BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR REPLACEMENT
OF
MEDIUM WAVE TRANSMITTER
OF
HIGH POWER TRANSMITTING STATION
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH

MARCH 1989

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to the request of the Government of the People's Republic of Bangladesh, the Government of Japan has decided to conduct a Basic Design Study on the Project for Replacement of Medium Wave Transmitter of High Power Transmitting Station and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Bangladesh a study team headed by Mr. Kenji Kamei, Deputy Director of Frequency Planning Division, Telecommunications Bureau, Ministry of Posts and Telecommunications, from November 16 to December 3, 1988.

The team exchanged views on the Project with the officials concerned of the Government of Bangladesh and conducted a field survey (in the Savar area). After the team returned to Japan, further studies were made and the present report has been prepared.

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

I wish to express my sincere appreciation to the officials concerned of the Government of the People's Republic of Bangladesh for their close cooperation extended to the team.

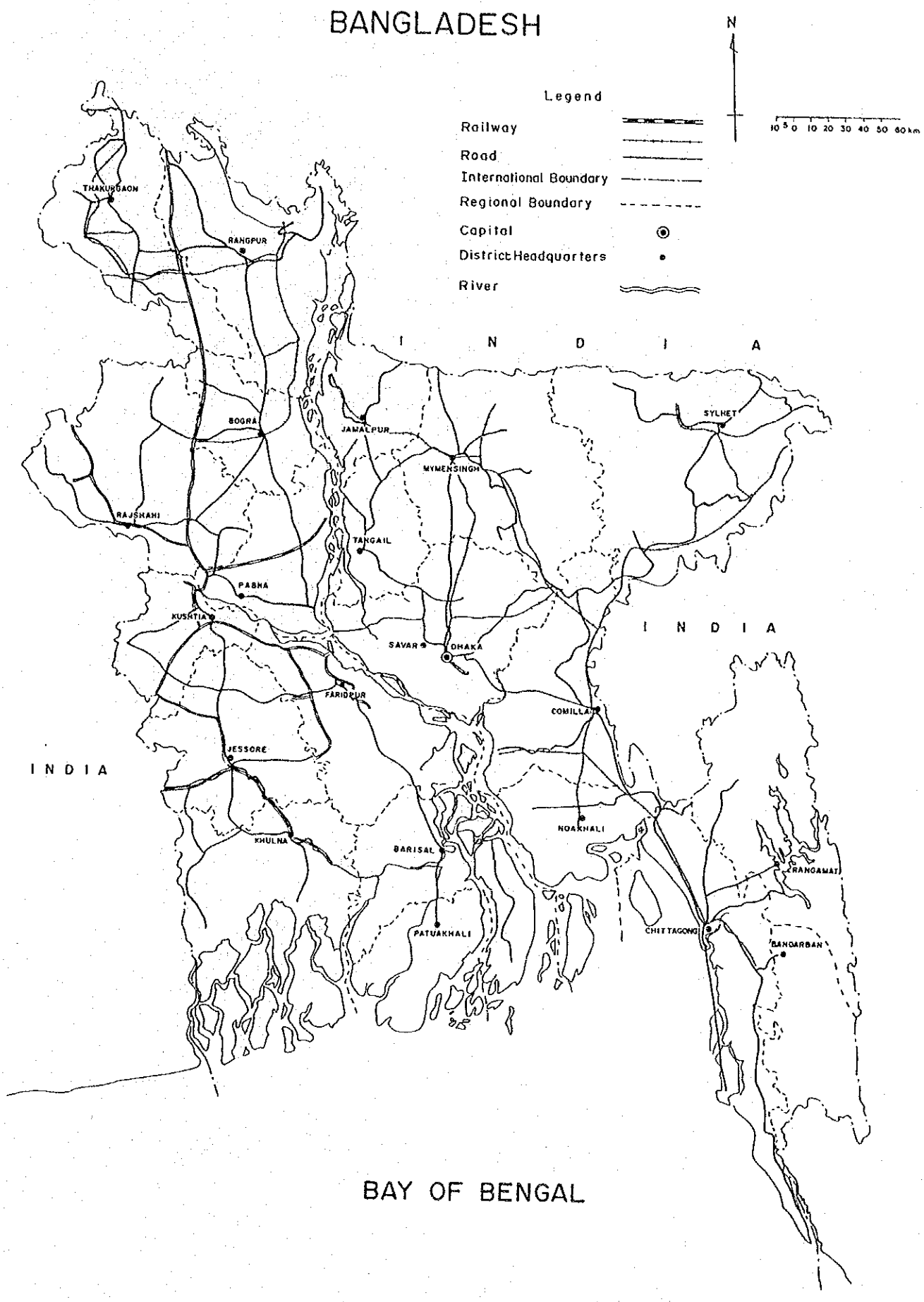
March, 1989

Kensuke Yanagiya

Kensuke Yanagiya

President

Japan International Cooperation Agency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Capital
District Headquarters
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BOGRA
JAMALPUR
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RAJSHAHI
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SAVAR
DHAKA
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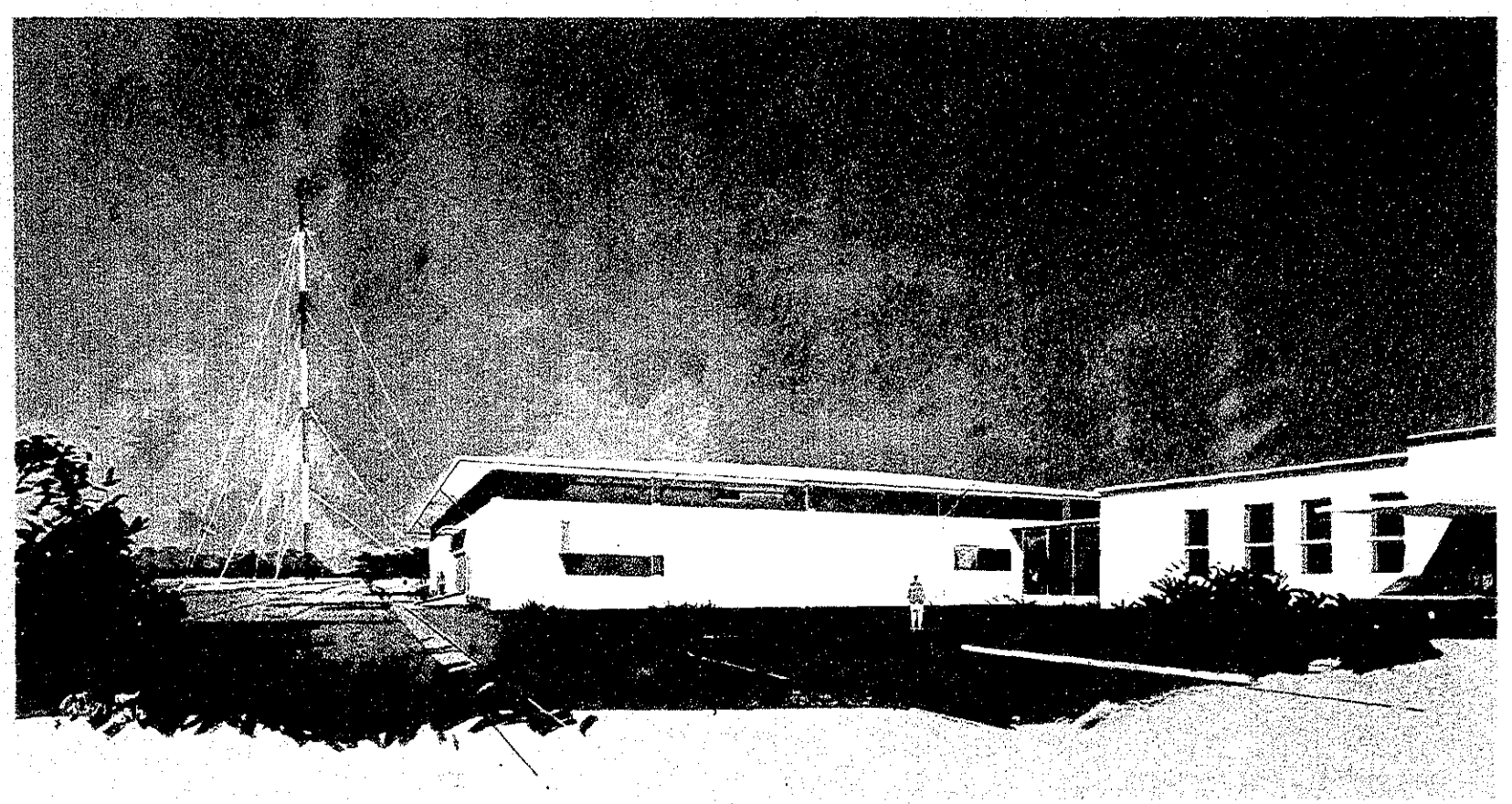

Perspective of Savar Transmitting Station

SUMMARY

Summary

At present the Government of the People's Republic of Bangladesh is implementing the Third Five Year Plan (1985 - 1990) for the development of the country. In order to promote the plan more effectively , mass media is essential to convey information to the whole nation, and consequently the importance of radio broadcasting had been emphasized. In accordance with this, Radio Bangladesh, the sole radio broadcasting organization has been contributing greatly to the development of the country by broadcasting programmes related to enlightenment of education, promotion of agriculture, weather information, general news and regional developments.

However, more than 25 years have passed since the present transmitter (100 kW) in Savar Transmitting Station having a wide coverage area centered on the metropolitan of Dhaka City was installed in 1963.
Therefore, the transmitting facilities are in a condition of superannuation, and in additon to this, as the manufacturers have stopped making the needed spare parts, it has been very difficult to execute proper maintenance. Considering the present store of spare parts, the remaining service life of the transmitter facility is estimated at only 2~3 years.

Furthermore, because of interference from co-channel or adjacent channel frequencies radiating from the high-power transmitters of neighbouring countries, the broadcasting area of Savar Transmitting Station is becoming narrower. Thus, in order to restore the coverage area to the original state, it is desirable to install a high-power transmitter.

To solve such an urgent problem, the Government of Bangladesh had made a request for Grant Aid from the Government of Japan in relation to the renewal project for increasing the output power of the present transmitter to 500 kW (630 kHz) for the accomplishment of the above-mentioned objective. In response to the request, the Japan International Cooperation Agency (JICA) carried out a field survey for the basic design.

During the field survey, in addition to the condition of the transmitter, antenna, power facility, station building, station site, duties of the staff and operational system, the condition of radio waves arriving in Dhaka City and regional cities were also investigated.

Thew results of the field survey are as follows.

(1) It was confirmed that there is a great fear that suspension of broadcasting may occur for a long period because the transmitting facilities of Savar Transmitting Station are superannuated, and furthermore, it is impossible to obtain spare parts for maintenance.

(2) It was confirmed that there was interference from neighbouring countries. In this field survey, at nighttime, considerable strength of interference was confirmed at Sylhet City (north-east of Dhaka City) which is near the border of India, and a slight interference was confirmed also at Rajshahi City (north-west of Dhaka City). In addition, regarding the frequencies, it was confirmed that inferference with 630kHz was less than that with the present 819kHz. From the items mentioned above, it was judged that it is desirable to renew the transmitting facilities of Savar Transmitting Station urgently to 630kHz, 500kW.

The outline of the basic design for this Project follows.

The principal equipment and materials for the transmitting facilities of this Project based on Japan's Grant Aid are as follows:

Items	Quantity	Remarks
Medium wave transmitter equipment 500 kW (250 kW × 2 sets)	1 set	Including dummy load and output power combiner
Antenna system	1 set	Remodelling of the existing antenna, including aviation obstruction lighting system
Audio equipment	1 set	
Measuring equipment	1 set	
Feeder line	1 set	
Power source facility	1 set	
Installation materials	1 set	
Spare parts	1 set	

According to the implementation of this Project, the broadcasting area of Savar Transmitting Station will be expanded and it will become possible to conduct high quality medeium wave radio broadcasting all area the country. The comparison between the broadcasting areas coverage [Note] is shown in the following Table.

Coverage existing [819kHz, 100kW]	Plan [630kHz, 500kW (250kW 2 sets)]
Population (Coverage rate against total population)	30% 71%
Area (Coverage rate against whole territory)	20% 61%

Note : Coverage area : It is also called "Service Area". It is the broadcasting area of which the signals is received in a good condition.

Radio Bangladesh is the main organization related to the construction work and operation of this Project. RB has many years of experience in the construction, maintenance and operation of transmitting stations.

Among the technical staff, there are many who already have experience in working at high-power transmitting stations such as 100 kW and 1000 kW stations, and many who have been trained in foreign countries. Therefore, there is no shortage of the manpower required for operation of the new facilities .

Also, the running cost of the new facilities has been authorized in the Project Proforma prepared by NBA, and the implementing system for this Project has been arranged.

The construction works that are to be borne by Bangladesh side are such as; addition of room for transmitter and power source, new antenna tuning house, change in route (Mirpur side) for receiving commercial power, and increase the capacity of receiving commercial power. The budgetary steps for these have already been considered.

The total cost required for this Project is estimated about 1079.1 lakh TK (include CDST) which is to be borne by the Bangladesh side. In addition, the expected term of the construction work, after concluding the Exchange of Notes between the two countries, is as follows: consultant contract, detailed designing, tendering - about 3.5 months; manufacture of equipment - about 6.0 months; transportation of equipment - about 2 months; installation, adjustment and inspection of equipment - 3.5 months, for a total of 14.5 months.

In order to increase the transmitting power for this Project, at present, NBA is proposing the change in power to 500kW through IFRB, in respect to the administrations that may be influenced with the change, NBA is negotiating with them to obtain their agreement.

Thus, the gains of expanded coverage resulting from the renewal of the facilities will be about 2.4 times in terms of population, and about 3 times in terms of area. Thus, the Savar Station will become an important part of the nationwide broadcasting network second in scale only to

Dhamrai Transmitting Station, and the broadcasted weather forecast programmes including information on cyclones which cause enormous disasters will be beneficial to the residents of the region.

Thus, as the effects of this Project according to the grant aid is jedged to be great, it is desired that this Project will be materialized at an early stage.

CONTENTS

CHAPTER 1 INTRODUCTION

CHAPTER 1 INTRODUCTION

In 1971 Bangladesh achieved independence, as a result of the Third India-Pakistan war. After that, political power had changed hands several times, but at present the Government of Bangladesh is implementing the Third-Five Year Plan (1985-1990) on the basis of the following targets.

1) Expansion of industrial employment

2) Limiting of increase in population rate

3) Popularization of elementary education and development of human resources

4) Reform of structure and development of technical foundation for accomplishment of long-term plans

5) Self-sufficiency in food production

6) Meeting the nation's fundamental requirements

7) Promotion of economic growth

8) Advancement of self-sufficiency

In Bangladesh, with only a short history since its independence the promotion of agriculture, construction of the nation through regional development, and establishment of the national economy are urgent necessities. A particular problem at present is the low literacy rate of 26%. Therefore, programmes related to the promotion of agriculture, advancement of the population plan, unification of the nation, heightening of the cultural level, weather forecasts, weather alert information on cyclones, dissemination of various information and news, etc., are presented through means of radio broadcasting and great expectations are placed on this form of media which conveys information simultaneously over a wide area.

NBA has devised a plan to renew the existing 100 kW radio transmitting facilities of Savar Transmitting Station, and provide a 500 kW (250 kW × 2 sets) of transmitting power. The Government of Bangladesh requested grant aid of the Government of Japan. In response to this request, the Government of Japan decided to execute a Basic Design Study for the Project through JICA and sent a study team to Bangladesh headed by Mr.Kenji Kamei, Deputy Director, Frequency Planning Division, Telecommunications Bureau, Ministry of Posts and Telecommunications, from November 16 through December 3, 1988.

The team comfirmed the required contents, the back ground of the Project, the scope of work to be the responsibility of the Bangladesh side. Also, the team implemented field surveys on the main facilities of RB and site surveys related to the Project.

After the field survey, the effects of the Project and its validity were reviewed in Japan in view of grant aid cooperation and the Basic Design was done in terms of the facilities, equipment and scale most suitable to the cooperation.

This report was arranged as the Final Report on the Basic Design and includes the implementation plan, execution schedule, evaluation of the Project and recommendations. It is to be noted that the Minutes of Discussion, Staffing of the Basic Design Study Team, Study Schedule, etc., are collected in the reference materials (Appendices NO. 1 ~No. 4).

CHAPTER 2 BACKGROUND OF THE PROJECT

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2.1 Outline and Usage of Broadcasting of the Bangladesh

(1) Topography

The territory of Bangladesh is a plain with an area of 143,999 km2 (about 0.38 times the area of Japan) situated at latitude 20°30' - 26°45' N and longitude 88°01' - 92°56' E. The territory is a large delta zone, the biggest in the world, formed by two rivers, the Ganges originating in the Himalayas, and the Brahmaputra originating in Tibet, which join together and become a large river flowing into the Bay of Bengal. The Brahmaputra River divides the territory in a east and west direction, and the Ganges River divides the territory in a south and north direction. Thus, the territory is divided in four large regions.

The rivers occupy as such as 10% of the territory of the country. The altitude of the rivers is almost 10 m above sea level excluding the hilly zone in the south-east part of Chittagong Hill Track and the north-east part of Sylhet, etc., and in the rainy season about half of the country's land is under water. The southern part of the country borders on the Bay of Bengal and the east, north and west parts are surrounded by India. The south-east part is the border zone with Burma. The majority of the territory is flat and it is an accumulation of alluvial soil.

(2) Weather

The temperature is uniform. In the winter season, the temperature is between 9.8°C ~ 13.4°C, and in the summer season it is between 25.5°C ~ 26.0°C. The highest average temperature in January is between 24.1°C ~ 25.8°C, and in July it is between 29.9°C ~ 31.8°C. The annual rainfall is 1270 mm in the western part, 2540 mm in the northern and eastern parts. In the mountainous zone of the Sylhet region, it rains as much as 5080 mm. The rainfall is frequently

accompanied by cyclones and typhoons of tropical atmospheric pressure.

1) The climatic conditions of Dhaka City are indicated in the following table.

Item \ Month		1	2	3	4	5	6	7	8	9	10	11	12
Humidity (%)	Min.	34	24	23	34	41	61	51	61	63	42	37	34
	Max.	92	89	85	89	88	91	94	92	92	92	89	93
Wind Velocity (m/s)	Max. record	7	16	20.1	19	24.5	10.8	10.7	6.7	12.3	23.2	10.3	6.5
	Average Velocity	7.6	1.7	2.2	2.7	2.5	2.2	2.1	2.0	1.8	1.7	1.3	1.2
Rainfall (m/m)	Max.	99	95	195	318	708	856	891	540	566	568	172	86
	Min.	0	0	0	17	69	161	140	92	91	29	0	0
	1986-87 average	4	0	33	230	109	297	526	462	363	104	7	33
Temper - ature (°C)	Max.	34.2	36.6	40.6	42.3	40.6	38.2	35.2	35.9	35.3	38.8	33.3	31.2
	Min.	5.6	4.5	10.4	15.6	18.4	20.4	21.7	21.0	22.0	10.4	17.6	6.7
	1986-87 Max.	26.7	30.4	33.2	33.8	34.9	34.0	31.4	31.9	32.3	32.4	30.3	27.4
	1986-87 Min.	13.1	16.4	20.7	23.9	24.7	27.2	26.5	26.6	26.6	24.3	20.2	15.2

2) Cyclones

The atmospheric low pressure that is generated in tropical waters is called a tropical cyclone, and such cyclones with maximum wind velocity over 33 m/s occur above the Indian Ocean. These correspond to the so-called typhoons of Japan which occur most often in the rainy season between March and October, especially between May and June.

There is a record (received from Radio Bangladesh) of a cyclone in 1985 which had a wind velocity of 160 m/h (46 m/s), a flood-tide of 7.5 m, which caused over 15,000 deaths.

In 1988 there was a particularly unusual atmospheric phenomenon which occurred. In August two-thirds of the country's territory was covered with the worst flood which had ever occurred. As a result of this flood, some 40 million people lost their houses. Following this catastrophe, in the middle of November, a cyclone with a wind velocity over 30 m/s hit the coastal zone centered on the southern Bay of Bengal, and about 1500 people were killed or missing. Furthermore, in late November, a cyclone with a record-breaking wind velocity of 180 Km (50 m/s) hit the Bengali coast and the south-west region. Even in Dhaka City, a great number of houses collapsed and electric power lines and communication lines were cut off. More than 1000 people were killed and more than 6000 people were missing. There was also great damage to cereals, cattle, etc.

As for records of severe cyclones, the following are given. Atmospheric conditions in 1988 were particularly unusual.

- 1985-46 m/s (Data received from R.B.)
- August 1988-30 m/s (The Bangladesh Times)
- November 1988-50 m/s (The Bangladesh Times, The World News)

Most of the records given above are those of the southern region of Bangladesh including the Bay of Bengal, but in November 1988, even in Dhaka City there was a recorded wind velocity of about 30 m/s observed.

It is very important to broadcast weather information exactly and promptly, including cyclones, from the view point of saving lives of many people and to protect their properties. Therfore, a highly reliable broadcasting is desired.

As close contact is maintained between RB and Meteorological Bureau by means of telephone and tele-printer, RB is available to obtain the latest information for emergency broadcasting, and is ready to prepare for disasters.

(3) State of Population and Education

One well-known feature of Bangladesh is that it has a large population. On the basis of the National Census 1981, the population prediction which the Ministry of Health and Population Control made in the "Third Five-Year Plan is as follows (1984 ~ 1985 Statistical Yearbook of Bangladesh).

1981	87.1 million people	(National Census)
1985	99.2 million people	
1986	102.9 million people	
1987	104.1 million people	
1988	106.6 million people	
1989	109.1 million people	
1990	111.7 million people	

The average rate of increase per year is 2.8% and as the population density was 605 people/km^2 in 1981, it will become 775 people/km^2 in 1990. In respect to the composition according to age, the number of school age persons (age from 5 ~ 24) was 46.9% of the whole population.

The population density of Bangladesh is about more than twice of that of Japan. For this reason supression of population is one of the important policies for the Third-Five year plan, aiming at 1.8% increase by the year 1990. To achieve this target, nationwide enlightenment programmes are being broadcast through Programmes A, B and C. Among the daily broadcasting hours, the rate of these programmes is between 3 ~ 7%.

In primary schools, five years are compulsory education. The rate of persons attending school is: primary school (age from 5-9) 72.8%; secondary school (age from 10 ~ 14) 22.17%; and college, institutes and university (age from 15 ~ 24) 2.03%.

The classification of kinds of schools/number of schools, and the ratio of teachers/students are as follows:

Classification of schools	Number of schools	Teacher/Students
Primary school	43,865	1 : 52
Secondary shool	8,551	1 : 27
Professional school (Regular)	657	1 : 30
Institutes (Commerce & Industry, Professional and Religious, etc.)	3,548	
University	6	1 : 16

The literacy rate was 26% in 1985 (male : 40%, female : 18%). (Year-Book of South-East Asia)

Diffusion of education and development of human resorces are the important policies for the Government's Third-Five year plan. The rate of educational budget of fiscal year 1983 corresponds to about 3.4% of the total budget Programme-B from Savar Transmitting Station is a broadcast toward the whole country and the feature of the programme is education.

Of the daily broadcasting hours the rate of these programmes is about 12%.

Besides this programme, there is a Programme-C which is composed of educational programmes mainly for the metropolis.

(4) National Economy of Bangladesh

The outline is as follows:

1) Gross National Product (GNP) : 15,840 million dollars (1986)
2) Economic Growth Rate : 4.5% (1973 ~ 1985)
3) GNP per Person : 157 dollars (1986)
4) Rising Rate of Consumer Goods : 10.7% (1985)
5) International Balance of Payments

(unit : million dollars)

	1980	1986	1987		
Export	793	880	1077	Trade Balance	Current Account
Import	2353	2301	2458		
Receipt	288	427	304	Excluding Trade Balance	
Deficit	551	670	655		
	2451	3064	3151	Transfer Balance [Note]	

Note: Includes economic cooperation such as compensation, donations and grant aid (National Statistics Directory 1988)

6) Economic Cooperation : Total amount of Official Development Aid (ODA) 248.5 million dollars, of which 49.4 million dollars are grant aid (1986)

(5) National Development Plan

The present administration has converted the former adminstration's policy by returning the factories to the private ownership, and is promoting a new industrial policy which is mainly based on private enterprise.

In the Third Five-Year Plan (1985 ~ 1990), the amount of investment is 386,000 million TK (including about 210,000 million TK of foreign aid).

The specific targets to be accomplished are as follows:

① Annual Growth Rate 5.4%
② The production of food for 1990 is aimed at 20.7 million tons for self-sufficiency in food.
③ To hold down the rate of increase in population to 1.8% (the average in 1980 ~ 1985 was 2.6%).

In addition, it should be noted that the targets for the "Third Five Year Plan" are as follows:

1) Expansion of industrial employment
2) Limiting of the rate of increase of the population
3) Popularization of elementary education and development of human resources
4) Reform of structure and development of technical foundation for accomplishment of long-term plans
5) Self-sufficiency in food production
6) Meeting the fundamental requirements of the nation
7) Promotion of economic growth
8) Promotion of self-sufficiency

In order to accomplish the targets of the Government's development plan, it is necessary to notify the objectives exactly to the whole nation. Therefore, radio broadcasting is an essential medium. Especially for the accomplishment of self-sufficiency on food production, it is very important to provide proper information for people engaged in agriculture which occupies 65% of the total labour population. Therefore, RB is allocating about 5 ~ 10% of daily broadcasting hours of each of the Programmes-A, B, and C for this purpose. In addition to this, public information of the Government is also broadcast daily through each of these programmes in combination with news and programmes toward the whole nation.

2-2 State of Broadcasting in the People's Republic of Bangladesh

2-2-1 Radio Broadcasting

(1) History

The radio broadcasting service was commenced in 1939 during the rule of Great Britain, and the present Radio Bangladesh (RB) became the National Broadcasting Organization since in September 1972, after the era of East Pakistan (1947-1971).

From the recognition that broadcasting is indispensible for the security and development of the country, the Bangladesh Government is making every endeavor to enhance the radio broadcasting facilities through the First Five-Year Plan (1974-1979) and the Second Five-Year Plan (1980-1985).

(2) Organization and Staff

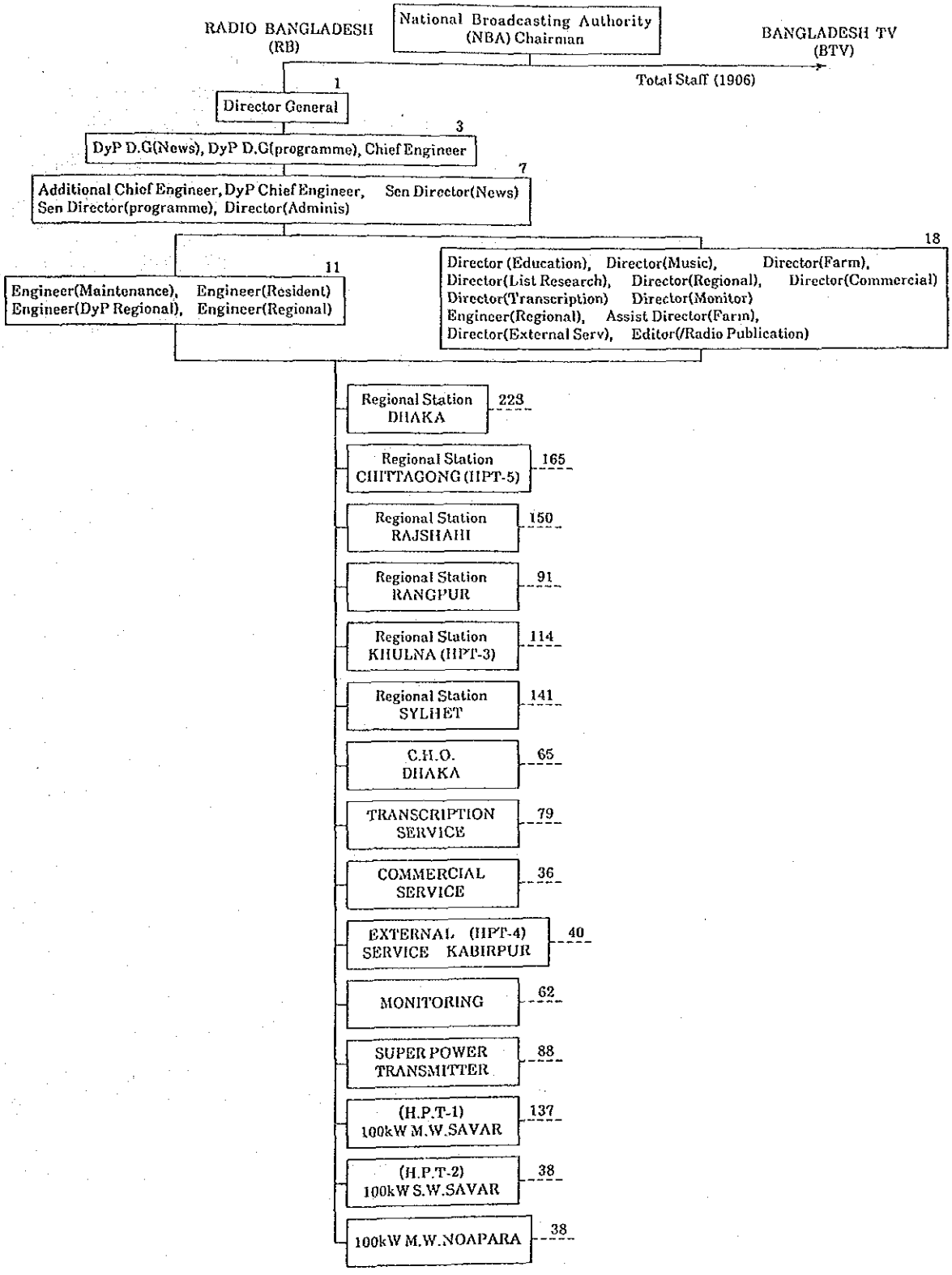
The National Broadcasting Authority (NBA) is composed of two organizations, Radio Bangladesh (RB) and Bangladesh Television (BTV), and the operation of broadcasting undertaking is unified. At present, three radio systems and one television system are in operation. The Ministry of Information had been directly controlling the broadcasting organizations, but based on the President's order in 1987, one independent "Board of Management" was established as the controlling organization.

Table 1 is the organization chart of the total staff of 1906 members of Radio Bangladesh.

(3) Programmes

RB as well as BTV (Bangladesh Television) is producing and transmitting programmes in accordance with the general programme principles established by NBA. In the general principles, four targets of the radio and television service as an intensive form of mass media are described. These are "Conveyance of Information", "Popularization of Education", "Enlightenment of Enterprise Development" and "Presentation of Healthy Entertainment".

Table 1 Organization Chart of NBA



At present, the three medium wave systems as follows are broadcasting to the entire country, and the details of transmissions are given in Table 2.

1) Dhaka Programme-A : This is a broadcast from the 1000 kW Dhamrai Transmitting Station to the entire country. The programmes broadcast deal with news (in Bengali and English), agriculture, religion, music, weather forecasts, family planning, military personnel information, etc., and the contents are given in Appendix No. 5-1. The broadcasting time is: 6:00(winter season, 6:30) ~ 10:30, and 17:00 ~23:30, or about 11 hours a day.

2) Dhaka Programme-B : This is a broadcast from the 100 kw Savar station to the entire coutry. The programmes deal with news (in Bengali and English, etc.), agriculture, religion, school and general education, weather forecasts, family planning, music and commercials. The contents are given in Appendix No. 5-2. The difference between Programme-A is that programmes related to education and commercials are composed. Especially, in respect to commercials, they occupy almost half of the daily broadcasting hours. The broadcasting time is 6:00 (winter season 6:30) ~7:30, and 10:30 ~ 23:30, or about 14 hours and 30 minutes a day.

3) Dhaka Programme-C : This programming is transmitted from Savar Station. It is local programming centered on Dhaka including commercials and programmes partly from Programme-A and B (Refer to Appendix 5-3). The broadcasting time is 7:30 ~ 22:00, or about 14 hours and 30 minutes a day.

Table 2 Broadcasting Hours & Breakdown of Broadcasting Programmes, Transmitted from Dhaka MW Radio Station

Programme	Broadcasting Hours	Ratio
Programme A		
Weather Forecast & Information	20min.	3%
News & Related Topics	2h 5min.	19%
Religious & Related Topics	1h 5min.	10%
Cultural Topics	1h	9.2%
Family Planning & Related Topics	20min.	3%
Music	3h 30min.	32%
For Army Personnel	35min.	5.3%
Agriculture	1h 15min.	11.5%
National Hook-up	15min.	2.3%
Others	30min.	5%
Programme B		
Weather Broadcast	15min.	1.72%
News & Related Topics	45min.	5.2%
Religious & Related Topics	1h 15min.	8.6%
Educational & Cultural Topics	1h 40min.	11.5%
Family Planning & Related Topics	55min.	6.3%
Commercial Programmes (Advertizements	6h 35min.	45.4%
/ Music)	2h 05min.	14.4%
Music	10min.	1.2%
For Regions	5min.	0.6%
Agriculture	45min.	5%
Other		
Programme C		
Weather Forecast	15min.	1.7%
News	1h45min.	12%
Religious & Related Topics	25min.	2.9%
Educational & Cultural Topics	2h10min.	15%
Family Planning & Related Topics	50min.	5.7%
Music	5h15min.	36.2%
Commercial (Advertizements / Music)	1h55min.	13.2%
For Army Personnel	35min.	4.1%
Agriculture	1h	6.9%
National Hook-up	20min.	2.3%

Hour : h, Minute : min.

(4) Broadcasting System

The broadcasting system for RB is as shown in Fig. 1.

1) Each of the local stations shown in Fig. 1 receives the Programme-A signal transmitted from Dhamrai Transmitting Station. Then the stations convert the frequencies received and rebroadcast them throughout the country by means of the broadcast wave relaying system.

These stations are equipped with programme production facilities, and produce programmes suitable for the local audience. The programmes produced are combined with Programme-A format for nationwide broadcast relaying and are broadcast to each region. In respect to the origin of programmes, about 80% of them are produced at local stations.

2) The Programme-B format is for nationwide broadcasting, but at present it is broadcast directly because there is no relaying stations.

3) The Programme-C format is local broadcasting for the coverage of areas centered on Dhaka City.

(5) Coverage

In Fig. 2 the coverage of Programme-A, Programme-B and Programme-C are shown.

The coverage shown is the case of the daytime in the dry season, it is the minimum condition of coverage throughout the year.

ⓐ Curve 1 : In the area surrounded with this curve, it is possible to receive "Programme-A" broadcasting from Dhamrai Transmitting Station in good condition. In this area, about 80% Of the total population of the country is dwelling. The area corresponds to 67% of the total area of the country.

ⓑ Curve 2 : In the area surrounded with this curve, it is possible to receive Programme-B broadcasting from Savar Transmitting Station in good condition. In this area about 30% of the total population of the country is dwelling. The area corresponds to 20% of the total area of the country.

ⓒ Curve 2 : In the area surrounded with this curve, it is possible to receive Programme-C broadcasting from Savar Transmitting Station.
In this area about 7% of the total population of the country is dwelling. The area corresponds to 3% of the total area of the country.

(6) Radio Broadcasting Facility

1) Programme Production Facility in Dhaka
The Radio Broadcasting House [Note] in Dhaka was constructed (1981 through 1983) under the Japanese Grant Aid. It is a standard facility consisting of 10 radio studios, one auditoriun, a master

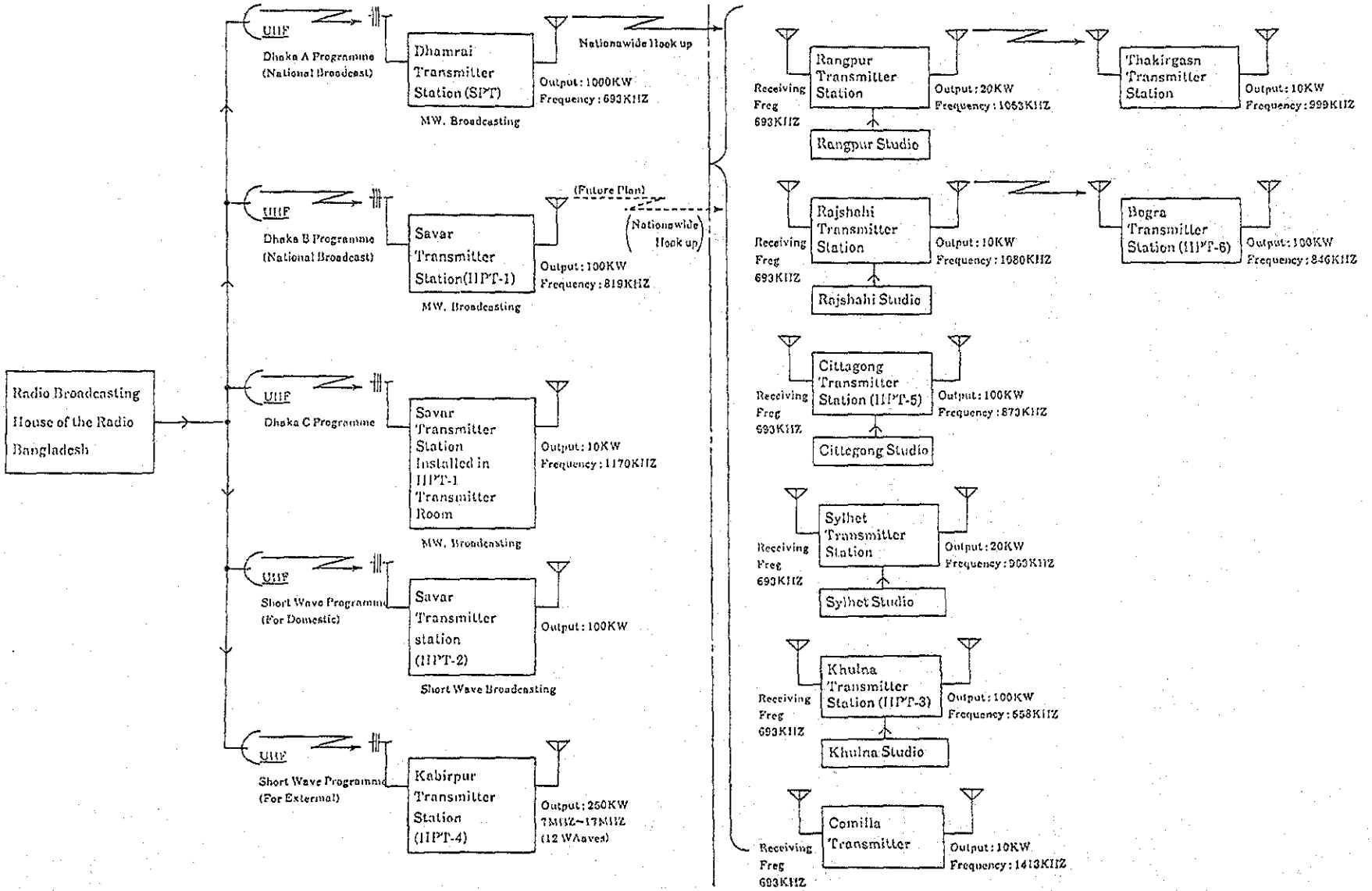


Fig. 1 Diagram of Broadcasting System of Radio Bangladesh

Programme	Frequency (kHz)	Power (kW)	Coverage (%)		Remarks
			Population	Area	
A	693	1000	80	67	Curve 1, Existing
B	819	100	30	20	Curve 3, Existing
C	1170	10	7	3	Curve 4, Existing

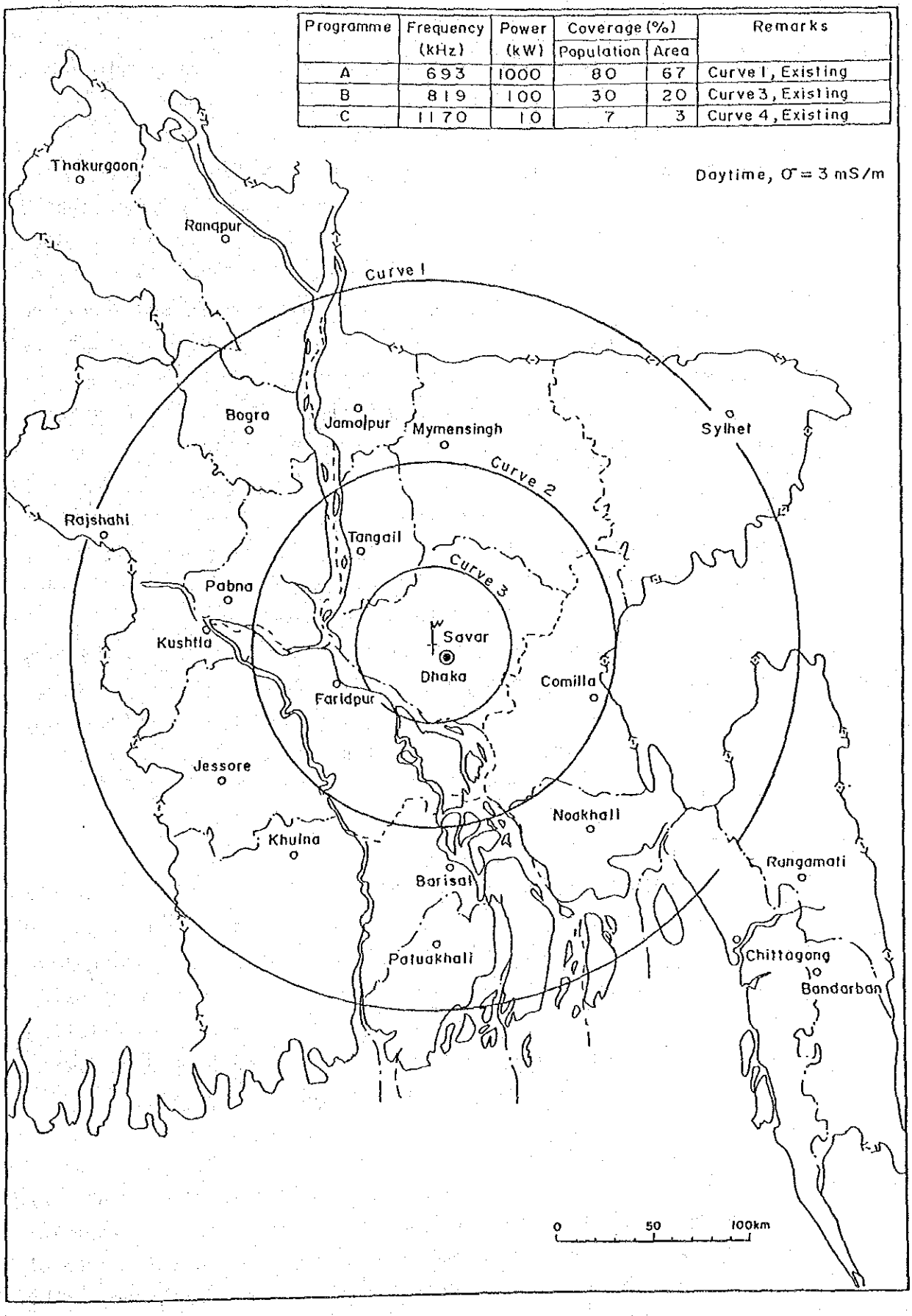


Fig. 2 Expected Coverage of Each Programme

control facility, power source facility and air conditioning facility.

The auditorium is used for multipurposes. At Dhaka Station, three programme systems are broadcast throughout the country, namely Programme-A (11 hours a day on the average), Programme-B (14.5 hours a day on the average) and Programme-C (14.5 hours a day on the average), as well as domestic shortwave service and shortwave service for foreign countries. The rate of use of the studio is extremely high; it is almost impossible to rehearse the programmes. Therefore, the programme composition is poor and the addition of studios is required to solve this problem.

In addition, as each section of RB is dispersed at seven places in Dhaka City (excluding the transmitting station), the efficiency of work is remarkably reduced. NBA wishes to integrate the facilities by the addition of a building in the site.

Note : The programme production studios in the Broadcasting House are equipped with facilities to produce programmes (A, B, C and foreign service) and functions for sending the programmes to transmitting stations -Savar, Dhamrai.

2) Medium Wave Transmitting Facility

At present, the medium wave transmitting stations in operation are the 1000 kW super high-power Dhamrai Transmitting Station, 100 kW high-power Savar Transmitting Station and high-power transmitting stations such as Chittagong, Khulna and Bogra, for a total of 11 stations. In Table 3, the medium wave radio transmitting facilities in Bangladesh are shown. It is be noted that in Dhaka, there are medium wave transmitting stations as follows.

ⓐ 1000 kW Transmitting Facility

The transmitter is installed at Dhamrai in the suburbs of Dhaka City, operating on 693 kHz. The facility is a parallel operation system of two 500 kW transmitter sets, but as one of them is out of order, only one set is in operation, and so the

present output power is about 500 kW. There is difficulty in the supply of spare parts. However, as the repair parts (high-voltage direct-current power source rectifier element) are to be obtained, 1000 kW operation will be possible at an early date.

The nationwide broadcasting conducted by this station is called Dhaka Programme-A.

ⓑ 100 kW Transmitting Facility
The transmitter is installed at Savar Station in the suburbs of Dhaka City, operating on 819 kHz. It is the object of this project. The broadcasting conducted by this station is called Programme-B.

ⓒ 10 kW Transmitting Facility
This transmitter is installed in the 100 kW transmitter room of the above-mentioned Savar Station, operating on 1170 kHz. It is for local broadcasting centered on Dhaka City and is using material from Programme-A and Programme-B for its broadcasts. This is called Programme-C.

3) Domestic Shortwave Transmitting Facility in Dhaka
A shortwave transmitter, etc., is installed in the Savar 100 kW medium wave transmitter room and in the separate station building in the site of Savar Transmitting Station, which is conducting domestic broadcasting.

4) Shortwave Transmitter Facility for Foreign Service
Broadcasting for foreign countries is transmitted from the two 250 kW transmitters in Kabirpur Station at about 30 km north-north-west of the Broadcasting House. The operating frequencies are 12 frequencies between 7MHz ~ 17MHz.
Table 4 shows the state of foreign broadcasting conducted in Bangladesh.

Table 3 Medium Wave Transmitter Facilities in Bangladesh

Transmitting Station	Opening of Station	Frequency (kHz)	Output Power (kW)	Remarks
Dhamrai *1 (Dhaka)	1974	693	1000 (500kw×2 sets)	Programme-A (Furnished by USSR)
Savar *2 (Dhaka)	1963 1982	819 1170	100 10	Programme-B (RCA make) Programme-C (Japanese make)
Mirpur		819	10	Standby for Savar 100 kW
*4 Chittagong	1988	873	100 (50kw×2 sets)	Renewal, 10 KW to 100kW *6
Khulna *3	1981	558	100 (50kw×2 sets)	
Rajshahi	1951	1080	10	
Sylhet	1961	963	20	with standby 10kW
Rangpur	1967	1053	20	〃
Comilla	1984	1413	10	〃
Bogra *5	1988	846	100	with standby 100kW
Thakurgaon	1988	999	10	with standby 10kW

*1 Called SHPT (Super High-Power Transmitter Station)
*2 Called No.1 HPT (High-Power Transmitter Station)
*3 Called No.3 HPT (High-Power Transmitter Station)
*4 Called No.5 HPT (High-Power Transmitter Station)
*5 Called No.6 HPT (High-Power Transmitter Station)
*6 Japan's Grant Aid

It is to be noted that No.2 HPT Station is the Shortwave Transmitting Station in Savar for Domestic Service, and No. 4 HPT Station is the Shortwave Station in Kabirpur for Foreign Service.

Table 4 Present State of Foreign Broadcasting Service

Language, etc.	Broadcasting Hours	Transmitting Frequency(kHz)
Arabic	16:00 - 16:30	9945 / 13670
Bengali	06:30 - 08:00	15625 / 17670
	16:30 - 18:00	9945 / 13670
English	12:30 - 13:00	15525 / 17645
	18:15 - 19:00	9815 / 11553
	19:00 - 19:15	9815 / 11553
Hindi	15:15 - 15:45	9640 / 11745
Nepalese	13:15 - 13:45	7105 / 9775
Urdu	14:00 - 15:00	9640 / 11745
Voice of Islam	08:00 - 08:30	15625 / 17670

5) Radio Programme Transmission Facility

At present, RB does not use particular communication lines for the transmission of nationwide radio programmes, but mainly uses medium wave and shortwave broadcast wave relaying. For this reason, first of all there is a problem of noise and deterioration of sound quality, and especially fading and interference is remarkable.

To solve these problems, the only method is to lease communication lines from Bangladesh T & T (Telegraph and Telephone Board) for the transmission of programmes. Fortunately, T & T is operating a nationwide micro-wave link (Telephone 1800 channels, standby) and all of the links are installed at the locations of RB's regional stations. For the programme transmission of radio broadcasts, a band width of 10 kHz is necessary, but this requires only three

channels of telephone lines. The facilities to prepare are a modulator/demodulator for wide-band (10 kHz) transmissions and some transmission lines between the terminals of T & T and RB Broadcasting House.

A schematic diagram of the related transmission links for relaying programmes is shown in Figs. 3-1, 3-2 and 3-3.
The programmes produced at the studio of NBA (Broadcasting House) become audio signals, and after adjustment of signals at the master control room, they are converted into UHF signals at the STL (Studio to Transmitter Link) room, and then transmitted to the main transmitting stations, such as Savar and Dhamrai.

6) State of Popularization of Radio and Television in Bangladesh

According to the Bangladesh Bureau of Statistics, the number of radio receiving sets was estimated at 2,333,343 in 1981, but in the East south Asian Handbook 1986, it was indicated as 4,500,000, and so a dramatic increase can be seen. Assuming that the population is 100 million, about one in every 3~4 households will have a receiver (1986). For reference, the cost of receivers is as follows:

- Radio receiver 1-band 354TK (about 1400 yen) } 1986
  3-band 757TK (about 3100 yen)

  It is to be noted that the annual listening fee is 15 TK (about 60 yen).

- TV receiver 20-inch (B&W) 6786TK (about 27,000 yen) } 1986
  20-inch (Colour) 16895TK (about 68,000 yen)

  The annual listening fee is as follows:

B&W set	125TK (about 500 yen)
Colour set	250TK (about 1000 yen)

Conversion rate 1 TK ≒ 4.05 yen.

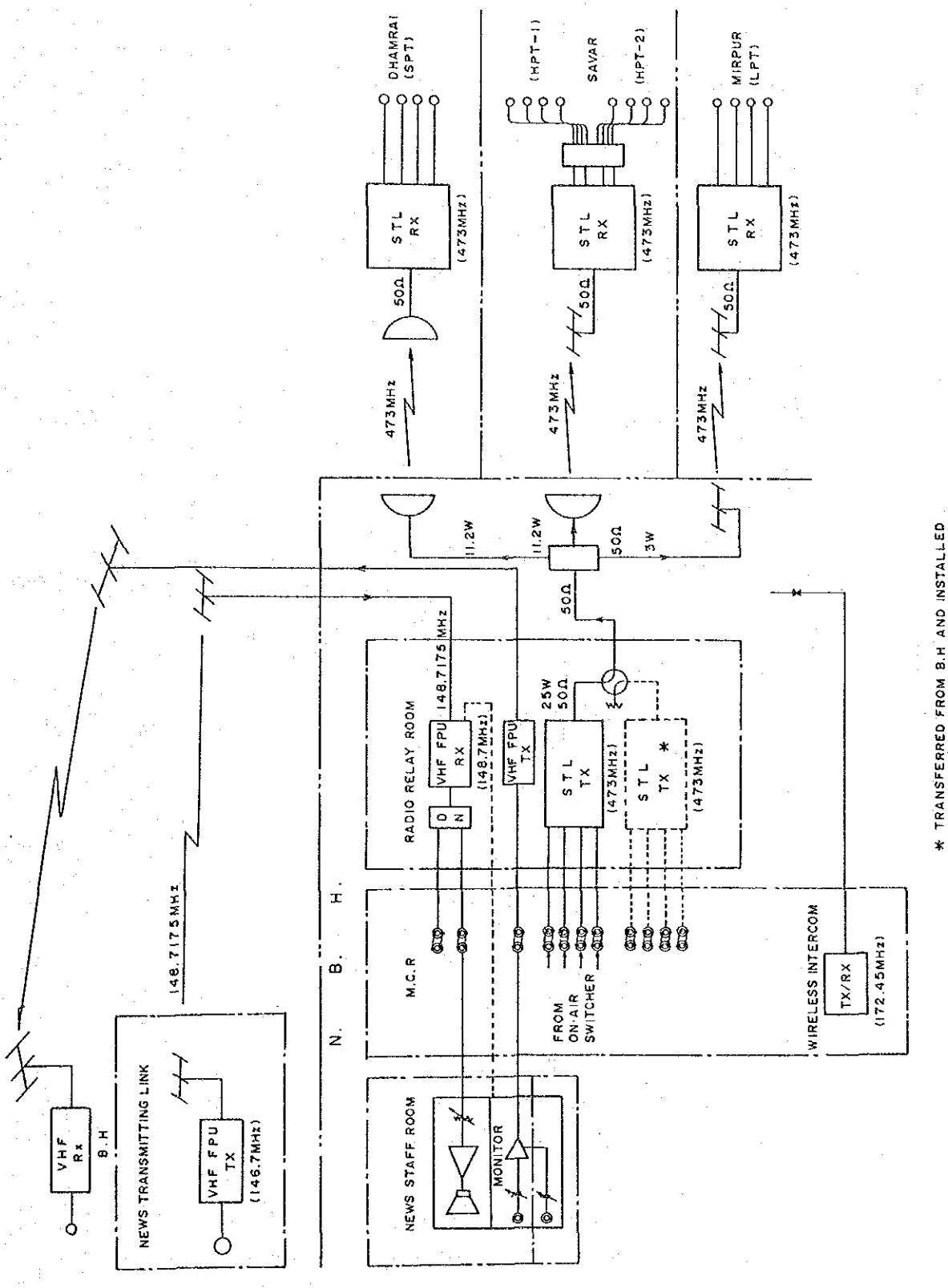
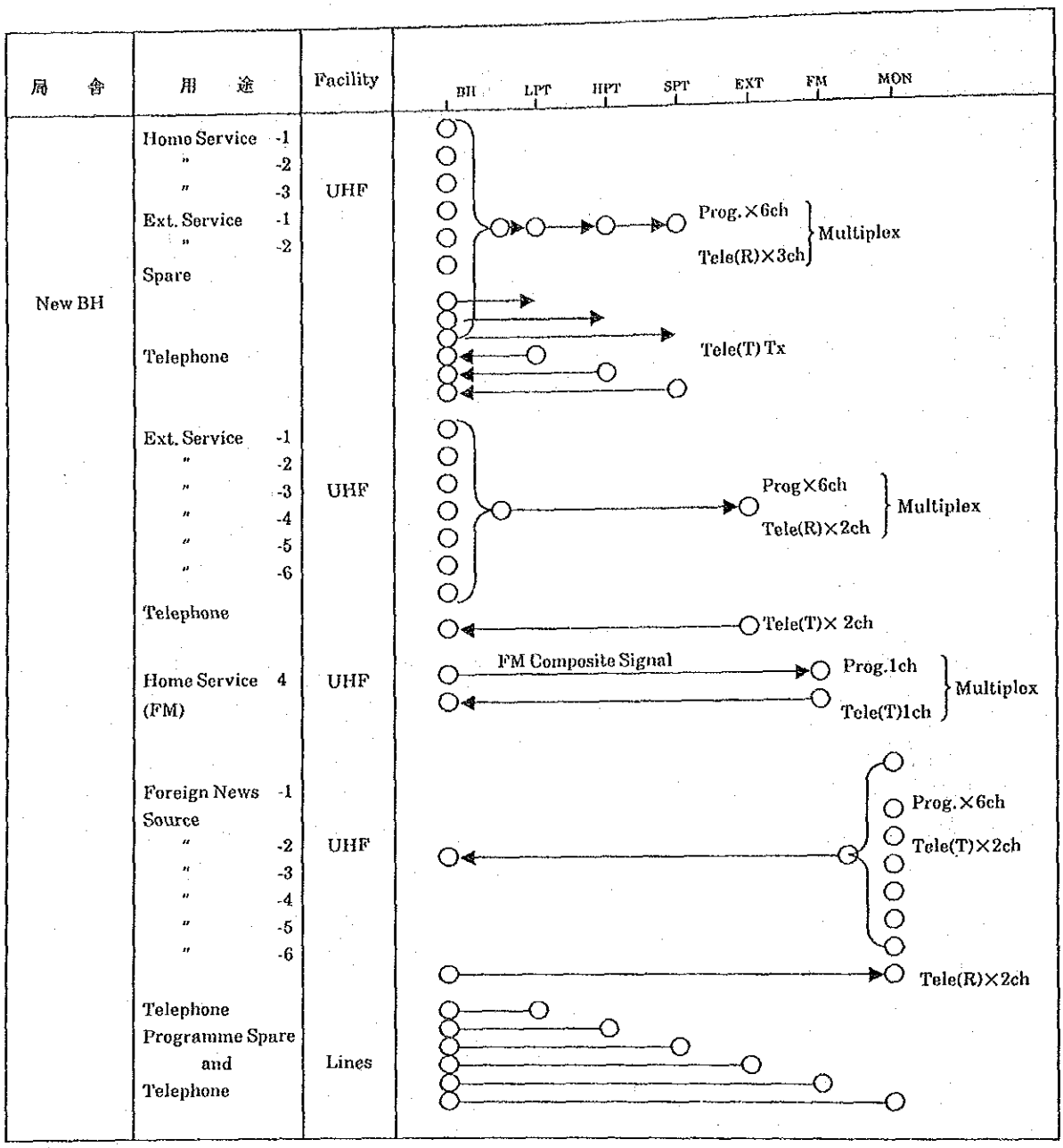
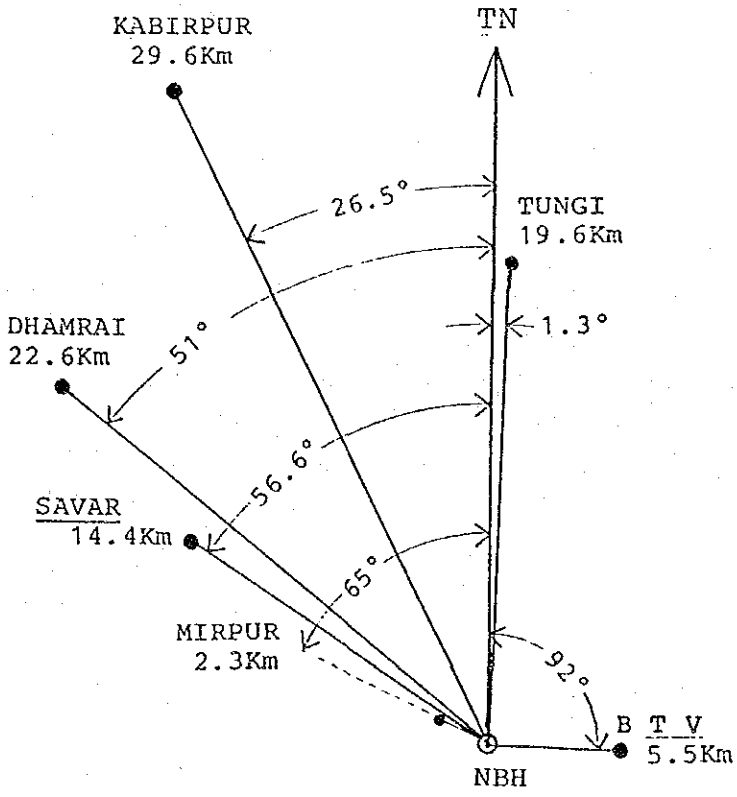


Fig. 3-1 Block Diagram of Programme Transmission System from NBA Broadcasting House to Main Broadcasting Facilities in Suburbs of Dhaka



Note: BH : Broadcasting House
LPT : Mirpur Transmitting Station
HPT : Savar Transmitting Station
SPT : Dhamrai Transmitting Station
EXT : Kabirpur Transmitting Station
FM : VHF FM Transmitting Station
MON : Tungi Monitoring Station

Fig. 3-2 Block Diagramme of Programme Transmission System from NBA Broadcasting House to Main Broadcasting Facilities in Suburb of Dhaka



NBH: National Broadcasting House
(Radio Broadcasting Centre)

MIRPUR: 10kW,819KHZ (standby of SAVAR 100kW)
SAVAR:100kW,819KHZ, HPT-1 Station
DHAMRAI: 1000kW,693KHZ,SHPT Station
KABIRPUR: 250kW,7 17MHZ, HPT-4 Station
TUNGI: Monitoring Station

Fig.3-3 Relative Location of Main Transmitting Stations Centered around National Broadcasting House

2-2-2 Television Broadcasting

The television broadcasting service started in 1964, and following this, the commencement of colour programming was in 1980. The colour standard adopted is PAL-B.

In 1984, Bangladesh Television (BTV) became the National Broadcasting Authority as did Radio Bangladesh (RB).

In the East Pakistan era of 1970, four television stations were constructed under the eighth yen loan from Japan. After that, based on the Japanese Grant Aid, BTV accepted a small TV van (1977), enhanced the Dhaka studio (1978) and constructed an auditorium (1978).

The state of television transmitting stations is as shown in the following table.

List of Television Transmitting Stations

Name of Station	Channel	Output Power	Remarks
Dhaka	ch-9	10kW	-
Dhaka	ch-6	〃	Operation is Suspended
Rangpur	ch-6	〃	-
Natore	ch-8	〃	-
Mymensingh	ch-12	〃	-
Sylhet	ch-7	〃	-
Khulna	ch-11	〃	-
Noakhali	ch-12	〃	-
Chittagong	ch-5	〃	-
Satkhira	ch-7	1kW	-
Rangamati	ch-8	〃	-
Cox's Bazar	ch-10	〃	-

Broadcasting Times : Saturday ~ Thursday : 17:00 ~ 23:40 (6 hours 40 minutes), Friday : 15:00 ~ 23:40 (8 hours 40 minutes)
Total broadcasting hours a week: 48 hours and 40 minutes.

According to the data of the Bangladesh Bureau of Statistics, the number of television sets was estimated at 159,864 in 1981, and in the East South Asian Handbook (1988), it was indicated as 410,000 sets (one set for about every 40 households), a trend of rapid increase.

The cost of a television set varies: 20-inch B & W 6,786 Taka (about 27,000 yen); 20-inch colour 16,895 Taka (about 68,000 yen) (as of 1986).

2-3 Present State of Savar Transmitting Station

2-3-1 Outline

In the 75 acre (304,000 m^2) site, the station buildings of HPT-1 and HPT-2 and antennas for the medium wave and shortwave transmitters are installed. The operation and management of these broadcasting facilities are maintained in good condition, as for a facility which has been operated for more than 25 years.

In the HPT-1 Transmitting Station, three transmitters—100kW, 819 kHz (the object of the Project - Programme-B); 10kW, 1170 kHz (Programme-C)and 100kW shortwave (for domestic broadcasts)—are installed in the same transmitter room. The operation and maintenance are carried out by 138 persons (of these persons, about 56 are the technical staff).

The Programmes-B, C and domestic shortwave programmes are sent from the Broadcasting House in Dhaka City to the transmitting station through a UHF link. The programmes are as follows.

- Programme-B: As explained in item 2-2-1, the particularity of this programme is education and commercials. The programmes are broadcast 14 hours and 30 minutes a day on the average or about 435 hours a month.
- Programme-C: As explained in item 2-2-1, a part of Programme-A and B is combined and broadcast.
- Domestic shortwave programme: the domestic shortwave programmes are broadcast from the 100 kW shortwave transmitter installed in the present medium wave transmitter room and from the 100 kW shortwave transmitter installed in the HPT-2 Transmitting Station.

2-3-2 Transmitter Facility

(1) Transmitter

The medium wave transmitter in operation is an RCA make BTH-100 B type made in 1962. The rated output power of 100 kW has been maintained so far, but in general it is becoming superannuated and it

is difficult to obtain spare parts. The condition of maintenance is good but the residual life is considered to be only about three years judging from the stock of spare transmitter tubes.

However, Savar Transmitting Station as well as Dhamrai Transmitting Station is graded as a transmitting station for nationwide broadcasting, and has a wide coverage centered on the capital city. Savar Station is steadily conveying official government reports, weather information and religious programmes directly related to daily life, to highly populated and important districts. For this reason, excellent reliability of the transmitter facility is desired.

(2) Reliability of Transmitting Facility

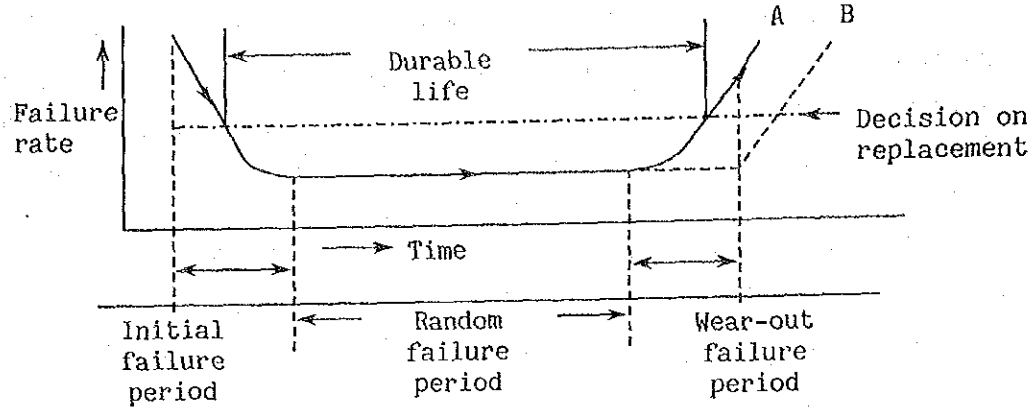
As the transmitter equipment could be considered to be a sort of consumption good, occurrences of equipment failure progress in accordance with the following "Bathtub Curve". In the early period of installation, for a short time (initial failure period) failures occur frequently due to weaknesses in the design and manufacture of the equipment. For these kinds of failures, corrective maintenance is appropriate. Next, a stable period in which failures do not occur much continues (random failure period). In this period, accidental failures do not occur much, but they can be avoided in advance by performing preventive maintenance (condition based maintenance).

Furthermore, if use of the equipment is continued, it will enter a period (wear-out failure period) when failures will increase gradually, and the number of times when maintenance is required will also increase rapidly. The relative expenses incurred will also increase accordingly, and finally, the need for replacement is recognized and the equipment is replaced.

It should be noted that if good maintenance (scheduled maintenance) is carried out, it would be possible to extend the stabilized period (random failure period) such as curve B. In general, if transmitter equipment is used for more than 20 years, it will enter the wear-out

failure period, and then enter the stage of replacement. It is needless to say that the medium wave 100 kW transmitter facility of Savar Station is in the wear-out failure period.

The related material is indicated as Reference Material (Appendixes No. 6, No. 7).



(3) State of Coverage

The present state of coverage in Bangladesh by the medium wave broadcasting facilities of Radio Bangladesh is shown in Fig. 4 (daytime in dry season).

The population coverage of Savar Transmitting Station in the daytime is about 30%, but at nighttime it tends to decrease to about 11% due to the recent co-channel interference from neighbouring countries. This is the reason that installation of a high power transmitter is strongly desired.

Regarding the interference from neighbouring countries, the waves were measured in the Sylhet district 200 km north-east of Dhaka City, and in the Rajshahi district about 200 km west of Dhaka City. As a result, in Sylhet city considerable interference was confirmed from neighboring countries at nighttime, and in Rajishahi city, slight interference was confirmed at nighttime and the daytime.

Based of the data, because of the interference from neighbouring countries, 630 kHz is appropriate (Appendix Material No. 8).

(4) Countermeasures against Failure

1) Interruptions of commercial power for a few minutes may occur several times a month, but in this case the motor generator is not used.

The motor generator power is used for longer power suspensions which happens about two or three times a year.

In this case, the motor generator power will be supplied only to the medium wave 100 kW transmitter (for Programme-B) and medium wave 10 kW (for Programme-C). It will not be supplied to the domestic 100 kW shortwave transmitter.

2) In case the medium wave 100 kW transmitter happens to fail, the 10 kW, 819 kHz standby transmitter at Mirpur Transmitting Station (about 12 Km south-east of Savar Station) will be used.

(5) Antenna

The conditions of the transmitting antennas were inspected by viewing and measurement, etc. The results were as follows. In Fig. 5 the outline of the antennas is shown.

1) Steel mast structure : Base insulator type, 3-direction 4-stage stay type, triangle truss tower, height about 152 m (Yugoslavian make)

2) Feeder line : 6-Wire type, length 180 m, impedance 236 Ω.

3) Measured value of antenna impedance : 451 Ω ~ j273 Ω (819 kHz)

4) Measured conductivity of ground : about 3 mS/m ~ 10 mS/m

5) Austin transformer : As superannuation is progressing, it is to be replaced.

6) Steel tower base-insulator : No cracking was observed.

7) Connection of steel tower base and radial earth :
The method of connection is somewhat incomplete (There is the possibility of loose contact). It is to be improved.

8) Ball-gap :
As superannuation is progressing, it is to be replaced.

9) Steel tower :
No rust was observed, and the structure is solid.

10) Base block for stays and stay insulators :
Rust was observed on stays, but no cracking was recognized in insulators.

11) Base block for stays : Cracks were discovered by viewing.

12) Aviation obstruction lighting : Replacement is required including the Austin transformer.

13) Antenna tuning unit : No deteriorated parts of π circuit were recognized.

14) Submergence of antenna base insulator :
No submergence was so far observed.

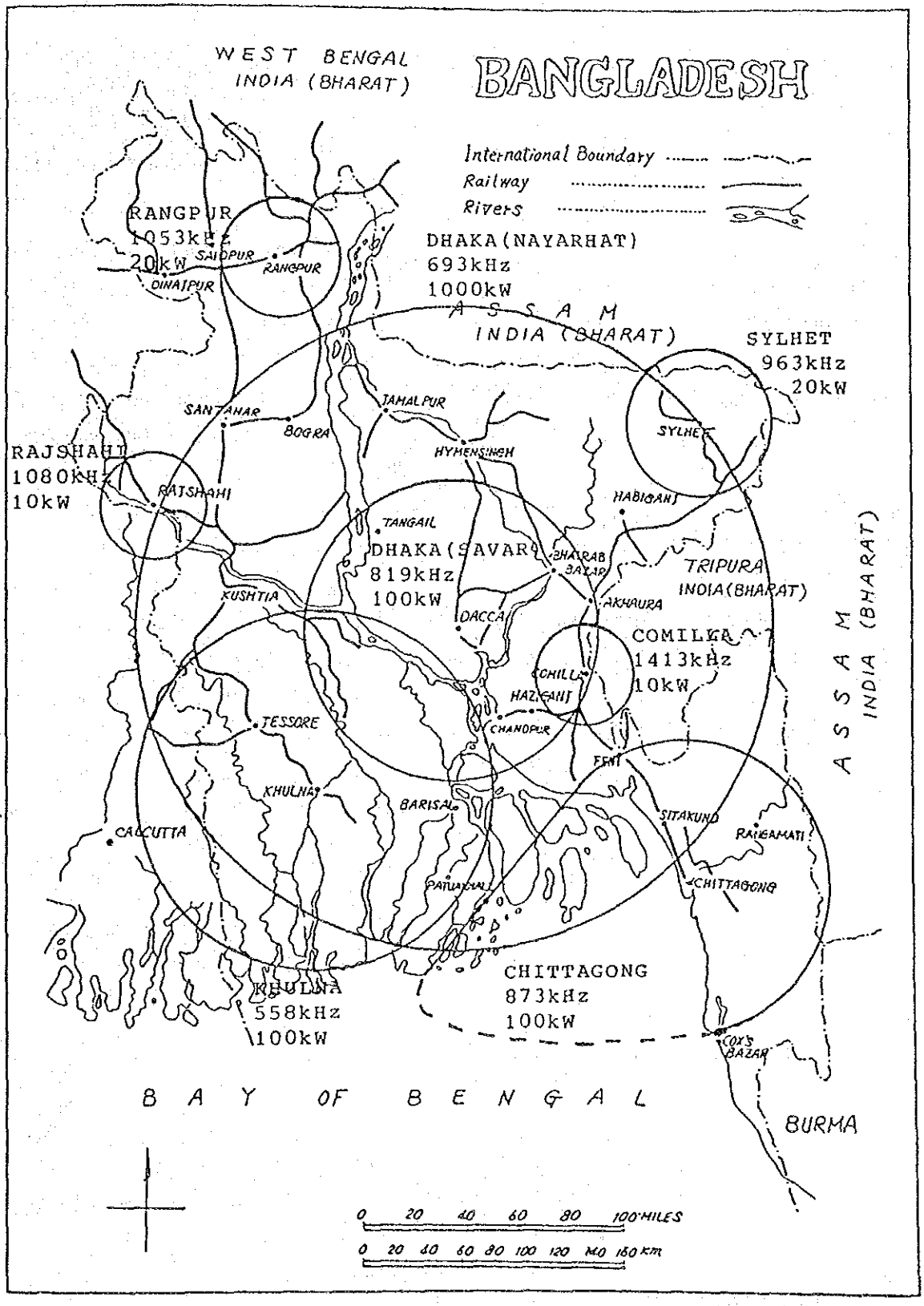


Fig. 4 Present State of Broadcasting Area of Radio Bangladesh

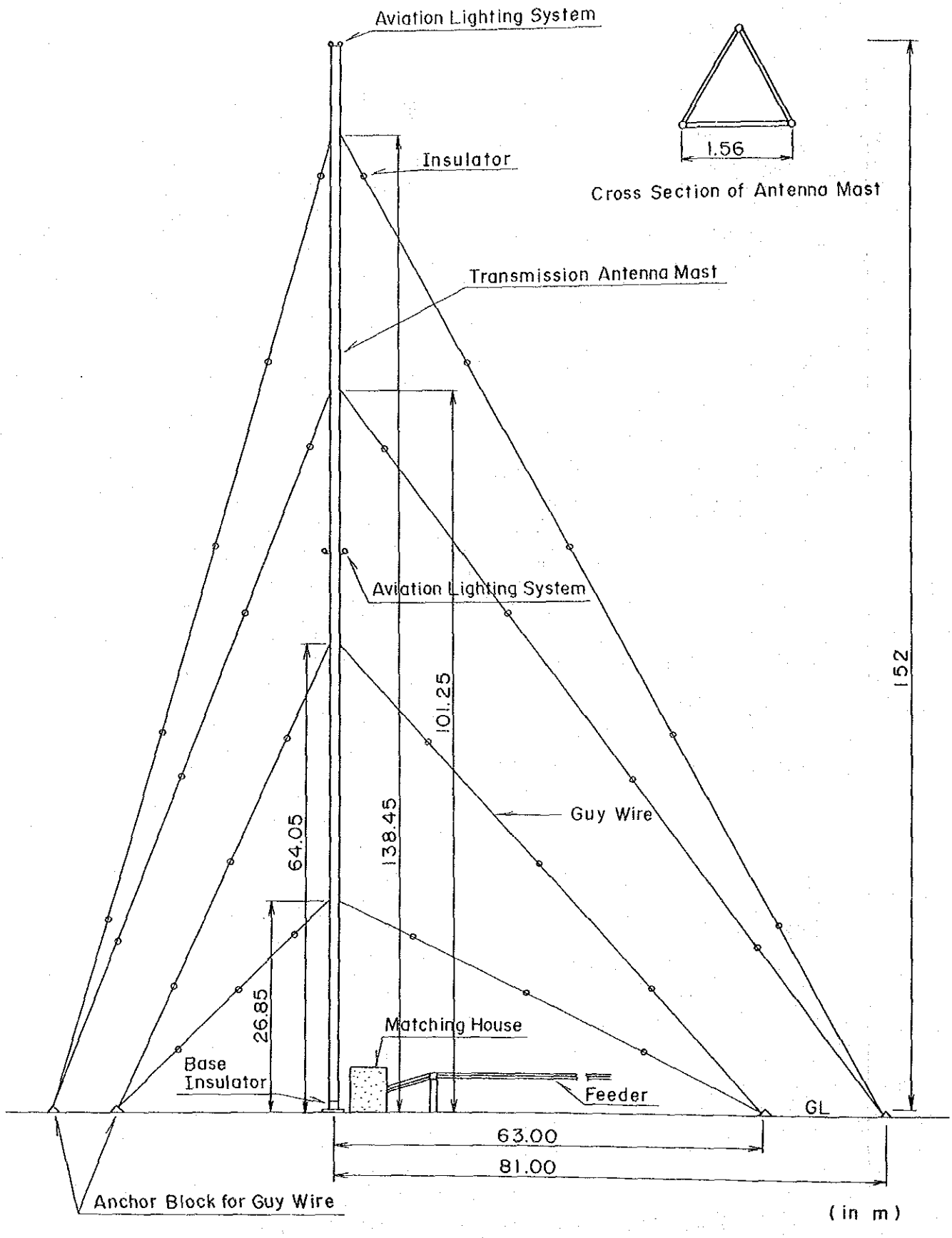


Fig. 5 Radio, Medium Wave Transmission Antenna at Savar Station. (100kW, 819kHz)

2-3-3 Present State of Station Building

The station building in the 75 acre site and the related position of the antennas are shown in Fig. 4-4-2. In Fig. 4-4-3, the floor layout of the HPT-1 Station Building is shown.

The floor area of the transmitter room shown in Fig. 4-4-3 is about 200 m^2. In addition to the medium wave 100 kW transmitter (for Programme-B) which is the object of this Project, a medium wave 10 kW transmitter (for Programme-C) and shortwave 100 kW transmitter (for domestic broadcasts), for a total of three transmitter systems, are installed. The operation and maintenance of these transmitters are performed by means of concentrated management.

The maintenance parts are well arranged in each store room but some large spare parts and materials are stored in the corridor of the building. There is shortage of store room.

In addition, a power source building accommodating receiving power equipment, and an engine generator building are installed at a place 20 - 50m away from the station building.

In the case of installing the new transmitter facilities in the present station building, there will not be enough space. Therefore, a new station building is required.

2-4 Outline of Related Projects

As for the related projects under Japan's Grant Aid, there are the construction of the Broadcasting House of Dhaka City and Renewal of the MW Transmitter at Chittagong Broadcasting Station.

The outline is as follows. Both of the facilities are operating in good condition.

(1) Construction of Broadcasting House of the People's Republic of Bangladesh

1) Location : Dhaka City
2) Objective: As the Broadcasting House constructed in 1959 has become superannuated, and was small in scale, it was impossible to cope with the production of various programmes which are increasing year by year. Therefore it was necessary to construct new programme production studios to send various programmes to each transmitting station.
3) Term of Construction Work : 1980 ~ 1983
4) Descriptions of Project
   - 3-story, total floor area 4,800m2
   - Number of studios 9
   - Programme production equipment 1 set
   - Function of the Broadcasting house
     In each studio, programmes for Programme-A, B, and C and foreign service are produced, and are sent to Dhamrai, Savar and foreign service transmitting stations.

Then, they are broadcasted to the whole nation, regions and to foreign countries from the respective transmitters.

(2) Renewal of Medium Wave Radio Transmitting Station of the People's Republic of Bangladesh

1) Location : Chittagong City
2) Objective: As more than 20 years had elapsed since Chittagong Station was constructed, the facilities had become superannuated

remarkably, and in addition, the receiving area had become narrow according to interference from neighbouring countries. To improve this superannuated condition and expand the coverage area the transmitter was renewed and power was increased.

3) Term of Construction work : 1987 ~ 1988

4) Descriptions of Project

Renewal of 10kW MW Transmitter → 100kW (50kW × 2) at Chittagong Broadcasting Station.

2-5 Description of Requirements

In Bangladesh, the same as in other countries, radio broadcasting is the most effective and constant form of mass communication. The various programmes broadcast play an important role in promoting the development plans of the country in such areas as education, agriculture and population problems which the Government of Bangladesh is executing.

Particularly, in order to minimize the serious damage from cyclones which frequently hit the country, the conveyance of accurate information through broadcasting is indispensable.

Thus, it is said that radio broadcasting is closly related to the daily life of the general public.

However, the present transmitter equipment of Savar Transmitting Station is in a state of superannuation as more than 25 years have elapsed since it was installed.

Therefore, there is a great risk of equipment failure that might lead to the long-term suspension of broadcasting services.

Furthermore, the areas which can receive the broadcasting services from Savar Station are becoming narrow due to the influence of high power broadcasting signals of neighbouring countries.

Reception conditions at nighttime are particularly bad, and the signal can be received clearly only at places close to the station.

In such a background, NBA has set a Project Proforma to renew the existing 100 kW transmitter facilities in Savar Transmitting Station, and thereby increase the transmitter output power to 500 kW.

The Government of Bangladesh has requested of the Government of Japan grant aid for this Project.

The outline of the equipment required for Savar Transmitting Station is as follows:

1) 500 kW (250 kW × 2 sets) combiner, dummy antenna and peripheral equipment	1 set
2) Audio equipment	1 set
3) Measuring equipment	1 set
4) Antenna system (Including tuning device, aviation obstruction lighting)	1 set
5) Feedeer line	1 set
6) Spare parts	1 set
7) Installation materials	1 set
8) Power source equipment	1 set

CHAPTER 3 DESCRIPTIONS OF THE PROJECT

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3.1 Objective

With the deterioration in functions of the transmitting facilities of the superannuated Savar Transmitting Station, as well as the recent increase in co-channel or adjacent channel interference from neighbouring countries, the areas where the broadcasting signal could be received in good condition becomes narrow. Thus interference is occuring to the reception environment of broadcasting signal as a nass media for the country of Bangladesh.

Thus, the objective of this Project is to overcome this interference and serve a high reliabilty broadcast signal to the whole country, as well as establish an excellent reception environment. To accomplish this objective, the transmitting facilities of Savar Transmitting Station which is the main transmitting station of Bangladdesh, will be renewed and enhanced.

3-2 Consideration of Description of Requirements

3-2-1 Renewal of Transmitter Equipment

As described in chapter 2 more than 25 years have elapsed since the transmitter equipment of Savar Transmitting Station has been installed. Thus as superannuation of equipment is progressing as a whole, and as it is very difficult to obtain space parts, the transmitter is to be renewed.

3-2-2 Frequency and Power

In respect to the frequency, power, scale of transmitting antenna and operation time zone of medium wave radio stations etc., they are determined at the Radio Administrative Conference on a world wide basis. According to the Regional Radio Administrative Conference of Region I and III related to "Long-wave and Medium wave", in respect to Bangladesh, the transmitting conditions such as the station site, transmitting power, transmitting frequency and scale of antenna are registered as shown in the Appendix (No. 9).

The power, frequency, etc. for medium wave radio broadcasting in Dhaka city are as shown in the following Table, and the frequencies are registered at IFRB. Of the frequencies proposed in the Table, the one that will be used for improvement of broadcasting area of this project is either 819 kHz or 630 kHz.

Registration of Mediumwave Frequency for Dhaka (IFRB)

Allocated Frequency (kHz)	Carrier Power (kW)	Max. Radiation (dB)	Type of Antenna	Operating Hours	Remarks
630	100	20.4	Vertical base feed	UTC 0:00~18:00	unused
693	1,000	32.1	〃	〃	used
819		22.1	〃	〃	〃
1,170		13.6	〃	〃	〃
1,260		12.1	〃	〃	unused

Note : Time difference between UTC and local time is 6 hours
UTC 0:00~18:00 is local time 6:00~24:00

In determing the transmitting power and transmitting frequency of this Project, measurement of potential field strength and reception tests on two frequencies (630 kHz and 819 kHz) were carried out in Dhaka City and at a distance of about 100 Km in two directions north-west and north-east from the centre of Dhaka City, and at a point about 200km near the border of India, to assume the influence from interfering signals.

From the measurements and tests, 630 kHz is seen to be advantageous because interference is less in comparison with that of 819 kHz, and because by increasing the transmitting power to 500 kW, a wider coverage area could be obtained, and reception during the daytime would be possible almost all over the country. Therefore, it is considered that it will satisfy the requests of Bangladesh.

As the transmitting power of 630 kHz for Dhaka Transmitting Station is now registered as 100 kW at IFRB, in the execution of this Project it will be necessary to change the registered 100 kW to 500kW. At present, NBA is taking the necessary steps for this change.

The outline of the results of reception tests and measurement of potential field strength is as follows.

According to the reception tests conducted in the north-west direction and Rajshahi and Sylhet in the north-east direction near the border of India, in the daytime there was no problem to either 819 kHz or 630 kHz, but at nighttime there was serious interference to the audience for receiving the broadcasting signal. At Sylhet, the reception evaluation[Note] of 819 kHz was 2^+ , and the level of interfering frequency wave of 630 kHz was 40dBμ/m (reception evaluation was about 3^+). Thus, 630 kHz is superior to 819 kHz. At Rajshahi, there was interference to both frequencies, but there is no problem for practical use. (Refer to Appendix No. 8)

Note: To compare and judge the reception condition simply, the following common codes are for expression internationally.

5 ··· Excellent 4 ··· Good 3 ··· Fair

2 ··· Bad 1 ··· Unpractical

In the case the evaluation is between two ranks, put a "+" or "—" on the evaluated rank. In the case the reception evaluation raises one rank (for instance such as 3→4), it is called an improvement of one rank.

3-2-3 Expansion of Broadcasting Area (coverage)

The area covered by the broadcasting signal of Savar Transmitting Station is the densely populated and important district centered on the capital city Dhaka. Its broadcasting hours are the longest, and it is responsible for broadcasting important programmes. Therefore, a broadcasting signal of higher quality and reliability as well as a wider coverage area than the present state is desired.

In Table 5, the coverages for the 630 kHz, 500 kW equipment of this Project, and of the present 819 kHz, 100 kW equipment during the daytime in the dry season are indicated. In comparing both coverages, that of this Project will be about 2.4 times larger in terms of population and about three times wider in area than the present coverage. It is to be noted that if the field strength[Note] is such as 54~60 dBμ/m (0.5 - 1 mV/m), it would be possible for reception almost throughout the country with an ordinary receiver.

The influence of co-channel and adjacent channel interference from neighbouring countries upon coverage at nighttime was examined, and the results are shown briefly in Table 5 and Fig. 6~7.

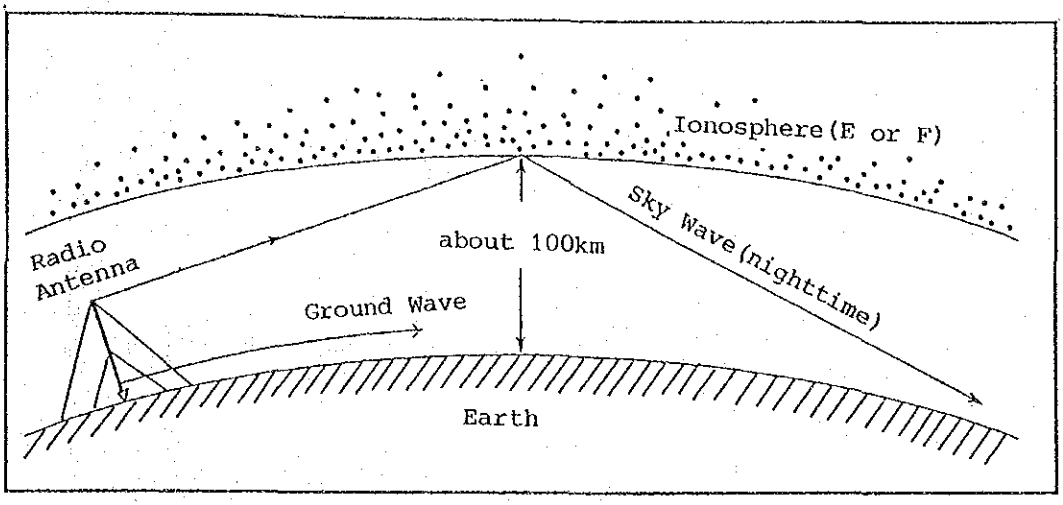
Note : Field strength

This is the strength of electric wave. The dB is a unit used for expressing the ratio of voltage (power), etc., and it indicates the ratio against the standard value by 20 times (or 10 times) in common logarithms.

In the case of field strength, the standard value is the case the voltage induced in a unit length of one meter antenna is 1 μ V.

For reference, the condition of propagation of radio waves is shown in the following figure.

The features of radio waves are as follows:



① The waves propagate farther in the following order.
Mountain → hill → plain → humid zone → on the sea
In addition, the waves propagate better in the rainy season than in the dry season.

② The distance the waves propagate becomes farther as the wave frequency becomes lower.

③ The propagating waves in the daytime are almost all ground waves, and the sky waves attenuate in the ionization layer.

④ At nighttime, the sky waves will not attenuate in the ionization layer but reflect from it and propagate over a long distance. For this reason, there is a possibility of receiving interference from neighbouring countries.

⑤ In the daytime, the coverage is determined by ground waves, and at nighttime it is determined by the relation between ground waves (desired waves) and sky waves (interfering waves, co-channel or adjacent channel).

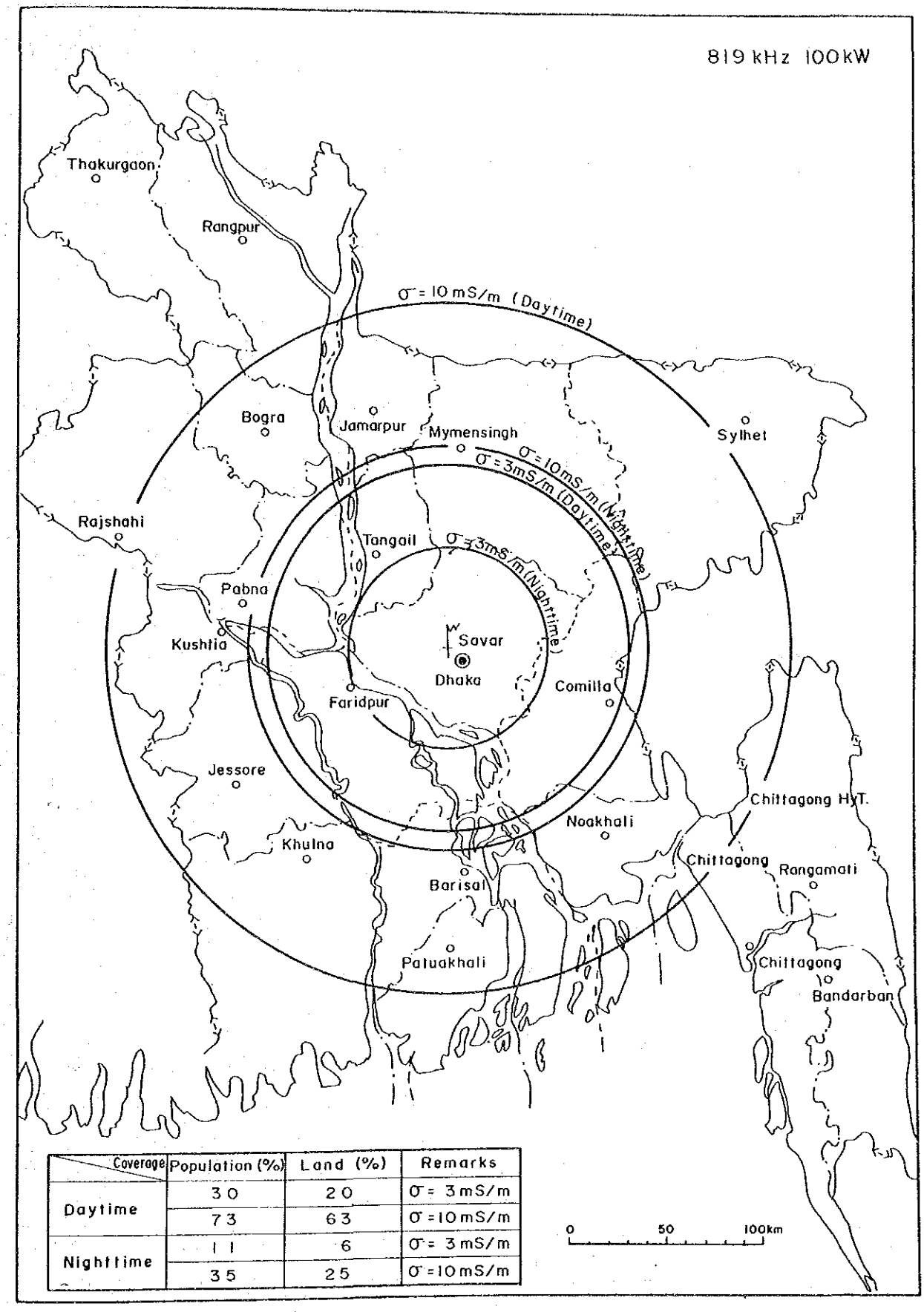
According to the above features, the coverage area of a certain frequency is different in the dry season, rainy season and in daytime and at nighttime.

Table 5 Comparison between The Present State and After Implementation of The Project

	Item		Daytime (no interference)		Nighttime (interference)		Remarks
	Coverage		dry Season	Rainy Season	dry Season	Rainy Season	
Present state	Radius of Coverage	(km)	95	180	52	105	Present state (819kHz, 100kW, antenna height : 152m). Reception is difficult at north-east part, north-west part near border of India and area along Bengali Bay etc..
	Population in Coverage (thousand)		31,100	74,600	11,400	36,300	
	Population Ratio (*1)	(%)	30	72	11	35	
	Area of Coverage	(km^2)	28,400	90,400	8,100	35,300	
	Area Ratio (*2)	(%)	20	63	6	25	
After implementation of the project	Radius of Coverage	(km)	175	320	125	240	After implementation of the project (630kHz,500kW, antenna height : 122m). According to the execution of this project, about the whole country will be able to receive the broadcasting signals. The damage from cyclones and floods of rivers could be considerably reduced through alert broadcasts, and conveyance of various information, education, culture and technical instruction of agriculture could be expanded over a vast area.
	Population in Coverage (thousand)		73,300	101,400	47,800	91,900	
	Population Ratio (*1)	(%)	71	99	46	89	
	Area of Coverage	(km^2)	87,600	140,500	50,000	125,300	
	Area Ratio (*2)	(%)	61	98	35	87	

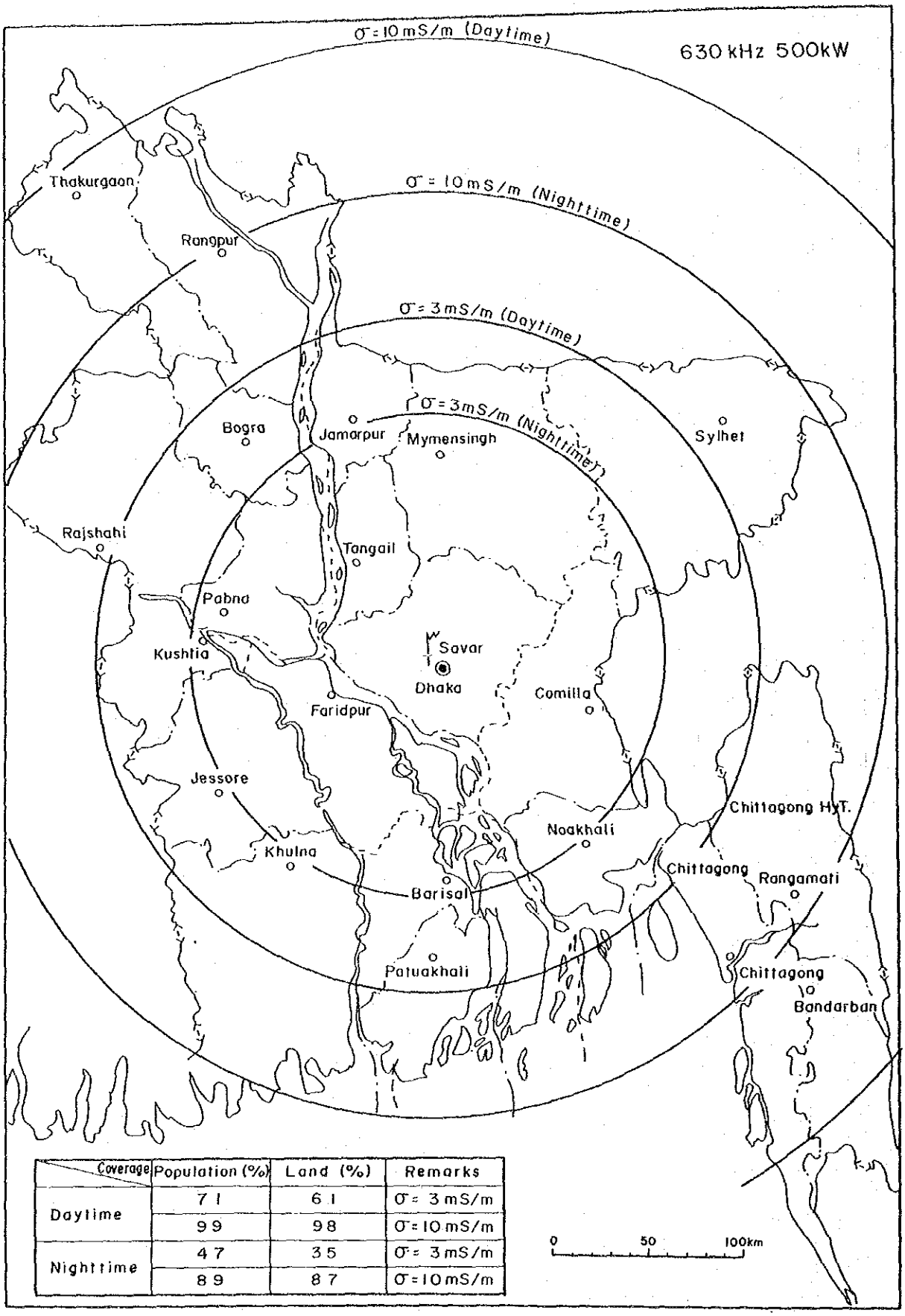
[Note] *1. The ratio of population in coverage area to total population. *2. The ratio of coverage area to the total area.

- The conductivity in dry season is (σ) = 3mS/m, and that in rainy season is (σ) = 10mS/m.
- Field strength in the coverages at daytime is more than 63 dBμ/m (1.4mV/ m) and at nighttime it depends on the relation of the desired and undesired radio wave.
- Protection ratio adopted for same frequency interference is 30 dB and for adjacent frequency interference is 9 dB. The estimated coverages (population and area) are the one of stations that are most interfered
- Total population : 102,900 thousand (1986)
- Total area : 143,999km



Coverage	Population (%)	Land (%)	Remarks
Daytime	30	20	σ = 3mS/m
	73	63	σ = 10mS/m
Nighttime	11	6	σ = 3mS/m
	35	25	σ = 10mS/m

Fig. 6 Expected Coverage of Savar MW Station (819kHz, 100kW)



Coverage	Population (%)	Land (%)	Remarks
Daytime	71	61	σ= 3mS/m
	99	98	σ=10mS/m
Nighttime	47	35	σ= 3mS/m
	89	87	σ=10mS/m

Fig. 7 Expected Coverage of Savar MW Station (630kHz, 500kW)

3-2-4 Projected Site and Surroundings

The site for this Project is Savar Transmitting Station.
The location of Savar Station is

Latitude North 23° 54' 08"
Longitude East 90° 12' 12"

and it is situated almost in the centre of Bangladesh at a point about 15 km north-west of the Broadcasting House.

The distance to the Broadcasting House in Dhaka City is about 20 minutes by car, and so it is an appropriate site for a transmitting station to serve the whole country.

The area around the station is mostly a grassy plain including some farmland. Jute and vegetables, etc., are also cultivated, and in the neighbourhood several groups of modern collective houses have been built.

When 500 kW broadcasting commences, the blanket area[Note] will be about 1.3 km in radius. However, as there are no villages with significant populations in this area there will be no problem.

In addition, as there will be no problem in the transportation of equipment and materials to the transmitting station site from Chittagong, the biggest port in Bangladesh, nor in the storage of equipment and construction materials, it is appropriate for the Project site.

Note : The blanket area is the high field strength area around the transmitting antenna. The radius of the area increases proportionally to the square root of the transmitting power. In this area, as its own signal transmitted is too strong, it is very difficult to receive radio signals transmitted from other stations.

3-2-5 Relation to IFRB

The frequency, power, scale of transmitting antenna and operating hour zone for medium wave radio transmitting stations are decided

internationally at the Radio Administrative Conference held by ITU. However, according to the Region I and Region III Radio Administrative Conference related to "Long wave and Medium wave" which was held in 1975, the conditions of the transmitting station sites, frequency band width, carrier power (transmitting power), scale of transmitting antenna and operation time, etc. , as shown in Appendix No.9 were registered for Bangladesh.

In the execution of this Project, it is necessary to negotiate with the countries(China, India, Pakistan, Singapore and Thailand) which may be influenced by the increase in power of the Savar Transmitting Station from 100 kW to 500 kW, and to change the registration at IFRB. At present, NBA is advancing the necessary procedures.

3-3 Outline of the Project

The objective of this Project is to restore the original reception area of the Programme-B format of Savar Transmitting Station which is becoming narrower due to the interference from neighbouring countries by replacement of the existing Savar transmitting facilities.

The related facilities are as follows:

1) The superannuated 819 kHz, 100kW transmitter now in operation will be replaced by a 630 kHz, 500 kW transmitter (250 kW x 2 sets) of parallel operation.

2) The transmitting antenna will be remodelled according to the change in transmitting frequency and transmitting power.
   a) The height of the transmitting antenna will be reduced from 152m to 122m.
   b) The insulators will be replaced or remodelled according to the change in rated power from 100 kW to 500 kW.

3) The tuning unit of the transmitting antenna will be renewed according to the change in radiation power.

4) The main feeder line will be renewed according to the increase in rated power.

5) The high-voltage switchboard for receiving electric power will be renewed according to the increase in consumption power.

The construction of a station building to accommodate the transmitter and the antenna tuning house are to be the responsibility of the Bangladesh side.

The organization to implement this Project, the operational system after completion, management planning, staff planning and programme planning follow.

3-3-1 Implementation Organization and Operation System

The implementation organization of this Project is Radio Bangladesh which is under the control of the Ministry of Information. Radio Bangladesh, the organization of which is as explained in Chapter 2, has experience in operating a total of four high-output power radio transmitting stations for example, the 1000 kW Dhamrai Station including Chittagong Station which was completed in 1988 under Japan's Grant Aid.

In Savar Transmitting Station, which is the site for this Project, there are a medium wave 100 kW transmitter (for Programme-B), a 10 kW medium wave transmitter (for Programme-C) and two 100 kW shortwave transmitters (for domestic broadcasts), of which the operation and maintenance are conducted by 138 persons, and the maintenance is well carried out. The level of technical ability is high, and sufficient for operating high-power transmitters.

3-3-2 Management Planning, Staff Planning

After completion of the Project, management, operation and maintenance of the facility will be conducted uniformly to the medium wave and shortwave transmitters.

As for the increase in the number of the staff resulting from the increase in transmitting power, an Additional Chief Engineer and two others are planned; a staff system with a total of 141 persons will be established.

(1) Working System

First shift	05:00~13:00
Second shift	11:00~19:00
Third shift	17:00~24:00

Staff composition for one shift

Regional Engineer	1 person
Radio Engineer	1 person
Assistant Radio Engineer	2 persons

Radio Technician	3 persons
Equipment Attendant	1 person

One shift will consist of 8 persons including the Regional Engineer as chief and considering the take over of duties, an overlap of two hours is set. In addition, regular maintenance work will be done between 7:30 and 10:30 when there are no broadcasts, and in the case where special maintenance is requested, it may also be done after termination of daily broadcasting (23:30).

(2) Staff Titles

Additional Chief Engineer		1 person*
Resident Engineer	1	person
Regional Engineer	3	persons
Radio Engineer	16	persons
Assistant Radio Engineer	9	persons
Administrative Officer	1	person
Head Assistant	1	person
Air Conditioning Supervisor	1	person
Accountant	1	person
Stenographer	1	person, 3 persons*
UDA-cum-Cashier	1	person
LDA-cum-Typist	4	persons
Store Keeper	1	person
Radio Technician	19	persons
Car Driver	2	persons
Daftary	1	person
Equipment Attendant	5	persons
MLSS Worker	12	persons (Regular)
MLSS Guard	10	persons (Regular)
Farash	18	persons (Irregular)
Chowkider	10	persons (Irregular)
Gardener	13	persons (Irregular)
Sweeper	8	persons (Irregular)
Total	138	persons
	141	Persons*

(* Number of staff after implementation of this Project)

3-3-3 Programme Planning

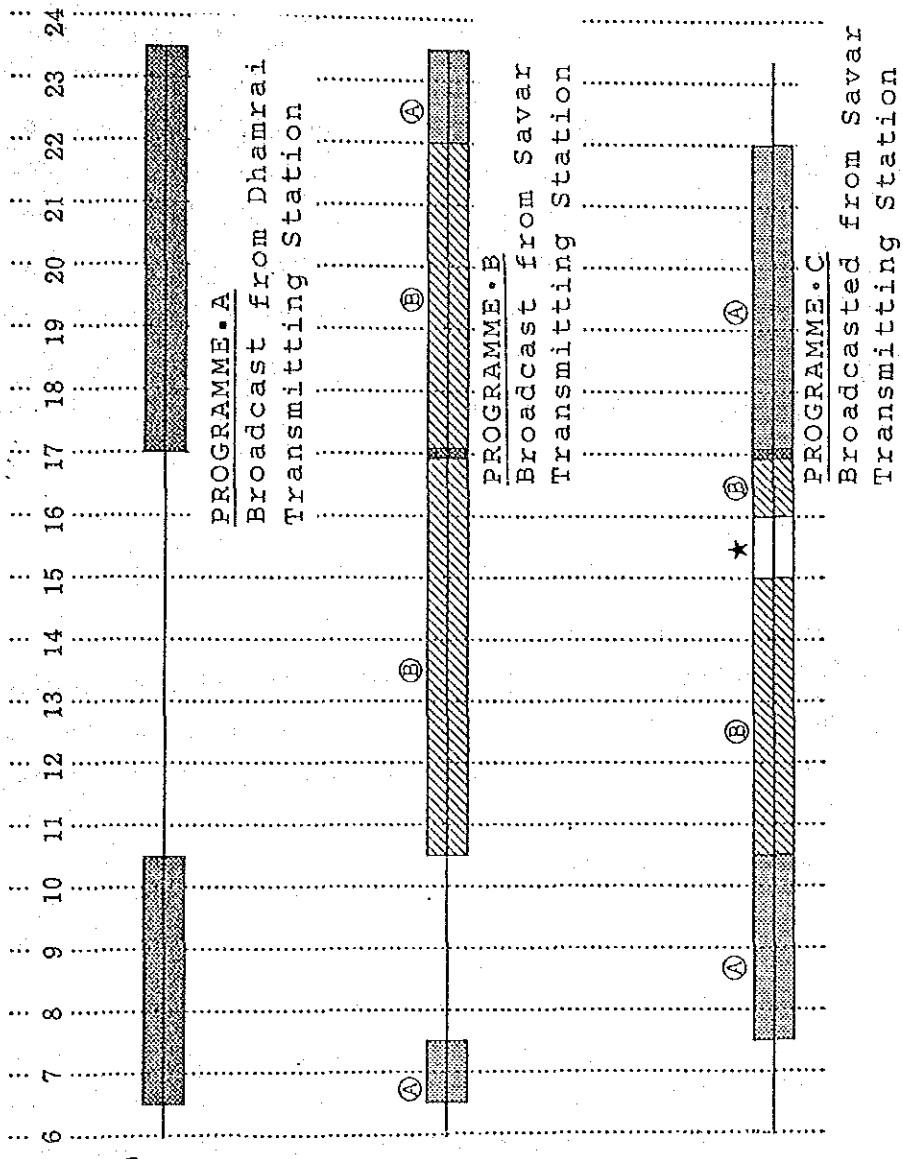
At present, the three programme formats produced at the Broadcasting House in Dhaka are; Programme-A, Programme-B and Programme-C (almost completely composed of Programme-A and Programme-B content, and broadcast simultaneously). Programme-A is transmitted from Dhamrai, Programme-B and Programme-C are transmitted from Savar Station (Composition of Programme-C is given in Fig. 8).

Programme-A and Programme-B are broadcast toward the whole country, but the coverage of Programme-B is somewhat insufficient. At present, reception in the north-east part and in the north-west part near the border of India, is difficult. However, with the implementation of this Project, Programme-B will be receivable throughout the whole country, and the whole country could be covered with two systems: Programme-A and Programme-B. Thus, school programmes, educational and cultural programmes, weather information and enlightenment programmes for the whole country will be enhanced.

3-3-4 Outline of Facility and Materials

The overall block diagram of the broadcasting system for this Project is given in Fig. 4-4-1.

The main facilities and materials are as follows:



Ⓐ : Same contents as A.PROGRAMME

Ⓑ : Same contents as B.PROGRAMME

Ⓒ : Same contents as C.PROGRAMME

* : Programme unique C.PROGRAMME (Music)

Fig. 8 Present State of Broadcasting Programme from Dhaka

1) Medium Wave 500 kW Transmitter

The transmitter is a parallel operation system of two sets of 630 kHz, 250 kW transmitters, and the output power of the two transmitters is combined by a combiner to obtain the rated 500 kW output power.

The circuit composition of each transmitter is the same, evaporation cooling transmitter tubes are used for modulated amplifier tubes and modulater tubes, and the rest are full solid state circuits to raise the reliability.

The composition of the peripheral equipment of the transmitters includes:

Programme Input Equipment

Control / Surveillance console

Dummy Antenna

Pure Water Device (for evaporation cooling tube)

2) Electric Power Facility

The facility consists of a high-voltage power switchboard for switching between the two power receiving routes, and a power receiving facility for the transmitter power source as follows:

Switchboard

Power Receiving Board

Transformer

Induction Voltage Regulator

Electric Power Distributing Board

The amount of consumption power varies according to the modulation degree of the transmitter, but the average amount is about 1030 kW and the maximum amount is about 1410 kW.

3) Main Feeder Line

An aerial 8-wire type feeder line to supply the transmitter output power to the transmitting antenna is installed over a total distance of about 180m.

4) Antenna Tuning Unit

This is an antenna tuning unit for matching the main feeder line impedance with the transmitting antenna input impedance, and it

is installed in the antenna tuning house at the transmitting antenna base.

5) Transmitting Antenna

The present 152m high 3-direction, 4-stage stay type truss mast, base insulator type transmitting antenna is remodelled into a 122 m high antenna registered at IFRB.

6) Others

For the programme transmission link between the Broadcasting House and Savar Transmitting Station, the existing radio link (UHF band 6-multiplexed full solid-state) is used.

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4-1 Establishment of Design Policy

In the drawing up of the design policy, the facts registered at the International Frequency Registration Board (IFRB) were reflected in the contents required and the results of the field survey.

In the design of the facility, the special situation of Bangladesh and the operation and maintenance system were taken into account so as to benefit the public and to create a system which is superior in operation, economical, easy to maintain and of high reliability over a long term. Moreover, sufficient consideration is to be paid so as to shorten the suspension term of broadcasting as much as possible.

With the above aim in mind, the equipment and facility necessary for replacing the present 819 kHz, 100 kW transmitter by 630 kHz, 500 kW transmitter is designed .

The overall broadcasting system for facilities which is the object of this Project is shown in Fig. 4-4-1.

4-1-1 Transmitting Facility

In the design for transmitting facilities, environmental conditions such as the weather are taken into account to provide facilities with excellent durability. In addition, sufficient attention is paid to high reliability, operability, maintainability and economy of operating cost from both aspects of hardware and software. In particular, as high voltage is handled, sufficient consideration will be given to safety measures.

The transmitter ratings will be 630 kHz and 500 kW (250kW transmitter × 2 sets) and the specifications for the equipment will comply with the CCIR technical standards.

In addition, in determining the method of executing the construction work, the suspension of broadcasting services because of the construction

work will be shortened as much as possible, and overall consideration will be given to ensuring that the construction work is carried out efficiently.

After the transmitting station is completed, it will basically be of attended operation.

4-1-2 Transmitting Antenna Facility

The present transmitting antenna will be used after it is remodelled, but the height of the transmitting antenna will be 122 m (630 kHz) to comply with the data registered at IFRB.

The insulators, etc., to be used are selected so that they will sufficiently endure the rated 500 kW power, and in the design for the base, anchors and stays, etc., the architectural standards, related regulations and various structure design standards established by the Japan Architectural Institute are referred to so that they will be sufficiently strong even against cyclones. In respect to the bearing capacity of the soil at the site, the results of the survey on the nature of the soil are referred to.

The base insulator will be replaced with larger ones that will endure high-frequency voltage of 500 kW, and a rain-hat and corona ring will be installed. In the stay insulator, a ball-gap and choke coil are inserted as countermeasures against lightning.

The present radial earth will be used but the conductors will be partly reinforced considering the increase in base current.

Colour painting of the aviation obstruction lighting system and the tower mast will be carried out according to the regulations of the International Civil Aviation Organization (ICAO).

In respect to the feeder line, the present one is changed to an 8-wire aerial feeder so that it will endure 500 kW power.

4-1-3 Power Source Facility

The power source for Savar Transmitting Station is received from two systems: Dhamrai Substation and Mirpur Substation. Interruption of power usually occurs several times a month, mainly in March through May, and October through December when there are many cyclones. However, the majority of the interruptions are usually short, just two to three minutes.

The range of voltage variation in the power source is about ±10%, and the power source to be used for the transmitter equipment is stabilized by an induction voltage regulator.

Equipment and wiring materials to be used will comply with the JIS standards and sufficient attention will be paid to ensure security.

4-1-4 Station Building

As it is impossible to accommodate the necessary facilities and equipment for this Project in the present station building because of insufficient space, it is necessary to remodel and enlarge the building. In addition, as three transmitters—medium wave 100 kW, 10 kW and shortwave 100 kW—are operated in the same station building, it is necessary to temporarily remove the presently operating facilities for remodelling and enlarging the station building. The new transmitting building is to be built adjacent to the present building, considering the relative position of the transmitting antenna and the line of movement of the people in executing their daily routine work.

The new station building consists of four rooms; the transmitter room, heat-exchange room, power room and control room. The new building should have sufficient durability against natural and environmental conditions, and the structure should be such that the dust and dirt in the external air does not enter the rooms, and the heat radiated from the equipment is drawn outside by means of ventilation.

Fig. 4-4-4 shows the layout plan of the new transmitter station building.

4-2 Basic Plan

4-2-1 Establishment of Scale

The scale of the plan is established as follows on the basis of the contents required, results of the field survey and agreements with IFRB so as to obtain the maximum effect with the minimum budget, and also to ensure economical and efficient operation after completion of the Project.

(1) Transmitting Facility

The transmitter output power is 500 kW (630 kHz) which is necessary for covering the whole of Bangladesh. The transmitting facility is a parallel operation system consisting of two sets of 250 kW transmitters. The output of each transmitter is combined by a combiner to obtain the rated 500 kW output power.

The estimated coverage area for 630 kHz 500 kW transmitter operation is shown in Fig. 7.

The merit of this system is that in case one of the two transmitter sets happens to break down, it is able to continue broadcasting on 125 kW [Note] with no interruption, and then increase the output power to 250 kW at an intermission of the programming. As it is possible to restore the output power to 500 kW by means of a simple operation after the trouble is repaired, the reception quality in remote areas during failure of one transmitter set is reduced. Also, as there will be almost no reduction in reception quality within a 100 km area, it is a superior system from the viewpoint of broadcasting service and also ease of maintenance.

Note: In the case of operating two sets in parallel, when one set fails, the functional output power of the combiner will become one-fourth of the combined output.

The economic merits of a 500 kW transmitter system consisting of two 250 kW sets, and that of a 500 kW main transmitter plus a spare 50 kW

transmitter system are just about the same. However, at the time of failure, the 250 kW × 2 set system is advantageous from the viewpoint of security of coverage, and common use of spare units, etc.

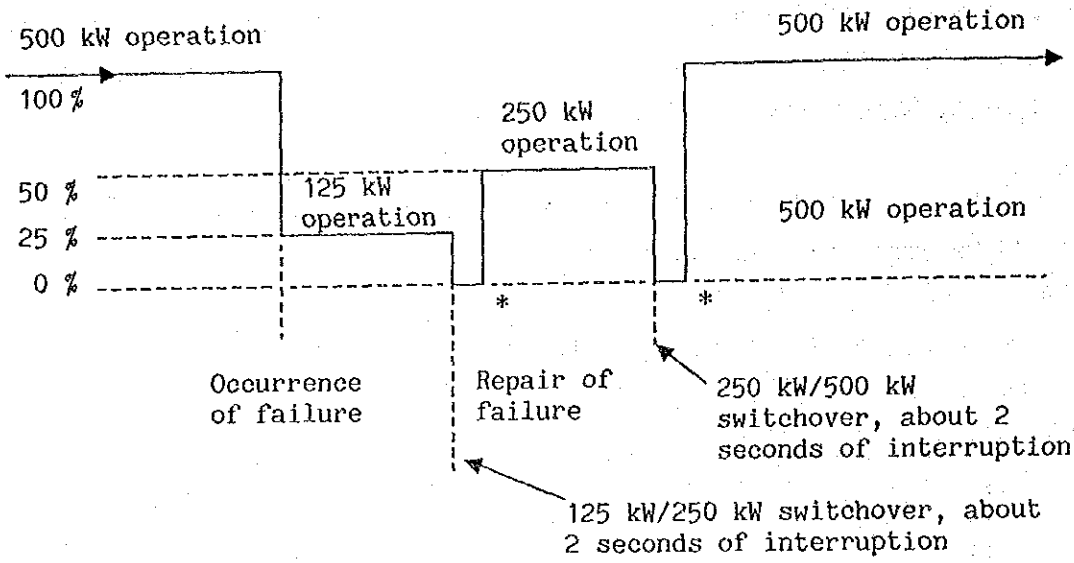
The peripheral equipment of the transmitter system include a programme input device, control console, pure-water device for cooling transmitter tubes and a dummy antenna.

In the following table the estimated coverage for 500 kW, 250 kW and 125 kW operations are indicated.

Comparison of coverage for 630 kHz when operated on 500 kW, 250 kW and 125 kW (daytime, dry season)

	500 kW	250 kW	125 kW
Area	61 %	46 %	34 %
Population	71 %	58 %	46 %
Comparison against 500kW (area ratio/ population ratio)	1	0.76/0.81	0.56/0.68

The flow from transmitter failure to restoration of rated output power is shown next.



* Switchover of programmes is performed at a time when the influence from it is small such as during pauses between programmes

(2) Transmitting Antenna

About more than 25 years have passed since the present transmitting antenna has been constructed. However, as some deterioration such as cracks in the anchor block, rust on the stays and trouble in the aviation obstruction lighting system can be observed, excluding the main tower mast, they will be renewed at the time the height of the present transmitting antenna and the antenna input power are changed to the rated values.

When installing a new transmitting antenna, an unoccupied ground surface (about 400m×400m) is newly required. As there is no such space in the present site, the existing transmitting antenna will be remodelled and repaired in its present location.

In the following table, the specifications for the new and old antennas are compared.

Comparison of New and Old Antenna

	Antenna height and type	Electrical ratings
Existing transmitting antenna	height 152 m, 3-direction 4-stage stay type Truss tower, base feed	819 kHz 100 kW
New transmitting antenna (after being remodelled)	height 122 m, 3-direction 4-stage stay type Truss tower, base feed	630 kHz 500 kW

As the antenna base voltage and antenna distribution voltage rise in accordance with the increase in transmitting power and change in transmitting frequency, countermeasures for preventing electrical discharge at the antenna base insulator and stay insulators will be provided. The earth conductor will also be reinforced to reduce the earth loss from the increase in base current as much as possible.

(3) Antenna Tuning Unit

In accordance with the change in transmitting frequency and the increase in transmitting power, the antenna tuning unit will be renewed. The rated input power is 500 kW and the antenna tuning unit is provided with measures against lightning damage.

The antenna tuning unit is to be accommodated in the antenna tuning house constructed at the antenna base. It is to be noted that the construction of the tuning house is a responsibility of the Bangladesh side.

(4) Main Feeder Line

Regarding the main feeder line for supplying transmitter output power to the antenna; it is to be an 8-wire aerial type; the rating is to be 500 kW, and the total length is about 180 m.

(5) Power Facility

The power consumption increases by about 900 kW as the transmitter output power is increased to 500kW. It is therefore necessary to increase the rated power of the power receiving step-up transformer (facility of electric supply company). The exchange of the present transformer with a larger one is to be a responsibility of the Bangladesh side.

The main types of equipment that will be enhanced by this Project are the high-voltage switchboard, power receiving transformer, high-voltage board, low-voltage board, power distribution board and induction voltage regulator.

The range of voltage variation that the induction voltage regulator is to cover is ± 15%, to meet voltage variation in the received power.

The power consumption of this Project is as follows:

During broadcasting hours	Average value	1,030 kW
	Max. value	1,410 kW

Fig. 4-4-11 shows the diagram of the power supply facility system.

(6) Station Building

The station building is an one-storied reinforced concrete structure, it consists of four rooms, transmitter room, heat-exchange room, power room and control room.

The layout of each room is arranged considering the line of movement of the work between the existing transmitter hall—control room, control

room—transmitter room—power room, transmitter room—heat-exchange room, and they are respectively arranged so that they could be connected mutually with the shortest path. As shown in Fig. 4-4-4, each room is located around the control room. As the floor area of each room will be decided on the layout of equipment to be accommodated, the layout of equipment is arranged so that the line of movement of the work, such as for daily operation, periodical maintenance and repair of trouble will be as short as possible, as well as working space for maintenance (space of 1.5m - 2m around each equipment) and space for carrying in and out equipment in case of breakdown is considered. In addition in 500 kW transmitters, as it is necessary to handle peripheral equipment dealing with high-voltage and large amount of current, a path will be provided around the equipment for daily inspection.

Taking the above into consideration, equipment will be arranged as shown in the Fig. 4-4-9.

The floor area of each room is as follows.

Transmitter room	about	480m^2
Control room	〃	54m^2
Power room	〃	144m^2
Heat-exchange room	〃	42m^2
Total	〃	720m^2

The height of ceiling is 4.6m so that it will be able to accommodate the sloping pipe (gradient 5°) for evaporation drawn from the transmitter to the heat-exchange room.

The height of the floor above ground is the same as the present station building, and the new and old buildings are connected with a roofed passage.

To maintain the ambient temperature of the equipment lower than 45°C over a long-term, the heat capacity released from the equipment in the rooms is drawn outside by ventilation. An air filter is attached to the open-air intake to prevent dust from entering the room.

(7) Spare Parts

The details are to be determined in the Implementation Design, but the following basic parts and their quantities are those with which operation of the facility would be possible without an additional supply of parts for at least two years after installation of the equipment. These are arranged so that the client can grasp the amount of the consumption of spare parts and take the necessary budgetary steps.

Transmitter tube	100 % of the number of tubes in use
Relay, switch, etc.	One for each kind
Lamp, fuse	200 % of the number of fuses in use
Motor for ventilation fan	100 % of the number of motors in use
Main equipment module	One for each kind
Transistor, IC	Two for each kind
Air filter	200 % of the number of filters in use

4-2-2 Transmitting Equipment

The transmitting equipment consists of transmitter, output power combiner, dummy antenna, input equipment, and control surveillance console.

(1) Transmitter

The transmitter system is a parallel operation of two 250 kW transmitter sets, and the two output powers are combined by a combiner to obtain the rated 500 kW output power.
The circuit composition of each transmitter set is the same in order to ensure interchangeability of each set and the use of common spare parts.

In order to raise the reliability, stabilize the operation and reduce the consumption of power, transmitter tubes (evaporation cooling) are used only in the final-stage modulated amplifier and modulator, and all other low-power stages use solid-state circuits.

The high-voltage power source equipment (transformers for high-voltage power source and rectifier circuit, modulation transformer and modulation choke-coil, etc.,) are installed in a safety fence separated from the transmitter. The high-voltage equipment are separated with a safety fence in order to ensure security at the time of maintenance work. A safety device is also attached to the fence.

The output power of each transmitter is combined by an output power combiner, and the rated 500 kW output power obtained is supplied to the transmitting antenna through the main feeder line.

The programme input equipment and control/surveillance device, etc., of the transmitter are installed in the control room. The heat-exchanger for transmitter tubes is accommodated in the heat exchange room.

The layout of equipment of the transmitter room is shown in Fig.4-4-9.

Basically, the transmitter station is of an attended operation type, and such operations as starting/stopping, etc., are done by hand. The transmitter system could be controlled from two places: the transmitter main body and control console.

(2) Dummy Antenna

As for the dummy load to adjust and test the transmitter, a dummy antenna for a 500 kW transmitter is installed in the transmitter room.

For ease of maintenance, the water cooling system is adopted.

(3) Programme Equipment

The programme signal will be sent to Savar Transmitting Station (about 15 km) from the Broadcasting House in Dhaka City through the

existing STL (Studio-to-Transmitter Link, UHF-band radio-link, 6-channel multiplex).

The programme signals, after passing through the programme input equipment, become the input signal of the transmitters.

The input equipment has the function of limiting the signal amplitude and adjusting the signal level in order to prevent the transmitter from overmodulation. The input equipment consists of a limiting amplifier, input/output switchboard, jack panel and power source unit, and is accommodated in a standard rack that is installed in the control/surveillance room.
In order to facilitate the daily maintenance work, a monitor amplifier, monitor switchboard and oscilloscope for measurement of modulation degree, etc., is also accommodated in the same rack.

(4) Control Console

A control console integrated with control/surveillance functions for daily operations, such as starting/stopping of the transmitters and adjustment of modulation degree, surveillance of operational conditions of transmitters, surveillance of modulation degree and sound quality, is installed in the control room.

As the noise of ventilation and cooling, etc., hinders the monitoring work, the control room is of a soundproof structure.

In the control room, an airconditioner is installed to adjust the room temperature.

(5) Ventilation Device

In order to draw out the heat radiated by each piece of equipment in the transmitter room by means of ventilation, an intake with an air filter attached is mounted on the wall, and a ventilation fan is also installed.

(6) Station Telephone System

To carry out the daily routine work and maintenance work smoothly, and to ensure security, a loud-speaker type interphone is installed in the control room, transmitter room, electric power room, antenna tuning house, power switch-board room, present transmitter hall and station master's room.

(7) Other equipment

Clock system to confirm the operation time of the transmitter, etc., and shelves for storing tools including spare parts, etc., which are necessary for operating the transmitter station are respectively installed.

4-2-3 Transmitting Antenna

At present, as the 152 m high transmitting antenna operating on 819 kHz, 100kW, is to operate on 630 kHz, 500kW, it will be remodelled into a 122 m high transmitting antenna, as stipulated by IFRB. In addition, the superannuated portion will be remodelled and repaired applicable to 500 kW.

(1) Change in Transmitting Antenna Height

The top of the present tower mast will be cut off and remodelled into a tower 122m in height. Due to this remodelling work, the base impedance against 630 kHz is estimated to be about $80\Omega+j70\Omega$.
In Fig. 9, the present and the remodelled antennas are shown.

(2) Renewal of Stays and Stay Anchor

With the change in tower height, it is necessary to change the position of the attached stays. In addition, as the voltage distribution of the transmitting antenna varies with the increase in radiated power of the antenna, and the voltage at the very top portion rises by several times the present level, it is necessary to exchange the insulators with ones of which the voltage endurance is

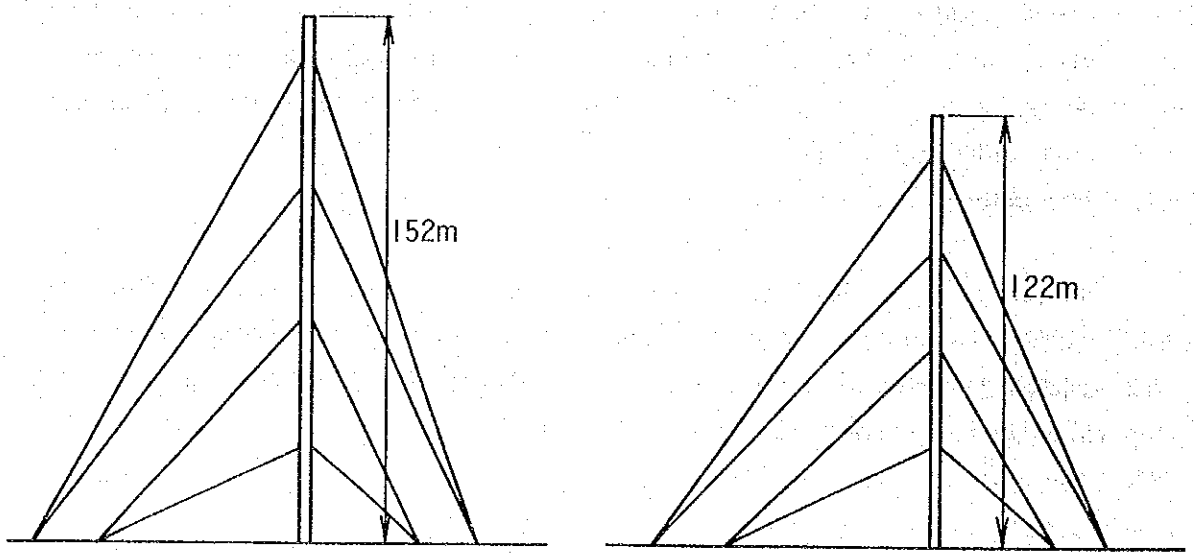


Fig. 9 Comparison Between Existing & Modified Antennas

high, and also increase the number of insulators. Therefore, all of the stays and stay insulators will be replaced.

In addition, the load on the stay anchors increases as the dimensions of the stay insulators become larger. Therefore, the anchors will be replaced with ones that will sufficiently endure the new load.

(3) Remodelling of Antenna Base Insulator

As the rated output power of a transmitter increases to 500 kW, the transmitting antenna base voltage rises. Therefore, to increase the endurance voltage at high frequencies, the base insulator will be enlarged and a rain hat and corona ring will be newly installed.

The weight on antenna base will increase by use of larger stay insulators. However, as the height of antenna tower will become lower, the weight on tower base will be canceled. Therefore, the present tower base will be used as it is.

(4) Radial Earth

The existing radial earth (radius 180m, 120 conductors) will be used. But as the earth current is estimated to increase by about 10 times with the increase in transmitting output power and the change in transmitting frequency, necessary steps such as repair of the earth connection points, etc., will be taken so that the loss will not increase.

(5) Aviation Obstruction Lighting System

The superannuated aviation obstruction lighting system will be renewed and the steel tower will be painted according to the ICAO regulations.

(6) Antenna Matching Device

With the change in antenna height and transmitting frequencies (152m to 122 m, 819 kHz to 630 kHz), the transmitting antenna impedance decreases greatly. Therefore, the antenna matching device is to be renewed in accordance with the increase in rated antenna power and the change in antenna impedance.
In the following table, the actually measured impedance of the present transmitting antenna and the estimated impedance after remodelling to 122 m is indicated.

Transmitting Antenna Impedance

Antenna Height	Impedance	Remarks
152 m (819 kHz)	451Ω-j 273Ω	Present State
122 m (630 kHz)	80Ω+j 70Ω	Estimated Value after Remodelling

(7) Main Feeder Line

The rating of the main feeder line is changed to 500 kW as the transmitter output power will be increased to 500 kW.

An 8-wire feeder line which is easy to maintain is used, and it will be installed between the new station building and the new antenna tuning house (length, about 180 m).

The height of the aerial feeder line will be about 4 m above ground level.

4-2-4 Power Source Facility

Either the Dhamrai Substation (11 kV) or Mirpur Substation power system (3.3 kV, boosted up to 11 kV at the transmitting station), is selected manually by a switch, and the output is distributed to each facility.

In the power system for broadcast equipment, an automatic voltage regulator is used to stabilize the operation of equipment. It is able to suppress ±15% voltage variation in the power receiving source within ±2%.

In Fig. 4-4-10 the schematic diagram of the power receiving power system is shown.
The amount of power consumption in the main equipment is as follows:

Transmitter Equipment		
500 kW Transmitter	(at 0% modulation)	850kW
	(at 100% modulation)	1,380kW
	(at average modulation)	1,000kW
Dummy Load		3kW
Reflected Wave Equalizer		2kW
Input Rack		1kW
Surveillance, Measurement Rack		
Control Console		1kW
Aviation Obstruction Lighting		2kW
Others		1kW
Subtotal	1,006kW(at average modulation)	
General Use		
General Lighting		5kW
Air Conditioner,Switchboard		10kW
Others		10kW
Subtotal		25kW
Grand Total		1,031kW

4-2-5 Equipment, Materials

The transmitter and its related peripheral equipment, transmitting antenna and receiving power facilities are as follows:

(1) Transmitter device and its peripheral equipment

Medium wave Radio Transmitter (630 kHz, 250 kW)		2 sets
Output Power Combiner (Input 250 kW X 2, Output 500 kW)		1 set
Dummy Antenna (500 kW water-cooled)		1 set
Programme Input/Surveillance Equipment		1 set
Limiting Amplifier	2 sets	
Modulation Meter	1 set	
Input Switch Board	1 set	
Monitor Switch Board	1 set	
Monitor Amplifier	1 unit	
Oscilloscope	1 set	
Audio Characteristic Measuring Apparatus	1 set	
Variable Attenuator (Audio frequency)	1 set	
Jack Panel	1 set	
Display Panel	1 set	
Cabinet Rack	1 set	
Pure Water Device		1 set
Heat Exchanger		1 set
Interphone Device		1 set
Control/Surveillance Console		1 set
Measuring Apparatus		1 set
Impedance		1 set
Frequency		1 set
Field Strength		1 set
Test Oscillator		1 set
Circuit Tester		3 units
Insulation Resistance Tester		1 unit
Air Conditioner (Refrigerator 4-ton)		2 sets

Power Distribution Board	1 set
Ventilation Fan	4 units
Clock	3 sets
Construction Material	1 set
Spare Parts (Transmitter tubes, etc.)	1 set

(2) Transmitting Antenna System

Antenna System Material (including Anchor Block)	1 set
Main Feeder Line (230Ω,500 kW, 8-wire aerial, including bowl type insulators)	1 set
Antenna Tuning Unit	1 set
Stay (with metal mountings and insulators)	1 set
Tubular Feeder	1 set
Austin Transformer	1 set
Aviation Obstruction Lighting System	1 set
Rain Hat	1 set
Corona Ring	1 set
Spare Parts	1 set

(3) Receiving Power Facilities

High Voltage Board		1 set
Lightning Arrester Board		1 set
Branch Board		1 set
Distribution Board		1 set
Transformer	1700 kVA (11 kV/6.6 kV)	1 set
Transformer	750 kVA (6.6 kV/400 V/230 V)	2 sets
Transformer	50 kVA (6.6 kV/400 V/230 V)	1 set
Induction Voltage Regulator	750 kVA	2 sets
Spare Parts		1 set

(4) Others