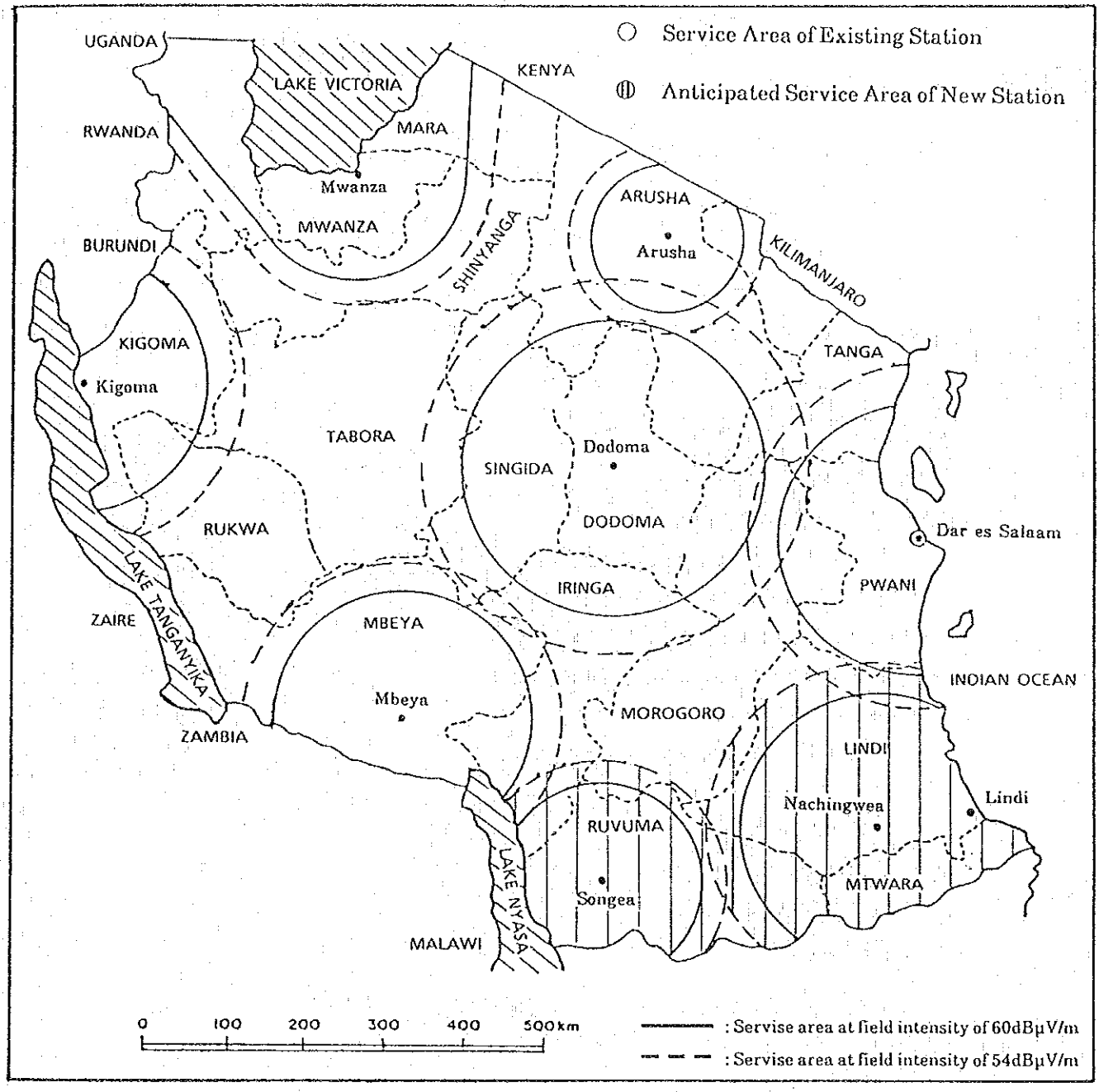


Fig. 3-2-2 Map of Expected Radio Service Areas

3-3 Outline of Proposed Sites

3-3-1 Position and Environment of the Proposed Sites

(1) The Target Area for Nachingwea (Lindi) Broadcasting Station

The service area of the Nachingwea (Lindi) station covers all of both Lindi and Mtwara Regions. The population* is about 650,000 (140,000 households) in Lindi Region and about 890,000 (200,000 households) in Mtwara Region. The area of Lindi Region is 66,000km^2; that of Mtwara Region is 16,000km^2. Both regions are located near the southeastern border of Tanzania, the eastern side of which fronts on the Indian Ocean. There is the second international port of Tanzania in Mtwara City.

This area is an important granary zone which produces such cash crops as maize, kassaba, cashew-nuts, and sisal. There are two land transportation routes from Dar es Salaam: One is to go south along the coastline to Lindi, while the other is to go via Songea and Masasi. (Refer to Appendix VIII for details.)

However, in the rainy season, it is impossible or difficult to pass through both routes. For this reason, sea transportation from the port of Dar es Salaam, or flying (Air Tanzania or chartered plane) are common alternatives.

*Based on the 1988 census.

1) The Nachingwea Transmitting Station

Nachingwea Town is located 150km west of Lindi City. The proposed site of the transmitting station is located 4km south along the road towards Masasi Town from the center of Nachingwea Town. The site, which is on the southwestern side of the road, is 396m above sea level, and is 4.5km from the airport. 400m× 600m farmland has been obtained as the site, and RTD plans to execute the site clearance as soon as possible.

2) The Masasi Repeater Station

Masasi Town is in Mtwara Region, about 50km south of Nachingwea Town. The center of the town is the junction point of the main roads connecting Lindi and Mtwara City, and Nachingwea Town and Songea City. Masasi Town itself is a small town, but since it is an important place for transportation, many people pass through. The area around the town is dotted with rock mountains 600-900m above sea level

A repeater station should be installed near by the TPTC Masasi station since a direct line-of-sight between the TPTC Masasi and the Nachingwea transmitting station could not be found because of these rock mountains. The proposed site for the station is a plot of farmland, 20m×20m wide, 450m above sea level, 2.5km west of the TPTC Tributary station, and about 50m west along the road from Masasi to Nachingwea.

The new Masasi diesel power generation station (output power 4.5MW) is located 300m north of this proposed site, and nearby there is a cashew-nut factory (closed at present). To obtain land for the station, since all land in Tanzania is communal, if RTD applies for a land lease with the Masasi Town Authority, which is a controller of the land, permission will be issued at once.

3) The Lindi Studio

Lindi City is the only commercial base and regional government office quarter in Lindi Region. The east side of the city faces the Indian Ocean. There is a port at which domestic ships call, but the port is small and can only be used at high tide.

The proposed site for the studio is about 2km southwest of the center of the city. The site is 300m×150m and is in the hills, 45m above sea level. The entire hill region is covered by woods and there is a steep slope along part of the southern side. In the future, Lindi City plans to relocate government offices

currently scattered throughout the city to this hill region. The land has been developed on a large scale.

(2) Target Area for Songea Station

The broadcasting service area targeted by the Songea station is the entire Ruvuma Region, with a population of 780,000 (150,000 households) and an area of 634km^2. This region is located along the southwestern border of Tanzania. Its southern edge borders Mozambique; on the west it borders Zambia through Lake Niaza. The regional capital is Songea City, which is 1,000m above sea level. The plateau is characterized by rolling hills,and the temperature rarely exceeds 30°C. The same is true of Lindi and Mtwara, which produce such cash crops as maize, kassaba, cashew-nuts, and sisal.

Songea City is 1,000km from Dar es Salaam, and is connected by a highway via Morogoro and Iringa. This road is useable even during the rainy season. There is also an airport located 7km west of the center of Songea City.

1) The Songea Transmitting Station

The proposed site for the Songea Transmitting Station is located about 7km north of Songea city, on the west side of the highway between Dar es Salaam and Songea. A large plot of farming land, 1000m×500m, has been obtained 10km from the airport in a straight line and about 7km north of Songea City.

A part of land from the center of site to the southern end, is inclined. The difference in height is about 20m at the most. Because of this grade, RTD plans to execute the site clearance as soon as possible.

2) The Songea Studio

The proposed site for the Songea Studio is midway between the site of the transmitting station and Songea City, which is where

the governmental offices are located.

The farmland obtained for the studio is about 250m×250m. It is located on the west side of the highway, as is the transmitting station.

The ground is inclined from east to west, with a maximum height difference of about 20m. RTD plans to execute the site clearance as soon as possible.

3-3-2 Ground Conditions

The results of ground soil test inside the proposed sites of Nachingwea and Songea transmitting stations, obtained by boring at the two points where the transmitting antennas will be erected, are shown in Table 3-3-1. (Refer to Appendix VII.)

Table 3-3-1 Results of Site Investigations

Name of Station	N Value	Estimated Resistance
Nachingwea Transmitting Station	Over 5 at 2m below the surface	Over 20t/m^2
Songea Transmitting Station	Over 5 at 2m below the surface	Over 20t/m^2

A stable stratum lies below the surface in each proposed site, so it will not be necessary to use special construction methods to build the base for an iron transmitting antenna mast of about 100m.

3-3-3 Commercial Electric Power

(1) The Nachingwea Transmitting Station and the Masasi Repeater Station

In Masasi Town, there is a new power generating station that generates 4.5MW of power. It supplies electricity to Masasi Town and Nachingwea Town.

The consumption of electricity is 0.9MW in the season of highest demand. Consequently, there are no problems with supplying electricity to the Nachingwea transmitting station and the Masasi repeater station. 33kV is sent to Nachingwea from Masasi, and the transmission line runs along through the northeastern side of the site of transmitting station. Since the Masasi repeater station is located 300m south of the new power generating station, obtaining a supply of electricity will present no problems.

(2) The Lindi Studio

In Lindi City, there is a 1.368MW power generating station.

Consumption of electricity is 0.9MW in the season of highest demand. Accordingly, there is no problem obtaining electricity for the studio. But it is necessary to extend an incoming line about 300m from the existing transmission line (11kV) to the studio.

(3) The Songea Transmitting Station and the Songea Studio

The generating capacity of the power generating station in Songea City is 2.4MW. Consumption of electricity is 1.5MW in the season of highest demand. Consequently, there is no problem in supplying electricity to the transmitting station and the studio. An 11kV transmission line runs along the eastern sides of both the transmitting station and the studio, so obtaining electricity is easy.

3-3-4 Reception Status and Latent Field Strength

Reception status for domestic medium-wave broadcasting and latent field strength at Lindi, Nachingwea, and Songea are shown in Table 3-3-1. In the daytime, medium-wave broadcasting cannot be received in any of these areas. At night, radio waves from the Dar es Salaam headquarters and Dodoma station reach with field strength of 60dBμV/m (highest value), but there were fadings of 18~35dB and noise level was high. Evaluation of reception quality is 2~3, and so it is difficult to maintain stable

reception over a long period. The latent frequencies, same as the frequencies allocated for the Nachingwea and Songea transmitting stations, were not confirmed. However, since there are latent radio waves at 33~60dBμV/m field strength in the vicinity,the broadcasting service area will probably be slightly smaller at night.

Table 3-3-2 Reception Status and Latent Field Strength

Item	Measured frequency (Hz)	Morning·Day Time		Evening·Night Time	
		Field strength (dBμV/m)	Reception evaluation	Field strength (dBμV/m)	Reception evaluation
(1) Nachingwea & Lindi areas					
Assigned transmitting frequency	684	not sensitive	-	not sensitive	-
Upper adjacent frequency	693	"	-	"	-
Lower adjacent frequency	675	"	-	48	2
Dar es Salaam headquarters (1)	531	"	-	30~50	1~3
Dodoma station	603	"	-	15~47	1~3
Mubea station	621	"	-	not sensitive	-
Dar es Salaam headquarters (2)	657	19~24	1	35	2
Kigoma station	711	not sensitive	-	25~43	2
Muanza station	720	"	-	not sensitive	2
Dar es Salaam headquarters (3)	1,035	"	-	15~38	-
(2) Songea area					
Assigned transmitting frequency	990	not sensitive	-	not sensitive	-
Upper adjacent frequency	999	"	-	"	-
Lower adjacent frequency	981	"	-	33~60	1~3
Dar es Salaam headquarters (1)	531	"	-	38~58	2~3
Dodoma station	603	"	-	26~60	1~3
Mubea station	621	20	1	not sensitive	-
Dar es Salaam headquarters (2)	657	not sensitive	-	32	2
Kigoma station	711	"	-	42~50	2
Muanza station	720	"	-	46	1
Dar es Salaam headquarters (3)	1,035	"	-	not sensitive	-

* The method to compare and analyze reception status is employed internationally by using the following grading scale:

5: excellent 4: good 3: fair 2: bad 1: very bad

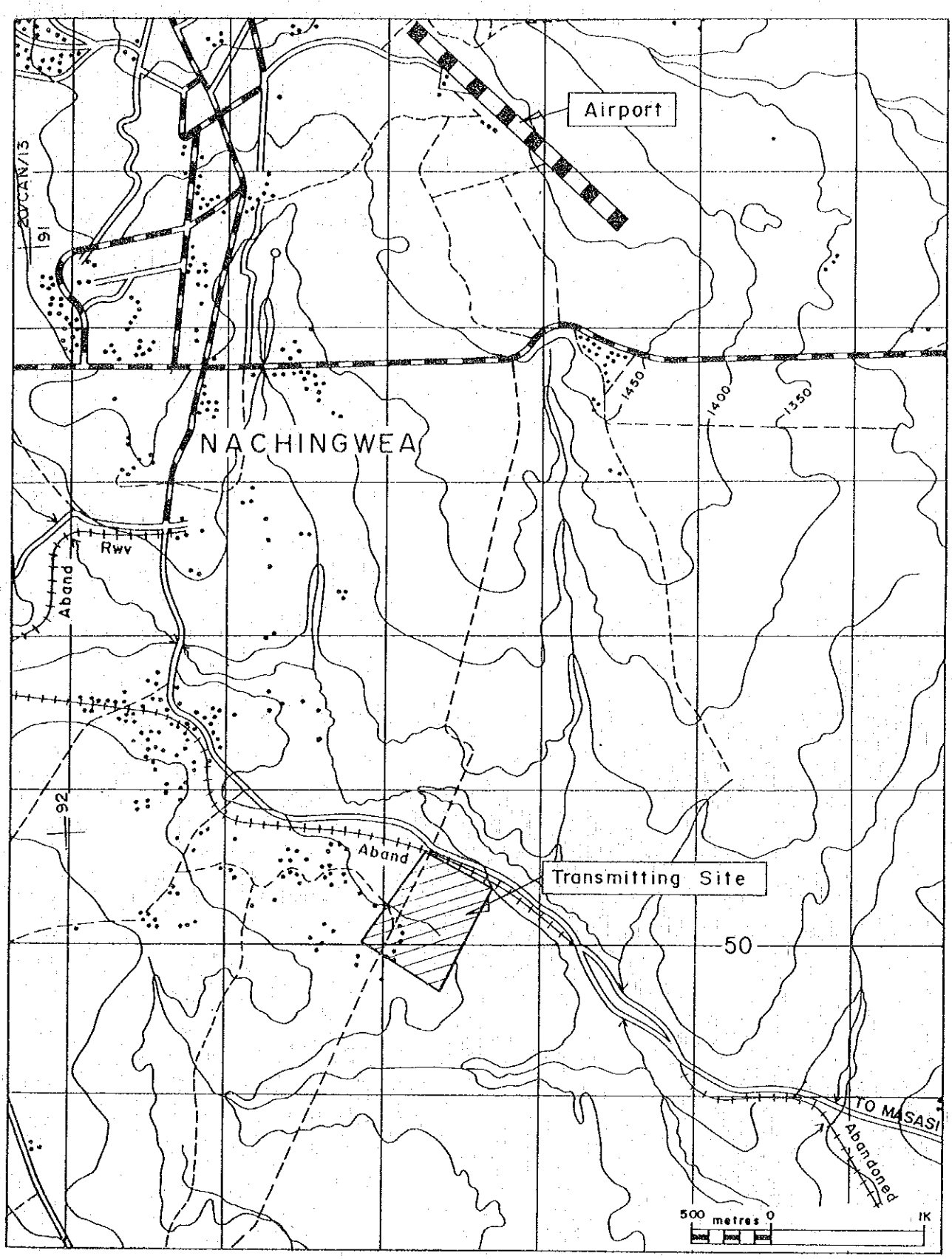


Fig. 3-3-1 Site of Nachingwea Transmitting Station

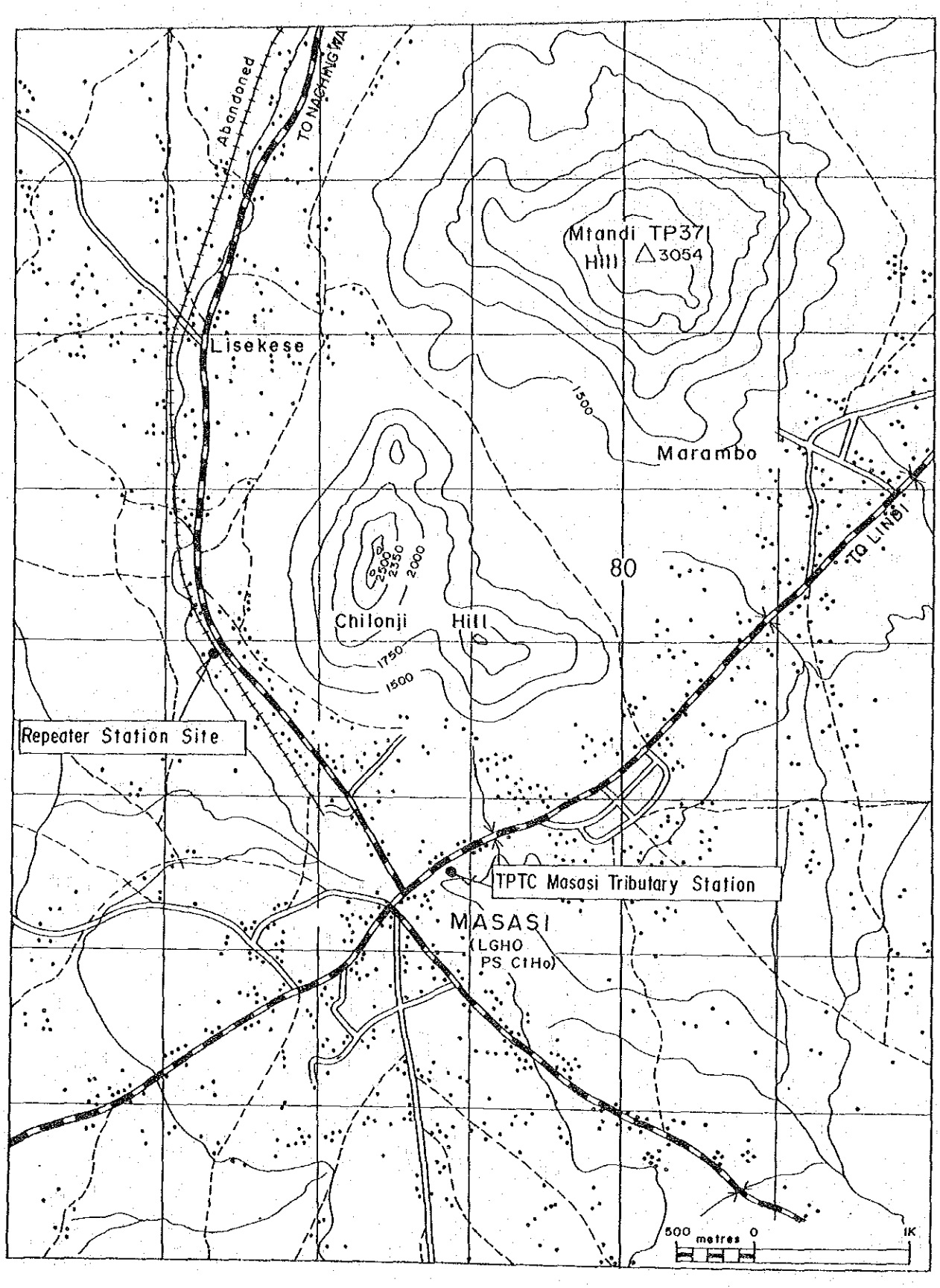
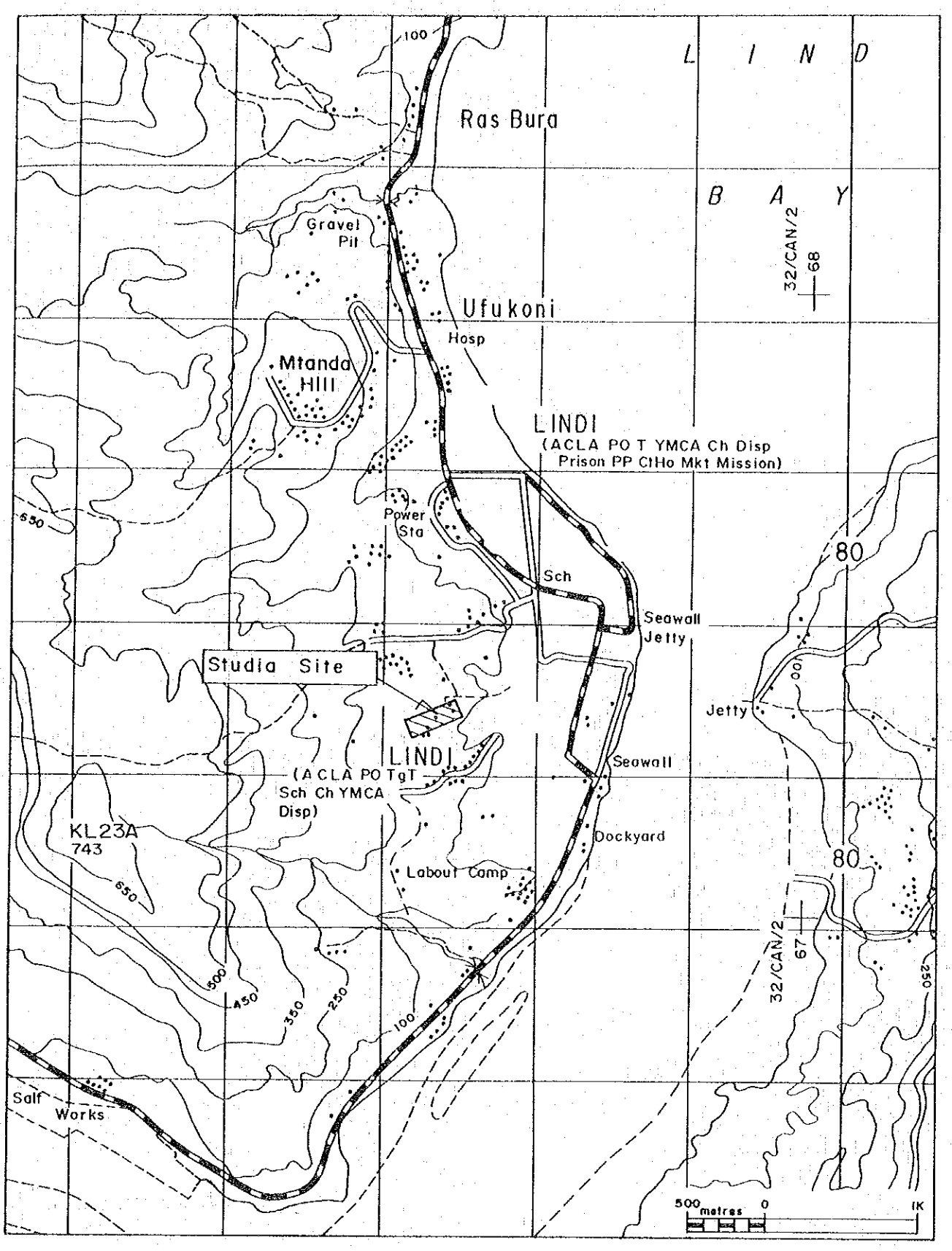


Fig. 3-3-2 Site of Masasi Repeater Station



Contours (100ft.)

Fig. 3-3-3 Site of Lindi Studio

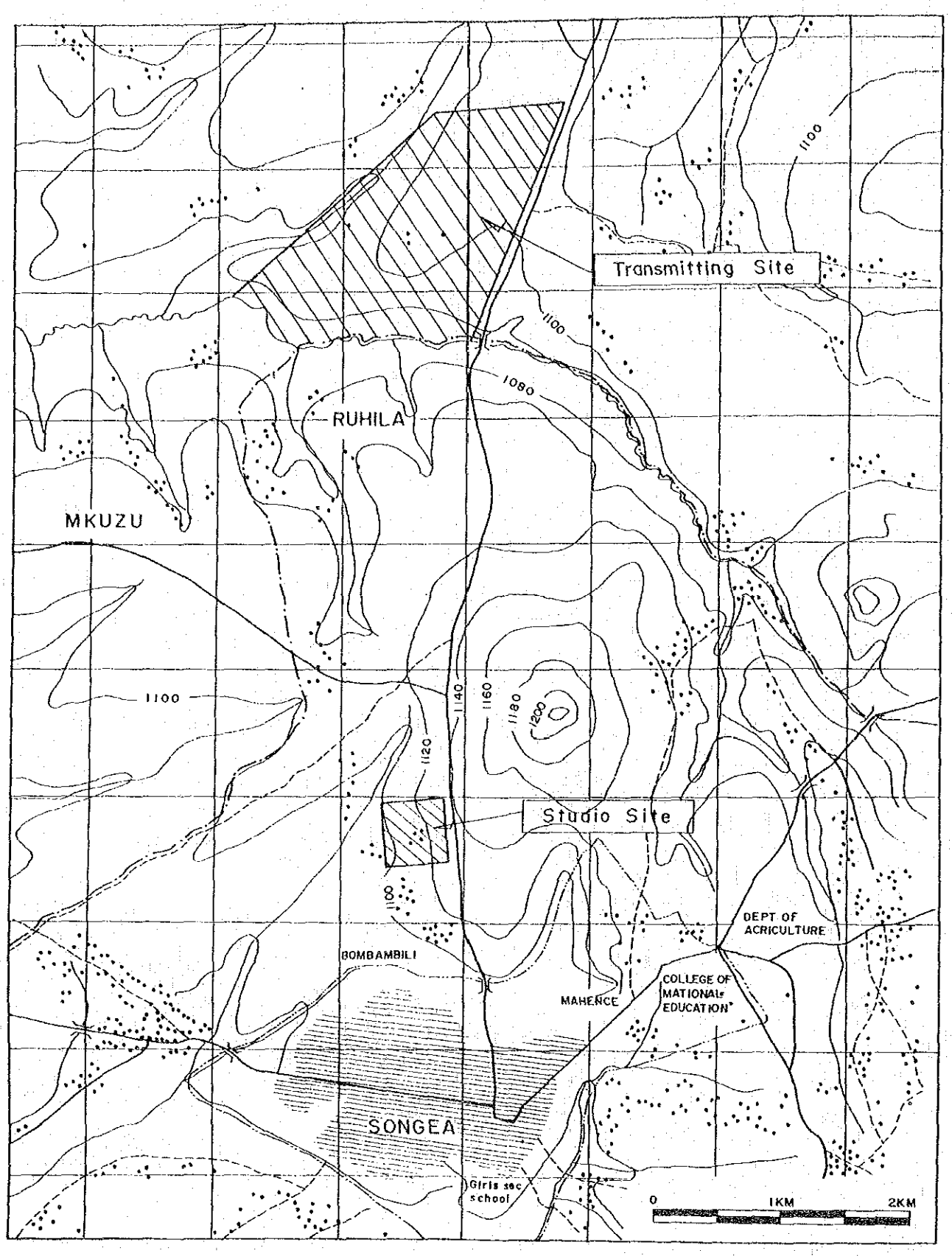


Fig. 3-3-4 Site of Songea Transmitting Station and Songea Studio

3-4 Basic Design

3.4.1 Design Policy

Taking account of public awareness and social role of radio broadcasting, the special conditions in Tanzania, easy operation and maintenance, the economic issues, and an appropriate and adequate scale, the design should be made with the following items defining basic policy:

(1) The facilities most suitable for the project should be provided to gain the most effective results within the framework of the assistance aid.

(2) Equipment and construction methods most suitable for the purpose of the facilities and a limited completion period should be employed.

(3) Equipment specifications should accord with the technical standards of the International Radio Consultative Committee (CCIR), and equipment must be designed to be safe and solid both mechanically and electrically.

(4) It is necessary to standardize the system to effect easy and economical operation and maintenance.

(5) The facilities should be strong and durable enough to withstand disasters.

(6) Due consideration should be given to the future expansion of the facilities.

3-4-2 Broadcasting Facilities

The Main factors and elements related to the design of broadcasting facilities are as follows:

(1) Transmitter System

The output powers of both main transmitters in Nachingwea and Songea transmitting station must be 100kW, in accordance with those registered at IFRB and 3-2-4. And a standby transmitter (10kW) for each main transmitter is provided to secure broadcasting even if the main transmitter is damaged or has broken down.

Electron tubes are adapted for the last-stage high-power section of the transmitter used, but solid-state circuits will be adapted for other sections, thus improving reliability of the transmitter. Hot sections of the electron tubes, must be cooled by a forced air cooling system, making maintenance easier.

Lightning may often be attracted to the transmitting antenna because it protrudes high into the air. Since the transmitter is connected to this antenna, the output section will be provided with a protective circuit as a surge protector to avoid the influence of lightning.

Program input equipment to the transmitter and monitors will be installed systematically in racks. Important operational conditions, trouble indications, operation and shutdown of the transmitter, and switchover from the main unit to the standby unit, will be controlled and monitored on one control monitoring console, thus easy operation can be expected.

(2) Antenna System

1) Transmitting antenna

The same antenna mast in the basic structure should be used for both transmitting stations of Nachingwea and Songea. Structural analysis and design are to be made with reference to the Building Standard Law, related regulations and various structural design standards specified by the Architectural Institute of Japan.

The antenna masts should be 89m and 133m for the Nachingwea and Songea transmitting stations, respectively, in accordance with those registered at IFRB. These are made of a steel cylinder of about 36cm diameter, and supported with guys in 3 directions and at 6 points.

The base is insulated with a base insulator, and a spherical bearing is installed in the base insulator so that no harmful forces will be applied to it. These are placed on top of an independent base made of reinforced concrete 2m above the ground. Guys supported in three directions are fixed to three anchor blocks made of steel-frame structural concrete. Insulators are inserted into each guy at appropriate intervals, and the insulators of the highest stack guys are provided with choke coils to ground DC and to prevent an abnormal voltage when lightning strikes.

The mast top is provided with a top hat of 8 m diameter to extend the effective length of the transmitting antenna.

For the antenna to be marked as an aeronautical obstruction at night, aeronautical obstruction lights will be fitted to the top and to other points of the mast. In addition, to be marked in the daytime, the antenna mast will be painted red and white, dividing it into seven sections.

2) Sub-antenna

Nachingwea station faces Mozambique in the south. It is necessary to restrict the radio wave radiation in this direction to avoid electrical interference.

IFRB, in its registration, specified that the service is to be mainly from 0 degrees to 270 degrees clockwise with north as zero degrees. Therefore, it is necessary to use a directional antenna, and there are 2 methods of accomplishing this: 1) sub-antenna by erecting an additional antenna mast, and 2) a sub-antenna using a copper wire, a so-called down lead.

The erection of 2 antenna masts makes the directivity greater but it costs too much. Accordingly, considering economics and ease of adjustment, directivity should be given by a single-output power feed and down lead system.

3) Radial Ground

The ground plays an important role in the radiation of medium frequency radio waves. In other words, the ground acts to return the antenna's current, and its efficiency worsens due to the loss taking place there (ground loss). Accordingly, a radial ground is installed to minimize ground loss as much as possible. It is best if that the scale in radius be 0.3 wavelengths to 0.5 wavelengths.
In this Project also, a radial ground is taken as 0.3 wavelength as long as the site size permits, and 120 copper wires are buried in the earth radially about 30cm below the surface.

For Nachingwea Station, a sub-antenna is provided to give directivity, and to further enhance its effect, a radial ground made up of 60 copper wires is buried overlapping the radial ground of the main mast over an area as wide as 30m in radius from the base of the sub-antenna.

4) Feeder Line

Feeder lines are of two types: aerial feeder and coaxial cable. Technical advantages of the coaxial cable are that it has no external wave radiation, and unlike the aerial feeder, it has no fluctuation of impedance and output due to winds. Also the circuit component for removing harmonics is simple.

In terms of material costs, however, coaxial cable is about twice as expensive as aerial feeder for a 10kW station, and about 8 times for a 100kW station if constructed under standard specifications. If trouble happens in the aerial feeder, it can be solved by partial replacement of the copper wire which is obtained relatively easily even in Tanzania, while an entire

replacement is necessary for coaxial cable. In short, the coaxial cable system has major drawbacks, and hence in this Project, 6-wire aerial feeders are employed. These are superior in cost and maintenance.

5) Tuning Unit Hut

A circuit is required for electrical matching between the transmitting antenna and the transmitter, and a tuning hut to accommodate this is installed around the antenna base. The tuning unit hut is electrically shielded inside and out by lining its inside with aluminum. The hut should be of the minimum required size to accommodate the matching device, and thus be 2m×5m.

6) Austin Transformer

To supply power to the aeronautical obstruction lights installed on the base insulation type antenna, medium wave high frequency power should be fed without any trouble. Therefore, an Austin transformer (insulated transformer) should be employed with its primary and secondary coils insulated for high frequencies.

7) Choke Coil and Ball Gap

To protect the equipment from lightning, a choke coil and ball gap are inserted. A choke coil makes a ground for direct current while a ball gap decreases electric potential by discharging when the potential goes too high.

(3) Program Transmission System

Broadcasting programs are transmitted from the studio to the transmitting station, which is generally installed in a location apart from the studio for the most effective service of radio waves. Therefore, it is necessary to install relay lines for program transmission between the studio and transmitting station.

Accordingly, program transmission equipment with a VHF band is provided for each broadcasting station in this Project.

1) Between Lindi Studio and Nachingwea Transmitting station

The direct distance between Lindi studio and Nachingwea transmitting station is about 150km. Accordingly, telephone lines are used for program transmission from Lindi studio to the Masasi Posts and Telecommunications Branch of TPTC (Masasi TPTC) which is nearest to the transmitting station and a VHF radio link should be planned for program transmission from Masasi TPTC of the transmitting station. However there is an obstacle in front to Masasi TPTC so that a repeater station should be installed because of no line-of-sight as shown in Fig. 3-2-1 (4), 2).

All the broadcasting programs are transmitted from RTD HQ to each regional station through TPTC's telephone line network.
Therefore, an all-wave receiver with a antenna will be provided for the Lindi studio and Nachingwea transmitting station. Each will receive and re-transmit short-wave broadcasting from Dar es Salaam as a back-up system when the telephone line network is unusable.

2) Between Songea Studio and Transmitting Station

The direct distance between Songea studio and transmitting station is about 4km, and there is no obstacle to VHF propagation, so programs can be transmitted directly. Therefore, VHF radio relay equipment is provided for program transmission from the studio to the transmitting station. An all-wave receiver and receiving antenna should be provided for the studio for the same reason as with the Lindi studio.

(4) Power Source

Power in each station should be supplied from a commercial power source. Power of the required capacity should be supplied via an 11

kV power line, and the site will be provided with a receiving transformer to step-down from 11kV to 400V/230V (3 phases/4 lines).
In the case of Nachingwea transmitting station, a receiving transformer to step down from 33kV to 400/230V will be provided by the Tanzania side because of the 33kV power line.
The power source system for the broadcasting equipment should have an automatic voltage regulator to cope with wide voltage fluctuations.

A standby generator with the capacity required for continuation of broadcasting is provided to cope with problems such as commercial power failure.

A main fuel tank capable of keeping fuel for five days to one week should be installed taking into account the duration of interruptions and the supply frequency as shown Table 3-4-1.

Table 3-4-1 Capacity of Engine Generator and Fuel Tank for Transmitting and Studio Site.

	Capacity of Engine Generator	Fuel tank		Note
		main	sub	
Transmitting Site	100kVA	3,000 ℓ	1,000 ℓ	*1 10 hours × 7days × 27ℓ/hours = *2 3,420ℓ
Studio Site	35kVA	390 ℓ	200 ℓ	*1 18 hours × *3 5days × *2 13ℓ/hours = 1,170ℓ

*1 Broadcasting hours/day
*2 Consumption Fuel
*3 Studio is in the proximity of an urban area, so refuelling is easy, and the supply electricity is reliable.

In addition, the Masasi repeater station is provided with an uninterruptible power supply system of about 1kVA, as an emergency power supply.

(5) Studio equipment

The studio will be provided with the minimum functions required for broadcasting and collection of news and local topics as regional program production centers.

A mixing console of eight channels will mix the following eight inputs:

Microphone	1
Open-reel tape recorder	2
Cartridge tape recorder	2
Cassette tape recorder	2
Disc player	1

The three types of tape machines are prepared for various program materials, and two sets (each for replaying and recording) are provided to make tape editing possible for each type. The disc player has been used less frequently in recent years but Radio Tanzania Dar es Salaam is keeping many discs stored, which may be used again, thus a minimum of one unit is provided.

An announcer cough box is a device to cut off sounds by an announcer (e.g. in coughing) and one set of this is provided. An announcer desk designed so as not to produce noise from paper sliding is also provided.

One set of monitor speakers per studio and per sub-control room, totaling two sets, are provided. The required number of microphones and microphone-stands are also provided.

(6) Measuring equipment

An appropriate maintenance service is necessary to maintain the equipment in good condition. Measuring devices capable of checking the equipment conditions precisely are required for such maintenance service. Solid and reliable instruments that are easy to use should be provided in accordance with necessary maintenance items.

(7) Maintenance Tools and Vehicles

The following tools should be provided:
Tool sets for broadcasting equipment comprising drivers, compact wrenches, pincers, pliers, cutting nippers, soldering irons, etc.
Electric drills, a vacuum cleaner, a vice, a dust blower, etc. taking frequency of use into consideration.
Set wrenches, pipe wrenches, a chain block, etc. for generators.

Vehicles are essential in Tanzania where the transport system and communication system are not yet well-developed. One maintenance vehicle equipped with a VHF radio will be provided for each station so that they can cope with accidents, buy goods necessary for routine maintenance, and coordinate with persons concerned. In consideration of difficulty in procurement of vehicles in Tanzania, two vehicles should be provided for each broadcasting station.

(8) Ancillaries and Others

In addition to the above equipment, the following equipment required for the broadcasting stations should be provided:

Intercom equipment:
Interphone type equipment for communications between the main manned rooms.

Clock: Battery-powered wall clocks in the main manned rooms.

VHF transceiver with antenna for communications:
VHF transceivers are provided for communications about change of broadcast schedule, emergency countermeasure etc, between studio and transmitting station.
In addition, portable transceivers are provided to use in news programs and interviews.

Locker: For accommodation of spare parts and accessories

Test tapes: Tapes with test signals recorded to check the recorder's conditions and tapes not recorded for trial checking.

(9) Spare Parts

Details are to be defined at the time of detailed design, but the following basic parts will be supplied as a minimum so that operation can be continued for about two years without replenishing parts after installation. During this period the manager can record spare parts consumption and take some budgetary actions.

transmitting tube	100% of the quantity in use
relay & switch	1 for each type
lamp & fuse	200% of the quantity in use
fan motor	100% of the quantity in use
main equipment module	1 for each type
transistor & IC	2 for each type
air filter	200% of the quantity in use

3-4-3 Transmitting Station Building Facilities

The studio building will be designed and constructed by the Government of Tanzania. Therefore, the main factors and element of design for transmitting station building are described below.

(1) Site Planning

The main elements to be arranged on the sites are the transmitting antenna masts and the transmitting station building. It is necessary to make a block plan so that these 2 elements can be reasonably arranged on the site while keeping the necessary positional relationship. This present plan should also sufficiently allow for any future plans. Fortunately, both sites for Nachingwea and Songea Transmitting Station are large enough for this project, thus sufficient space can be kept for future plans such as increasing transmitting facilities, constructing office blocks and staff houses.

A transmitting antenna mast has a circular high level electrical field with a radius equal to the mast's height, hence it is necessary to shield the whole transmitter building if it is located within that electrical field. Since the site is large enough, the transmitting

station building should be situated outside the high level electrical field, and the tuning unit hut placed beside the antenna mast. The transmitting station building and the tuning unit hut are connected by a feeder line.

An entrance turn is provided in front of the entrance hall of the transmitting station building and a parking lot on the power supply room side. A 6m wide road will also be constructed in the site to connect with the access road.

(2) Architectural Plan

1) Floor plan

The block plan for the room inside the station building is simple, and has no unnecessary sections. style by excluding parts of uselessness. Various functions inside the station building are accommodated by dividing the building into four zones: the transmitting function zone, transmitting function auxiliary zone, the administration zone, and the communication passage zone.

First, the transmitting function zone is extended in a line for the convenience of monitoring, maintenance and inspection. The transmitting function auxiliary zone is arranged at the back, parallel to this zone. The communication passage zone is placed in front and the administration zone and studio zone are arranged opposite to the communication passage zone.
(refer to Fig. 3-4-1)

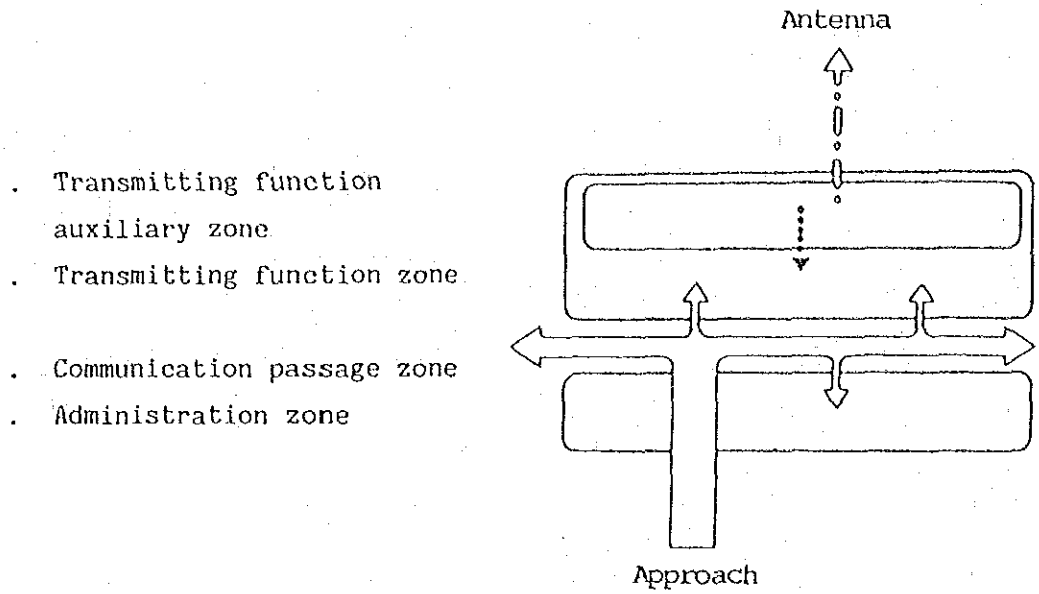


Fig. 3-4-1 Conceptual Floor Plan for the Station Building

(a) Transmitting function zone and transmitting function auxiliary zone

The transmitting function zone and transmitting function auxiliary zone include a transmitter room for 100kW and 10kW transmitters, a console room for monitoring and control, a blower room for cooling down the transmitters, a dummy load room for the dummy load device for the adjustment of transmitters, a generator room for a standby generator, etc. The floor plan for these rooms was made by taking into account the functional and organic arrangement of the transmitting equipment first, and then their sizes, shape and mutual locations were decided, taking into account maintenance and safety.

Many pieces of transmitting equipment are charged with high voltages, thus sufficient space should be maintained around them.

Dangerous pieces of equipment in particular should be put together in one place and surrounded by a fence. Sufficient space for inspection should be secured outside the equipment. Surrounding spaces required for the equipment vary with the type of equipment, but it is necessary to reserve at least

60cm for maintenance and inspection, and at least 100cm for equipment having doors opening to the front.

The various pieces of equipment installed form one system as a whole, thus their locations are important, requiring the layout to be connected organically. Moreover, the blower, dummy load, and generator require air charging and exhausting, so their locational relationship to the outside is important.

Taking into account the installation of a commercial power panel and an automatic voltage regulator, and to minimize space besides that used for the equipment, a minimum area should be secured for the generator room.

(b) Administration zone

The administration zone consists of offices and a night-duty room. Four types of office rooms for administration staff, engineering staff, maintenance and receptionists/janitors are prepared as required.

The three shift system is employed because transmitting hours last from 06:00 hours to 24:00 hours. Thus, a night-duty room is necessary for two persons. A 12.6m^2 space has been set aside, taking as a standard the sick room space for one person in a hospital (more than 6.3m^2/person by Japanese medical law) and them doubling this.

A hot water service room is also to be installed next to the night-duty room and space for lockers is also provided. A shower room is provided in a corner of the rest room.

(c) Communication Passage Zone

The communication passage zone includes a corridor, rest room, shower room, hot water service room, etc. About 20% of the total floor area is taken up in this zone (referring to

general office buildings). The maximum number of persons working at any time is about five (one manager, one clerk, three engineers), thus one closet booth, one urinal stall and one wash basin are provided as minimum standard. A shower booth is also provided for the duty staff. Area standards of Japan are employed for these space sizes.

(d) Stockroom

Spaces for storing parts for transmitting equipment and the transmitting antenna and antenna tower, plus tools, various measuring equipment, maintenance and repair equipment, etc. are required. 7% is set aside for this purpose based on experiences in Japan. 5.6% is normally taken as the average for general buildings, but 7% is employed taking into consideration the functions of a transmitting station.

2) Section plan

The possibility of a temporary flooding due to localized torrential downpours should be taken into consideration. Thus, the floor should be 400mm higher than the average GL. And the floor of all rooms must be the same level to facilitate the movement of equipment. Exceptions are the floors of the rest room and the shower room.

As for the room height, some equipment is about 2,400mm high and an additional space of about 1,500mm for ducts, piping, and wiring is required above the 2,400mm height, thus a total height of 3,900mm should be allowed below the girders.

3) Building structural plan

The base will be a spread foundation with footing, and the reinforced concrete for the base shall be cast in place.
A prefabricated system should be employed for the main structure above GL, in order to make construction period shorter. This system is one in which autoclaved light-weight concrete panels

(ALC panels) are fixed to pin-braced construction frames with structural steel as the external wall, and in which the roof is covered with galvanized sheet-iron plates utilizing a folded plate structure (double). Partition walls are light-weight steel frames with backing boards fixed.

With some exceptions, all of the main structures are of dry construction, and plaster work requiring drying time should be limited to the rest room and shower room.

4) Interior and exterior finishing plan

To fully realize the basic policy that the main structure is to be of prefabricated construction and to improve its advantages, a dry finish system should be employed for both interior and exterior work.

The floor should be covered mainly with plastic tiles which make maintenance easier and minimize the dust due to wear. Porcelain tiles should only be used for places where there is running water.

The console room, office rooms, night-duty room, and water-related rooms should be provided with ceilings to limit the room capacity and to secure comfortable living, but other rooms are not provided with ceilings.

Paint should be applied to both the interior and exterior surfaces as a final finishing material. Paints made in Japan which are stable in quality should be used, taking durability into consideration.

(3) Equipment Plan

Equipment systems suitable for the climatic conditions on the sites, easy to maintain and control, and inexpensive to operate should be employed. In addition, the systems should be highly durable and

maintainable, as well as easily replenished with consumables and spare parts.

1) Electric equipment

The main electric power, 3-phase, 4-line 400V/230V, will be obtained from a distribution board in the generator room and supplied to three channels for power, lighting fixtures, and receptacle outputs.

Fluorescent lamps, which are economical for lighting, will be mainly used, and the illumination intensity will be 400 luxes for the office rooms, studio and console room, 300 luxes for the transmitter room and 100 luxes for the other rooms.

2) Plumbing equipment

The government of Tanzania is responsible for laying a water supply pipe up to the boundary line of the site. Piping should be led in from this point, and water should first be put into a $2m^3$ tank with a fixed gauge, and then distributed to each faucet with automatic water supply units. Water supply points should be the hot water service room, rest room, shower room and outside sprinklers.

General drain and waste water should be divided into different drainage systems, and they are to be accumulated at a drainage basin outside the buildings. A sewage system cannot be expected in the future, thus a septic tank and an infiltration tank should be installed at an appropriate spot on the site.

3) Ventilating equipment

Sufficient ventilation is required for the transmitter room, generator room, dummy load room, etc., which build up heat generated by their equipment. The necessary number of exhaust fans shall be installed on the outside walls.

Air is supplied from air supply louvers fitted on the outside walls, and air chambers should be provided to prevent dust, sand, leaves, and insects from coming in. Forced ventilation should be provided for the 100kW transmitter by installing a blower.

Ventilation in the console room should be provided by installing a ventilation louver and fan between the room and the transmitter room. A forced ventilation system should also be provided for the rest room, shower room, and hot water service room.

4) Air conditioning equipment

At the Nachingwea area, the average highest temperature in a day is about 30 degrees throughout the year. At Songea, there are two months when the average highest temperature becomes nearly 30 degrees. The humidity is high in both areas 75% ~ 85%throughout the year.

In Songea, it is especially high in the morning and reaches 80~95%. Accordingly, air-conditioning is installed in such rooms as the transmitter control room, operation room, night duty room, and studio.

The transmitter room is designed to function correctly at temperatures below 40°C, thus a specific blower for the transmitter should be provided to restrict the rise of temperatures in the room or in the transmitter itself by heat generation. A large propeller fan should be provided to vent the room air to the outside. Forced ventilation should be provided for the dummy load room and generator room only when they are in use to prevent a rise in room temperatures.

3-4-4 Principal Equipment for Each Station

Principal equipment for Nachingwea Transmitting Station, Masasi Repeater Station, Lindi Studio, Songea Transmitting Station and Songea Studio is shown in the Table 3-4-2.

Table 3-4-2 Principal Equipment for Each Station

(Nachingwea Transmitting Station 1/3)

Item	Description	Quantity
(Nachingwea Transmitting Station)		
1) Transmitter System	100kW AM Radio Transmitter	1set
	10kW AM Radio Transmitter	1set
	100kW/10kW HF Change-Over Switch	1set
	100kW/10kW Air-cooled Dummy Load	1set
	High-speed Surge Protector	2sets
	Program Input Equipment	1set
	Monitoring Equipment	1set
	Control/Monitoring Console	1set
	Rack Assembly	2sets
	Loudspeaker for Monitor	1set
2) Antenna System	Cylindrical Steel Mast (89m)	1set
	Sub-Antenna	1set
	Obstruction Lighting Equipment	1set
	Radial Ground	1set
	6-wire Aerial Feeder Line	1set
	Antenna Tuning Unit with Hut	1set
3) Program Transmission Line System	FM Receiver	2sets
	All Wave Receiver	2sets
	Input Selection Switcher	1set
	Rack Assembly	1set
	FM Receiving Antenna with Feeder	1set
	Triangle Steel Tower (30m)	1set
	Iron Pole (20m)	2sets

(Nachingwea Transmitting Station 2/3)

Item	Description	Quantity
4) Power Supply System	Incoming Panel	1set
	Feeder Panel	1set
	Distribution Panel	1set
	Automatic Voltage Regulator (400kVA) & Control Panel	1set
	Engine Generator (100kVA)	1set
	Dummy Load for the above	1set
	Generator Control Panel	1set
	Main Fuel Oil Tank (3,000ℓ)	1set
	Sub Fuel Oil Tank (390ℓ)	1set
	Battery & Charger	1set
5) Measuring Equipment	Audio Test Set	1set
	Variable Attenuator	1set
	Fixed Attenuator	1set
	Frequency Counter	1set
	AM Modulation Monitor	1set
	Oscilloscope with Cart	1set
	Circuit Tester	2sets
	RF Bridge/Oscillator	1set
	Spectrum Analyzer	1set
	Field Strength Meter	1set
	Electric Voltmeter	1set
	Megger	1set
	Ammeter	1set
	Voltmeter	1set
	Earthmeter	1set
6) Maintenance Tool & Vehicle	Tools for Broadcasting Equipment	2sets
	Tools for Engine Generator	1set
	Vehicle for Maintenance	1

(Nachingwea Transmitting Station 3/3)

Item	Description	Quantity
7) Ancillaries & Others	Room to Room Intercom	1set
	Clock	3
	VHF Transceiver with Antenna	1set
	SSB Short-Wave Transceiver with Antenna	1set
	Locker	2sets
	Test Tape	1lot
8) Spare parts	Spare Parts for Broadcasting Equipment	1lot
	Spare Parts for Engine Generator	1lot
9) Station Building	Station Building ($432m^2$)	1
	Electric Equipment	1set
	Plumbing Equipment	1set
	Ventilating Equipment	1set
	Air Conditioning Equipment	1set

(Masasi Repeater Station 1/1)

Item	Description	Quantity
(Masasi Repeater Station)		
1) Repeater System	100W FM Transmitter	2sets
	Program Input Equipment	1set
	Rack Assembly	1set
	FM Transmitting Antenna with Feeder	1set
	Triangle Steel Tower (30m)	1
2) Power Supply System	Uninterruptible Power System	1set
3) Measuring Equipment	Audio Test Set	1set
	Variable Attenuator	1set
	Frequency Counter	1set
	Circuit Tester	1set
	FM Standard Signal Generator	1set
	Electric Voltmeter	1set
	FM Linear Detector	1set
	Directional Coupler	1set
	Portable Type VHF Dummy Load	1set
4) Tool for Maintenance	Tools for Broadcasting Equipment	1set
	Tools for Power Supply Equipment	1set
5) Ancillaries & Others	VHF Transceiver with Antenna	1set
	Electric Cables for Telephone (3km) with line hardware	1set
6) Spare parts	Spare Parts for Broadcasting Equipment	1lot
	Spare Parts for Power Supply Equipment	1lot
7) Container	Container for Equipment ($45m^2 \times 1$)	2sets
	Electric Equipment	1set
	Ventilating Equipment	1set

(Lindi Studio 1/2)

Item	Description	Quantity
(Lindi Studio)		
1) Studio System	8-channel Audio Mixing Console	1set
	Open-Reel Tape Recorder	2sets
	Cartridge Tape Recorder	2sets
	Cassette Tape Recorder	2sets
	Disc Player	1set
	Audio Change-Over Switch	1set
	Microphone & Cable	1lot
	Microphone Stand	1lot
	Announcer Cough Box	1set
	Announcer Desk	1set
	Loudspeaker for Monitor	2sets
2) Program Transmission Line System	All wave Receiver	2sets
	Input Selection Switcher	1set
	Rack Assembly	1set
	HF Receiving Antenna with Feeder	1set
	Iron pole (20m)	2
3) Power Supply System	Step-down Transformer (50kVA)	1set
	Incoming panel	1set
	Feeder panel	1set
	Distribution Panel	1set
	Automatic Voltage Regulator (10kVA) & Control Panel	1set
	Engine Generator (35kVA)	1set
	Dummy Load for the above	1set
	Generator Control Panel	1set
	Main Fuel Oil Tank (1,000ℓ)	1set
	Sub Fuel Oil Tank (200ℓ)	1set
	Battery & Charger	1set

(Lindi Studio 2/2)

Item	Description	Quantity
4) Measuring Equipment	Audio Test Set	1set
	Variable Attenuator	1set
	Fixed Attenuator	1set
	Oscilloscope with Cart	1set
	Circuit Tester	2sets
	Electric Voltmeter	1set
	Megger	1set
	Ammeter	1set
	Voltmeter	1set
	Earthmeter	1set
5) Maintenance Tool & Vehicle	Tools for Broadcasting Equipment	2sets
	Tools for Engine Generator	1set
	Vehicle for Maintenance	1
6) Ancillaries & Others	Clock	3
	VHF Transceiver with Antenna	1set
	SSB Short-Wave Transceiver with Antenna	1set
	Portable Type VHF Transceiver	1set
	Locker	2sets
	Test Tape	1lot
7) Spare parts	Spare Parts for Broadcasting Equipment	1lot
	Spare Parts for Engine Generator	1lot

(Songea Transmitting Station 1/2)

Item	Description	Quantity
(Songea Transmitting Station)		
1) Transmitter System	100kW AM Radio Transmitter	1set
	10kW AM Radio Transmitter	1set
	100kW/10kW HF Change-Over Switch	1set
	100kW/10kW Air-cooled Dummy Load	1set
	High-speed Surge protector	2sets
	Program Input Equipment	1set
	Monitoring Equipment	1set
	Control/Monitoring Console	1set
	Rack Assembly	2sets
	Loudspeaker for Monitor	1set
2) Antenna System	Cylindrical Steel Mast (133m)	1
	Obstruction Lighting Equipment	1set
	Radial Ground	1set
	6-wire Aerial Feeder Line	1set
	Antenna Tuning Unit with Hut	1set
3) Program Transmission	FM Receiver	2sets
	Rack Assembly	1set
	FM Receiving Antenna with Feeder	1set
	Triangle Steel Tower (15m)	1set
4) Power Supply System	Step-down Transformer (500kVA)	1set
	Incoming panel	1set
	Feeder panel	1set
	Distribution Panel	1set
	Automatic Voltage Regulator (400kVA) & Control Panel	1set
	Engine Generator (100kVA)	1set
	Dummy Load for the above	1set
	Generator Control Panel	1set
	Main Fuel Oil Tank (3,000ℓ)	1set
	Sub Fuel Oil Tank (390ℓ)	1set
	Battery & Charger	1set

(Songea Transmitting Station 2/2)

Item	Description	Quantity
5) Measuring Equipment	Audio Test Set	1set
	Variable Attenuator	1set
	Fixed Attenuator	1set
	Frequency Counter	1set
	AM Modulation Monitor	1set
	Oscilloscope with Cart	1set
	Circuit Tester	2sets
	RF Bridge/Oscillator	1set
	Spectrum Analyzer	1set
	Field Strength Meter	1set
	Electric Voltmeter	1set
	Megger	1set
	Ammeter	1set
	Voltmeter	1set
	Earthmeter	1set
6) Maintenance Tool & Vehicle	Tools for Broadcasting Equipment	3sets
	Tools for Engine Generator	1set
	Vehicle for Maintenance	1
7) Ancillaries & Others	Room to Room Intercom	1set
	Clock	3
	VHF Radio Telephone Equipment with Antenna	1set
	VHF Transceiver with Antenna	1set
	Locker	2sets
	Test Tape	1lot
8) Spare parts	Spare Parts for Broadcasting Equipment	1lot
	Spare Parts for Engine Generator	1lot
9) Station Building	Station Building (432m^2)	1
	Electric Equipment	1set
	Plumbing Equipment	1set
	Ventilating Equipment	1set
	Air Conditioning Equipment	1set

(Songea Studio 1/2)

Item	Description	Quantity
(Songea Studio)		
1) Studio System	8-channel Audio Mixing Console	1set
	Open-Reel Tape Recorder	2sets
	Cartridge Tape Recorder	2sets
	Cassette Tape Recorder	2sets
	Disc Player	1set
	Audio Change-Over Switch	1set
	Microphone & Cable	1lot
	Microphone Stand	1lot
	Announcer Cough Box	1set
	Announcer Desk	1set
	Loudspeaker for Monitor	2sets
2) Program Transmission Line System	50W FM Transmitter	2sets
	All wave Receiver	2sets
	Input Selection Switcher	1set
	Rack Assembly	1set
	FM Transmitting Antenna with Feeder	1set
	HF Receiving Antenna with Feeder	1set
	Triangle Steel Tower (15m)	1
	Iron pole (20m)	2
3) Power Supply System	Step-down Transformer (50kVA)	1set
	Incoming panel	1set
	Feeder panel	1set
	Distribution Panel	1set
	Automatic Voltage Regulator (10kVA) & Control Panel	1set
	Engine Generator (35kVA)	1set
	Dummy Load for the above	1set
	Generator Control Panel	1set
	Main Fuel Oil Tank (1,000ℓ)	1set
	Sub Fuel Oil Tank (200ℓ)	1set
	Battery & Charger	1set

(Songea Studio 2/2)

Item	Description	Quantity
4) Measuring Equipment	Audio Test Set	1set
	Variable Attenuator	1set
	Fixed Attenuator	1set
	Oscilloscope with Cart	1set
	Circuit Tester	2sets
	FM Standard Signal Generator	1set
	Electric Voltmeter	1set
	FM Linear Detector	1set
	Directional Coupler	1set
	Megger	1set
	Ammeter	1set
	Voltmeter	1set
	Earthmeter	1set
	Portable Type VHF Dummy Load	1set
5) Maintenance Tool & Vehicle	Tools for Broadcasting Equipment	2sets
	Tools for Engine Generator	1set
	Vehicle for Maintenance	1
6) Ancillaries & Others	Clock	3
	VHF Transceiver with Antenna	1set
	Portable Type VHF Transceiver	1set
	Locker	2sets
	Test Tape	1lot
7) Spare parts	Spare Parts for Broadcasting Equipment	1lot
	Spare Parts for Engine Generator	1lot

3-4-5 Basic Design Drawings

Fig 3-4-2 System Diagram of Nachingwea Transmitting Station
Fig 3-4-3 Repeater System Diagram of Masasi Repeater Station
Fig 3-4-4 Audio System Diagram of Lindi Studio
Fig 3-4-5 System Diagram of Songea Transmitting Station
Fig 3-4-6 Audio System Diagram of Songea Studio
Fig 3-4-7 Outline of Antenna System of Nachingwea Transmitting Station 1/100
Fig 3-4-8 Site plan of Nachingwea Transmitting Station 1/6,000
Fig 3-4-9 Floor plan of Station House of Nachingwea Transmitting Station 1/100
Fig 3-4-10 Elevation of Station House of Nachingwea Transmitting Station 1/100
Fig 3-4-11 Section of Station House of Nachingwea Transmitting Station 1/100
Fig 3-4-12 Site Plan of Masasi Repeater Station 1/50
Fig 3-4-13 Floor Plan of Container of Masasi Repeater Station 1/20
Fig 3-4-14 Elevation of Container of Masasi Repeater Station 1/20
Fig 3-4-15 Site Plan of Lindi Studio
Fig 3-4-16 Floor Plan of Station House of Lindi Studio 1/200
Fig 3-4-17 Outline of Antenna System of Songea Transmitting Station 1/100
Fig 3-4-18 Site Plan of Songea Transmitting Station 1/6,000
Fig 3-4-19 Floor Plan of Station House of Songea Transmitting Station 1/100
Fig 3-4-20 Elevation of Station House of Songea Transmitting Station 1/100
Fig 3-4-21 Section of Station House of Songea Transmitting Station 1/100
Fig 3-4-22 Site Plan of Songea Studio
Fig 3-4-23 Floor Plan of Station House of Songea Studio 1/200

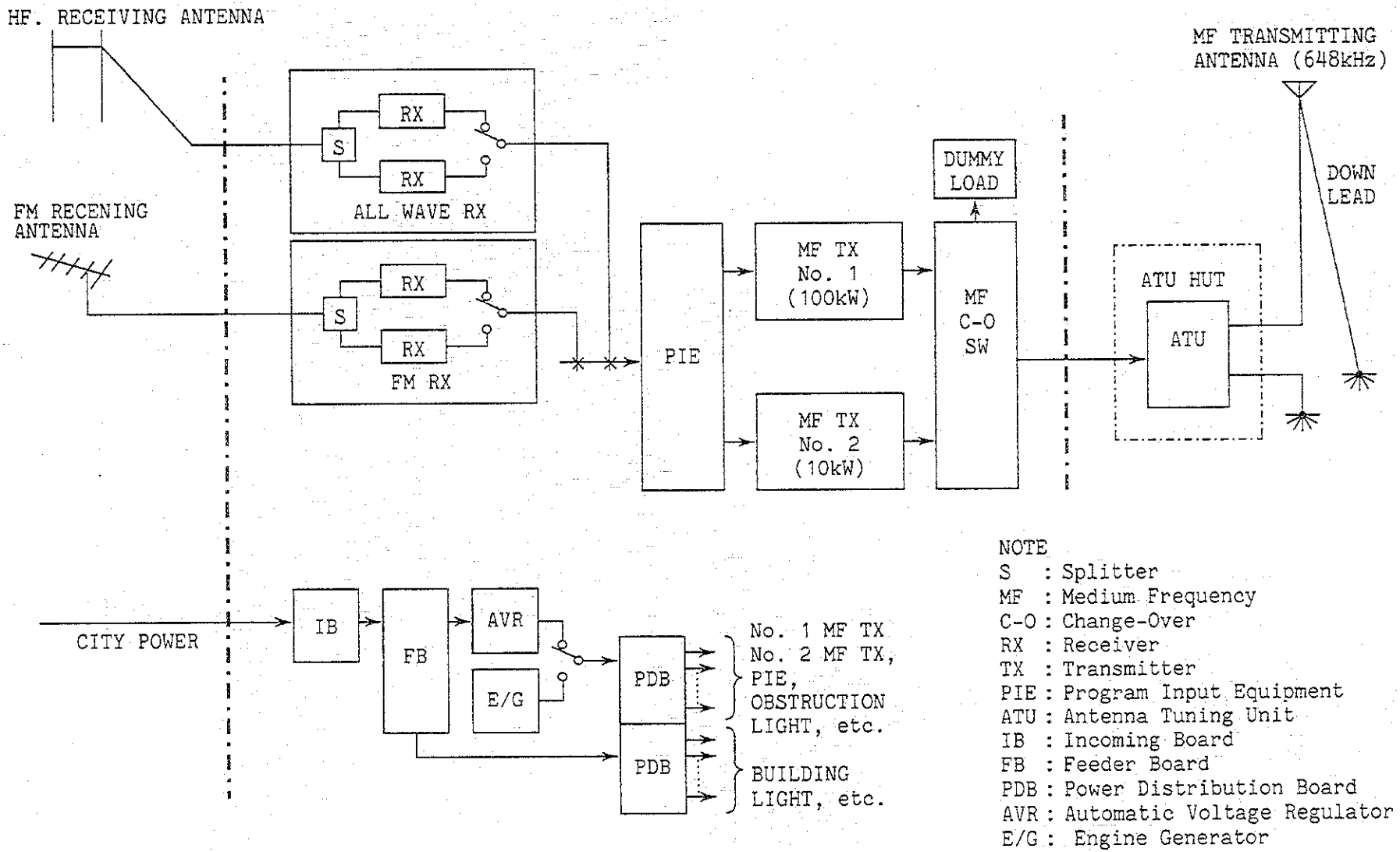


Fig. 3-4-2 System Diagram of Nachingwea Transmitting Station

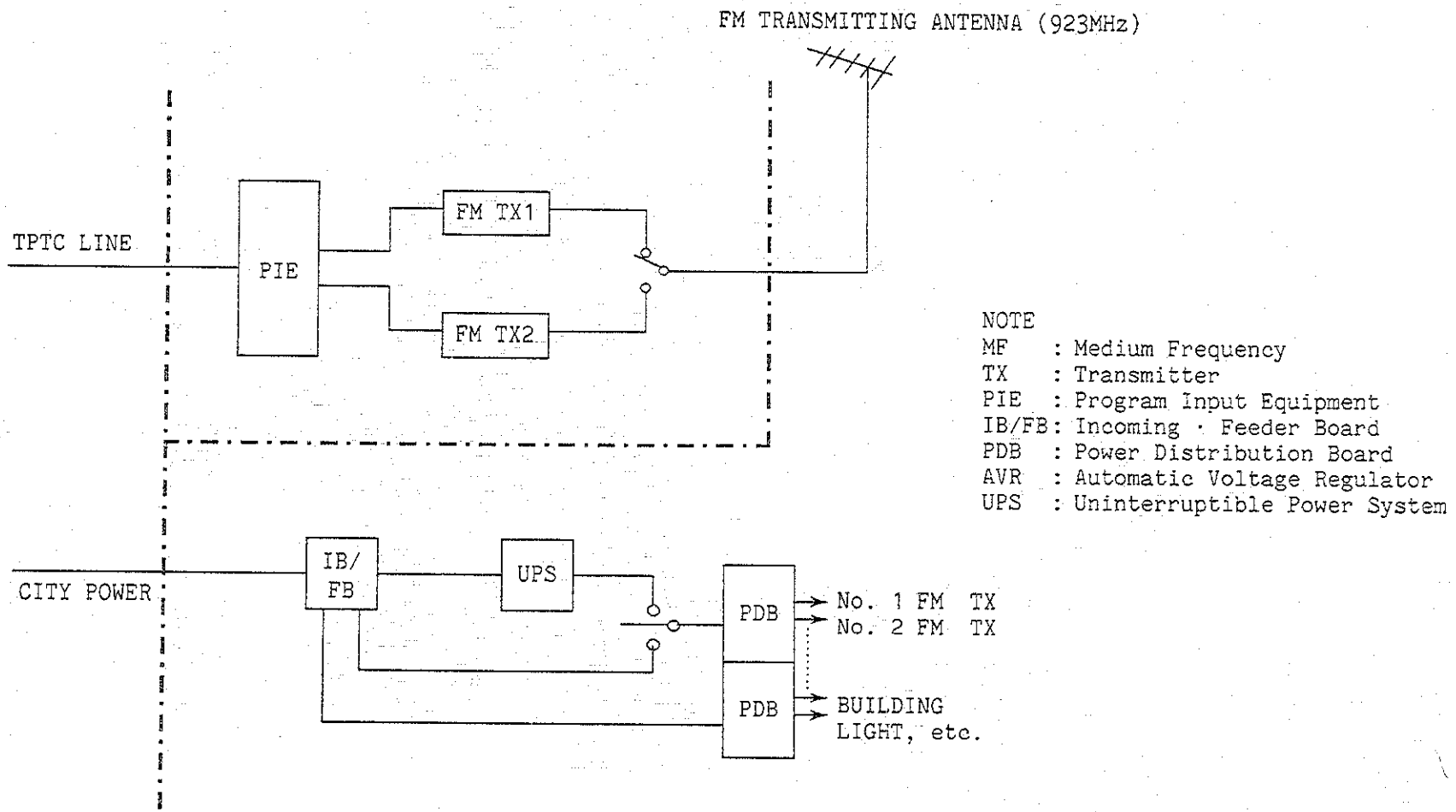


Fig 3-4-3 Repeater System Diagram of Masasi Repeater Station

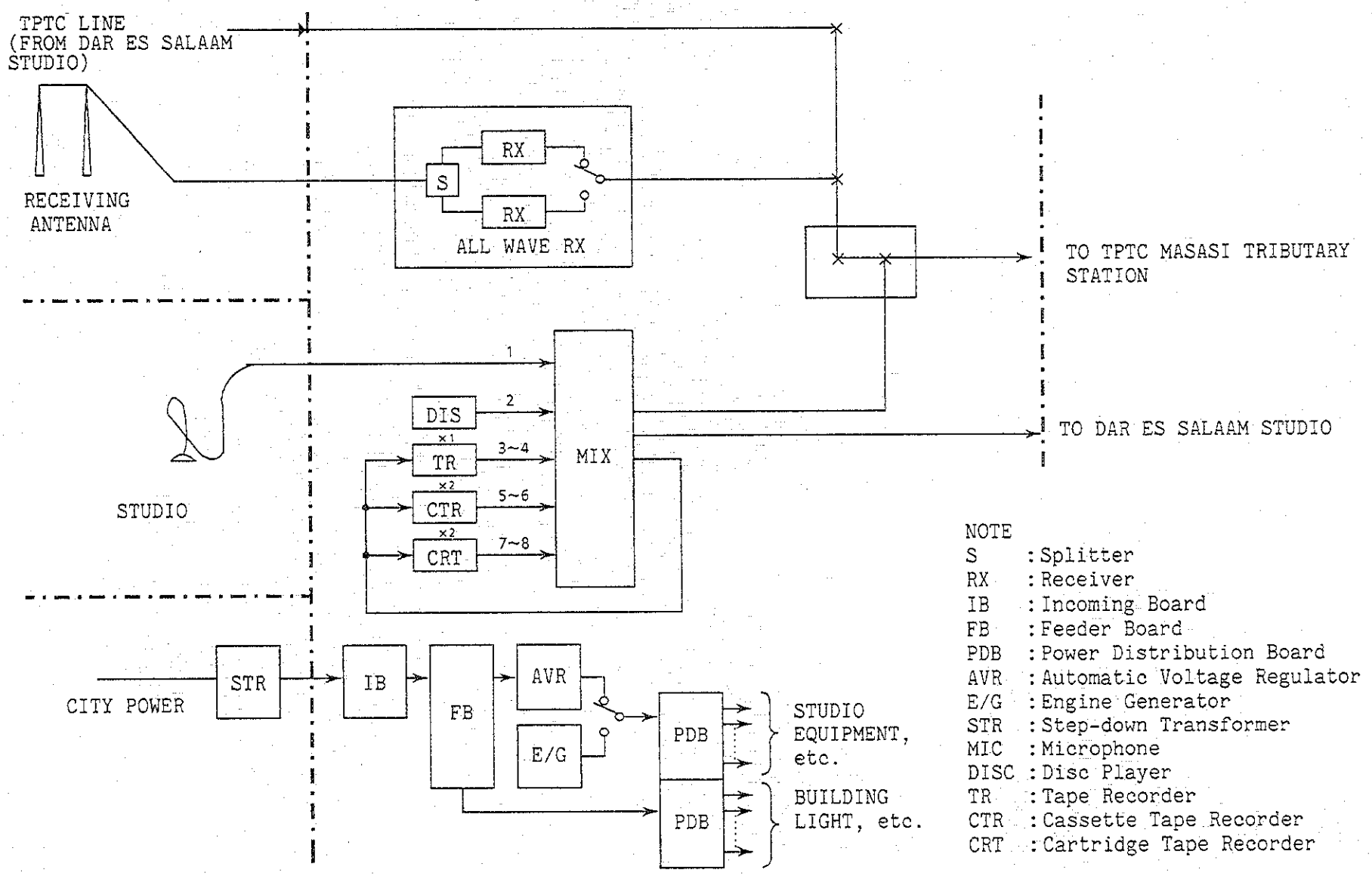


Fig. 3-4-4 Audio System Diagram of Lindi Studio

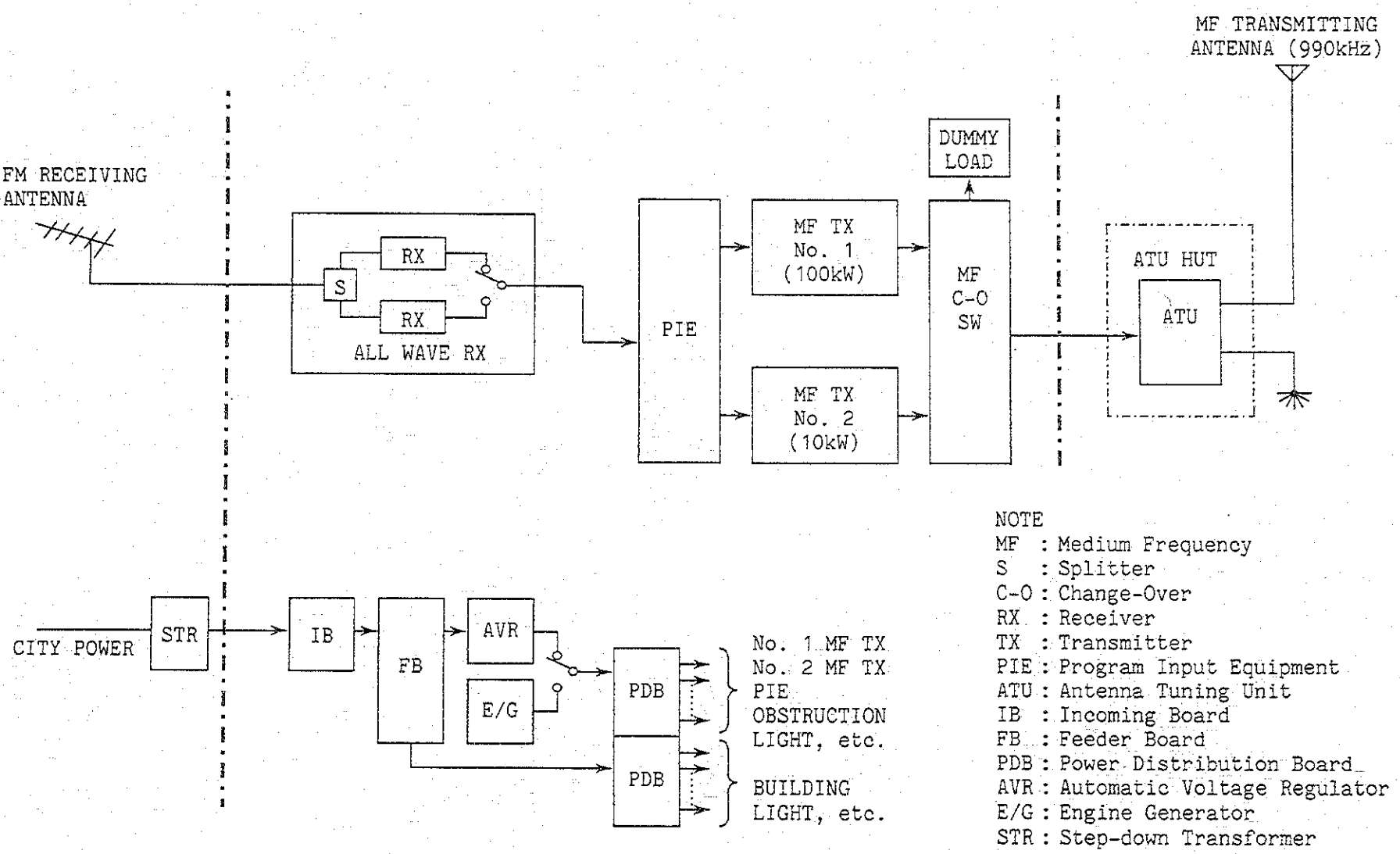
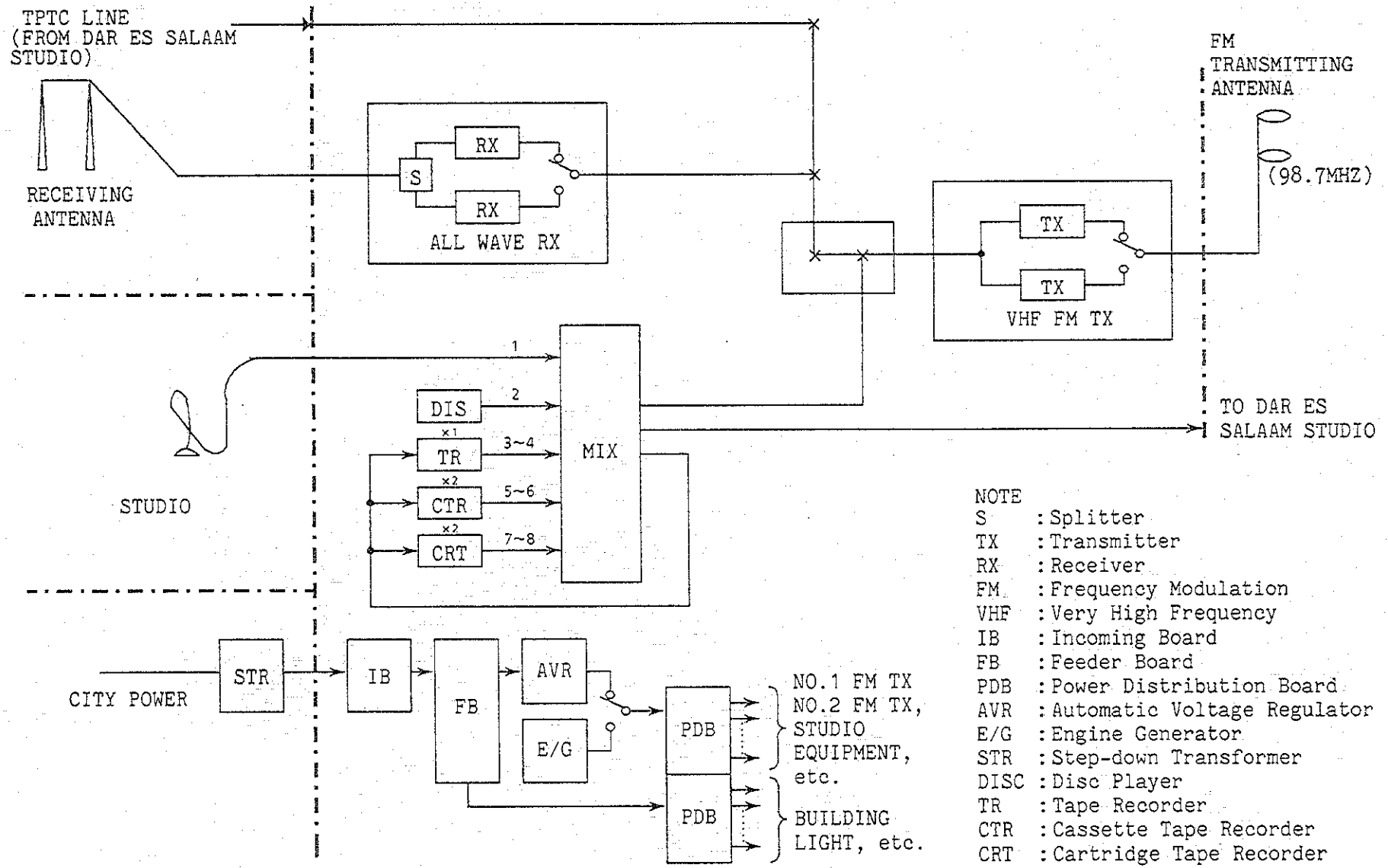


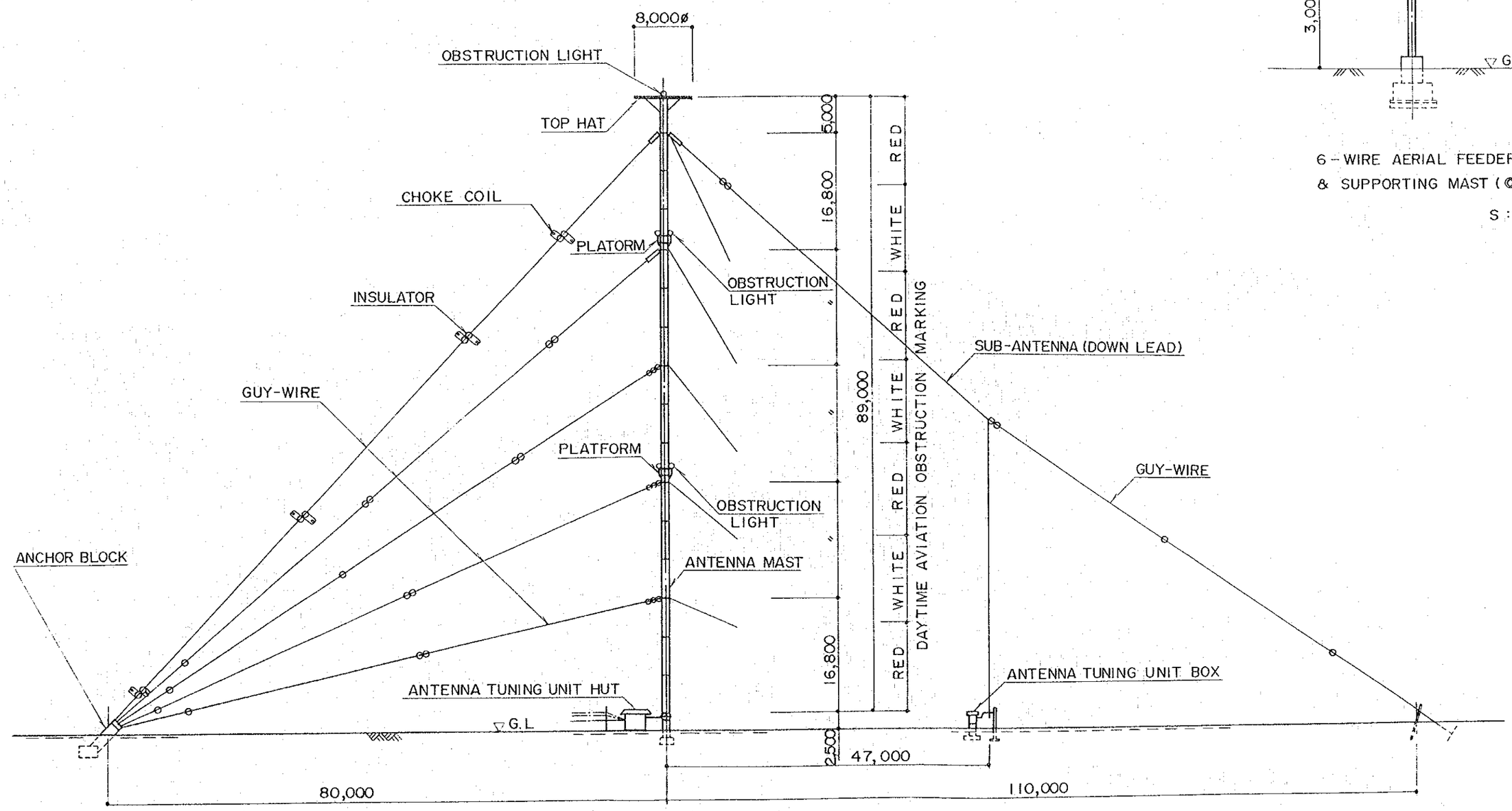
Fig. 3-4-5 System Diagram of Songea Transmitting Station



NOTE

S	: Splitter
TX	: Transmitter
RX	: Receiver
FM	: Frequency Modulation
VHF	: Very High Frequency
IB	: Incoming Board
FB	: Feeder Board
PDB	: Power Distribution Board
AVR	: Automatic Voltage Regulator
E/G	: Engine Generator
STR	: Step-down Transformer
DISC	: Disc Player
TR	: Tape Recorder
CTR	: Cassette Tape Recorder
CRT	: Cartridge Tape Recorder

Fig. 3-4-6 Audio System Diagram of Songea Studio

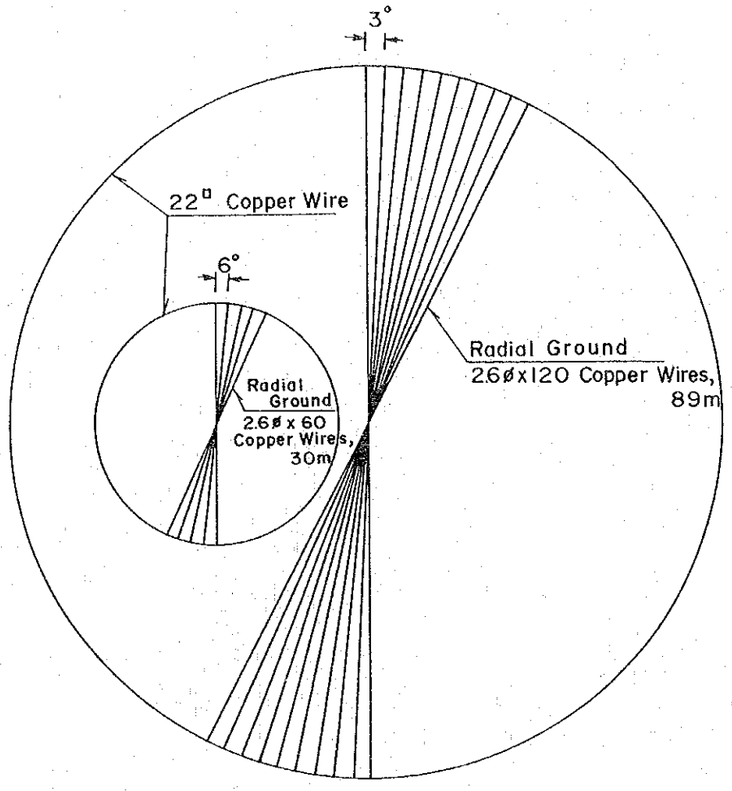


S : 1/600

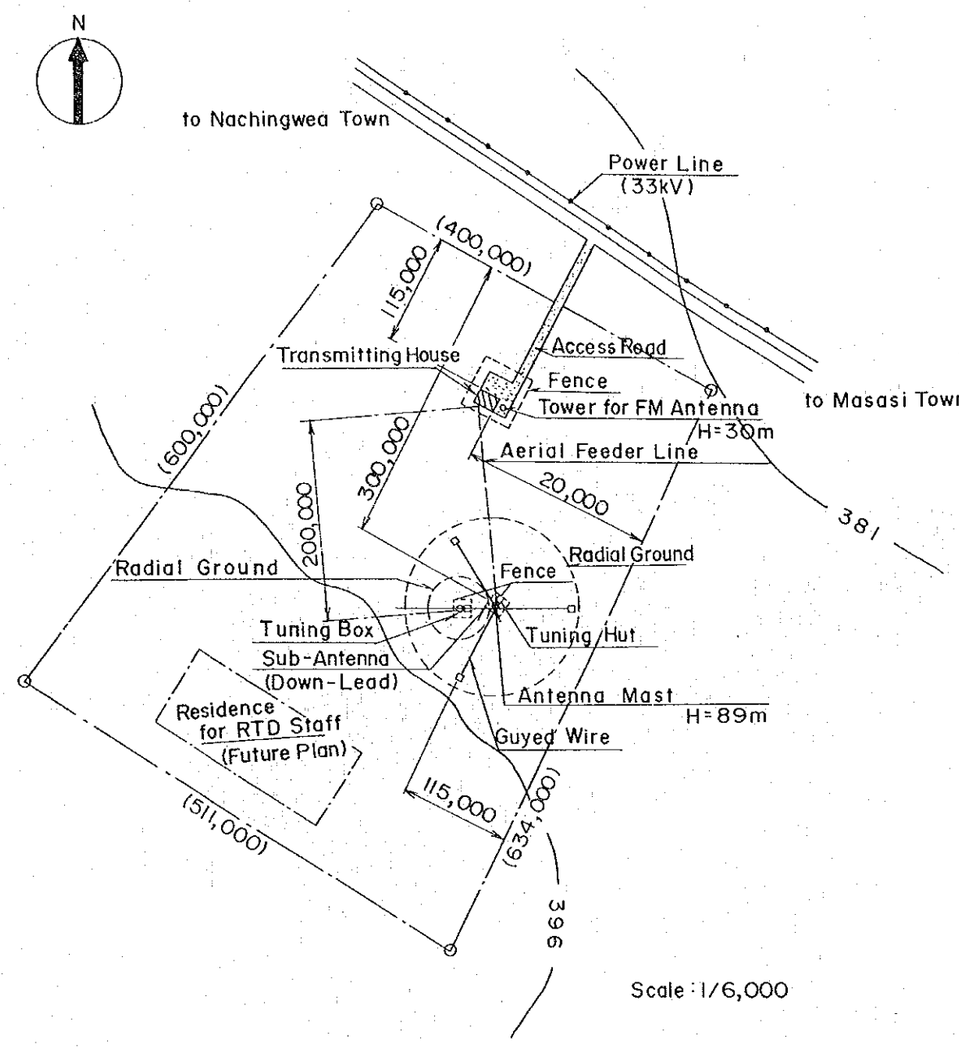
6 - WIRE AERIAL FEEDER
& SUPPORTING MAST (@ 10,000)

S : 1/100

Fig. 3-4-7 Outline of Antenna System of Nachingwea Transmitting Station 1/100



Laying of Radial Ground



Layout of Facilities

Fig. 3-4-8 Site Plan of Nachingwea Transmitting Station 1/6,000

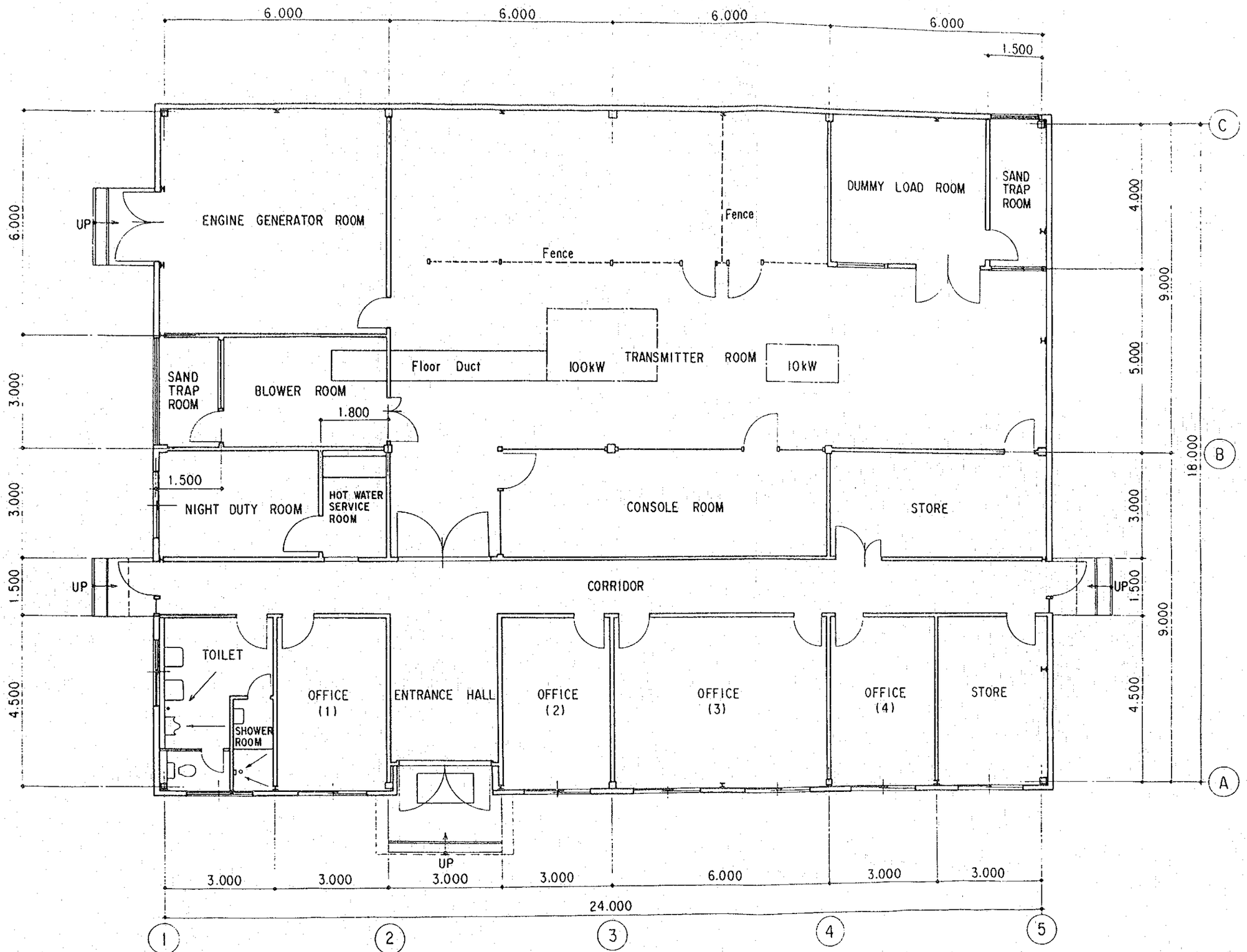
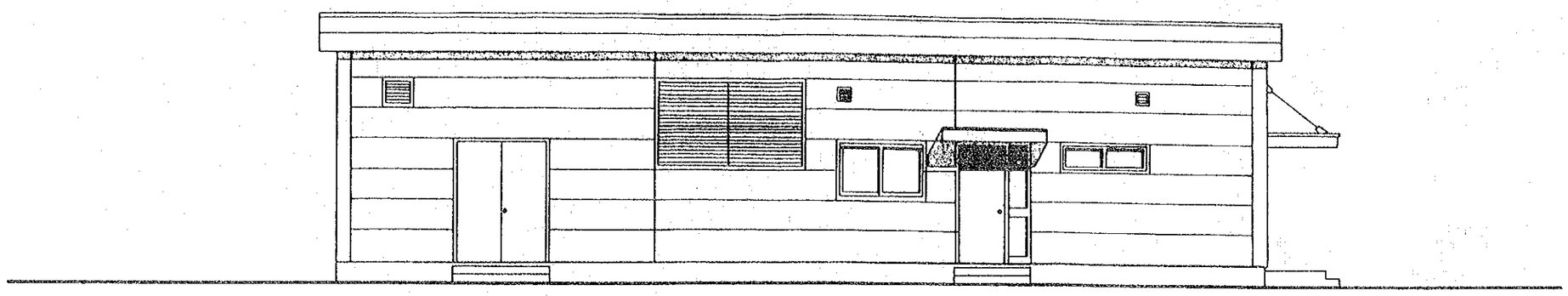
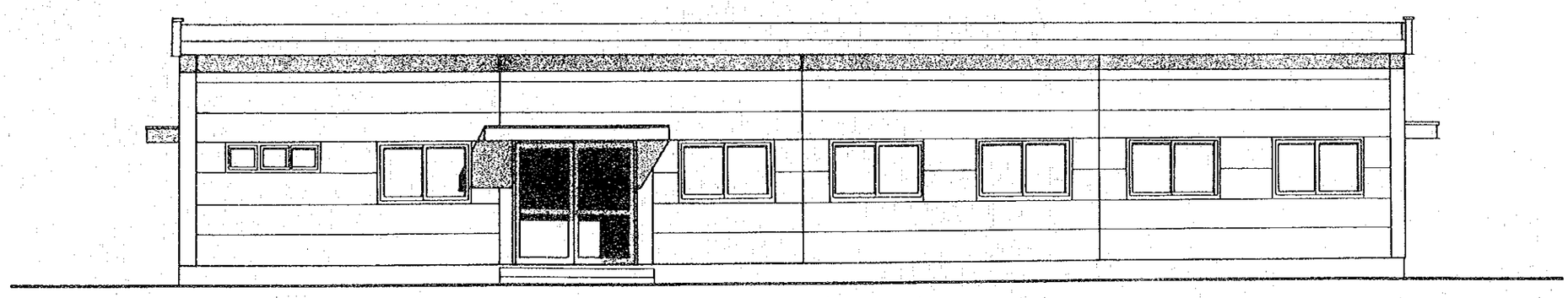


Fig. 3-4-9 Floor Plan of Station House of Nachingwea Transmitting Station 1/100

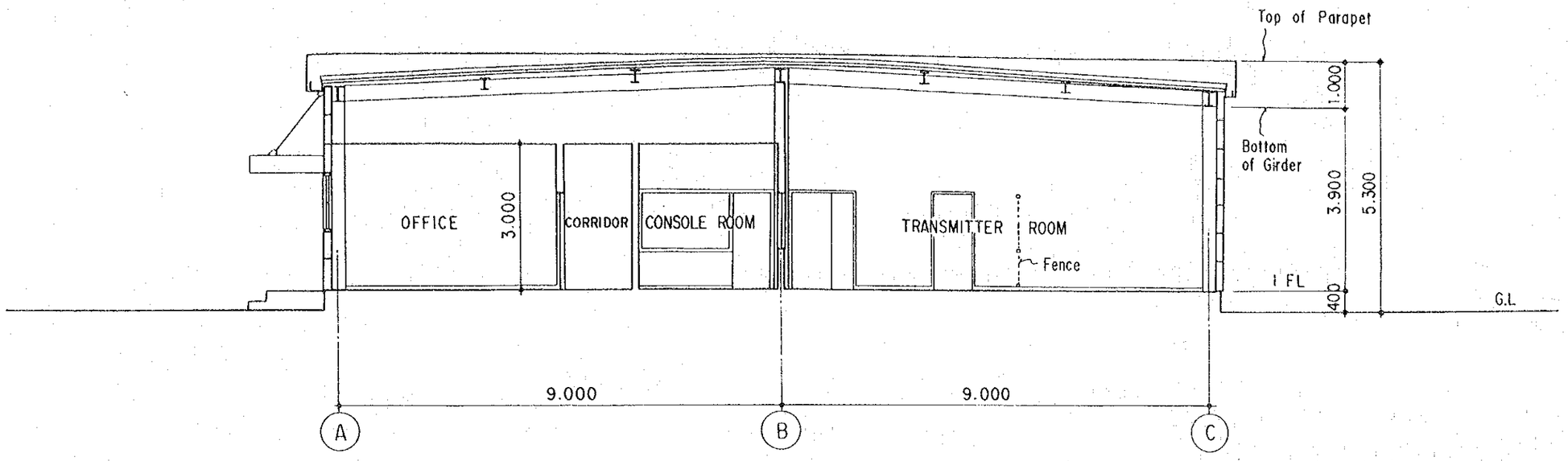


SIDE ELEVATION 1/100

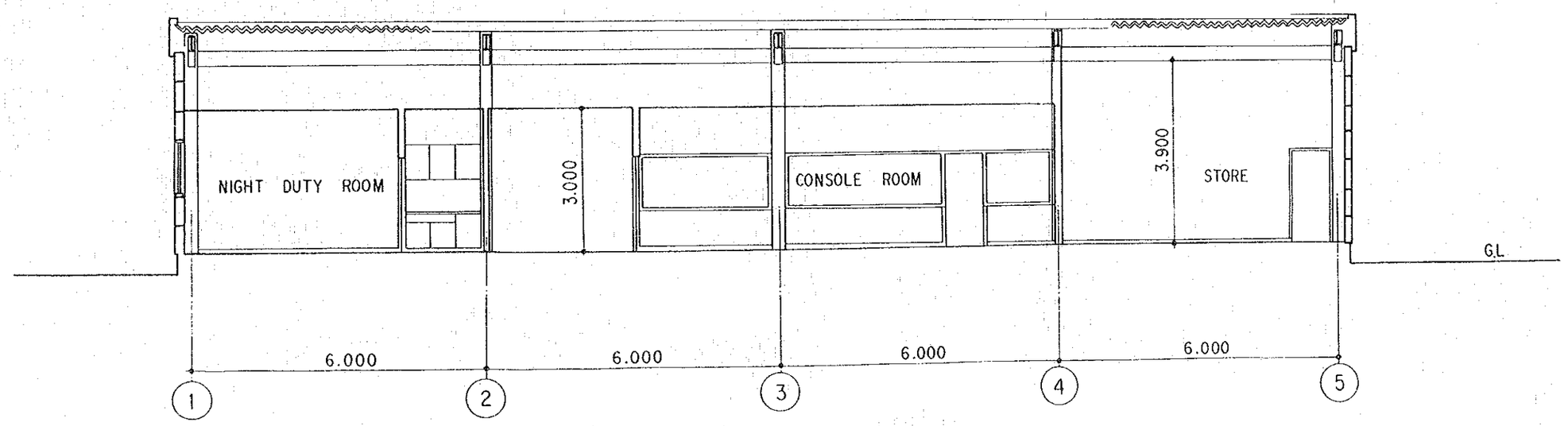


FRONT ELEVATION 1/100

Fig. 3-4-10 Elevation of Station House of Nachingwea Transmitting Station 1/100



X - X SECTION 1/100



Y - Y SECTION 1/100

Fig. 3-4-11 Section of Station House of Nachingwea Transmitting Station 1/100

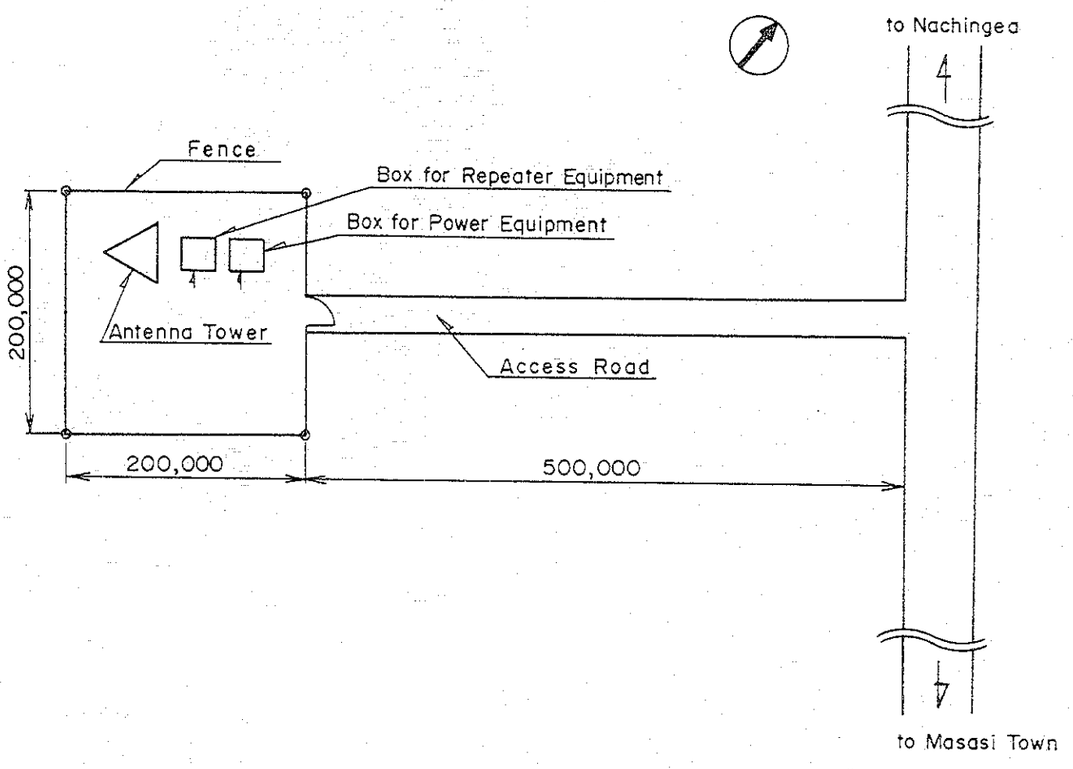


Fig. 3-4-12 Site Plan of Masasi Repeater Station 1/50

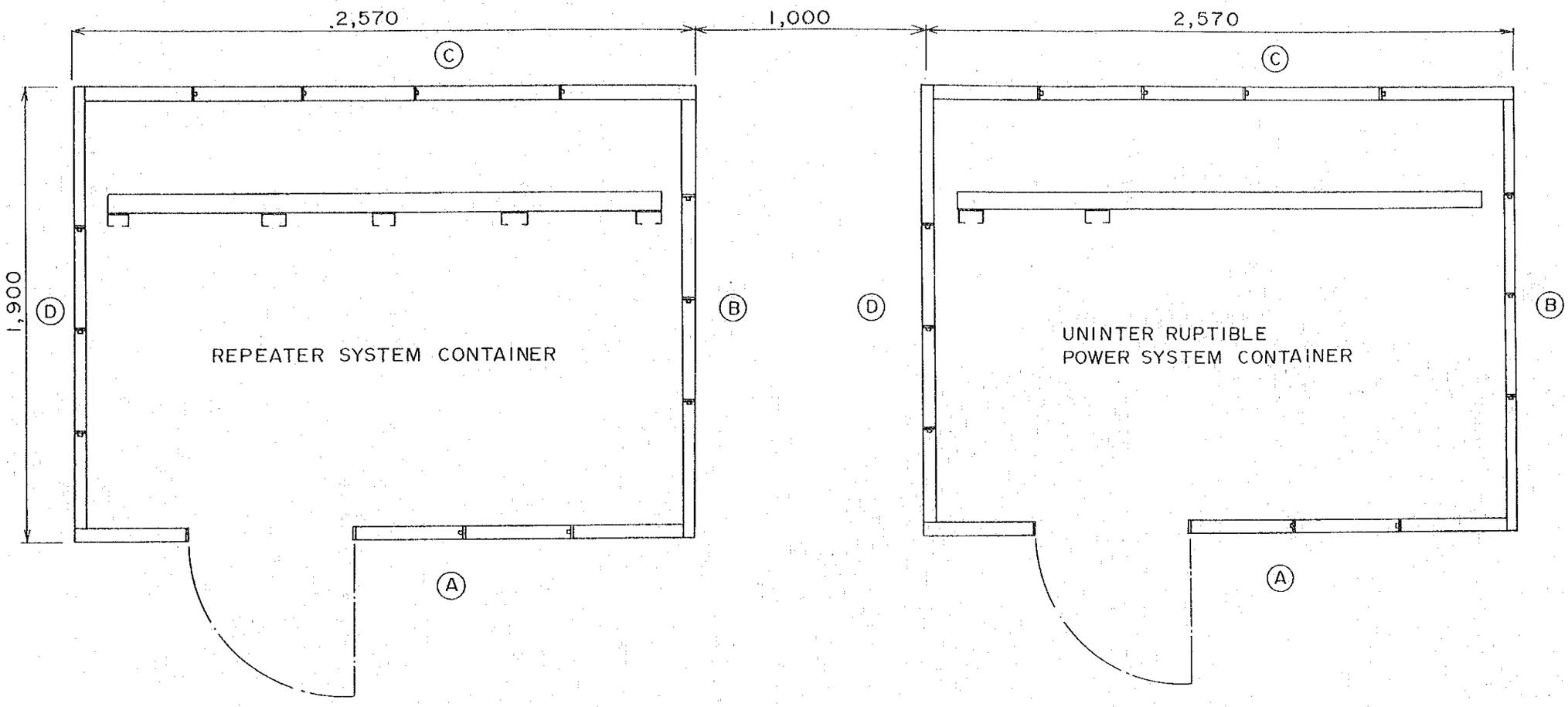
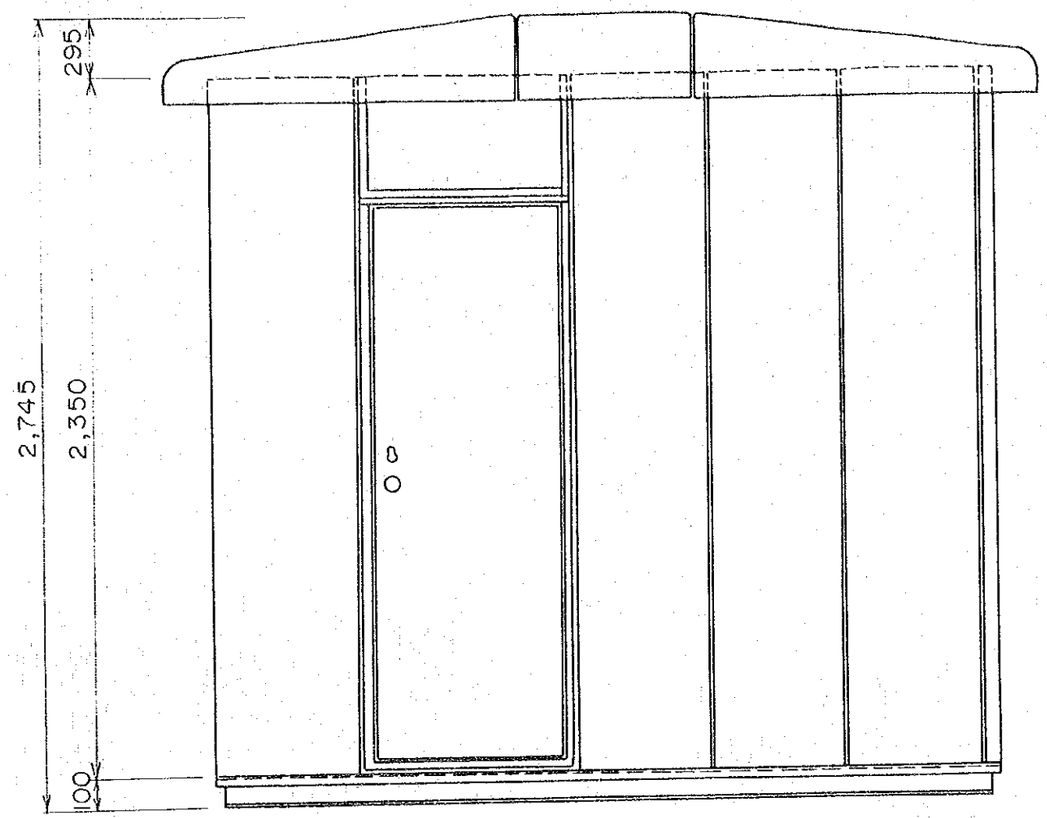
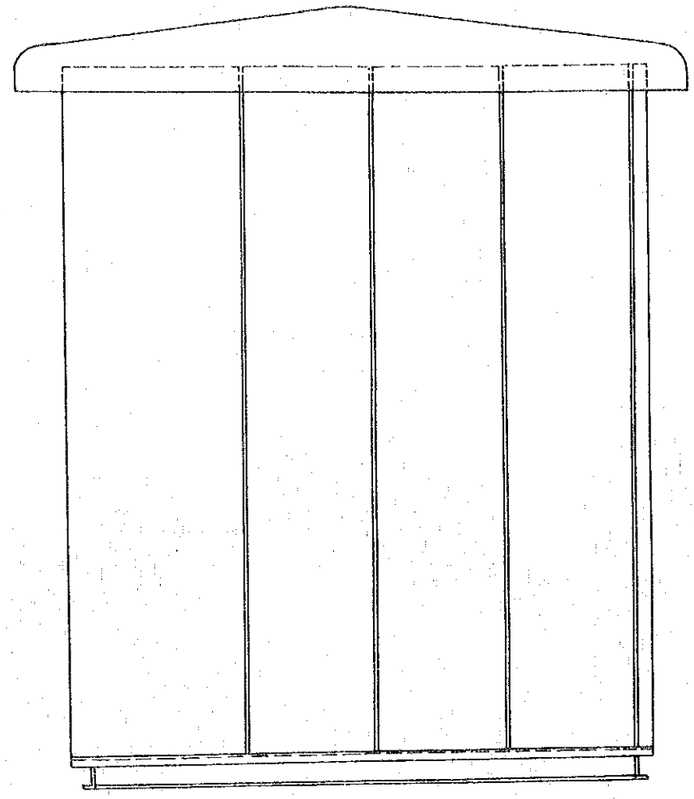


Fig. 3-4-13 Floor Plan of Container of Masasi Repeater Station
1/20



FRONT ELEVATION (Ⓐ)



SIDE ELEVATION (Ⓑ)

Fig. 3-4-14 Elevation of Container of Masasi Repeater Station
1/20

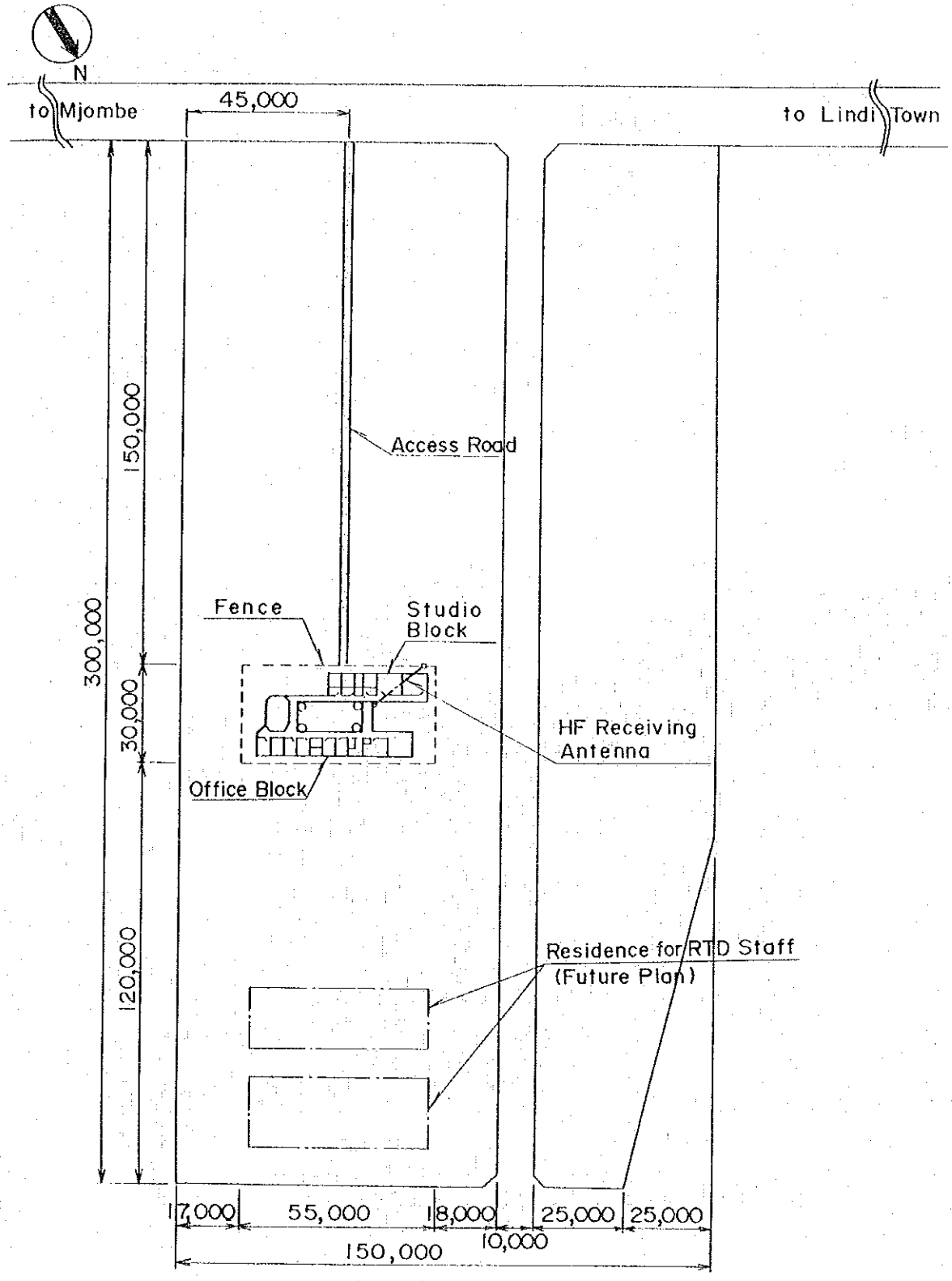


Fig. 3-4-15 Site Plan of Lindi Studio

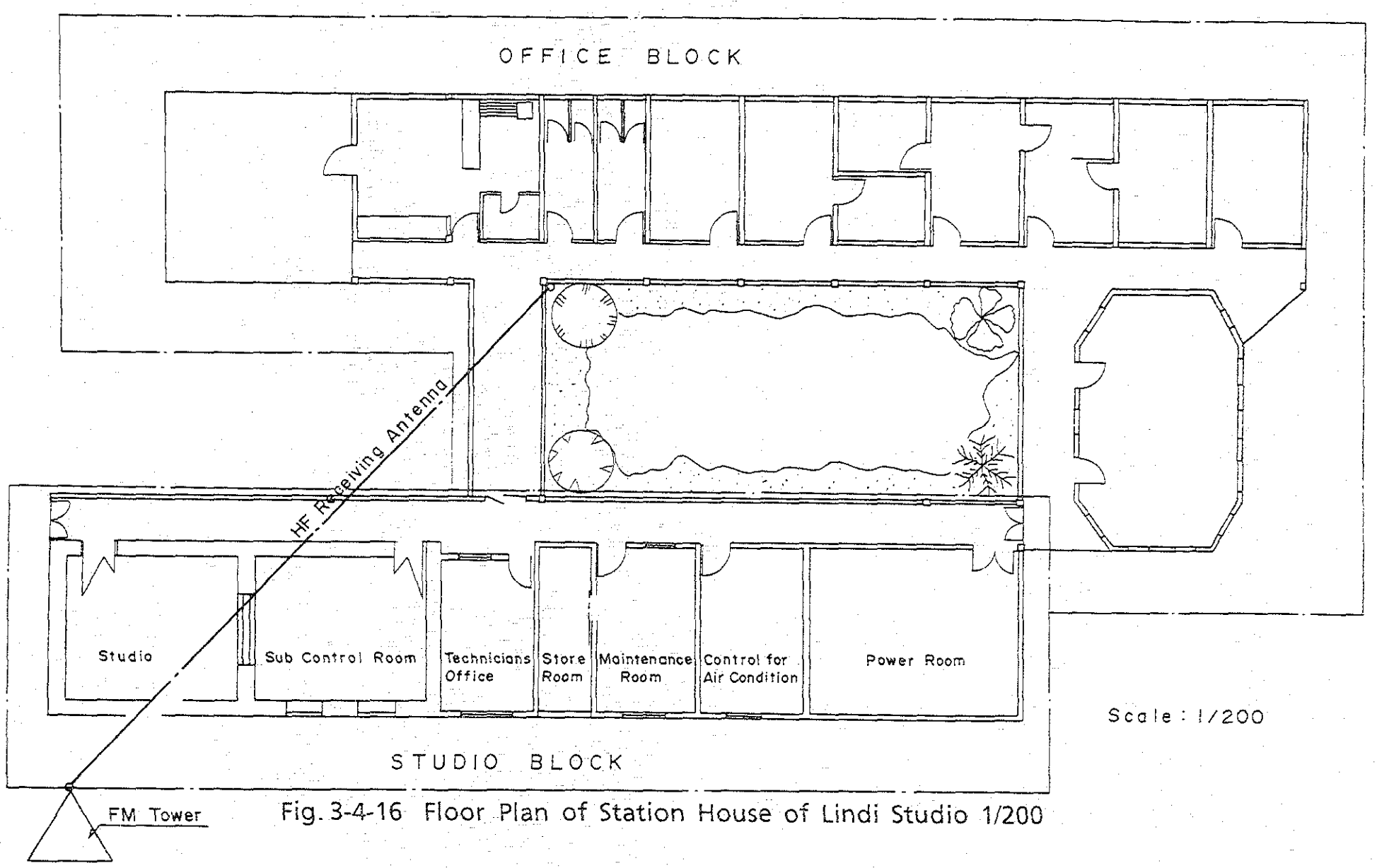
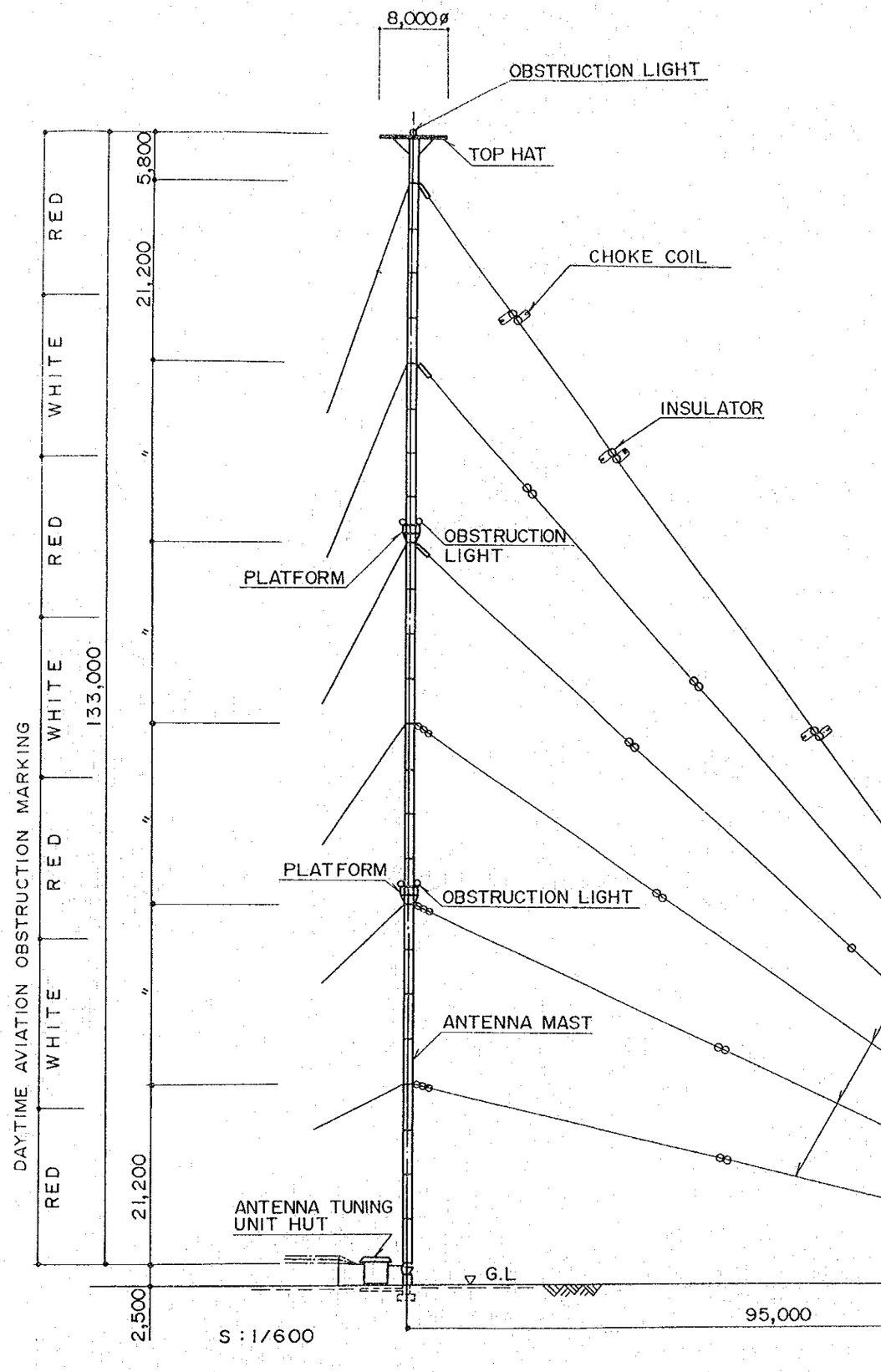
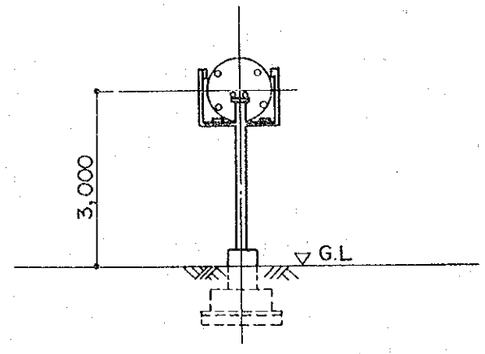


Fig. 3-4-16 Floor Plan of Station House of Lindi Studio 1/200

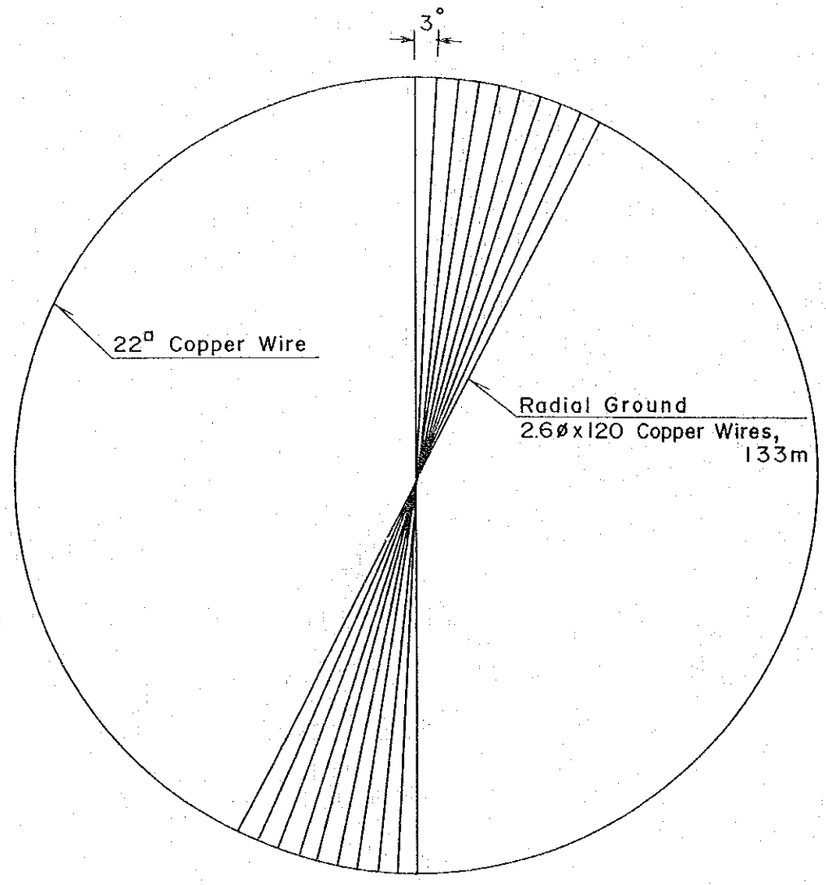




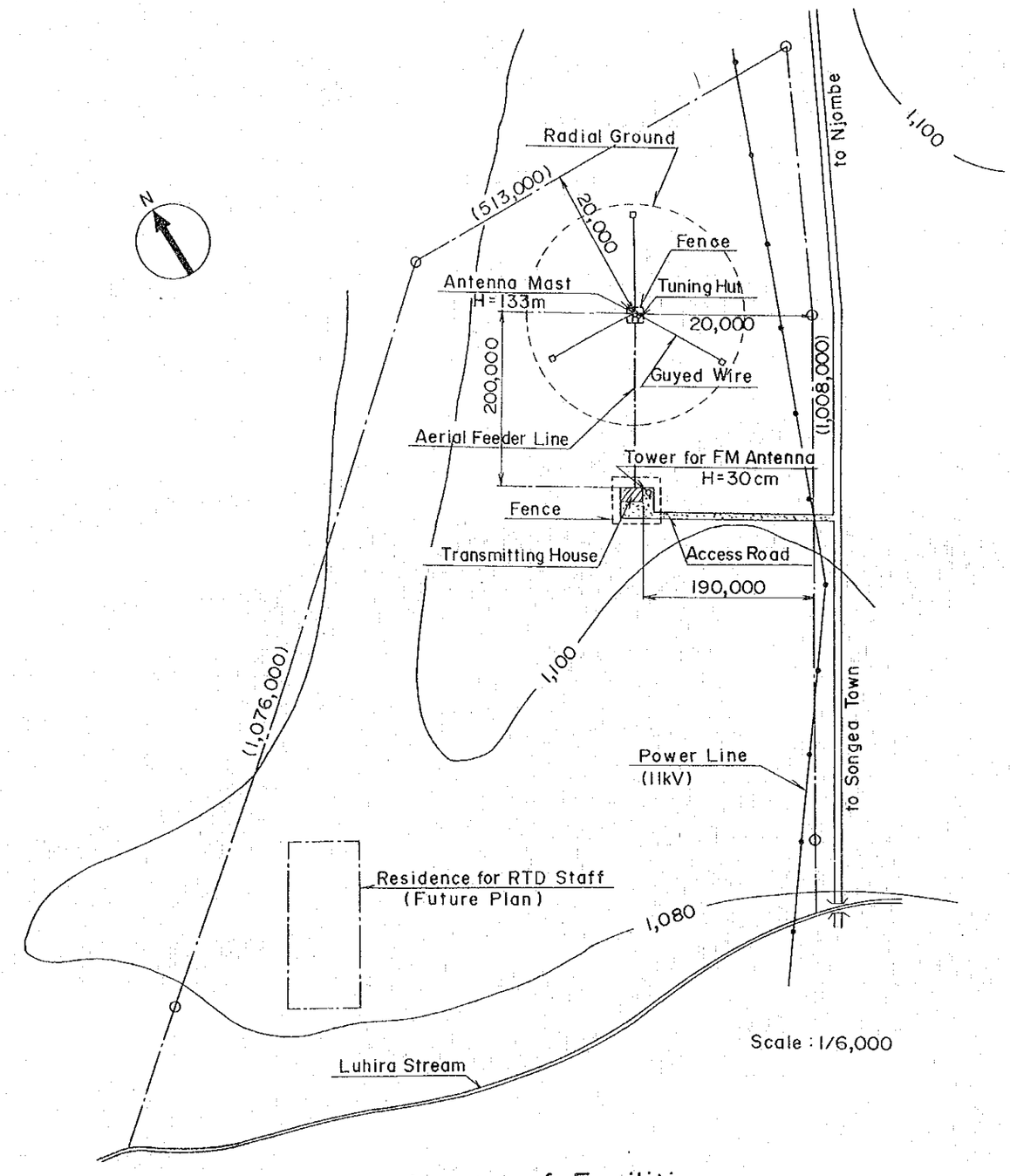
6 - WIRE AERIAL FEEDER
& SUPPORTING MAST (@ 10,000)

S : 1/100

Fig. 3-4-17 Outline of Antenna System of Songea Transmitting Station 1/100



Laying of Radial Ground



Layout of Facilities

Fig. 3-4-18 Site Plan of Songea Transmitting Station 1/6,000

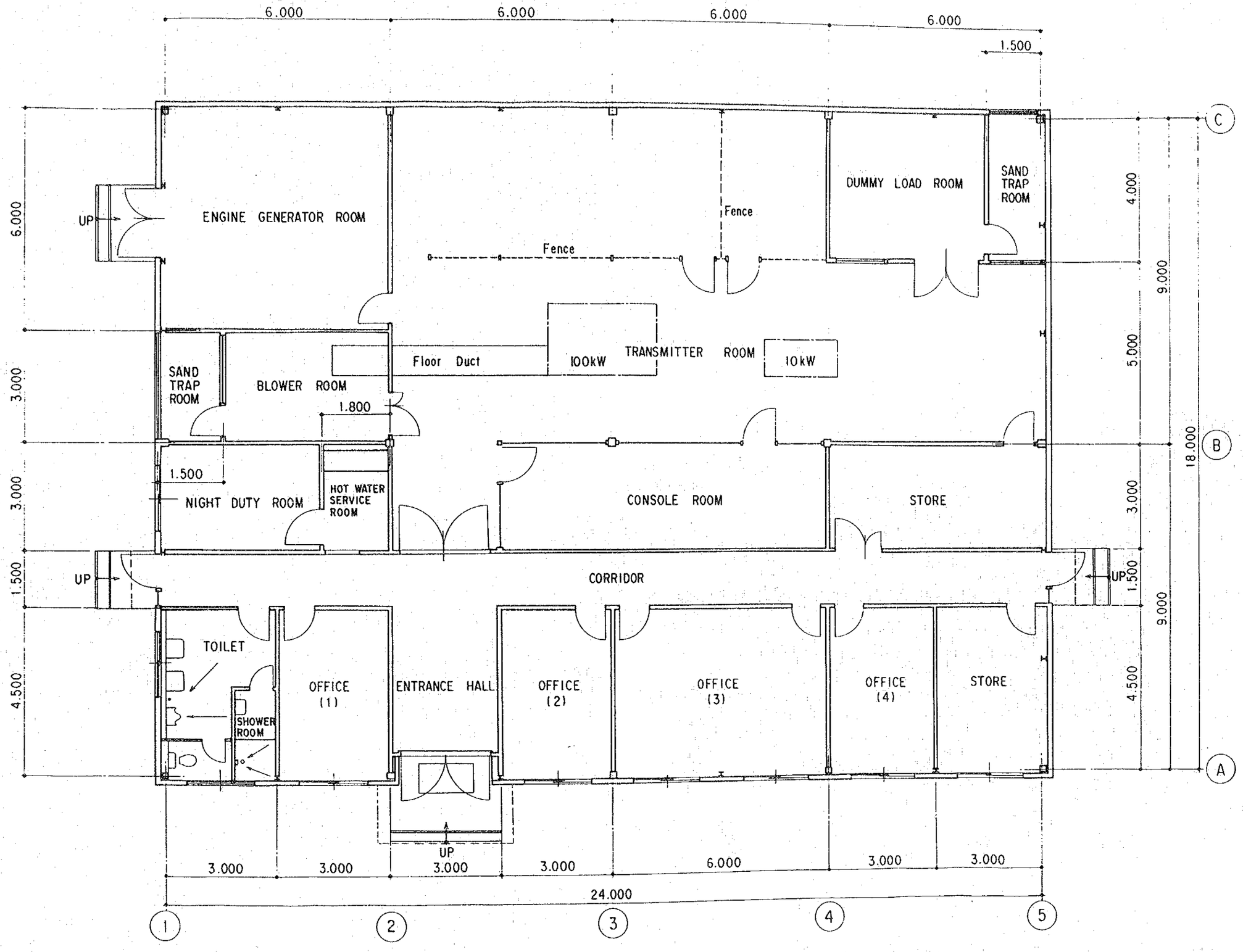
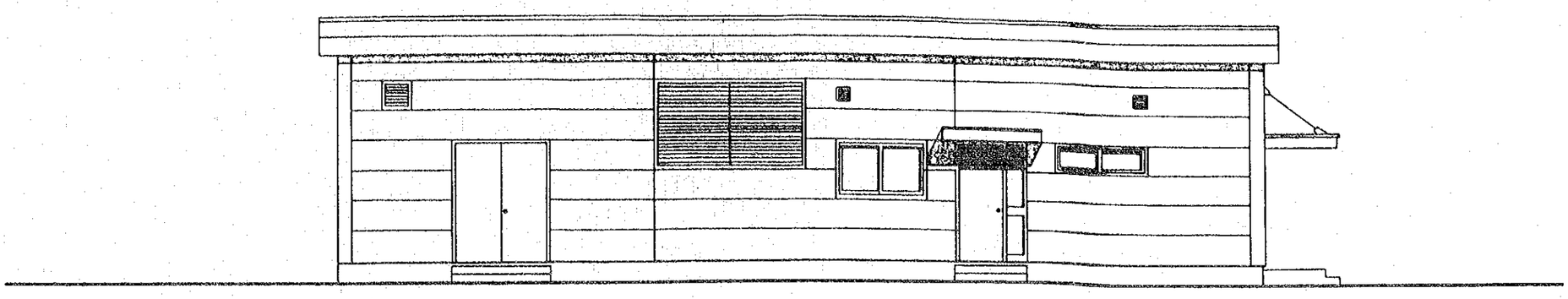
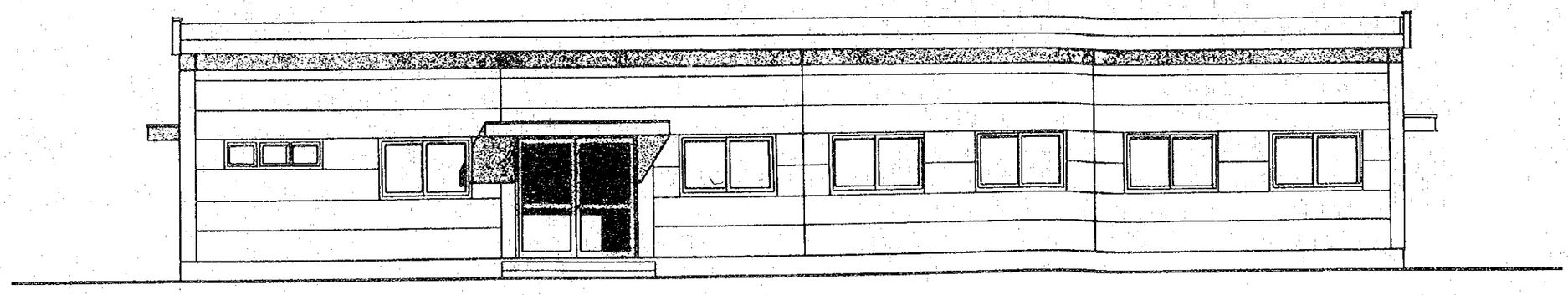


Fig. 3-4-19 Floor Plan of Station House of Songea Transmitting Station 1/100

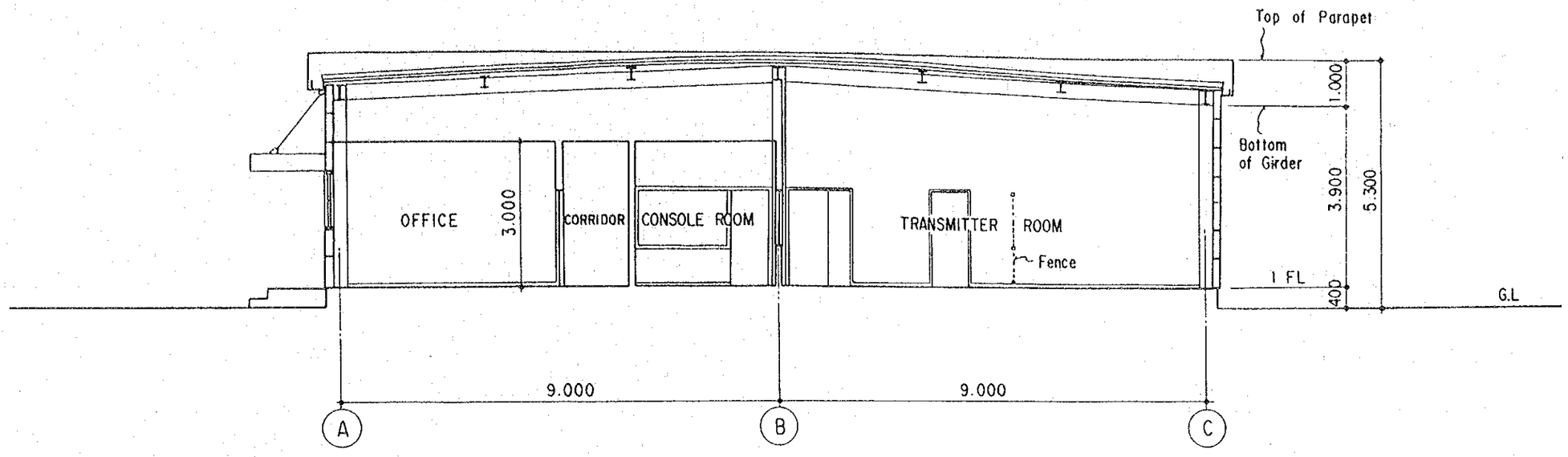


SIDE ELEVATION 1 / 100

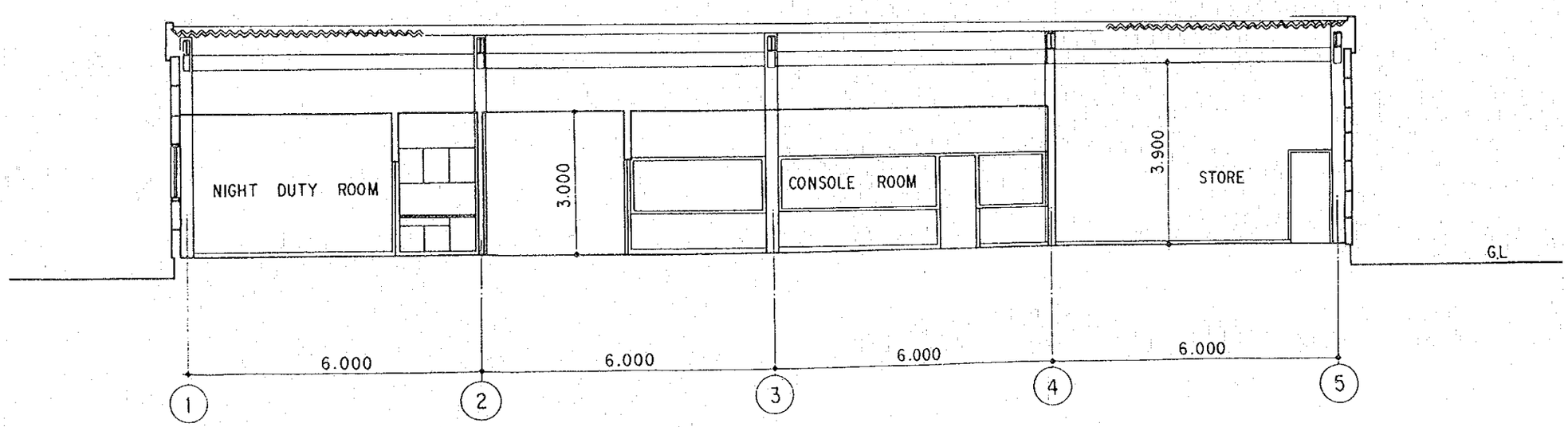


FRONT ELEVATION 1 / 100

Fig. 3-4-20 Elevation of Station House of Songea Transmitting Station 1/100



X - X SECTION 1/100



Y - Y SECTION 1/100

Fig. 3-4-21 Section of Station House of Songea Transmitting Station 1/100

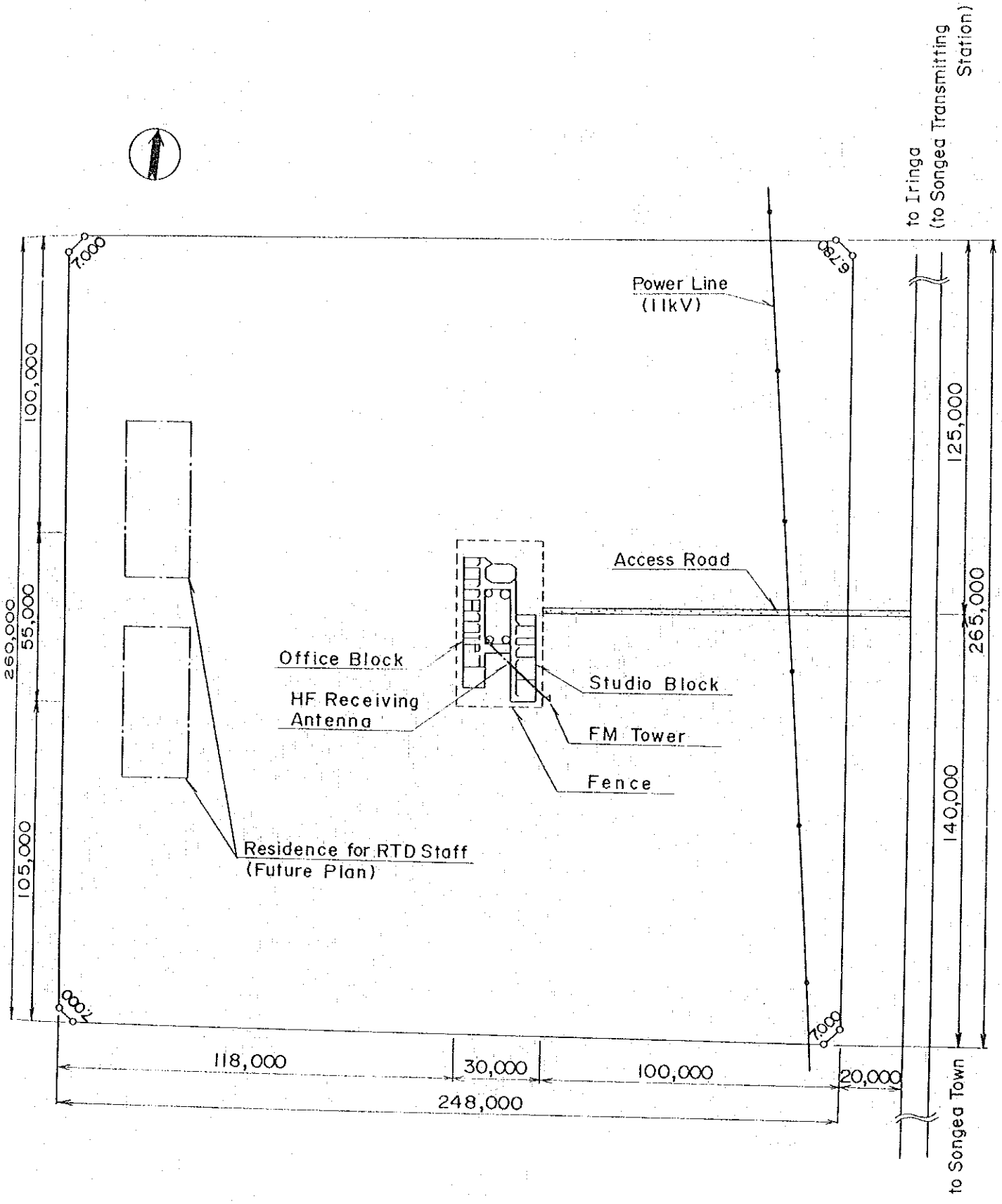


Fig. 3-4-22 Site Plan of Songea Studio

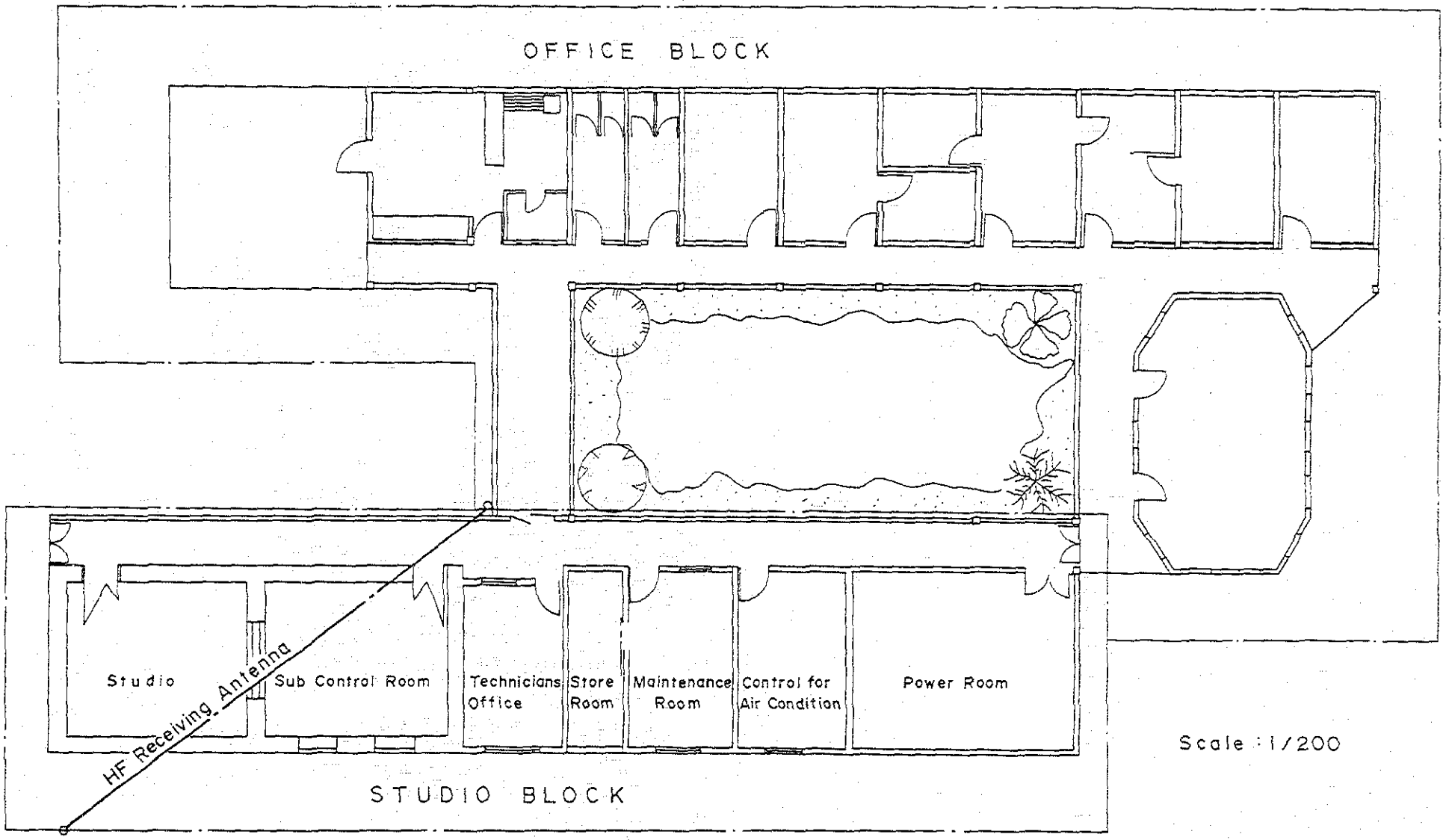


Fig. 3-4-23 Floor Plan of Station House of Songea Studio 1/200

CHAPTER 4 EXECUTION PLANS

Chapter 4 EXECUTION PLANS

4-1 Executing Body

This project will be executed by Office of the Prime Minister and First Vice President in the United Republic of Tanzania and RTD will take responsibility for carrying out the project under the control of this office.

RTD has been operating a radio broadcasting service with a consolidated organization and personnel as mentioned in 2-4 and maintaining well the three existing stations in Arusha, Mwanza and Mbeya and new two stations in Dodoma and Kigoma, which were completed in 1988 under Japan's Grant Aid, under its own maintenance schedule. Since the conditions of operation by RTD are very good and also their technical and managerial abilities are of high level, it is evaluated that RTD is qualified to be the executing body of this plan.

4-2 Current State of Building Industry and Construction Guideline

(1) Building Activities and Labour Conditions

The fifth 5-year Economic Development Plan is now under way in Tanzania and it is certain that the World Bank will furnish the Government of Tanzania with each 8 billion dollars for 1988 and 1989. Furthermore, development expenditure in the national budget for fiscal year 1988/89 is about double that of last year.

However, imports of raw materials and spare parts have decreased because of the imbalance of international trade, an increase of accumulated debt and a shortage of foreign currency. Thus the operations rate of industrial facilities have dropped and so the economy is still sluggish. Consequently, there are only few construction activities even at the economic center of Dar es Salaam, though a large scale building (10 storied) is under construction with foreign assistance.

Generally, the construction industry seems stagnant, and there exists a shortage of construction workers, particularly skilled workers. Since

it is uncertain whether it will be possible to secure these skilled persons, the design policy to minimize work requiring skills on the site becomes more important.

Working time is from 8 a.m. to 2 p.m. for governmental organizations and public offices but it is possible for construction workers to work until 4 p.m.

Both stations are far away from the cities, hence it is necessary to set the working time taking into account the commuting hours of the workers both in the morning and evening. As for simple work such as earthwork, external work and radial earth burying work, the labour force living around the transmitting sites can be expected to be available.

(2) Building Materials and Building Methods

General houses in local cities such as Nachingwea and Songea are of bearing wall structure with either bricks or soil using trunks and branches of shrubs as core lath. The roof, supported by a wooden truss, is covered with galvanized sheet iron. Buildings a little larger than the houses are of bearing wall structure in which the spaces between the corner posts and between the beams are filled with bricks. Roofing material is normally galvanized sheet iron. Multistoried buildings are few, and are mostly governmental buildings. Iron fences for crime prevention and insect screens are only used at openings, and fittings are seldom used. As a window fitting, plate glass louvered can be seen.

(3) Material Procurement Plan

As can be inferred from the above-mentioned state of the building trade, construction materials obtainable in the local market are limited, and acquisition of basic materials such as structural steel and reinforcing bars (round bars are produced in this country)is very difficult because these materials are very expensive and in short supply. Cement is being produced at 3 plants in Kunduchi, Mbeya and Tanga by technical introduction from West Germany, and it has been confirmed that this cement is suitable to use on this project in terms of its quality and quantity. Aggregates can be procured for both stations. Interior and

exterior materials are mostly imported, so they are very expensive, and supply is uncertain. Therefore, it will be preferable to procure them in Japan.

(4) Codes and Standards

The Department of Construction and Maintenance of the Ministry of Communications and Works controls the construction administration, and the Tanzania Bureau of Standards administers technical matters regarding buildings. Also the National Construction Council checks each construction plan. BS is employed as the technical standard for buildings.

Confirmation of a building application is not required but there exists a system to inform the construction committee in each region of the plan and register it.

4-3 Allotment of Scope of Work

Outline of the allotment of scope of work for the execution of this programme by the Government of Japan and Government of the United Republic of Tanzania is as follows.

(1) The scope of the works covered by the government of Japan

1) Equipment

a) Manufacturing, installation and wiring of broadcasting equipment

b) Manufacturing, foundation work and erection of antennas

c) Manufacturing, foundation work and fabrication of transmitting station houses

2) Basic Work

a) Water supply (in the site)

b) Power supply after low voltage (380/220V)

c) Telephone (ducts, pipes, terminal boxes and outlet boxes inside the station house)

3) External Work

a) Parking area and in-site road

b) Drainage (in the site)

c) Septic tank

4) Associated Work

. Transportation between Japan and the proposed sites in Tanzania

(2) The scope of the works covered by Government of the United Republic of Tanzania

1) Site, Building and External Work

a) Acquisition of the land for each site

b) Construction of the Studio Building

c) Clearance and demolishing of the lands for each site

d) Fencing

e) Landscaping

2) Basic Work

(a) City power

a) A city power line from outside site to the proposed site

b) Provision and Installation of a step-down transformer for Nachingwea Transmitting Station

c) Power supply for studui

(b) Water supply

Construction of the main water pipe to the transmitting site

(c) Telephone

a) Telephone line from outside the site to the proposed site

b) Telephone equipment for studio

3) Furniture and Utensils

. Procurement of necessary furniture and utensils

4) Steps, Commission, etc.

a) Bank commissions on the bank agreement

b) The expenses on the exemption of tax and tariffs

c) Undertakings on the customs clearance and inland transportation

d) Exemption of tax and tariffs on the Japanese nationals who work for the purpose of executing the Project under the agreement/contract approved by the Government of Japan

e) Undertakings to the above-mentioned Japanese nationals for getting permission for their entry, departure and stay for the purpose of their work on the Project

f) Maintenance and operation to ensure proper and effective operation and maintenance of equipment and facilities

which have been supplied and installed through Japan's grant aid

5) Others

Procurement for materials and installation works beyond the scope of grant aid agreement.

4-4 Execution Supervision Plan

In this Project, various works are conducted such as the construction of radio broadcasting stations in which medium-wave transmitters, studio equipment, and the related power equipment are installed, and the erection of the transmitting antenna masts of 89m and 133m high and a prefabricated house.

In order to carry out the above works smoothly and efficiently within the specified time frame of the works, it is necessary to send in appropriate specialists at the right time. It is also common to all projects that transportation influences the time period of the work. Since a large amount of sophisticated precision equipment is to be transported for use in this project, much attention is required.

From these points of view, it is necessary to select well-experienced contractors, and examine and set the stages of execution of the work very carefully. It is also necessary to exchange information sufficiently with the Tanzanian side so that this project may be executed smoothly as a joint undertaking.

Consultants make the detailed design, assigning of appropriate staff for supervision of the work, coordinate closely with not only related organizations of the Japanese side but also those of the Tanzanian side to make the execution of the work go smoothly. Also, they give appropriate and timely advice and guidance concerning the various problems that may occur or the matters concerning safety.

4-5 Materials and Equipment Procurement Plan

All of the broadcasting equipment, their related equipment and construction materials shall be procured in Japan.

The broadcasting equipment and their related equipment shall be inspected after assembly (factory inspection) in Japan as units or a system, and transported after being disassembled again as appropriate. After arrival at the site, equipment installation work shall be done and then the equipment shall be reassembled.

The transmitting house shall be of pure steel frame construction, and of prefabricated design using autoclaved light-weight concrete panels for the external walls and a folded structure of galvanized sheet iron for the roof.

A shelter shall be used for the tuning unit hut, of which the inside shall be shielded with aluminum plates. All of the above shall be procured in Japan.

Foundations for the transmitting house and antenna mast should be made on site. Cement and aggregate shall be procured on site but reinforcing bars shall be procured in Japan.

4-6 Execution Schedule

The necessary procedures to be taken for the execution of this project are:

- After the conclusion of Exchange of Notes between the Government of Tanzania and the Government of Japan, a Japanese consultant firm is appointed by the Government of Tanzania and the contract for the consulting service is concluded between them.
- After that, the detailed design and the preparation of the tender documents are carried out by the consultant and the tender takes place,
- After the evaluation of the tender, a contract for the execution of the project is concluded between the Government of Tanzania and the Japanese contractor, and the construction work begins.

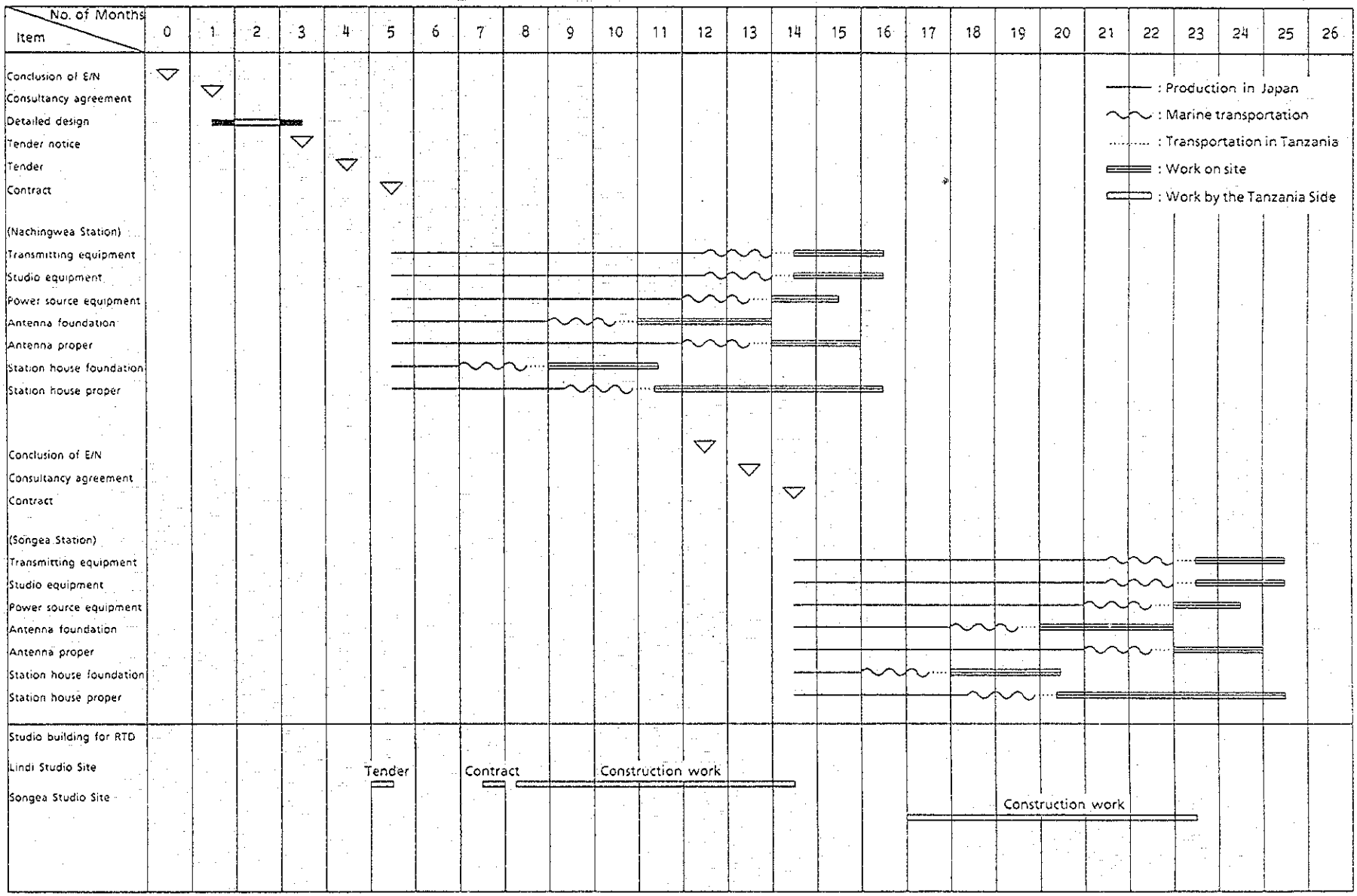
The term of the execution of this project will be divided into two phases. In the first phase Nachingwea station will be constructed, and Songea station in the second phase.

The total term including the 1st phase and the 2nd phase will be 20 months.

Given the period for curing the building, the studio buildings, which Tanzania will construct, must be completed at least half a month before broadcasting equipment is taken there.

The summary of the execution schedule is shown in Table 4-6-1.

Table 4-6-1 Execution Schedule



4-7 Cost Estimate of the Project

The portion of expenses paid for by the Government of Tanzania is estimated about at 1.33 billion TShs.

This estimate includes all local portion works necessary for this project: site clearance, construction of studio buildings, electric power supply, installation of telephone line, water supply and fencing of sites, etc. which are directly related to this project as shown in Table 4-7-1 .

Table 4-7-1 Breakdown of Business Expenses shared by Tanzania

Unit: 1,000 Tshs

Name of Site / Items	Songea TX station	Songea studio	Nachingwea TX station	Lindi studio	Mashi relay station	Total
Work for power supply	1,400	840	3,500	1,360	460	7,560
Works for program transmission (TPTC)	-	1,200	-	1,200	-	2,400
Work for site clearance	300	300	300	300	80	1,280
Studio Construction of studio block	-	(23,000)	-	23,000	-	46,000
Construction of office block	-	(29,100)	-	29,100	-	58,200
Work for the water supply	860	860	1,200	2,900	-	5,820
Work for outer fences	4,040	(2,300)	4,000	2,000	100	12,440
Sub-total	6,600	57,600	9,000	59,860	640	133,700
Grand total	64,200		69,500			133,700

( ) : To be established in 1989/90.

4-8 Maintenance and Management Plans

(1) Staff plan

The number of staffers necessary for new transmitting stations and studios after completion of this project are estimated based on the model of the existing Kigoma Station as shown in Table 4-8-1.

Table 4-8-1 Staff Planned for Each Station

Items	Present status		Plan	
	all RTD	Kigoma station	Nachingwea station	Songea station
Technical staff	204	16 *1	16	16
Staff for program production	100	2	2	2
Staff for news gathering	52	2	2	2
Clerical staff and assistants	348	25 *2	25	25
Total	704	45	45	45

*1 : Eight staffers for the studio + eight staffers for the transmitting station.

*2 : Driver, guard, typist, telephone operator and assistant staff (such as room cleaners).

A total of 90 staffers will be needed for the two new stations which will be installed in this project. There will be no problem about the recruitment of clerical staff and assistants because it is easy to employ them in each region. And regarding personnel for program production and news gathering, staffers under training at present will be assigned because personnel necessary for each station is small in number.

A total of 32 engineering staffers will be needed for this project. RTD plans to recruit more than 20 persons every year, including supplement for the present engineering staff during three fiscal years 1988/89, 1989/90 and 1989/90.

There is a limit in the number of graduates with a Full Technician Certificate and graduates with a Diploma Certificate from the technical colleges who are assigned to RTD every year by the Minister of Labour and

Manpower Development. Therefore, RTD plans to recruit the necessary number of people out of graduates from secondary schools and vocational training centers, which are good manpower resources, and to train them into assistant technicians by making full use of RTD's training system.

(2) Plan of funds

Annual expenses necessary for maintenance and operation of both Nachingwea (Lindi) and Songea stations after the completion of this project are estimated as shown in Table 4-8-2. Each expense in Table 4-8-2 was estimated roughly with reference to annual expenses (settlement) of Kigoma station, which is similar to both stations in scale of maintenance and operation.

Table 4-8-2 Operating Expenses for Nachingwea (Lindi) and Songea Stations

(Unit: 1,000 Tshs)

Items	Nachingwea (Lindi) station	Songea station	Total
Personnel expenses	1,280	1,280	2,560
Program Transmission Fee	1,500	1,200	2,700
Electric Power Charge	6,600	6,160	12,760
Maintenance Expenses	4,300	3,800	8,100
Program Production Expenses	400	400	800
Others	750	680	1,430
Total	14,830	13,520	28,350

Remarks: Personnel expenses are calculated on annual salary to be paid corresponding to a type of occupation, based on recruitment plan of each station.

4-9 Technical Cooperation

RTD, which has had many achievements and ample experience in radio broadcasting since the start of radio broadcasting in the nation in 1951, is currently operating the radio station of the same scale as those to be constructed in this project. Since RTD's key staffers are going to receive on-the-job training on composition of system, adjustment of

equipment and machinery and operation of systems during the implementation of this project, there will be no problem on the part of Tanzania in operating and managing the facilities and equipment after completion of this project.

Japan has been accepting many trainees from Tanzania to seminars and training courses on management, administration, program production and broadcasting technologies which are organized and implemented in Japan for them. RTD strongly hopes that Japan will continue to accept Tanzanian trainees to receive in-service training in program production and radio broadcasting technology.

Such seminars and training courses to be organized and implemented in Japan is not a necessary condition for operation and management of the facilities and equipment after completion of this project, but these will serve as a factor to increase the effect of this assistance project if they help RTD staffers to acquire advanced broadcasting and program production technologies, and thereby contribute to the broadening of the scope of radio broadcasting and the qualitative improvement of radio programs broadcast in Tanzania.

CHAPTER 5 EVALUATION

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Medium-wave radio broadcasting is an excellent medium in that it can simultaneously spread stable audio information over a wide area, and that it can be received by simple and inexpensive battery-powered receiving sets.

Having an extensive territory two and a half times the area of Japan, Tanzania does not yet have a well-developed infrastructure of communications and transportation which constitute a country's arteries. The Government of Tanzania is thus working to transmit news and information to regions by means of newspapers, periodicals or other publications; but it is facing difficult conditions in realizing this plan.

Because of this, medium-wave radio broadcasting has been drawing attention as the most stable and certain means of spreading information. The present medium-wave radio broadcasting service area, however, is now 52% (61 percent within 54dB of intensity field) of the total population. Accordingly, the majority of people cannot yet enjoy the broadcasting service.

This project aims to widen the medium-wave radio broadcasting coverage through the establishment of transmitting stations in two cities of relatively high importance. (Nachingwea and Songea are located in one of the greatest granaries along the east-southeast boundaries.) It also aims to contribute to the improvement of local residents' standard of living and to help community development by establishing complete program production centers in the two cities of Lindi and Songea to facilitate the gathering of information that is closely connected with the communities.

The realization of this project will enable an additional 2.32 million people to listen to the medium-wave radio broadcasting. Within an field intensity of 54dBμV/m, more than a 79% expansion of the broadcasting network (in terms of population) can be realized almost all over the country. This will bring common topics to more people and facilitate the sending of information on education, agriculture, and health and hygiene from the central government. Moreover, programs produced by the zonal

production centers will give information full of local color and thoughtful services to the people of the community and help to reduce regional gaps.

For RTD, which will manage the new facilities after the completion of this project, the Government of Tanzania not only has been allocating increased operation expenses for the two radio stations established during 1987 and 1988 but also has been meeting the yearly increase in necessary RTD expenditures by appropriating them in the budget. The Government also considers, as mentioned in 2-2-2, that the expansion of the medium-wave radio broadcasting network is of vital importance for socio-economic development, and that the expenditures for it are a reasonable government investment which corresponds to a direct acceleration in socio-economic development. As to the securing of technical and program personnel, RTD has its own training system for newly employed personnel and has been carrying out a 3-year plan for securing recruits including the filling of vacancies.

It has been concluded, therefore, that the Government of Tanzania will be able to secure the necessary personnel systematically by the time of completion of this project.

In the meantime, the diffusion of radio receivers has reached 2.5 million, which represents 70 percent of the total households of the country, despite the fact that medium-wave radio broadcasting service areas now cover only 52 percent of the population. This means a 100 percent penetration of radio receivers within the service areas as well as a 40~60 percent penetration even outside these areas. This indicates that a great many people live in areas where they can hear medium-wave radio but with great difficulty, or where they can only hear unstable short wave broadcasts. It also indicates that people have a great interest in listening to the radio. As some 2.32 million people living within the newly expanded service areas of Nachingwea and Songea are considered to become able to utilize medium-wave radio broadcasting immediately upon completion of this project, per-capita construction expenses would amount to only about 700 yen.

As shown above, the development project for a medium-wave radio broadcasting network in Tanzania is appropriate for Japan's cooperation through grant aid in every respect.

CHAPTER 6 CONCLUSION AND RECOMMENDATIONS

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6-1 Conclusion

Medium-wave radio broadcasting in the United Republic of Tanzania is the only means to transmit information efficiently over the extensive land area of the country.

The stations to be installed in Nachingwea (Lindi) and Songea under this project provide important remaining bases for building up an almost nationwide medium wave radio broadcasting network. They will have important functions as program production centers of their regions.

After the completion of this project, programs broadcast by the two stations will enable the dissemination of timely and appropriate information to the people in these regions, who have up to now relied upon unstable short wave broadcasting alone. This will help promote agriculture as well as build up human resources in Tanzania. This is expected to contribute significantly to the regional socio-economic development.

RTD, the operation agency in Tanzania, will be able to sufficiently meet the broadcasting network expansion under this project in drawing up of programs, operational systems, staffing and so on. There will be no problems either in the maintenance or in the operation of the completed facilities.

6-2 Recommendations

(1) Unification of Program Production

RTD is now broadcasting public relations and educational programs, some of which are produced by the ministries in charge (i.e. the Ministries of Agriculture and Livestock, of Health and Social Welfare, of Education, and so on), and some of which are produced by RTD itself.

To utilize radio broadcasting effectively after the completion of this project, it is desirable to improve the quality of radio programs so that more people will listen to the radio.

To that end it will be best to produce programs at RTD where experts can make free use of advanced production techniques. This should be true even in cases where the ministries concerned take charge of planning the programs.

It would be especially effective if RTD itself directly collects listener's opinions and proposals for radio programs by taking the monitoring surveys which have previously been conducted by the ministries concerned, and reflect them on the content of programs and programming. This will lead to the improved contents of radio programs.

(2) Zonal Broadcasting

In RTD, all programs are sent from the RTD headquarters located in Dar es Salaam to regional stations which only repeat the programs. But Tanzania has an extensive land area and embraces great diversity both in climate, and manners and customs.

People will relate more to programs which cover familiar topics such as local news and information for daily life, agricultural instructions in conformity with the regional weather, and information on health and hygiene relating to the local climate.

After the completion of this project, zonal program production centers where locally produced programs can be broadcast will total four, including those of two stations in Dodoma and Kigoma. RTD hopes that nationwide and zonal broadcasting from each station will be executed in equal condition with the above two stations after completion of the three program production centers in Arusha, Mwanza and Mbeya, which will be installed during the period of the 5-year plan.

However, it is desirable that this system of nationwide and zonal

broadcasting should be introduced experimentally and gradually at least in Dodoma station, where program resources will become more plentiful according to the progress of transfer to the future capital city.

(3) Diffusion of Radio Receivers

To be effective, it is necessary to make efforts toward the spread of radio receivers along with innovations in program contents so that more people can listen to the radio.

It is recommended that domestic production of low-priced radio receivers such as one medium-wave band radio receivers be increased and also distribution channels be improved so that they can easily spread among the people. Although the Government of Tanzania has been making efforts to do so, it is urgently necessary to establish a concrete long-term plan, including the allocation plan of foreign currency for importing the materials necessary for increased production of radio receivers.

Another recommendation is that maintenance expenses be reduced by using solar batteries in place of the dry-cell batteries which are now generally used as power sources.

(4) Construction Work by the Tanzanian Side

Construction work implemented by the Tanzanian side is shown in 4-3. The most important local portion work is to build the two studio complexes in Lindi and Songea. Both studio complexes should be constructed by the dead-line shown in Fig. 4-6-1.

Leveling the ground for the transmitting stations, preparing the service lines of a commercial power source, preparing electric wiring for installing of broadcasting equipment in production rooms and preparing TPTC lines are all indispensable for the smooth realization of this project. It would therefore be essential for the Government of Tanzania to take necessary actions to secure a special development budget for allocation in 1988/89~1989/90 fiscal years. Besides, RTD

should dispatch to both sites one or two engineers as supervisors, who will supervise the progress of all local work.

(5) Strengthening RTD's training system for acquiring engineering staff

RTD has been making efforts to utilize the training system for acquiring and training engineering staff, but it is more necessary to strengthen further the training system aimed at acquiring and training mainly C-class qualification holders of whom RTD can expect many applicants, and to further improve and systematize training plans.

To execute continuously the development plan for radio broadcasting network, it is important to make a 5-year staff plan at least in consideration of the number of recruits required each year including replacement of retired employees, duration of training courses, on-the-job training, and so on. And also it is more important to execute this plan steadily according the schedule.

(6) Long-term plan for developing the medium-wave radio network

RTD has established a program to install a 100kW transmitting station in Morogoro and two 50kW transmitting stations in Jornsecornor and Tabora during the 5-year plan (1988/89-1992/93) after the completion of two 100kW broadcasting stations in Nachingwea (Lindi) and Songea.

But the following outlook would become apparent if the whole service area were to be set on the population distribution map.

1) The whole service areas will become about 79% in terms of population within the range of 54dBμV/m field intensity after the completion of Nachingwea and Songea stations.

2) Among these, the service area of Nwanza transmitting station will cover almost all of the Kagera region and a part of the Mara region, considering the propagation characteristics above the water surface of Lake Victoria.

3) Morogora region will be within the service areas of Dodoma and Dar es Salaam stations.

Accordingly, in the development plan for medium-wave radio broadcasting network of the national service, as the most efficient way to achieve the primary purpose of attaining a 100% coverage, it is reasonable to make an installation plan for installing transmitting stations in the following order of priority:

① 20kW station in Tanga
② 50kW station in Tabora
③ 20kW station in Jornsecornor (registered with IFRB as "50kW")

In order to establish an overall long-term plan to expand the radio broadcasting service in Tanzania before carrying out the installation plans as mentioned above, it is necessary to review the previous installation plans which have been registered with the IFRB and, at the same time, to conduct a comprehensive feasibility study in Tanzania. Such a feasibility study should cover various aspects of existing conditions, including the superannuation and shortage of equipment for radio program production which is in the charge of different ministries, as well as the needs for renewal of superannuated equipment and facilities at the existing broadcasting stations including the RTD headquarters.

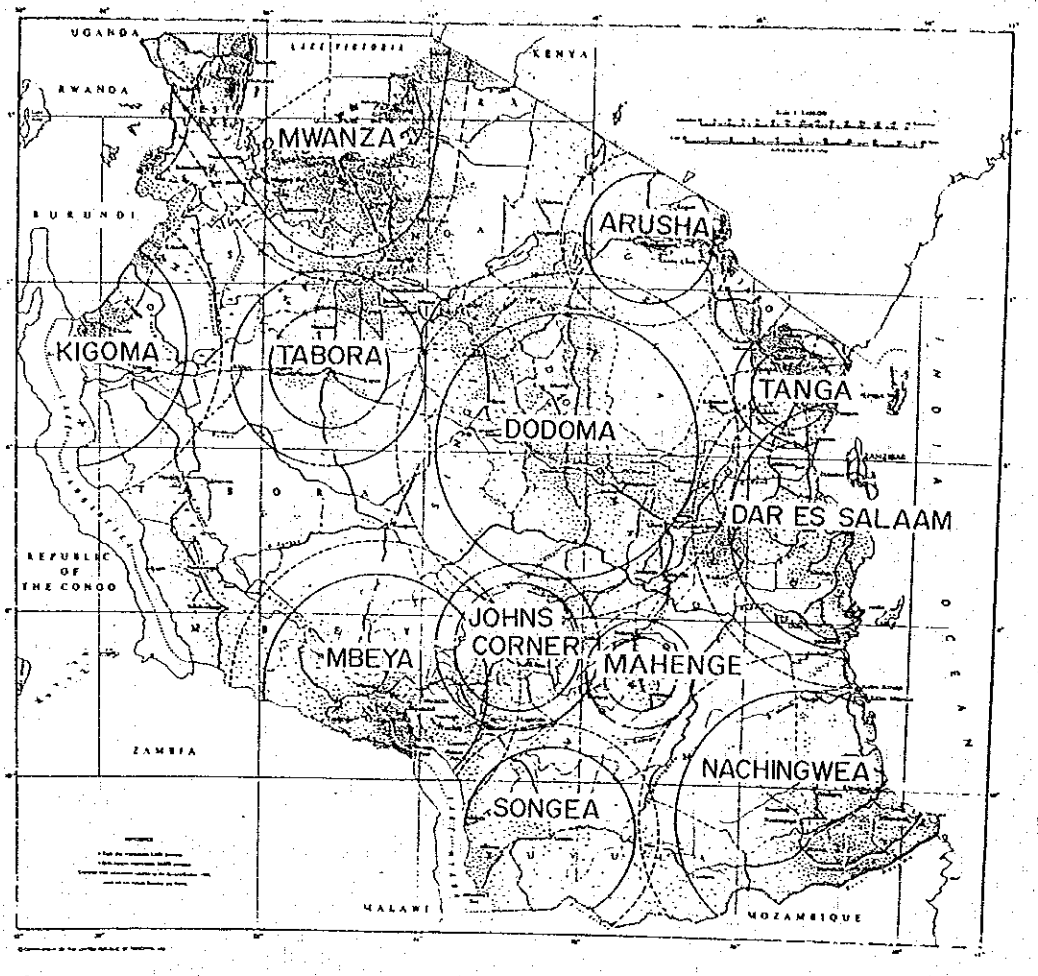

Fig. 6-2-1 Proposed plan to promote expansion of an efficient medium-wave radio network