

2-3-5 Social Environment

(1) Road Conditions

The major and traditional transportation means in Bhutan "transportation on foot" through footpaths. The first road was constructed connecting Thimphu, Paro and Phuntsholing in the Western region as a north-south route. After that, two north-south routes were constructed in the Central and Eastern regions. Finally, a east-west route road construction was completed recently.

The Project sites except Samchi are connected by the trunk roads, which extend passing through steep mountains, sometimes winding sharply. Therefore, it takes a lot of times to get to an exchange office from another though they are not so distant from each other in a straight line length. For instance, Thimphu and Tashigang are located along the east-west trunk road, and the straight line length between them is only 310 km. However, the road length reaches approx. 560 km and it takes about 3 days to get to Tashigang from Thimphu.

The Project sites of almost all repeater stations are located on the top, ridge or slope of mountains (except 2-3 repeater stations). For these stations, new access road construction is essential for installation, operation and maintenance of telecommunication facilities.

(2) Electricity

The public power supply is available in the district centers and major towns in Bhutan. As for the Project sites, only in Pemagatsel no public power is supplied. For all the repeater stations, public power is unavailable. Public power is generated by a mini/micro hydro electric power generator or diesel engine generator except for

Chhuka Hydro Electric Power Generating Station (336 MW). Therefore, the generating capacity is relatively small. The receiving power condition in Thimphu and Jakar is rather stable, but in other Project sites the power is not stable. Especially, in Shemgang, public power is supplied only 3.5 hours (18:30 - 22:00) a day.

(3) Others

As mentioned previously, almost all exchange sites are district centers and they have the basic infrastructure on the subsistence level, such as hospitals and schools.

CHAPTER 3
OUTLINE OF THE PROJECT

Chapter 3 Outline of the Project

3-1 Objective

The objective of the Project is to promote the regionally well balanced socio-economic development in the country, by establishing a unified nationwide telecommunication network including the renewal of existing telecommunication facilities.

3-2 Study and Examination on the Request

3-2-1 Adequacy and Necessity of the Project

The requested Telecommunication Network Project aims to establish a nationwide telecommunication network in the Kingdom of Bhutan, unifying the existing Western, Central and Eastern regional networks, each now being operated independently from each other. For this purpose, the Project plans to install a telecommunication system consisting of digital microwave transmission links, digital telephone exchanges and DRCS, to connect 21 towns which are the centers of social, economic and administrative activities in the country.

The interregional communication system now in use is the HF radio system based on the Morse codes and, therefore, extremely poor in quality and reliability. Implementation of this Project means an establishment of the first national backbone network, which is an urgent need for the country.

In 13 of 21 towns telephone exchanges exist, and in 8 no telephones at all. The switching equipment in these exchanges, except that in the capital Thimphu, are the outdated, of which production has already been stopped. That is, additional procurement of the same type of switching equipment for system expansion is impracticable. Even spares to replace the overage

parts are difficult to obtain or very expensive, if any. Trunk lines connecting 13 sites, except for Thimphu-Phuntsholing, are of open wires which are frequently disconnected due to wire breaking. From a technical viewpoint, expansion of this system is not practicable.

Under this Project it is planned to eliminate non-telephone areas and to replace all the outdated telephone switching equipment and the transmission lines with new ones, except for Thimphu.

As described above, the existing facilities are inadequate for providing satisfactory services to the existing subscribers, as well as for meeting new demands. Therefore, overall rehabilitation of the existing telephone switching and microwave transmission networks is an urgent necessity for the nation.

A regional telephone network has already been established connecting 8 towns in the Western region with Thimphu as its center, though its facilities have qualitative and quantitative problems. On the other hand, communications between Thimphu and the Central region and between Thimphu and the Eastern region are barely maintained by the Morse codes system. That is, there exists a considerable imbalance among the regions in telephone service grade.

It is a pressing need for Kingdom of Bhutan, therefore, to establish a unified nationwide communication network with Thimphu as its center, accommodating the Central and Eastern regions. A high priority should be given to this plan in the national development program.

Under the Project, it is planned to incorporate the existing telephone switching equipment and telex switching equipment in Thimphu in the new network as they are. Both being the digital equipment introduced rather recently and equipped with sufficient functions to work as a center of the national network and a

gateway to the international network as well, this arrangement is considered reasonable.

All the requested communication facilities except subscribers cables are of digital systems. Since the equipment in Thimphu Exchange are the digital equipment, adoption of the digital system for the new national network is appropriate from both technical and economical standpoints.

3-2-2. Execution Plan of the Project

The number of the staff of the Department of Telecommunication is 335 in total as mentioned in Section 2-2-3, i.e., 136 staff for 1,000 subscribers. This ratio is rather high as compared with other countries, though it can be attributed, to some extent, to such factors causing inefficient maintenance as the average and small scale facilities, low telephone density, etc.

Upon completion of this Project, the operation and maintenance system will be rationalized, and the above ratio can be improved considerably. Assuming that the number of staff in the year 2002 will be approx. 7,000, the necessary number of staff of the Department of Telecommunications will be about 350. That is, only a limited number of staff will have to be recruited annually.

The advanced digital technology will be introduced in the national network under the Project. Therefore, expertise in analogue technology only will not be sufficient for the operation and maintenance of the network.

Judging from the high technological level of the engineers (including junior engineers) of the Department of Telecommunications, it is considered most desirable and also practicable to train some of these engineers into the responsible staff for operation and maintenance of the new system.

3-2-3 Other Aid for Telecommunication Sector

No other aid that the Government of Japan has been planned and committed for the telecommunication sector in Bhutan.

3-2-4 Elements of the Project

The Project consists of digital microwave transmission network, DRCS network, digital switching network and subscriber network including telephone instruments. These networks are integrated into a nationwide total network, in which every network must interwork systematically with each other satisfying traffic requirements, functional requirements, electrical conditions, etc. Therefore, it is most desirable that the Project will be executed as one project consists of all the elements.

3-2-5 Study of the Requested Facilities, Equipment and Materials

- (1) The requested microwave transmission links are to cover non telephone services, such as telex, telegram and data, in addition to the telephone service. Judging from the current situation of telecommunication services and the scale of the social and economic activities in Bhutan, demands for such services are considered not to increase so sharply. Provision of circuits of small capacity will sufficiently meet the requirements.
- (2) For the microwave transmission links, one 34-Mbit/s system for telephone service (including non-telephone service) plus one standby system (i.e., 1+1 system) will be installed. The spare system can be utilized for TV broadcasting and no exclusive system for TV broadcasting only will not be provided.

- (3) The DRCS (digital radio concentration system) having a capacity of 128 connections is requested. However, the demand study has disclosed that the requested system is not preferable: a number of additional systems will have to be installed in the near future, giving rise to a frequency allocation problem. Even at present the capacity of 128 connections is not adequate to cover the existing demands. To avoid the frequency allocation problem and achieve cost economization, it is recommended to install the system having a capacity of 1,024 connections under this Project.
- (4) As for the other exchanges than the primary exchanges, application of a remote line unit (RSU) is a suitable approach from economic point of view.
- (5) Upgrading and renewal of subscriber cables is also included in the request. However, since Bhutan staff have enough capabilities in network design and installation practice, only the supply of cables and jointing materials will be preferable. As for the type of cables to be supplied, aerial cables will be recommendable, in view of the geographical conditions in Bhutan and the scale of the cable network.

3-2-6 Basic Policy of Cooperation for the Project

Cooperation for the Project under the Grant Aid of the Government of Japan is considered reasonable because the effectiveness and realities of the Project, Bhutans capabilities for accomplishing the Project, etc. have been ascertained. The effectiveness of the Project meets the philosophy of the Grant Aid system. Therefore, the basic design was carried out to the following scope of the Project, that is a matter of large urgency and ranked with top priority, provided that the Project would be executed under the Grant Aid of the Government of Japan.

- (1) New installation of Routes 1, 2 and 3 of the digital microwave transmission network.
- (2) New installation of digital telephone exchanges related to Routes 1, 2 and 3.
- (3) New installation of DRCS related to Routes 1 and 2.
- (4) New installation or renewall of local networks related to the new telephone exchanges and the new DRCS subscriber stations.

3-3 Project Description

3-3-1 Executing Agency and Operational Structure

Executing Agency of the Project is Department of Telecommunication, Ministry of Communication, Royal Government of Bhutan. The telecommunication facilities to be provided by the Project will also be operated and maintained by the Department. The organization structure of the Ministry of Communication is shown in the following page.

The Project aims to satisfy the telephone demands in 2002 which are forecasted in the ITU Master Plan. That is:

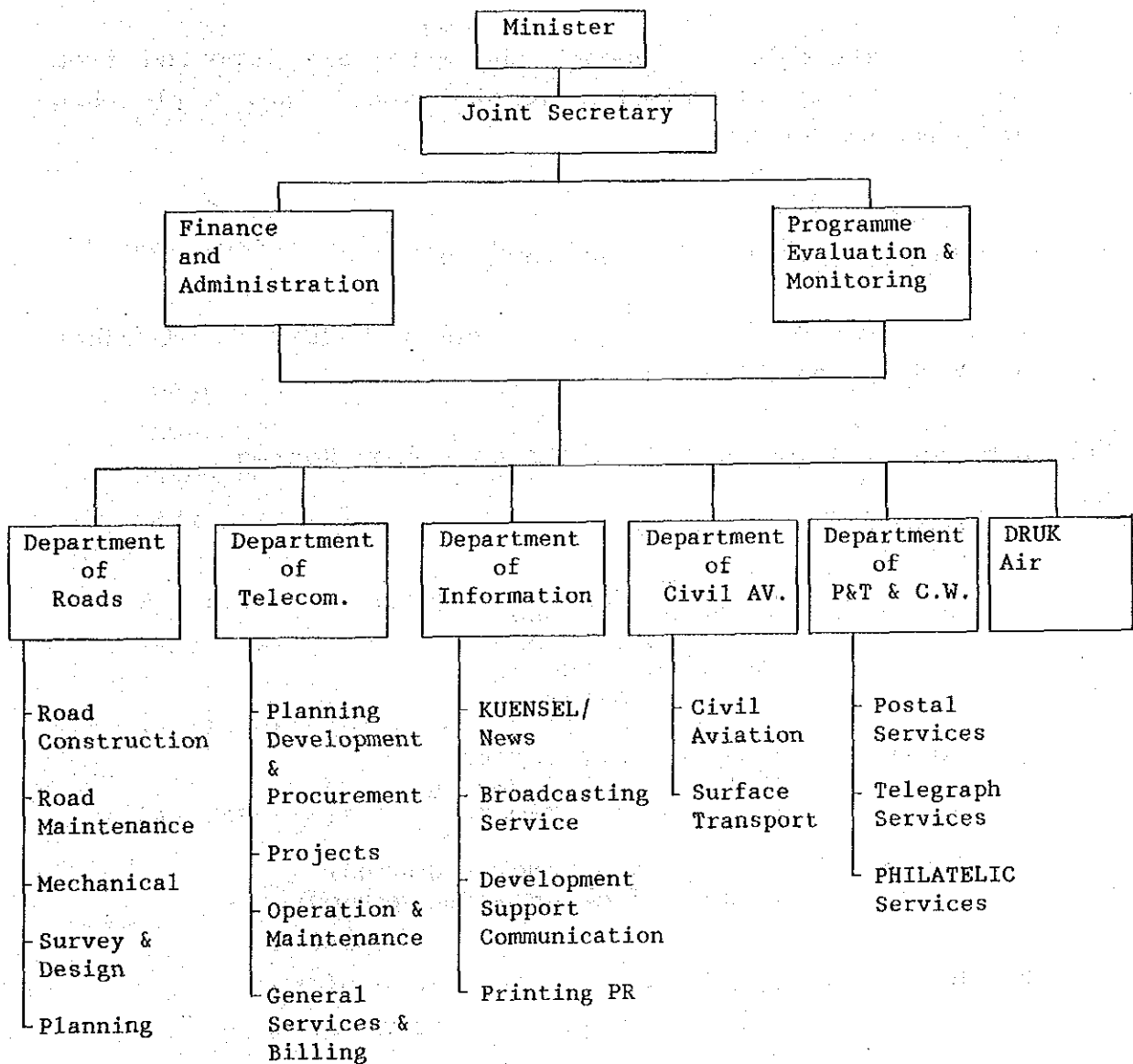
Telephone densities per household

Farmers:	1.3%
Workers:	0.6%
Shop Keepers:	20.0%
Govt. employees:	14.0%
Others:	33.0%

Telephone density per population: 0.642%

Taking the above demands into consideration, the demands to be satisfied by the Project are estimated as follows:

Tongsa:	250	Geylegphug:	230
Tashigan:	220	Sarbhong:	150
Jakar:	250	Shembang:	100
Yongphula:	190	Damphu:	260
Mongar:	100	Daga:	80
Lhuntshi:	90	Samdrup Jonkhar:	290
		Pemagatsel:	100



Organization Chart of the Ministry of Communications

3-3-2 Location and Condition of Project Sites

- (1) Locations of telephone exchanges, microwave repeater stations, etc. have been planned by Telecom Australia. These sites shall be finalized through confirmation of the line of sight and studies on radio transmission quality, economization of facilities, ease of operation and maintenance, etc. To confirm the line of sight, high trees in the direction of radio path at the sites must be cut down at the time of the Detail Design of the Project.
- (2) It is preferable to deposit the materials imported from outside Bhutan at Thimphu, Tongsa, Tashiling, Geylegphug and Samdrup Jonkhar.

3-3-3 Outline of Facilities and Equipment

Facilities and equipment to be supplied under the Project are outlined in the following:

(1) New Installation of Digital Transmission Routes

1) Transmission section for:

- | | |
|---------|--|
| Route 1 | Thimphu - Tongsa
Tongsa - Tashigan
Tashigan - Mongar
Tongsa - Jakar |
| Route 2 | Tongsa - Geylegphug
Geylegphug - Shemgang
Geylegphug - Damphu |
| Route 3 | Tashigang - Samdrup Jonkhar
Samdrup Jonkhar - Pemagatsel |

2) Bearing capacity of:

34 Mb/s 1 + 1

Introduction of TV signal transmission will become possible by adding a TV CODEC.

(2) New Installation of Digital Telephone Exchanges

<u>Name of site</u>	<u>Type of equipment</u>	<u>Number of line</u>	<u>Host exchange</u>
Tongsa	Independent (S.C.)	500	
Jakar	RSU	500	Tongsa
Tashigang	Independent (S.C.)	810	
Mongar	RSU	410	Tashigang
Geylegphug	Independent (P.C.)	650	
Shemgang	RSU	200	Geylegphug
Damphu	RSU	620	Geylegphug
Samdrup Jonkhar	Independent (P.C.)	600	
Pemagatsel	RSU	200	Samdrup Jonkhar

(3) New Installation of DRCSs

<u>Name of site</u>	<u>Number of line</u>	<u>Base station exchange</u>
Yongphula	190	Tashigang
Lhuntshi	90	Mongar RSU
Sarbhang	150	Geylegphug
Daga	80	Damphu

The maximum capacity of DRCS is 1,024 lines, and 1 DRCS system will be installed in each site.

(4) Supply of Cables for Local Networks

1) Materials consist of:

- Cables, jointing materials and cable suspending hardware
- Cable distribution boxes (D.P.)
- Pole bands for fixing of cable
- Installation tools
- Testers for maintenance

2) Number of lines and cable length

<u>Number of site</u>	<u>Number of line</u>	<u>Cable length (m)</u>
Tongsa	250	7,000
Jakar	250	14,000
Tashigan	220	5,000
Yongphula	190	7,000
Mongar	100	6,000
Lhuntshi	90	5,000
Geyulegphug	230	7,000
Sarbhang	150	5,000
Shemgang	100	5,000
Damphu	260	8,000
Daga	80	6,000
Samdrup Jonkhar	290	4,000
Pemagatsel	100	5,000

(5) New Installation of Shelters

All repeater stations for the digital microwave transmission network and DRCSs.

CHAPTER 4
BASIC DESIGN

Chapter 4 Basic Design

4-1 Design Policy

International standards such as CCITT, CCIR recommendations and reports will be applied for the basic design of the Project.

4-2 Basic Plan

4-2-1 Digital Microwave Transmission Network

(1) Qualities of Transmission Line

1) CCIR recommendation 634 for digital radio transmission will be satisfied as follows:

- 1. Bit Error Rate will not exceed $10E-3$ during more than 0.054% of any month.
- 2. Bit Error Rate will not exceed $10E-6$ during more than 0.4% of any month.
- 3. Total error time will not exceed more than 0.3% of any month.
- 4. Residual Bit Error Rate (RBER) satisfy the following formula:

$$RBER \leq (L \times 5 \times 10E-9)/2500$$

2) Calculation of fading occurrence probability will be in accordance to CCIR Report 338.

(2) Radio Frequency

8 GHz band (CCIR Rec.386-3, Annex I) for main transmission routes and 8.3 GHz band (CCIR Rep.1055, Annex III) for spur transmission routes will be used.

(3) Antenna

- 1) Antenna heights will satisfy more than 1.0 of clearance efficient at $K = 4/3$.
- 2) Two reflectors will be applied for passive repeater where the reflect angle is extremely wide.

(4) Rain Attenuation

Attenuation of radio propagation by rainfall will not be less than flat fade margin, and calculation of the attenuation will be in accordance with CCIR Reports 721-2 and 563-3.

(5) TV Transmission

TV signal transmission will function in the future in such a manner that signals are parallelly sent to all remote radio terminal stations from Thimphu, and individually received from every remote terminal station at Thimphu.

(6) Design Parameter

Radio frequency 8 GHz for main route
 8.3 GHz for spur route

Transmission capacity 34 Mb/s 1 + 1

Modulation method 4 PSK

Transmit power +30 dBm or +20 dBm

Minimum input level -84.5 dBm (10E-3 BER)

Antenna gain:

<u>Diameter</u>	<u>8 GHz</u>	<u>8.3 GHz</u>
1.2 m	37.5 dB	37.8 dB
1.8	41.0	41.3
2.4	43.5	43.8
3.0	45.4	45.8
3.6	47.0	47.4
4.6	48.5	48.5

4-2-2 Digital Radio Concentration System (DRCS)

(1) Qualities of Radio Transmission Line

1) Local Grade in the CCITT Rec. G-821 will be applied between the base station and any subscriber stations as follows:

- 1. Bit Error Rate will not exceed $10E-3$ during more than 0.015% of any month.
- 2. Bit Error Rate will not exceed $10E-6$ more than 1.5% of any month.

2) Probability of fading occurrence will be in accordance to CCIR Rep.338-5.

(2) Radio Frequency

2.4 GHz band (CCIR Rep.933) will be applied.

(3) Antenna

Antenna height will be calculated by the following formulas:

Calculation A $K = 4/3$, clearance efficient ≥ 1

Calculation B $K = 2/3$, clearance efficient ≥ 0.3

Higher one of the above shall be selected. However, the antenna height shall not be less than 10 m in any case.

(4) Design Parameter

Radio frequency	2.4 GHz
Channel spacing	4 MHz
Transmit-receiving frequency spacing	94 MHz
Modulation method	4 PSK
Transmit power	31.5 dBm

Minimum input level	-92 dBm
Non directional antenna gain	10 dB
Horn antenna gain	20 dB

4-2-3 Digital Telephone Exchange

(1) Type and Capacity of Switching Equipment

Switching equipment type and capacity in terms of subscriber line including DRCS subscribers are as follows:

<u>Name of site</u>	<u>Type of equipment</u>	<u>Number of line</u>	<u>Host exchange</u>
Tongsa	Independent (S.C)	500	
Jakar	RSU	500	Tongsa
Tashigang	Independent (S.C)	1,000	
Mongar	RSU	500	Tashigang
Gaylegphug	Independent (P.C)	800	
Shemgang	RSU	200	Gaylegphug
Damphu	RSU	700	Gaylegphug
Samdrup Jonkhar	Independent (P.C)	600	
Pemagatsel	RSU	200	Samdrup Jonkhar

(2) Traffic

The following traffic distribution will be satisfied.

	THI	PHU	TON	GAY	TAS	SAJ	SCI	PAR	INT	TOT
THI	89.0	11.4	3.2	15.0	11.7	3.1	6.2	5.7	4.7	150.0
PHU	13.0	24.0	.7	2.3	2.4	.7	4.3	.4	1.9	50.0
TON	2.4	.9	13.6	9.6	3.0	.5	.3	.2	.5	30.0
GAY	15.8	2.5	9.3	28.9	6.7	1.2	1.3	.8	3.5	70.0
TAS	7.2	2.7	2.6	5.9	21.0	8.0	.8	.3	1.4	50.0
SAJ	6.7	2.8	.4	1.7	1.5	10.3	.3	.2	1.1	25.0
SCI	6.3	2.8	.4	2.0	1.5	.3	10.3	.3	1.1	25.0
PAR	4.4	1.1	.2	1.0	.8	.2	.3	6.5	.5	15.0
INT	4.9	1.9	.5	3.6	1.4	.8	1.1	.5	.0	14.7
TOT	150.0	50.0	30.0	70.0	50.0	25.0	25.0	15.0	14.7	150.0

(3) Signalling

CCITT R2 signalling system will be applied between exchanges at an initial stage. Introduction of No.7 signalling in future will also be considered.

(4) Numbering

Switching will correspond flexibly to the following numbering.

International call prefix: "00"

Trunk call prefix: "0"

6-digit subscriber numbering: ABxxxx

A = Trunk (Area) code

B = Exchange code

Special numbering: 1xx

(5) Charging

Any charging method of Automatic Message Accounting (AMA) and Multimetering will be available. Charging information will be recorded and stored on the magnetic tape (MT).

(6) Subscriber Categories

Any subscriber category of ordinary, PABX, PBX and public telephones (coin and/or prepaid card) will be handed.

(7) Supervision and Control

Two sets of input/output equipment to supervise and control the switching equipment will be provided for each independent exchange. RSU will also be supervised and controlled remotely through input/output equipment in the host exchange.

(8) Operation Position

- 1) Two operator positions will be provided at each independent exchange to offer various operator services.
- 2) Existing manual board at Tongsa, Tashigang, Geyleghug and Samdrup Jonkhar will continue to operate to offer manual connection service by the existing open wire lines. 2 ringdown trunk circuits will be provided between the manual board and new digital exchange.

(9) Rearrangement of Thimphu Switching Equipment

The existing switching equipment in Thimphu will be rearranged, mainly with respect to software, as necessary for interworking with the new exchanges under the unified switching network. Existing digital trunk interface (DTI) provided in Thimphu exchange as spare will be utilized for interconnection with the new exchanges.

4-2-4 Power Supplies

(1) Primary Power Source

Public power shall be used as much as possible. For DRCS station only Solar Power System will be applied in view of its small power consumption.

For the exchange where the public electricity power cannot be used, Dual Prime Engine Generating System will be applied.

For the repeater stations where the power consumption is rather small, Solar Power System will be applied, and for the repeater stations where power consumption is rather large, Combined Power System (Solar Power and Diesel Engine Generator) will be applied.

For the exchange where the public power cannot be used, Dual Prime Engine Generating System will be applied.

For the repeater stations where power consumption is rather small, Solar Power System will be applied, and for the repeater stations where power consumption is rather large, Combined Power System (Solar Power and Diesel Engine Generator) will be applied.

For the exchange where the public power is available, the standby engine generator will be installed for emergency use. However, in the case that the public power is not stable, the standby engine generator shall be of dual type to ensure satisfactory operation and maintenance.

(2) Secondary Power Source

When the primary power source cannot be used, the required power for the telecommunication equipment will be supplied from storage batteries. The duration of power supply from storage batteries to the telecommunication equipment at the busiest time shall be as follows:

Exchange (Public Electric Power and Single Standby Engine Generator):	12 hours
Exchange (Public Electric Power and Dual Standby Engine Generator):	6 hours
Exchange (Dual Prime Engine Generator):	6 hours
Repeater station (Solar Power System and Single Engine Generator):	5 days
Repeater stations and DRCS stations (Solar Power System):	15 days

(3) Public Electric Power

Nominal: 415 V, 50 Hz, 3-phase, 4-wire or
240 V, 50 Hz, single-phase, 2-wire

Standard: 400 V, 50 Hz, 3-phase, 4-wire or
230 V, 50 Hz, single-phase, 2-wire

(4) Insolation

Concerning insolation and sunshine, no reliable data exist in Bhutan. Therefore, the insolation data in Kathumandu, Nepal will be applied because the meteorological condition in Kathumandu is very similar to that in Bhutan. (These data were used in the Master Plan, also.)

Insolation Data Kathumandu

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Insolation Hours of Ra- diatio/Month	183	158	236	285	177	147	81	74	99	161	156	158

(5) Storage Battery

Two banks of Lead-Acid Storage Batteries (1 bank is composed of 24 cells) will be used in each station.

(6) Rectifying Equipment

Rectifying equipment will consist of N+1 rectifier units including standby unit.

(7) Diesel Engine Generator

Diesel Engine Generator with air-cooling type will be used. The output power of a generator shall be A.C 415/240 V, 50 Hz, 3-phase, 4-wire. The required capacity is not only

the power consumption of telecommunication load but also 2 to 3 kVA as the auxiliary power consumption, such as an electric lamp, motors.

(8) Mobile Type Diesel Engine Generator

Public electric power in Bhutan is not reliable. To cope with this problem, a Mobile Type Diesel Engine Generator will be provided as well as for the overhaul of the single standby engine generator.

(9) Portable Type Diesel Engine Generator

For the purpose of maintenance work in the place where public power is not available, the Portable Type Diesel Engine Generator as well as the Portable Type Rectifying Equipment for charging of storage batteries (small capacity) will be provided.

4-2-5 Antenna Supporting Structures and Buildings

(1) Antenna Supporting Structure

1) Type of Supporting Structures

A self-supporting tower will be constructed except for DRCS antennas considering the shape and size of the sites. As for DRCS, a prefabricated mast made of steel plate will be installed because the antenna required is small in size and low in height.

2) Height of Supporting Structures and Reflectors

Height of an antenna supporting tower is the antenna height plus 2 m in consideration of the size of antennas and effectiveness of lightning arrester. Height of

a reflector shall be 3 m above the ground at its bottom so as to avoid radio transmission disturbance due to snowbank on the ground.

3) Components of Antenna Supporting Tower

Feeder rack, working ladder, platform, lightning arrester and earthing will be included. No feeder rack and working ladder will be provided for DRCS mast.

(2) Building

Prefabricated shelter will be provided for all the microwave repeater and DRCS repeater stations considering ease of installation and shortening of installation periods. The size of floor space will be reasonably considered taking into account the future expansion of equipment.

(3) Structural Design Conditions

1) Deflection and Distortion of Antenna

The structures shall maintain 3 dB or less transmission loss against ground level wind velocity of 90 km/h and 20 dB or less against 150 km/h. Radome will be provided for antennas in snowfall areas.

2) Wind Loading

No observation data exist in Bhutan concerning snowfall. A ground level wind velocity of 160 km/h will be applied in all the structural design.

3) Snowfall Loading

Approx. 70% of the loading by piled-up snow on the ground will be considered in the foundation design for

the site over 2,500 m in altitude. As for the snowfall sticks to the structure and antenna, a loading with approx. 10 mm, 0.6 g/cm³ weight on the surface will be considered.

4) Seismic Loading

No observation data exist in Bhutan concerning the seismic intensity, though Bhutan belongs to the Asian seismic area. As for the horizontal seismic intensity in the elasticity design, therefore, the data shown in "Seismicity Distribution Map of the World" published by the Building Research Institute (Ministry of Construction, Japan) will be applied for all the structural design.

5) Soil Bearing Capacity

10 t/m² will be applied for all the sites as a minimum expected soil bearing capacity.

6) Concrete Strength of Foundations

The cement made in Bhutan will be used. In this case, Ultimate concrete strength of 150 kg/cm² (28 days after molding) in compression will be applied.

7) Temperature

Since the temperature at sites at an altitude of over 4,000 m becomes approx. -20°C in the winter season, a particular consideration will be required for the concrete foundations, e.g., depth of the foundation, etc.

8) Standard for Structure Design

British Standard (BS), Electric Industries Association Standard (EIA) and Japanese Industrial Standard (JIS) will be applied for the structural design concerned.

9) Other Design Conditions

- For treatment of steel surfaces of antenna supporting structures, thickness of galvanization by hot dip process shall be 500 g/m².
- No air craft warning lighting and warning painting will be made.
- In designing the antenna supporting structures, future expansion of antennas for Route 5 and DRCS will be taken into consideration.

4-3 Basic Telecommunication Network Plan

As the result of the basic design based on the above-mentioned criteria, the microwave transmission network plan and telephone switching network plan have been drawn up as shown in Fig. 3 and Fig. 4, respectively.

Details of the basic design are described in VOLUME II.

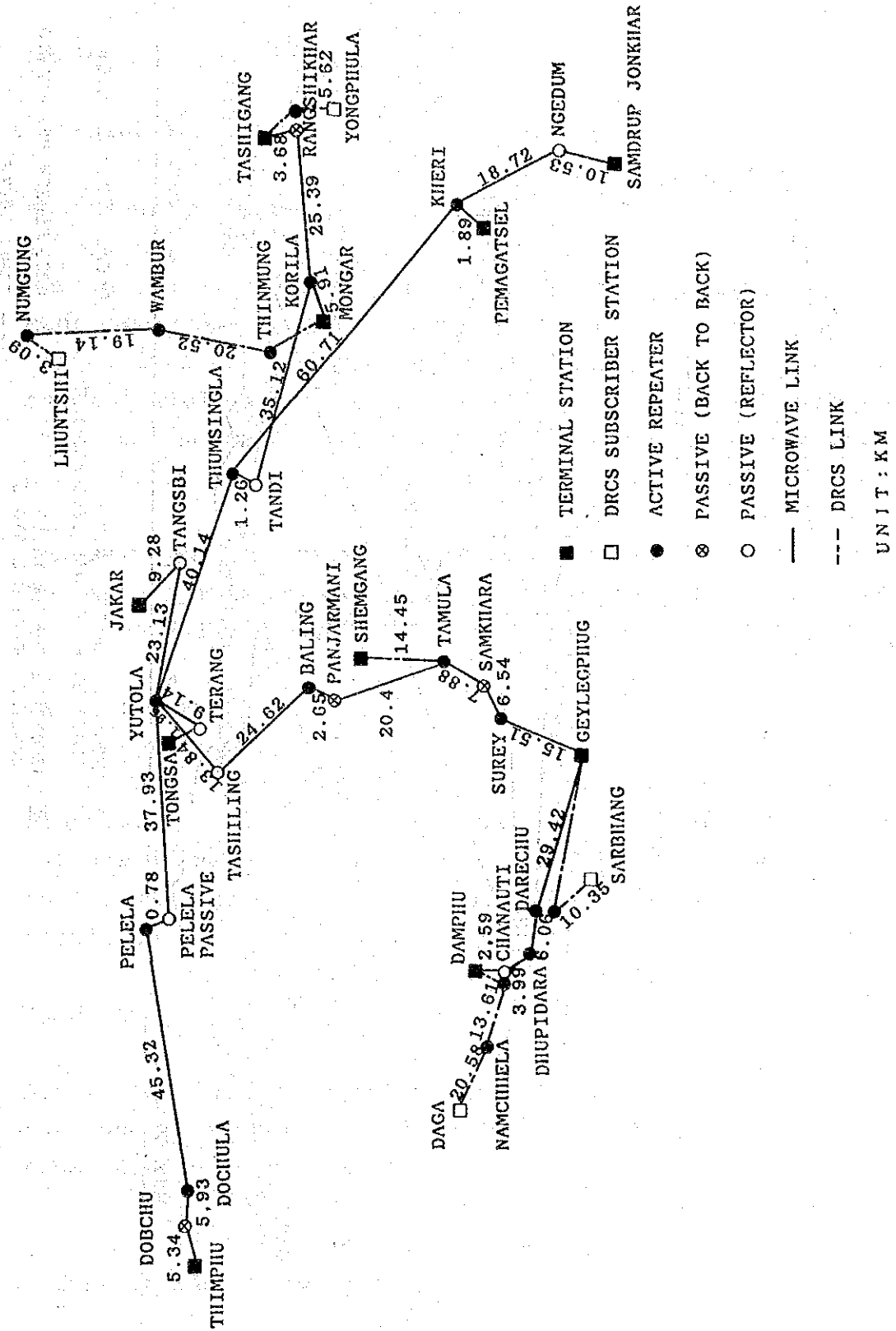


Fig. 3 Microwave Transmission Network Plan

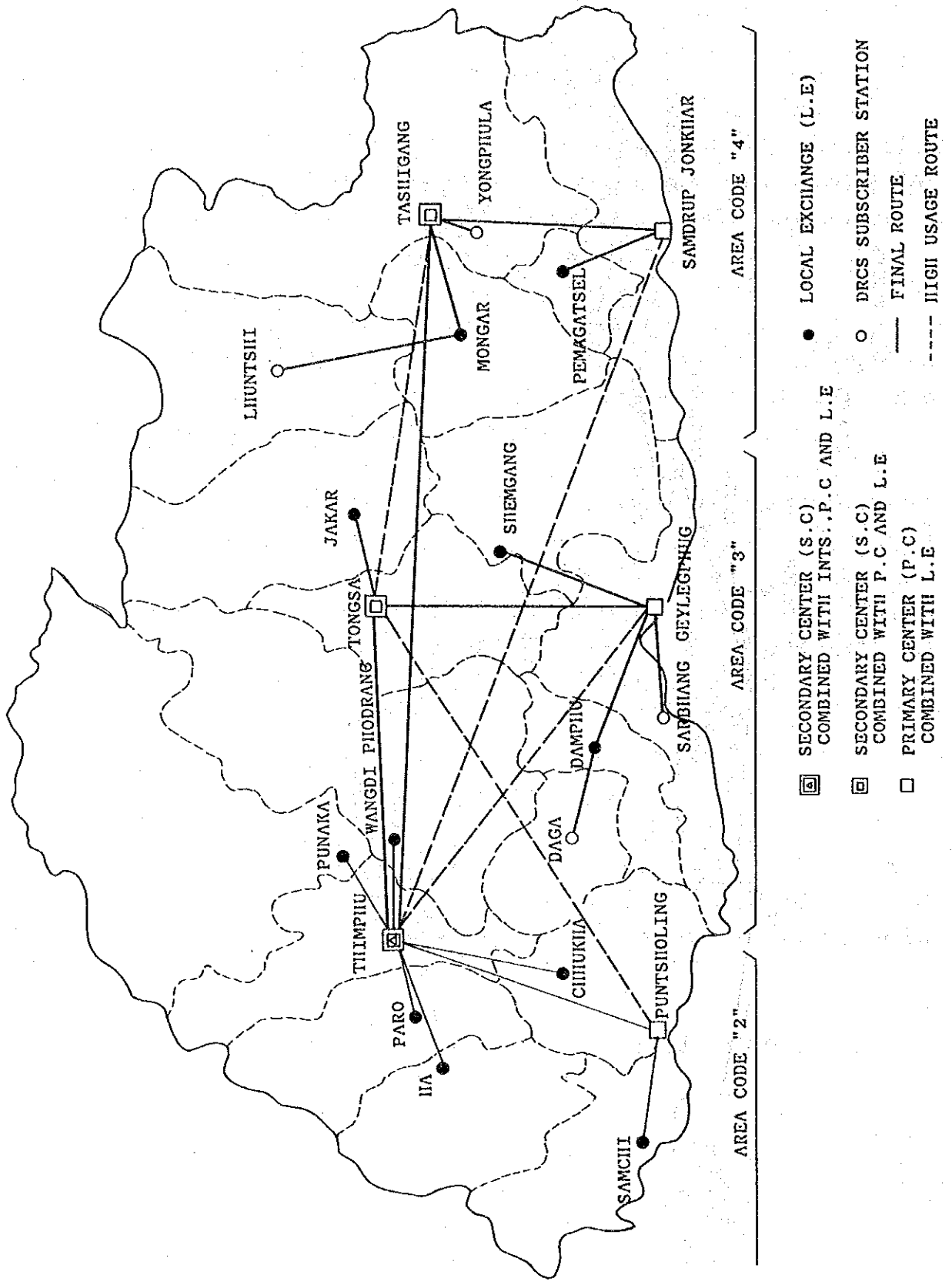


Fig. 4 Telephone Switching Network Plan

4-4 Implementation Plan

4-4-1 Procurement

(1) Equipment and Materials

Considering the market circumstances and quality of equipment and materials obtainable in Bhutan, as well as the target date for the Project completion, all the equipment and materials/accessories for the Project except primary products and cement will be supplied from Japan. Primary products and cement will be procured in Bhutan.

Spares, tools, testing instruments necessary for normal operation and maintenance of the telecommunication network for a period of 3 years will be included in the Project.

(2) Manufacturer

In general, procurement of telecommunication facilities from various manufacturers is not advisable for a unified nationwide network because the running cost becomes high. As for this Project, it is most desirable to procure the facilities from one manufacturer.

(3) Manpower

Due to the lack of manpower in Bhutan, it is necessary to introduce some skilled personnel and technical specialists from outside Bhutan for the Project construction.

4-4-2 Construction Condition

(1) The natural conditions at the Project sites are very severe, with low temperature and heavy snowfall. To construct the telecommunication facilities at such sites is

the first experience for Bhutan. To ensure the reliability of the system after completion, therefore, due attention should be paid in constructing the facilities.

- (2) The severe natural conditions at the sites will also affect adversely the progress of the construction and installation works. Especially the low temperature and heavy snowfall at high land in northern part and heavy rainfall at low land in southern part must be taken into consideration. An appropriate coordination of the Project implementation will become necessary.

4-4-3 Installation and Supervision

- (1) Detail Design

A Japanese consultant will carry out the detail design of the Project and prepare tender documents consisting of detailed technical specifications and general conditions of tender and contract.

- (2) Supervision

Contractor's works will be supervised by the consultant. The supervision consisting of full attendances and spot attendance will be desirable to cover a number of sites scattered widely. For each technical field of radio, multiplex, switching, power and civil, a spot supervisor is required. For overall supervision and coordination of the Project, a full attendance supervisor is required.

4-4-4 Implementation Schedule

To implement the Project a period of approximately 30 months will be required, in view of the widely scattered sites, and the

climatic and geographical conditions in Bhutan. Consequently, the Project is to be divided into three (3) phases as shown below:

First phase:

Route 1 of digital microwave transmission

Second phase:

Routes 2 and 3 of digital microwave transmission network, and digital telephone exchanges:

- Tongsa
- Jakar
- Mongar
- Tashigang
- Geylegphug
- Samdrup Jonkhar

and Cables for 6 local networks

Third phase:

4 DRCS network, and digital telephone exchanges:

- Shembang
- Dampfu
- Pemagatsel

and Cables for 7 local networks

4-4-5 Scope of Works

(1) Scope of the Japan Side

The following works will be carried out by the Government of Japan:

- 1. New installation of Routes 1, 2 and of digital microwave transmission network
- 2. New installation of digital telephone exchanges related to Routes 1, 2 and 3
- 3. New installation of DRCS related to Routes 1 and 2

- 4. Supply of cables for local networks related to the new telephone exchanges and DRCS subscriber stations
- 5. Supply of spares, tools and testing instruments for operation and maintenance works

(2) Scope of the Bhutan Side

1) The following works will be carried out by the Royal Government of Bhutan:

- 1. Construction of new buildings and/or modification of existing building for new telephone exchanges and new DRCS subscriber stations.
- 2. Land acquisition
- 3. Construction of access roads to sites, site preparation with fencing
- 4. Detail design of local networks
- 5. Procurement of cable laying materials, wiring materials for subscriber's premises and telephone instruments
- 6. Laying of local cables

2) The funds required to execute the above works will be secured by the Royal Government of Bhutan. The following budget is estimated.

- | | |
|---|-------------------|
| -1. Land procurement: | Nu. 300,000 |
| -2. Access roads, site leveling and fencing: | Nu. 22.72 Million |
| -3. Buildings | |
| New: | Nu. 500,000 each |
| Renovation/extension of existing buildings: | Nu. 250,000 each |
| -4. Local network materials and installation cost for routes 1 and 2: | Nu. 4.00 Million |
| -5. Cost for telephone instruments: | Nu. 1,000.- |
| | Nu. 1,200 each |

CHAPTER 5

PROJECT EVALUATION AND CONCLUSION

Chapter 5 Project Evaluation and Conclusion

The towns where the telephone connection from Thimphu - the capital of Kingdom of Bhutan - is available number only seven (7) in the Western region at present. Five (5) towns of them are the centers of DZONGKHAGs. One town among them, Phuntsholing, is the center of the national economy. Another town, Samchi, is a strategic town located near the border with India. The telephone connection from the capital to the towns in the Central and Eastern regions is also not available. That is, there is no means of telephone connection between the capital region and the areas of six (6) districts in the Central region and five (5) districts in the Eastern region out of the total eighteen (18) districts in the whole Bhutan. Therefore, inhabitants in both regions are isolated from the cardinal information in the capital.

There are three (3) exchanges in the Central region and two (2) exchanges in the Eastern region, for inner-region telecommunication. There is no telephone service to connect both Central and Eastern regions also. Moreover, inhabitants in seven (7) DZONGKHAGs have no opportunity to reach a telecommunication service except civil wireless.

As described above, Bhutan's telecommunication system is divided into three (3) to work independently for Western, Central and Eastern regions. Inter-region communication is being maintained through ardnous one (1) narrow road and by an unreliable HF radio link because the rugged mountains stand along borders of these regions.

The unified nation-wide telecommunication network to be established under this Project will function as a national fundamental networks. Its impact will be extended to every aspect of socio-economic activities. For instance, as a direct impact, consumers surplus will be increased by the replacement of the vehicle transportation with the modern telecommunication means.

In the field of primary industry (mainly agriculture and forest), the production efficiency will be boosted and better services are to be expected in market economy. The unified nation-wide telecommunication network is marvelous tools for the government so that administration will be in force more efficiently at any community in the whole nation. That will be able to contribute greatly to accomplishment of the target of the Seventh National Development Plan.

The Project planned is to provide not only for telephone services but also non-telephone services, such as facsimile, telex and data communication services, as well as basic preparation for nation-wide broadcasting network of television and radio. It is clear that nowadays above mentioned telecommunication network is essential for any citizen and government that have any sort of connection with socio-economic activities.

It is concluded that the planned Project is appropriate to be implemented as a Grant Aid project because the benefit created from such telecommunication network is shared with all nationals and the government.

APPENDICES

Appendix 1 Member List of Survey Team

Team Leader	Toru FUJITA	Researcher Grant Aid Div. Economic Corporation Bureau Ministry of Foreign Affairs
Telecommunication Policy Planner	Katsumi KOBAYASHI	Deputy Director Frequency Planning Div. Radio Dept. Telecommunication Bureau Ministry of Posts and Telecommunications
Project Coordinator	Yuki ARATSU	Second Basic Design Study Div. Grant Aid Study & Design Dept. JICA
Telecommunication Network Planner (General)	Shigeto KIMURA	The Nippon Telecommunications Consulting Co., Ltd. (NTC)
Telecommunication Network Planner (Radio Transmission)	Katsuya OWATARI	The Nippon Telecommunications Consulting Co., Ltd. (NTC)
Telecommunication Network Planner (Radio Transmission)	Nobuyuki SUETSUGU	The Nippon Telecommunications Consulting Co., Ltd. (NTC)
Telecommunication Network Planner (Switching)	Shoji EZAWA	The Nippon Telecommunications Consulting Co., Ltd. (NTC)
Telecommunication Network Planner (Outside Plant)	Kunio YUKINO	The Nippon Telecommunications Consulting Co., Ltd. (NTC)
Telecommunication Network Planner (Architecture)	Yoshihisa UCHIDA	Nissoken Architects & Engineers (NISSOKEN)
Telecommunication Network Planner (Power)	Takeshi KOMIYA	The Nippon Telecommunications Consulting Co., Ltd. (NTC)

Appendix 2 Member List of Concerning Party

Agency of the Kingdom of Bhutan

Dasho C. Dorji	Dy. Minister, Planning Commission
Dasho Yeshey Zimba	Joint Secretary, Planning Commission
Mr. Karma Sonam	Planning Officer, Planning Commission
Lyonpo T. Tobgyel	Honorable Minister, Ministry of Communication
Mr. R. B. Rai	Dy. Secretary, MOC
Mr. Dawa Tenzin	Dy. Director, MOC
Ms. Sonam Wangmo	Planning Officer, MOC
Mr. D. K. Chhetri	Joint Secretary, Ministry of Foreign Affairs
Dasho Dophu Tshering	Chief of Protocol, Ministry of Foreign Affairs
Dasho Nakchung Tshering	Director, Ministry of Finance
Mr. Bap Kesang	Managing Director, RMA
Mr. Wangdi Norbu	Director, National Budget & Accounts
Mr. Bhim Subba	Director, Department of Power
Mr. Ugyen Namgyel	Director, MOC
Mr. Pema Wangdi	Director, Ministry of Home Affairs
Dasho Sonam Tobgye	Secretary, RCSC
Dasho Leki Dorji	Secretary, Ministry of Agriculture
Dasho Khandu Wangchuk	Secretary, Department of Agriculture
Mr. Tshering Wangdi	Director General, Department of Revenue & Customs
Mr. Bap Yeshey Dorji	Director, Department of Telecom
Mr. Thinley Dorji	Project Manager, Department of Telecommunication
Mr. Om Dhungel	Department of Telecommunication
Mr. Rabilal Pokhrel	Department of Telecommunication
Mr. Pushpa Mani Pradhan	Department of Telecommunication
Mr. Tandi Wangchuk	Department of Telecommunication
Mr. Tashi Tshering	Department of Telecommunication

International Agency

Mr. Ismet Hamiti	ITU Project Coordinator
Mr. An N. Mandeville	Senior Hydrologist, Norpower
Mr. M. Mosleh Uddin	Faculty Member, United Nations

Japanese Agency

Mr. Kenichi Sasaki	Coordinator, JOCV
Mr. T. Hida	Resident Representative in India, JICA

ON

BASIC DESIGN STUDY

ON

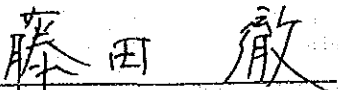
THE PROJECT FOR DEVELOPMENT OF DOMESTIC TELECOMMUNICATION
NETWORK IN THE KINGDOM OF BHUTAN

In response to the request of the Royal Government of Bhutan, the Government of Japan decided to conduct a Basic Design Study on the Project for Development of Domestic Telecommunication Network (hereinafter referred to as "the Project") after the examination of the result of the Preliminary Study conducted in July, 1990, and entrusted the Study to the Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA sent to Bhutan the Basic Design Study team headed by Mr. Toru FUJITA, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, to carry out a field survey in the Kingdom of Bhutan from February 28 to April 18, 1991.

The Study team had a series of discussions on the Project with the officials concerned with the Royal Government of Bhutan headed by Bap Yeshey Dorji, Director, Department of Telecommunication.

As a result of the discussions, both parties agreed to recommend to their respective Governments that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

Thimphu, March 6, 1991

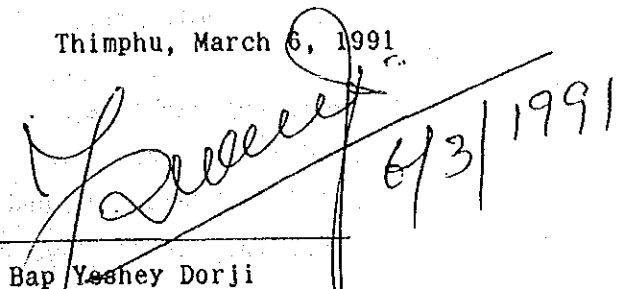


Toru FUJITA

Leader

Basic Design Study Team

JICA



6/3/1991

Bap Yeshey Dorji

Director, Telecommunication

Ministry of Communication

The Kingdom of Bhutan

ATTACHMENT

1. EXTENT OF THE BASIC DESIGN STUDY

As a result of discussions in relation to the extent of the Basic Design Study toward the request made by the Royal Government of Bhutan, the following parts out of the requests have been finally defined to be studied by the Study team at the present, even though the original request made by the Royal Government of Bhutan remains unchanged.

(1) Radio transmission network

New digital microwave transmission routes to link with:

- 1) Thimphu-Tongsa-Bumthang(Jakar)-Mongar-Tashigang;
- 2) Tongsa-Shemgang-Gaylegphug-Damphu; and
- 3) Tashigang-Pemagatshel-Samdrup Jongkhar

(2) Switching network

1) New digital primary exchanges to be integrated into national telephone switching network:

-1. Tongsa exchange

*1000 local lines

300 for Tongsa and surrounds

200 for Bumthang(Jakar) and surrounds

500 spare

*7x2 Mbps transit routes

2 for Thimphu

2 for Gaylegphug

2 for Tashigang

1 for Phumtsholing

-2. Tashigang exchange

*1500 local lines

400 for Tashigang and surrounds

600 for Mongar, Lhuntshi, Yongphula and surrounds

500 spare

T.

*6x2 Mbps transit routes

2 for Thimphu

2 for Tongsa

2 for Samdrup Jongkhar

-3. Gaylegphug exchange

*2000 local lines

400 for Gaylegphug local and surrounds

400 for Shemgang, Sarbhang and surrounds

1000 for Damphu, Daga and surrounds

200 spare

*4x2 Mbps transit routes

2 for Tongsa

2 for Thimphu

-4. Samdrup Jongkhar

*1000 local lines

300 for Samdrup Jongkhar local and surrounds

100 for Pemagatshel and surrounds

100 Deothang, Bhangtar and surrounds

500 spare

*3x2 Mbps transit routes

2 for Tashigang

1 for Thimphu

2) New digital terminal exchanges(SSOC,DRCS, RLC or RSU) parented on the primary exchanges:

-1. Tongsa exchange -Bumthang(Jakar)

-2. Tashigang exchange -Mongar

-Lhuntshi

-Yongphula

-3. Gaylegphug exchange -Shemgang

-Damphu

-Daga

-Sarbhang

-4. Samdrup Jongkhar exchange -Pemgatsel

(3) Local network

Cable network (cables, jointing materials and DPs)
for each exchange of:

- 1) Tongsa
- 2) Tashigang
- 3) Gaylegphug
- 4) Samdrup Jongkhar
- 5) Bumthang(Jakar)
- 6) Mongar
- 7) Lhuntshi
- 8) Yongphula
- 9) Shemgang
- 10) Damphu
- 11) Daga
- 12) Sarbhang
- 13) Pemagatshel

2. MEASURES TO BE TAKEN BY THE ROYAL GOVERNMENT OF BHUTAN

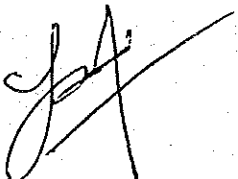
Necessary measures will be taken by the Royal Government of Bhutan to the followings, provided that the Grant Aid by the Government of Japan would be extended to the Project.

- (1) To provide data and information necessary for the Project.
- (2) To secure land site necessary for the execution of the Project.
- (3) To provide access roads to the sites for construction.
- (4) To execute necessary preparation works before the commencement of the works, such as ;
 - 1) Carry out alteration to existing buildings
 - 2) To construct new buildings where required, excepting all shelters to accommodate telecommunication facilities of radio and DRCS



repeater stations respectively which would be provided under the Grant Aid.

- (5) To undertake detailed design of the 13 local networks.
- (6) To procure all the materials required to establish the 13 local networks.
- (7) To install the 13 local networks.
- (8) To clear obstructive trees at the sites, where necessary.
- (9) To provide storages and yards in Thimpu, Tongsa, Tashigang and Samdrup Jongkhar.
- (10) To assist custom clearance of imported materials and equipment of the execution of works at the port of disembarkation in neighboring country.
- (11) To exempt any equipment, materials and supplies brought into and/or purchased in Bhutan in connection with the performance of the works from any tax, duties and levies which are imposed in Bhutan.
- (12) To exempt Japanese nationals engaged in the project from custom duties, internal taxes and other fiscal levies which may be imposed in Bhutan with respect to the supply of the products and services under the verified contracts.
- (13) To accord Japanese nationals whose services may be required in connection with the supply of products and services under the verified contracts the visas, permissions, and licence necessary for their entry into Bhutan and stay therein and for the performance of their works.
- (14) To bear all commissions to the Japanese Foreign Exchange Bank for the banking service based on the banking arrangement (B/A), in accordance with Japan's Grant Aid procedure.
- (15) To bear all expenses in connection with works stated above.



- (16) to demolish or remove the existing faulty/deteriorated facilities, after cutover to new system.
- (17) To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid.

3. CONCEPT ON IMPLEMENTATION OF THE PROJECT

- (1) The Government of Bhutan desired that each phase of the Project should be completed systematically so as to put the network into service for customers concerned.

The Study team have understood the above and is to proceed the Study considering suitable combination of networks concerned (i.e. radio transmission, switching and local networks) in technical and budgetary points of view.

- (2) The design of the microwave repeater stations is to be considered for future expansion of spur links.

4. SUPPLY OF LOCAL NETWORKING MATERIALS

The Government of Bhutan desired that subscriber's telephone instruments required would be provided in addition to cables, jointing materials and distribution points (DP) under the Japan's Grant Aid.

The Study team commented that such as the telephone instruments should be provided by the recipient country in the Japan's Grant Aid Scheme in principle.



Appendix 4 Survey Schedule

Feb. 26 (Tue)	Departure from Tokyo
27 (Wed)	Arrival at Delhi, Courtesy call for Japanese Embassy
28 (Thu)	Departure from Delhi, Arrived at Paro/Thimphu
Mar. 1 (Fri)	Explanation of Inception Report to the Ministry of Communication
2-3 (Sat-Sun)	Map survey
4-5 (Mon-Tue)	Explanation and discussions on Inception Report with Ministry of Communication
6 (Wed)	Discussions and Signing on Record of Discussions with Ministry of Communication
7-8 (Thu-Fri)	Preparation work for Field survey, Discussion with Ministry of Communication and Data collection
9-10 (Sat-Sun)	Map survey
10-12 (Mon-Tue)	Preparation work for Field survey, Discussion with Ministry of Communication and Data Collection
13-14 (Wed-Thu)	Field survey for Tongsa area
15 (Fri)	Field survey for Jakar area
16 (Sat)	Field survey for Thumshingla
17 (Sun)	Move to Rolons
18 (Mon)	Field survey for Pemagatsel area
19 (Tue)	Field survey for Samdrup Jonkhar area
20-21 (Wed-Thu)	Field survey for Tashigang area
22 (Fri)	Field survey for Mongar area
23-25 (Sat-Mon)	Field survey for Shemgang area
26 (Tue)	Back to Thimphu from Field survey
27-28 (Wed-Thu)	Arrangement of Survey equipment and collected data
29 (Fri)	Study of survey results and Discussions with Ministry of Communication
May 16 (Tue)	
17 (Wed)	Arrangement of Field work and Courtesy call for Ministry of Communication
18 (Thu)	Departure from Thimphu/Paro, arrival to Delhi
19 (Fri)	Departure from Delhi
20 (Sat)	Arrived at Tokyo

Appendix 5 Country Data

Land area:	46,500 km ²
Location:	Latitude 26°45'N - 28°10'N Longitude 88°45'E - 92°10'E
Population:	1,357,400 persons
Population density:	30.0 persons/km ²
Population growth:	2.2% per year
Capital:	Thimphu
Sovereign (King):	Jigme Singye Wangchuck
Form of administration:	Constitutional monarchy
Religion:	Druk in Kagye sect. of Buddhism
Language:	Dzongkha
Currency:	Ngultrum (Nu.) 1 Nu. = India 1 Rupee
Gross Domestic Product (GDP):	3,530.8 million Nu. (1987)
GDP per capita:	2,629 Nu. (1987)
Av. GDP growth (Real):	8.8% (1980-87)

Appendix 6 Member List of Draft Final Study Team

Team Leader	Akira NISHIHARAGUCHI	Special Advisor for International Cooperation, Communications Policy Bureau, Ministry of Posts & Telecommunications
Project Coordinator	Kunihiro YAMAUCHI	First Project Management Division, Grant Aid Project Management Department, JICA
Telecommunication Network Planner (General)	Shigeo KIMURA	The Nippon Telecommunications Consulting Co., Ltd. (NTC)
Telecommunication Network Planner (Radio Transmission)	Katsuya OWATARI	The Nippon Telecommunications Consulting Co., Ltd. (NTC)

Appendix 7 Member List of Concerning Party (Draft Final)

Agency of the Kingdom of Bhutan

Dasho C. Dorji	Minister of Planning Commission
Dasho Nado Rinchen	Secretary, Ministry of Communications
Mr. Ugen Namgyel	Director, Ministry of Communications
Mr. Tshering Dorji	Director, Telecom
Mr. Sangay Tenzin	S.E. Telecom
Mr. Thinley Dorji	Project Manager, Telecom
Mr. Om Dhungel	Engineer Officer, Telecom
Ms. Sonam Wangmo	Planning Officer, Moc
Mr. Rabilal Dokhrel	Planning Engineer, Telecom
Mr. Karma Sonam	Planning Officer, Planning Commission

Japanese Agency

Mr. Hajime Matsuo	First Secretary, Embassy of Japan, New Delhi
Mr. Toshio Hida	President Representative, JICA, New Delhi
Mr. Toshifumi Sakai	Deputy President Representative, JICA, New Delhi

THE MINUTES OF DISCUSSIONS HELD
ON
BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR THE DEVELOPMENT OF THE
DOMESTIC TELECOMMUNICATION NETWORK
IN
THE KINGDOM OF BHUTAN

In response to the request made by the Royal Government of Bhutan, the Government of Japan decided to conduct a Basic Design Study on the Project for the Development of Domestic Telecommunication Network (hereinafter referred to as "the Project") after examination of the result of the Preliminary Study conducted in August 1990. Japan International Cooperation Agency (hereinafter referred to as "JICA") then sent to Bhutan the Basic Design Study Team headed by Mr. Toru FUJITA, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, to carry out a field survey in the Kingdom of Bhutan from February 28 to April 18, 1991.

After the Field Survey and home office work in Japan, JICA prepared a Draft Final Report on the Project for the Development of Domestic Telecommunication Network in the Kingdom of Bhutan (herein after referred to as "the Report") and sent the Basic Design Study Team (hereinafter referred to as "the Team") headed by Mr. Akira NISHIHARAGUCHI, International Cooperation Division, Communications Policy Bureau, Ministry of Posts and Telecommunications, to present the Report to the Royal Government from July 12 to July 17, 1991.

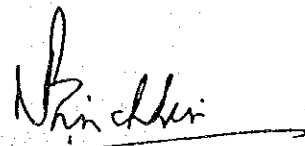
The Study Team had a series of discussions on the Report with the concerned officials of the Royal Government of Bhutan headed by Dasho Nado Rinchhen, Secretary, Ministry of Communications.

As a result of the discussions, both parties agreed to recommend to their respective governments that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

Thimphu, July 17, 1991

西原口 晃

Akira NISHIHARAGUCHI
Leader
Basic Design Study Team
JICA



Dasho Nado Rinchhen
Secretary
Ministry of Communications
Royal Government of Bhutan

ATTACHMENT

As a result of the discussions, the Bhutan side agreed, in principle, with the overall contents of the Report.

1. Consideration on the implementation of the Project

Both parties agreed to make every possible effort to synchronize with implementation of the respective scope of work described in the Report in order to execute the Project smoothly.

2. Request by the Royal Government of Bhutan

The Team was requested to take the following points into consideration:

(1) Implementation Schedule

It was requested to complete the following networks by the end of 1994 in order to meet the Royal Government's Seventh Five Year Plan objectives:

a) Microwave Route I (Thimphu-Tongsa-Jakar-Mongar-Tashigang),
Route II (Tongsa-Shemgang-Gaylegphug-Damphu),
Route III (Tashigang-Pemagatshel-Samdrup Jongkhar)

b) Nine Exchanges

Tongsa, Jakar, Mongar, Tashigang, Pemagatshel, Samdrup Jongkhar, Shemgang, Gaylegphug and Damphu.

c) Four Digital Radio Concentrator System (DRCS) Routes

Lhunsi, Daga, Sarbhang and Yonphula

(2) Supply of Cables, Jointing Materials and Accessories for Local Network.

Cables, Jointing Materials and Accessories for six towns (Tongsa, Jakar, Tashigang, Mongar, Gaylegphug and Samdrup Jongkhar) should be supplied in time for the Exchanges at these towns to be put into service by March 1994. The Local Network materials for the remaining seven towns (Damphu, Shemgang, Sarbhang, Yonphula, Pemagatshel, Daga and Lhunshi) should be supplied in time for the Exchanges to be put into service by the end of 1994 in order to meet the implementation schedule of the Department of Telecommunication, Royal Government of Bhutan.

(3) Billing System

A request was made for Billing Systems for each of the following Exchanges: Tongsa, Tashigang, Samdrup Jongkhar and Gaylegphug.

(4) Training

In view of the importance of training for proper maintenance of the system, a request was made to the Team to include Operation and Maintenance training of the maintenance personnel within the scope of the Project.

The Team informed that the Operation and Maintenance training could not be included in Japan's Grant Aid System. However, the Team agreed to convey the request of the Royal Government of Bhutan to the Government of Japan to increase the training slots under the JICA Technical Cooperation Programme.

NE

Am

Appendix 9 Itinerary of Draft Final Study Team

- Jul. 9 (Tue) Departure from Tokyo
- 10 (Wed) Courtesy call for Japan Embassy and JICA,
New Delhi
- 11 (Thu) New Delhi
- 12 (Fri) Explanation of draft report for Ministry of
Communications
- 13 (Sat) Discussions on the draft report with Ministry
of Communications
- 14 (Sun)
- 15 (Mon) Discussions of the draft report with Ministry of
Communications
- 16 (Tue) Drafting of minutes of the discussions
- 17 (Wed) Signing of the minutes of discussions
- 18 (Thu)
- 19 (Fri) Report on the discussions to Japan Embassy and
JICA, New Delhi
- 20 (Sat) Departure of Delhi
- 21 (Sun) Arrival to Tokyo

JICA