付 属 資 料 — II

SCOPE OF WORK

FOR

FEASIBILITY STUDY

ON

THE RURAL TELECOMMUNICATIONS NETWORK PROJECT

AGREED BETWEEN

HIS MAJESTY'S GOVERNMENT OF NEPAL

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

KATHMANDU
23RD SEPTEMBER 1982

(FUKUSHI KITAHARA)
LEADER
JAPANESE PRELIMINARY
STUDY TEAM
on behalf of JAPAN
INTERNATIONAL COOPERATION AGENCY

(RAM PRASAD SHARMA)
GENERAL MANAGER
NEPAL TELECOMMUNICATIONS
CORPORATION
on behalf of
HIS MAJESTY'S GOVERNMENT OF
NEPAL

I INTRODUCTION

In response to the request of His Majesty's Government of Nepal, the Government of Japan has decided to conduct a feasibility stud on Rural Telecommunications Network Project in accordance with laws and regulations in force in Japan, and the Japan International Cooperation Agency (hereinafter referred to as JICA), the official agency responsible for the implementation of the technical cooperation programmes of the Government of Japan, will carry out the Study in close cooperation with His Majesty's Government of Nepal and authorities concerned.

The present document sets forth the Scope of Work for the Study mentioned above.

II OBJECTIVE OF THE STUDY

To conduct the Feasibility Study on the Rural Telecommunications Network Project.

III OUTLINE OF THE STUDY

The Study will entail field survey in Nepal and analysis work in Japan. Items to be covered by the Study are as follows:

1 General

Present status of telecommunications facilities and services in Nepal.

1) Telecommunications development plan.
2) Present technical standards of telecommunications facilities.
3) Telecommunications service revenues and expenditures.
4) Present and prospective tariff system.

2 Project

1) Telecommunications demand forecast.
2) Telecommunications traffic forecast.
3) Telephone network plan.
4) Installation plan for telecommunications facilities.
5) System design
   a) Telephone exchange
   b) Subscriber network
   c) Transmission systems
   d) Building

6) Implementation schedule.
7) Operation and maintenance.
8) Cost estimation.
9) Financial and economic analysis.
10) Project evaluation.

IV SCHEDULE OF THE STUDY

The Study shall be undertaken in accordance with the schedule of Study (refer to Annex).

V REPORT

The JICA will prepare and submit the following reports in English to His Majesty's Government of Nepal.

1 Draft final report (20 copies)

Within about five months after completion of the field survey, the draft final report will be submitted to His Majesty's Government of Nepal by a team from JICA.

His Majesty's Government of Nepal is requested to provide with its comments on the draft final report during stay of th team in Nepal.

2 Final report (20 copies)

Within two months after the return of the team, JICA will submit the final report to His Majesty's Government of Nepal

3 Contents of report

The report will contain the following items:

1) Telecommunications demand forecast.
2) Telecommunications traffic forecast.
3) Telephone network plan.
4) Technical standards for the project.
5) Preliminary design of
   a) Telephone exchanges
   b) Subscriber network
   c) Transmission systems
   d) Buildings
6) Operation and maintenance.
7) Implementation schedule.
8) Cost estimation.
9) Financial and economic analysis.
10) Project evaluation.

VI UNDERTAKINGS OF HIS MAJESTY'S GOVERNMENT OF NEPAL

1 To provide the Study team with relevant data, information and materials necessary for implementation of the Study.

2 To exempt the Study team from taxes and duties on the materials, equipment and personal effects brought into Nepal by the Study team.

3 To appoint counterpart personnel to the Study team during the Study period.

4 To provide the Study team with suitable office space with necessary equipment and services for the studies.

5 To provide the Study team with appropriate number of vehicles with drivers.

6 To make arrangements for the Study team to take back to Japan the data, maps and materials connected with the Study subject to the approval by His Majesty's Government of Nepal in order to prepare the reports.

7 To secure the necessary entry permits for the Study team to conduct field surveys in Nepal.

8 To provide the Study team with medical services when needed, but medical expenses shall be chargeable to the Study team.

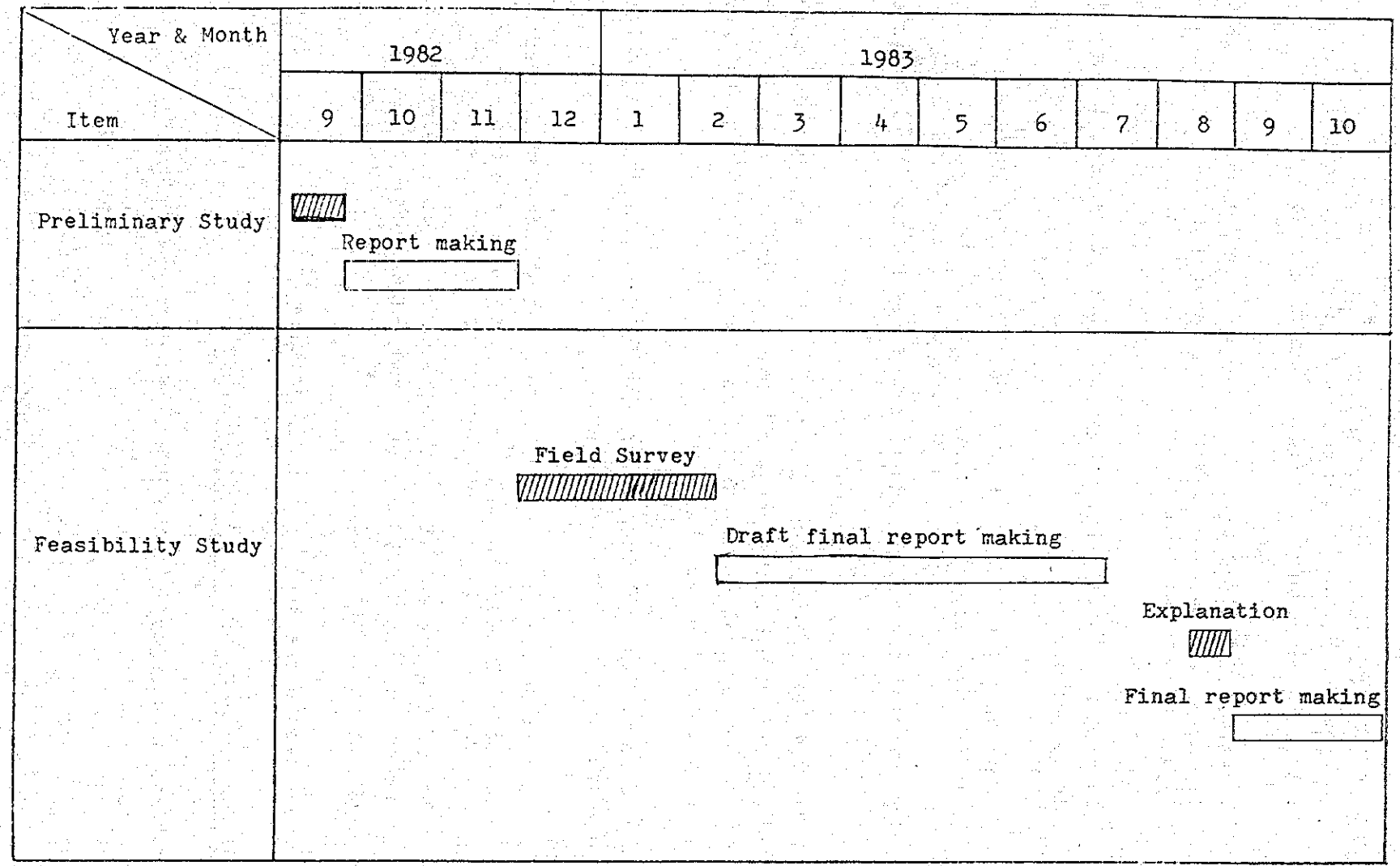
9 To provide credentials or identification (ID) cards to the members of the Study team who shall work in Nepal for the execution of the study.

10 To ensure the safty of the Study team.

VII UNDERTAKINGS OF THE GOVERNMENT OF JAPAN

To transfer knowledge to the Nepalese counterparts during the study period.

STUDY SCHEDULE (TENTATIVE)



Remarks: Work in Nepal

Work in Japan

2. MINUTES OF THE MEETING.

MINUTES OF THE MEETING TO THE SCOPE OF WORK
ON THE RURAL TELECOMMUNICATIONS NETWORK PROJECT IN THE
KINGDOM OF NEPAL

In response to the request of His Majesty's Government of Nepal for technical cooperation in establishing the rural telecommunications network in the Kingdom of Nepal, the Government of Japan, through the Japan International Cooperation Agency, has sent a preliminary study team headed by Mr. Fukushi Kitahara in September 1982 to discuss the draft of the Scope of Work for feasibility study on the Rural Telecommunications Network Project in the Kingdom of Nepal.

During its stay in Nepal, the Preliminary Study Team has held a series of discussions and exchanged views with the Nepal Telecommunications Corporation on the project.

As a result of the exchanges of views and discussions, both parties, the Nepal Telecommunications Corporation and the Preliminary Study Team, have agreed upon the Scope of Work.

The major points confirmed between the Nepal Telecommunications Corporation and the Preliminary Study Team are attached herewith.

F. Kitahara
(Fukushi Kitahara)
Leader of the Japanese
Preliminary Study Team

R. Sharma
(Ram Prasad Sharma)
General Manager of the
Nepal Telecommunications
Corporation

Sighned at Kathmandu
on 23rd December 1982

Attachment

Major points confirmed between the Nepal Telecommunications Corporation and the Preliminary Study Team

1. To discuss the draft of the Scope of Work, meetings were held on 13, 14, 15, 16, 17, 22 and 23 September 1982 at the conference room of the Nepal Telecommunicatione Corporation. The list of attendants is given in the attched paper.

2. Mr. Ram Prasad Sharma, General Manager of the Nepal Telecommunications Corporation expressed his thanks to the Government of Japan and its Preliminary Study Team visiting the Kingdom of Nepal in response to the request of His Majesty's Government of Nepal and expressed that this study will be carried out successfully.

3. Mr. Fukushi Kitahara, Leader of the Preliminary Study Team, appreciated the cooperation extended by the Nepal Telecommunications Corporation to the Team.

4. The Japanese Study Team submitted the draft of the Scope of Work for the feasibility study on the Rural Telecommunications Network Project to the representatives of the Nepal Telecommunications Corporation for consideration.

5. Representatives of the Nepal Telecommunications Corporation and the Japanese Study Team discussed the draft of the Scope of Work.

   The results of the meetings are as follows:

   1) The draft of the Scope of Work submitted by the Japanese Study Team was accepted by the Nepal Telecommunications Corporation.
   2) The Japanese Feasibility Study Team will arrive in

Nepal in December 1982 to perform a feasibility study.

3) The places to be studied by the Japanese Feasibility Study Team are shown in the Annex.
4) The field study will be in principle carried out on the spot. The study may be, however, carried out on the maps or by any other effective ways according to the circumstances.
5) Minor changes of this project in the study places may be acceptable on the feasibility study.
6) The Nepal Telecommunications Corporation will provide the Japanese Study Team with a counterpart to each group. The Team may be divided into several groups.
7) The expenses relating to the counterpart personnel will be borne by the Nepal Telecommunicatins Corporation.
8) The Nepal Telecommunications Corporation will make all transport means available to the Japanese Feasibility Study Team at the latter's cost.
9) The Nepal Telecommunications Corporation will make necessary arrangements to enable the Japanese Feasibility Study Team to cross the Indian territory for the study when need arises.

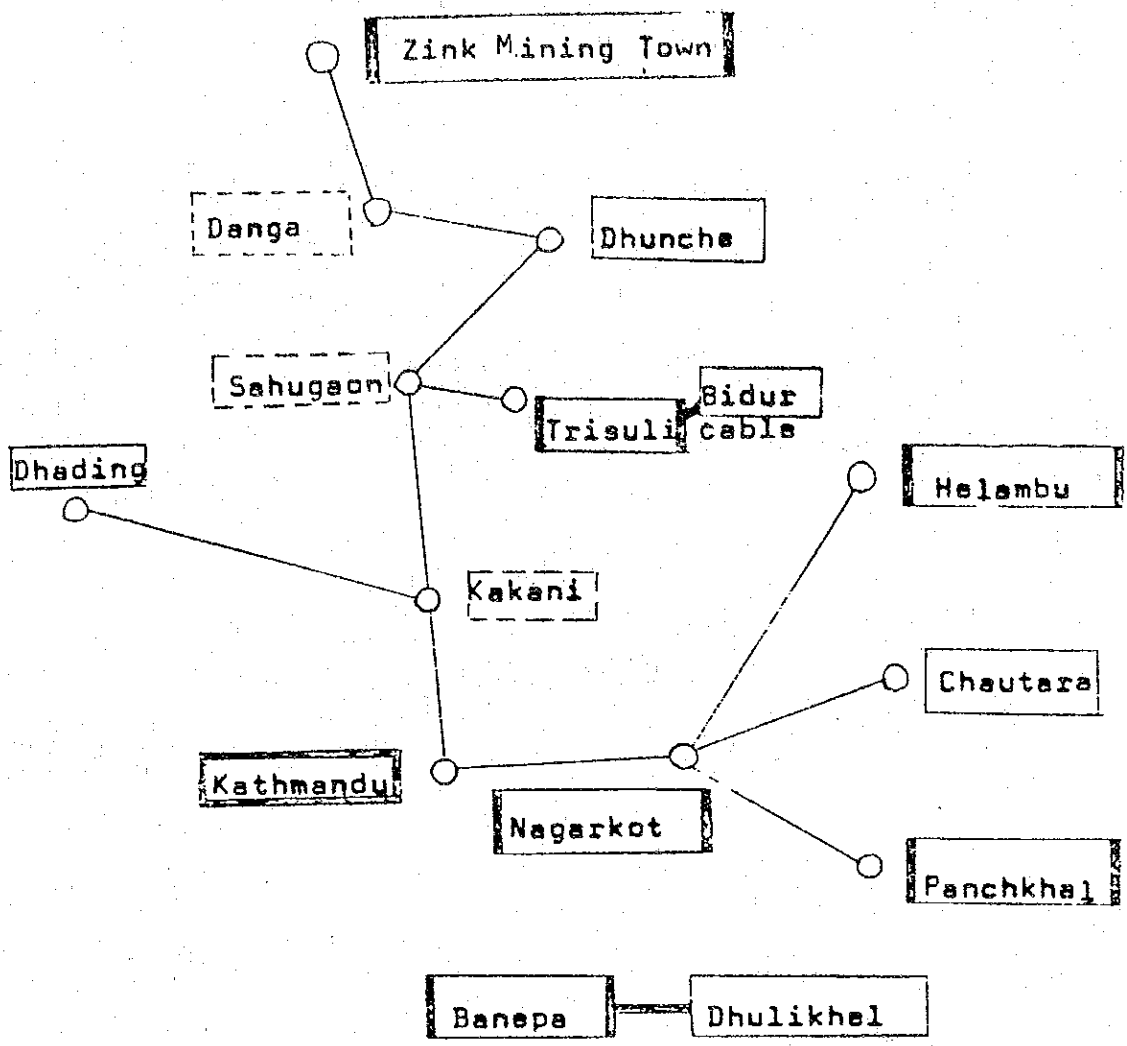
******

LIST OF ATTENDANTS

Nepal Telecommunications Corporation	Mr. Ram Prasad Sharma	General Manager
	Mr. Bhopp Raj Pandey	Deputy General Manager
	Mr. Gajendra Singh Bora	Chief Engineer
	Mr. Gopal Prasad Shrestha	Service Manager
	Mr. Lok Raj Sharma	Assistant Executive Enginee
Embassy of Japan	Mr. Hideo Morikawa	Second Secretary
Japanese Study Team	Mr. Fukushi Kitahara	Leader
	Mr. Seiji Harada	Member
	Mr. Satoru Hashimoto	Member
	Mr. Wataru Kurashima	Member
	Mr. Mitsutoshi Kikuchi	Coordinator

Annex

The places to be studied by the Japanese Feasibility Study Team



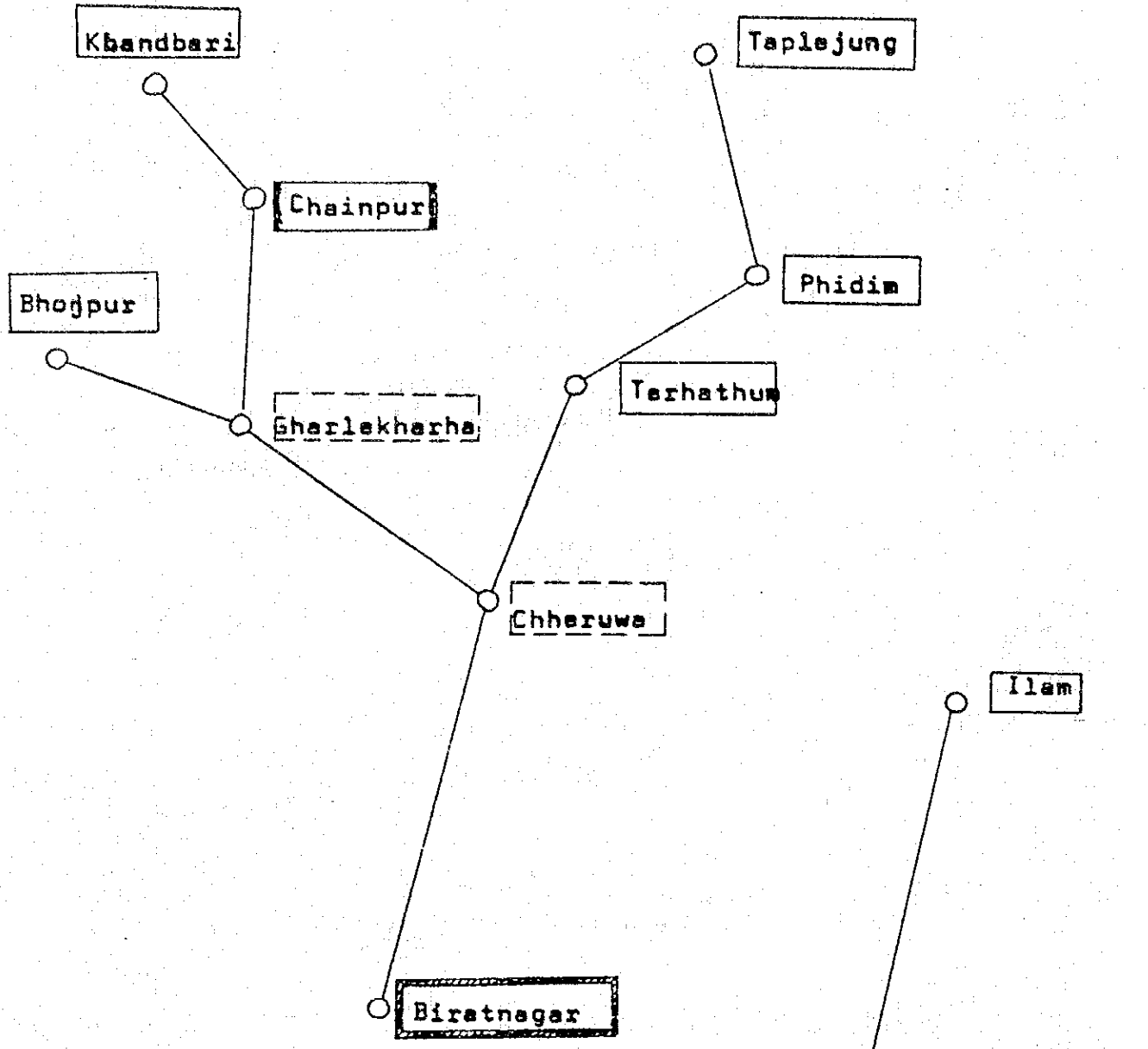
Existing telephone exchange

District headquarters (without exchange)

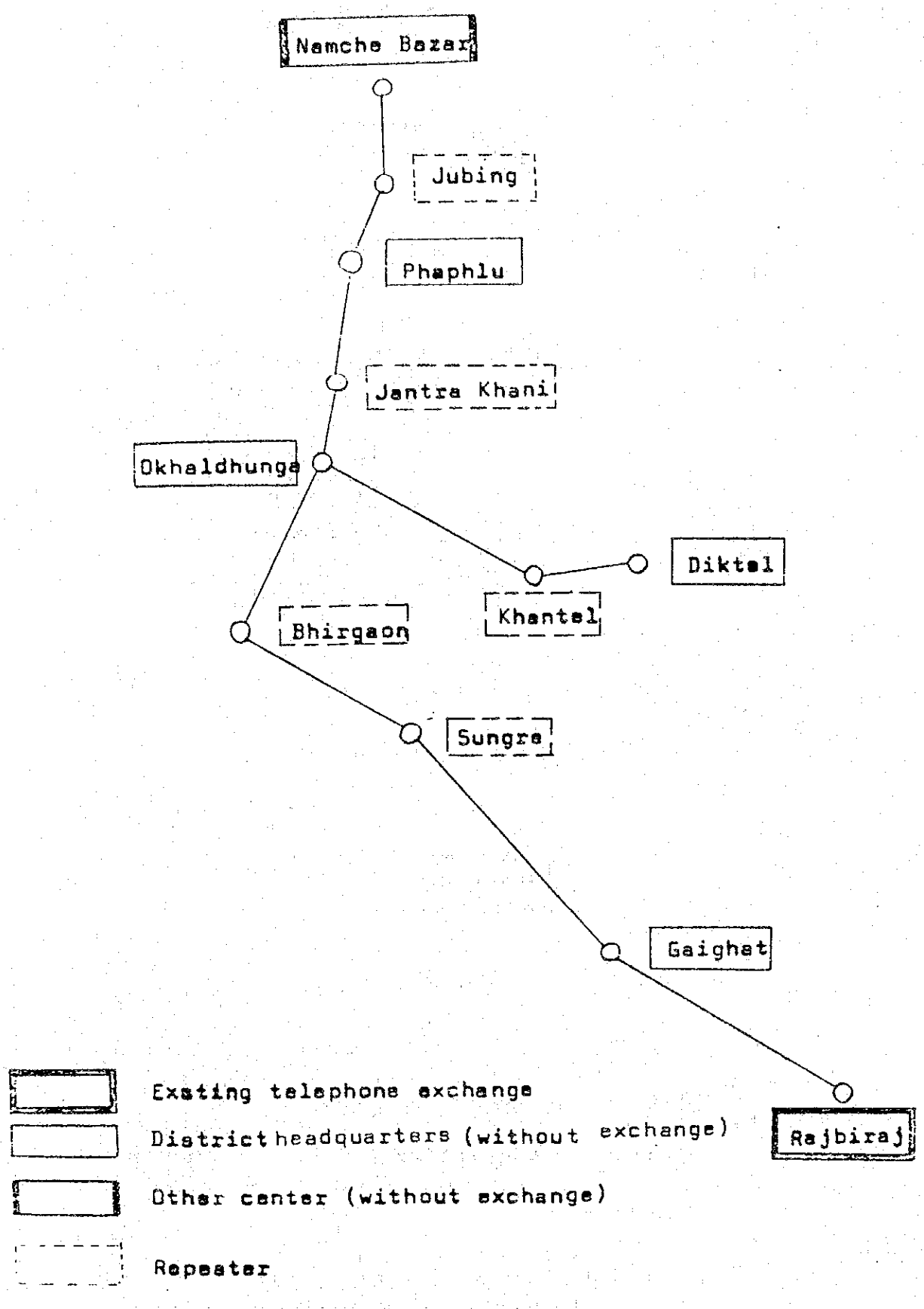
Other centers (without exchange)

Repeater

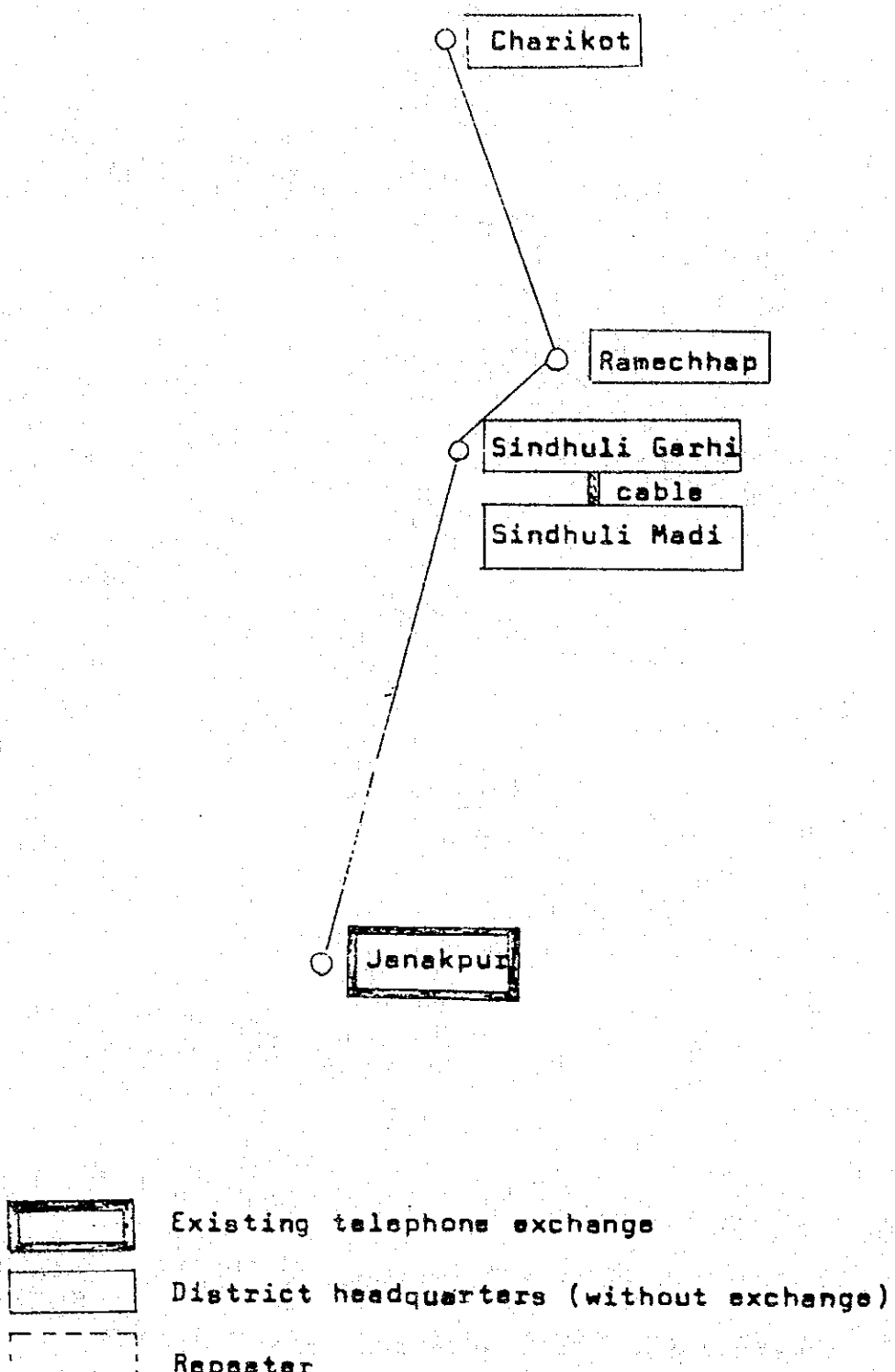
Transmission Network in Area 01



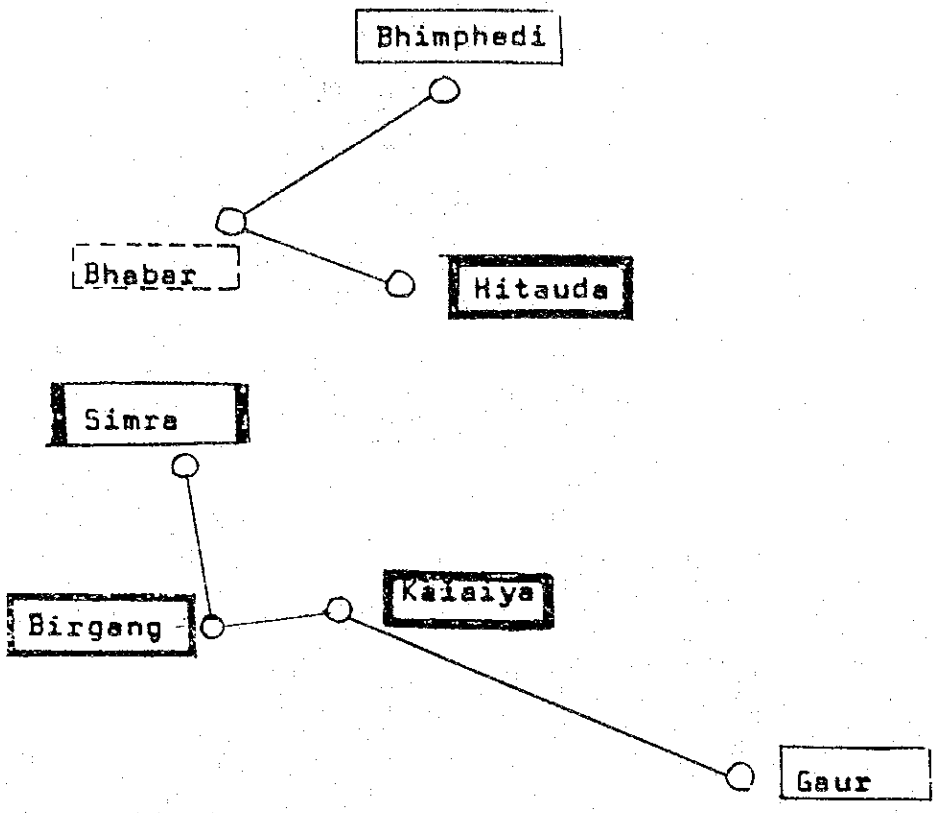
Transmission Network in Area 02



Transmission Network in Area 03



Transmission Network in Area 04



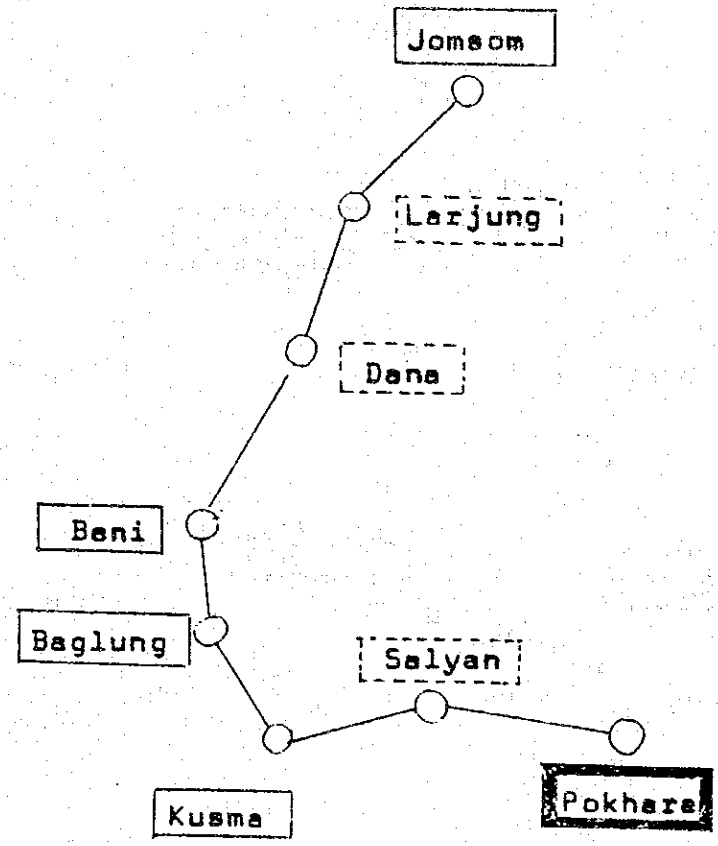
Existing telephone exchange

District headquarters(without exchange)

Other center (without exchange)

Repeater

Transmission Network in Area 05

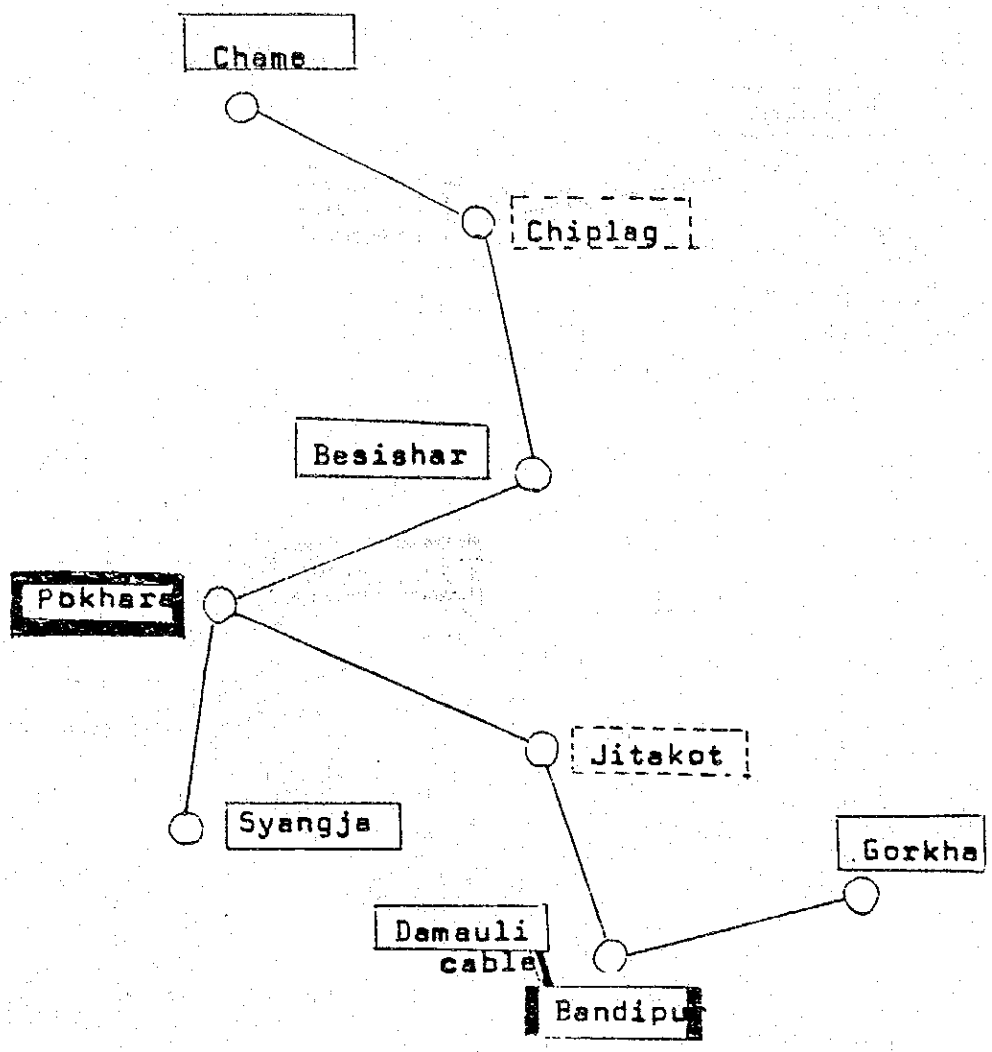


Existing telephone exchange

District headquarters(without exchange)

Repeater

Transmission Network in Area 06 (1/2)



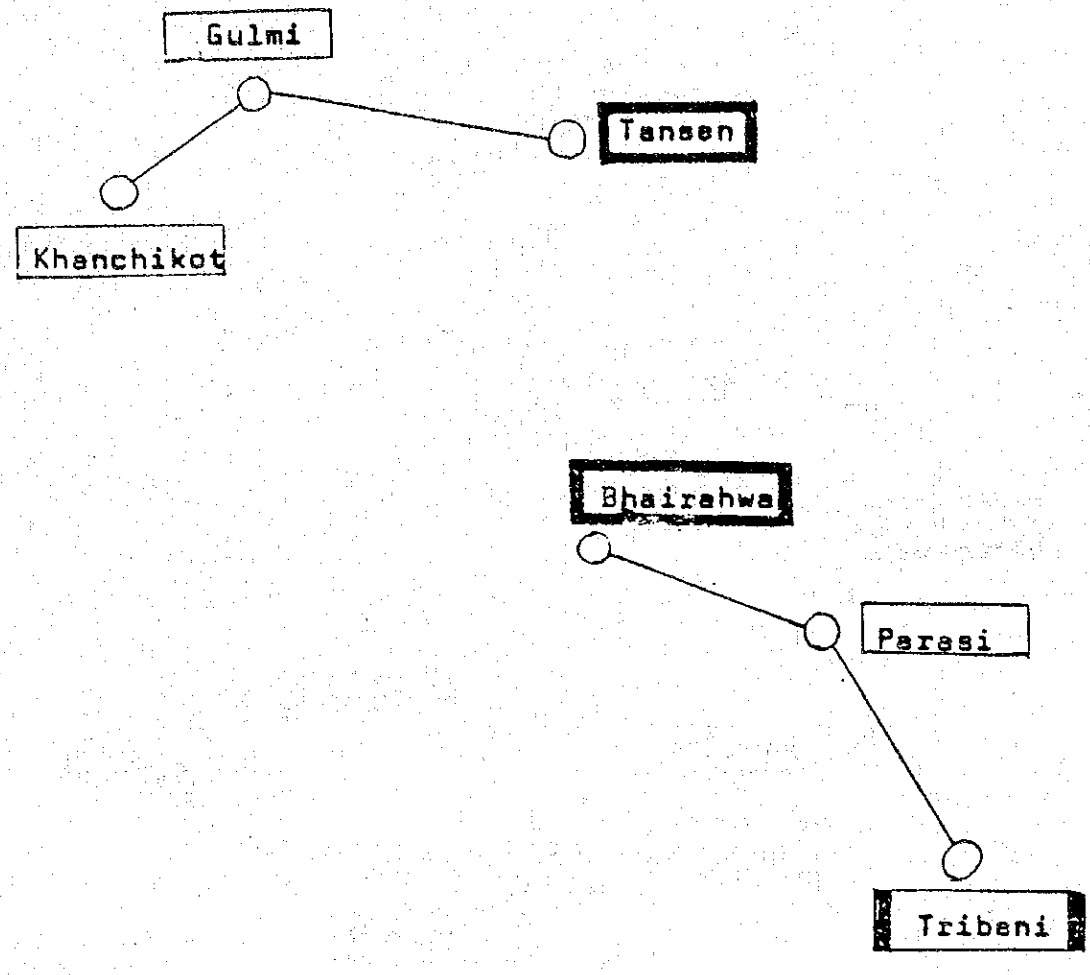
Existing telephone exchange

District headquarters (without exchange)

Other center (without exchange)

Repeater

Transmission Network in Area 06 (2/2)

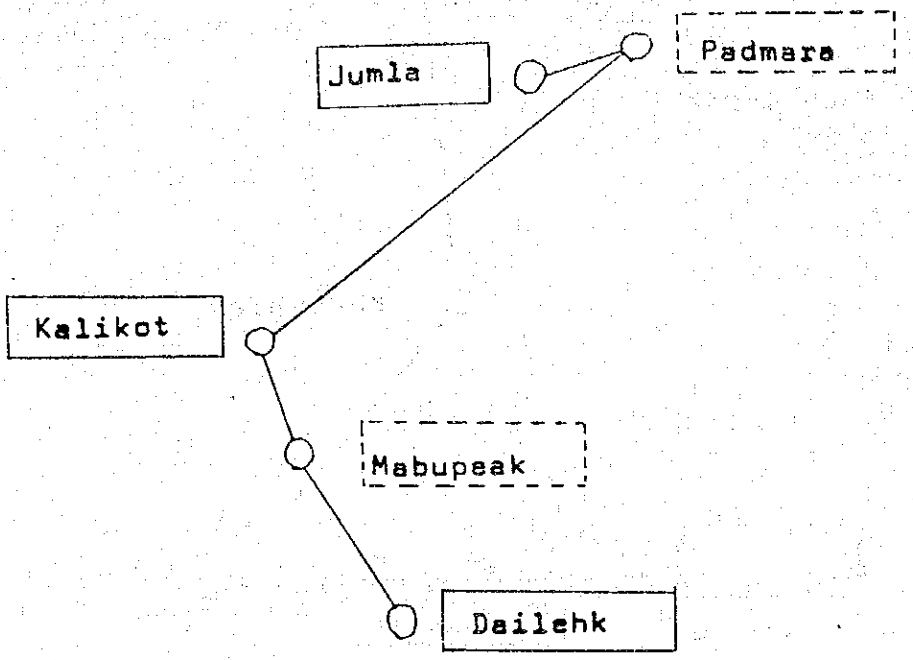


Existing telephone exchange

District headquarters (without exchange)

Other center (without exchange)

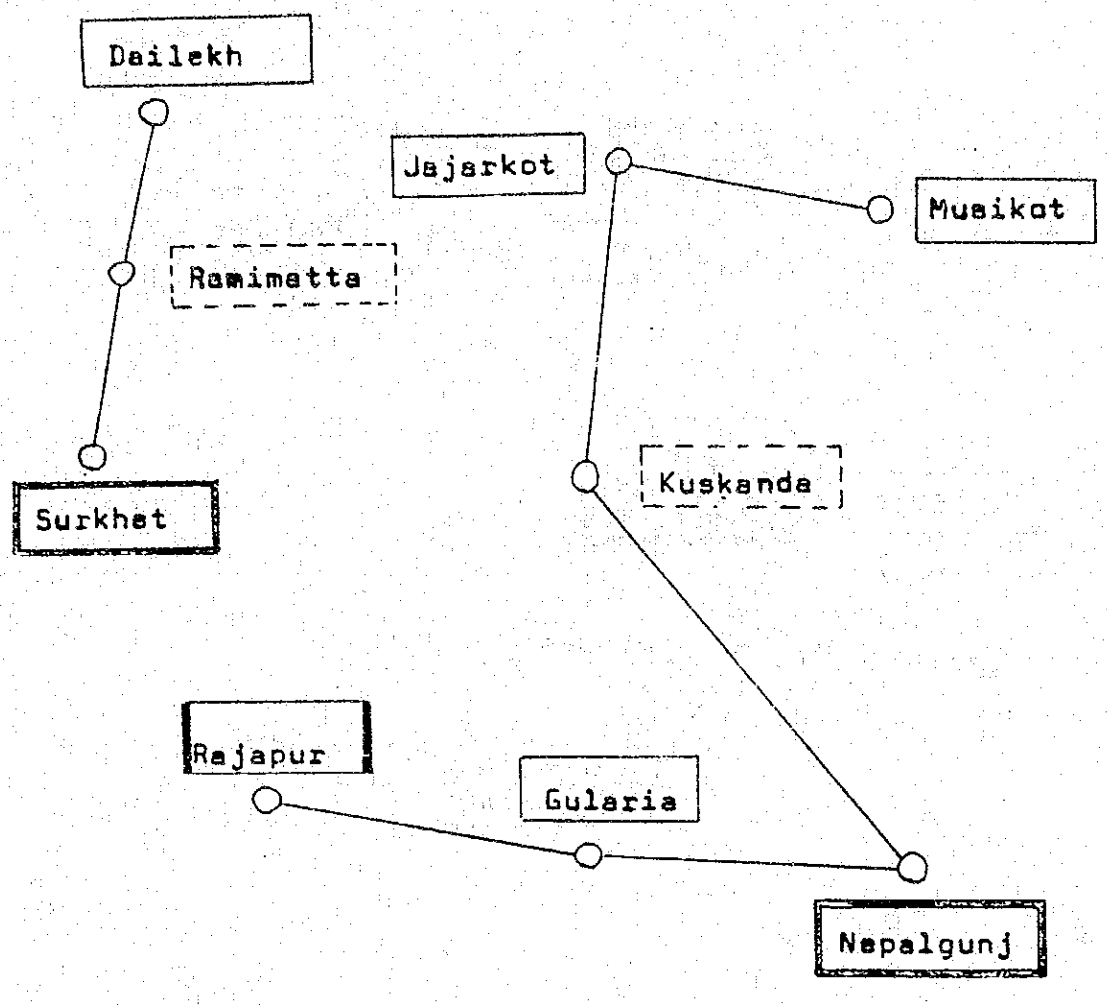
Transmission Network in Area 07



District headquarters (without exchange)

Repeater

Transmission Network in rea 08 (1/3)



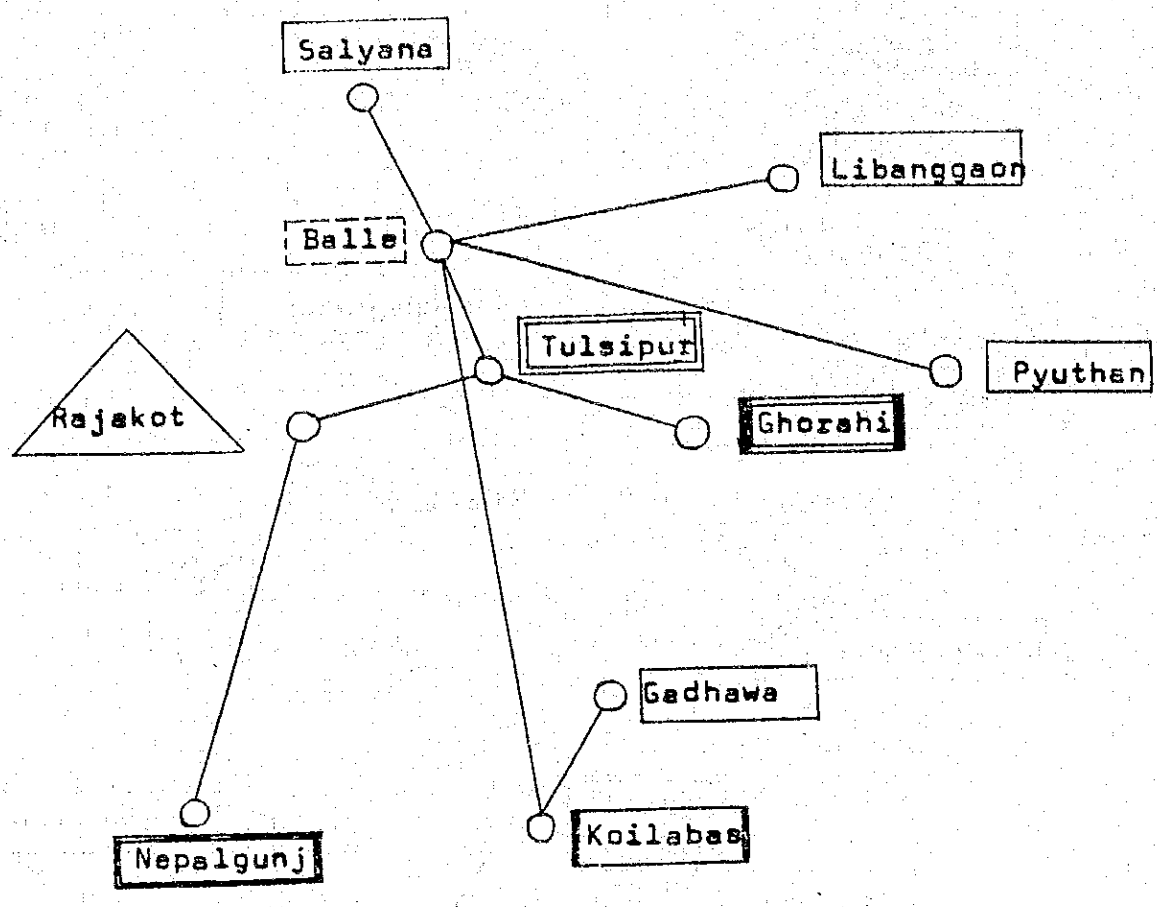
Existing telephone exchange

District headquarters (without exchange)

Other center (without exchange)

Repeater

Transmission Network in Area 08 (2/3)



Existing telephone exchange

Telephone exchange

District headquarters (without exchange)

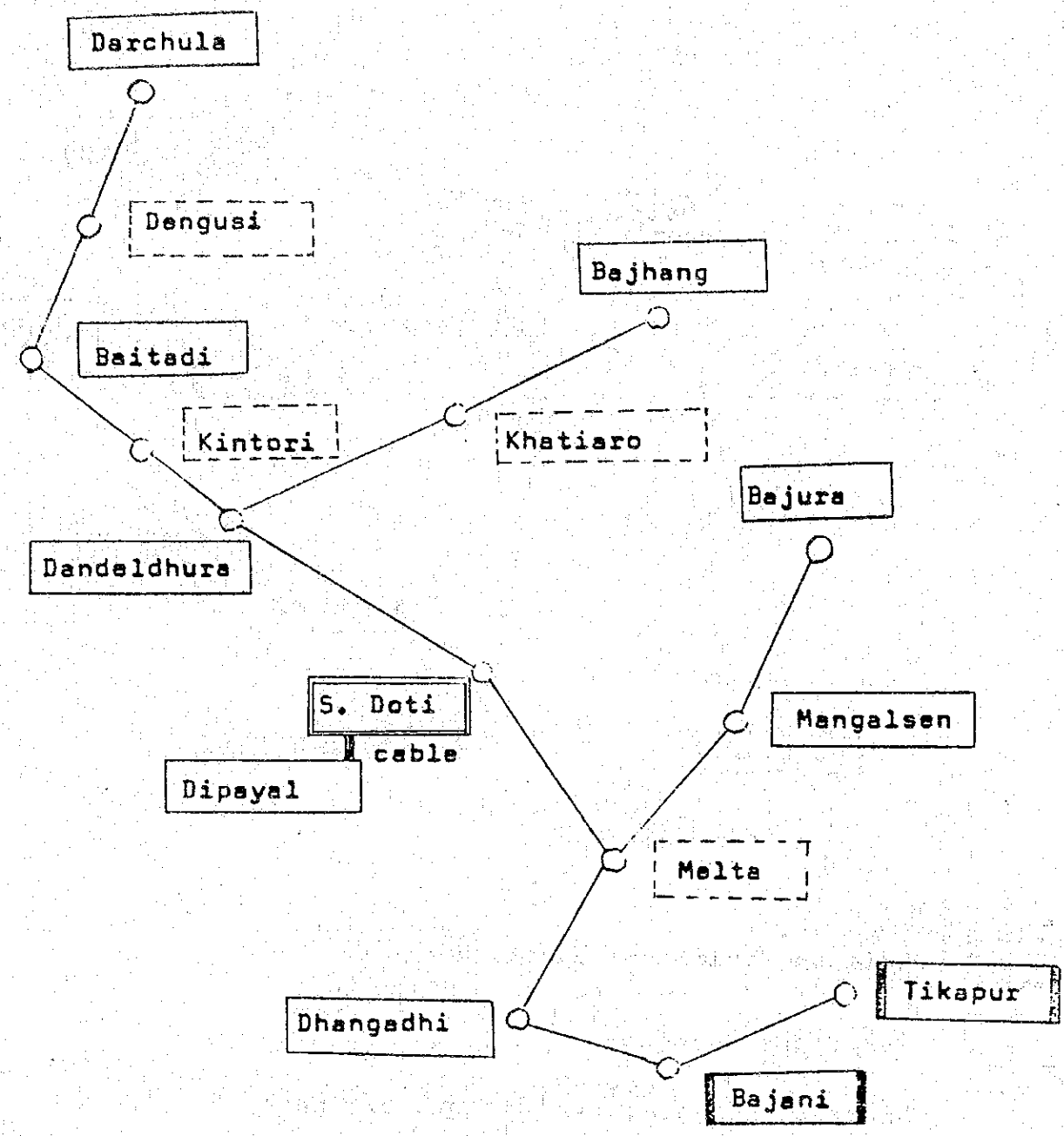
Other center (without exchange)

Other center with exchange

Repeater

Existing repeater

Transmission Network in Area 08 (3/3)



Transmission Network in Area 09

F/S要請書　3. 正式要請書

MINISTRY OF FOREIGN AFFAIRS

His Majesty's Government of Nepal
Kathmandu

SEA/72-2/2469

The Ministry of Foreign Affairs, His Majesty's Government of Nepal presents its compliments to the Embassy of Japan in Kathmandu and has the honour to request the Embassy to convey the follow-ing to the Government of Japan:

With a view to develop the telecommunications facilitdes in the country, His Majesty's government of Nepal wishes to introduce rural telecommunication network in the Kingdom of Nepal. In order to initiate the plan, His Majesty's Government of Nepal seeks the cooperation of the Government of Japan, and request the Government of Japan to provide necessary assistance to conduct a feasibility study for the rural telecommunication in Nepal. In this respect the Ministry has the honour to forward herewith a copy of the Basic Plan for the Rural Telecommunications Network in the Kingdom of Nepal, prepared under the suspices of the Asia-Pacific Telecommunity, Bangkok by an expert Mr. Yasuo Sujiki in November 1981.

The Ministry of Foreign Affairs will appreciate if the Embassy could inform the decision of the Government of Japan in this regard at their earliest convenience.

The Ministry of Foreign Affairs avails itself of this opportunity to renew to the Embassy of Japan the assurances of its highest consideration.

March 26, 1982

The Embassy of Japan
KATHMANDU

His Majesty's Government
Ministry of Foreign Affairs

Asia - Pacific Telecommunity

BASIC PLAN
FOR
THE RURAL TELECOMMUNICATIONS NETWORK
IN
THE KINGDOM OF NEPAL

BANGKOK
23 November 1981

Report
prepared by
Yasuo Suzuki

ASIA-PACIFIC
TELECOMMUNITY

APT/PRO/81/2.4/EX/3/NE
23 November 1981

BASIC PLAN FOR THE RURAL TELECOMMUNICATIONS NETWORK IN THE KINGDOM OF NEPAL

REPORT

Prepared by
Yasuo Suzuki

III

Present Nepal keenly requires modern rural telecommunications network. For the purpose, feasibility and detailed survey for the project should be conducted as soon as possible. This report is expected to be used as a terms of reference for detailed feasibility survey. It is certain that realization of the project may result modernization of the communications situation in the country and contribute further development of the country.

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TABLE OF CONTENTS

4.(4).G /..

1. INTRODUCTION

The Kingdom of Nepal has area of about 141 thousand square kilometers and comprises 14 zones, and 75 districts which comes under zonal administration. In present telecommunications situation automatic local telephone exchange service is available in Kathmandu area and other two cities, and manual service in 16 localities like central battery or magneto methods. Trunk call service with the inter-localities is not necessarily good due to various objections. In His Majesty's Government, communications among Kathmandu and 14 zones, as well as each zone with its districts, are essential in order that the government administrates through the country so stably, and the good communications facility among them should be established at any cost. The more development of industries of different sectors, it is natural that communications demand of everywhere increases more. But actually the present communications situation does not allow to keep sufficient service even between Kathmandu and every zone. Because of that, Nepal Telecommunications Corporation (NTC) is now organizing HF simplex communications network by 100 watts tranceiver on 5MHZ radio band. The equipment is placed at not only Kathmandu but also in all zonal headquarters and district headquarters and offers the service of a kind of information transference. The service is, of course, opened to the government, private enterprise activities and publics. The minimum charge of the service is Rs. 3 up to 30 letters in Nepali script. The HF simplex network is independent from the usual telephone network. It can be said that the service may be similar to telegraph service and very good idea as short relief or temporary service. There are big objections on the network, that is to say, less reliability, low communications quality, less transmission capacity, and poor confidential. Anyway, the HF network is still useful now, but it is true that there are much inconvenience for present regular activities on various fields.

Presently, telecommunications circuit between Kathmandu and every zone (zonal headquarters) are being installed and already 23 radio sections by microwave, partly by UHF, have been installed. 14 zones and districts have already been connected each other by telecommunication circuits. Most of the zones are located at plain area, therefore it is not difficult to connect them. But problem is that some zones and almost all districts are in hilly or mountainous area. These areas are more than 1500 meters above the sea

../ level

level and in very steep and complex topographical place. Under such circumstances it is to be considered how it could introduce economical and reliable telecommunications network to those areas.

In this context role of the report is to advise and propose adequate and actual basic methods to the Nepal Telecommunications Corporation.

2. [illegible] /..

2. PRESENT RURAL TELECOMMUNICATIONS NETWORK IN NEPAL

2.(1) Out Line

Zonal headquarters which are now connected by a microwave circuit are as follows:

Kathmandu
Bhadrapur, Biratnagar, Rajbiraj,
Janakpur, Birgunj, Pokhara,
Bhairahwa, Nepalgunj
(9 zonal headquarters)

But there are some zones where still no microwave circuit is available, they are as follows:

Baglung, Tulsipur, Jumla
Dhangarhi, Mahendranagar
(5 zonal headquarters)

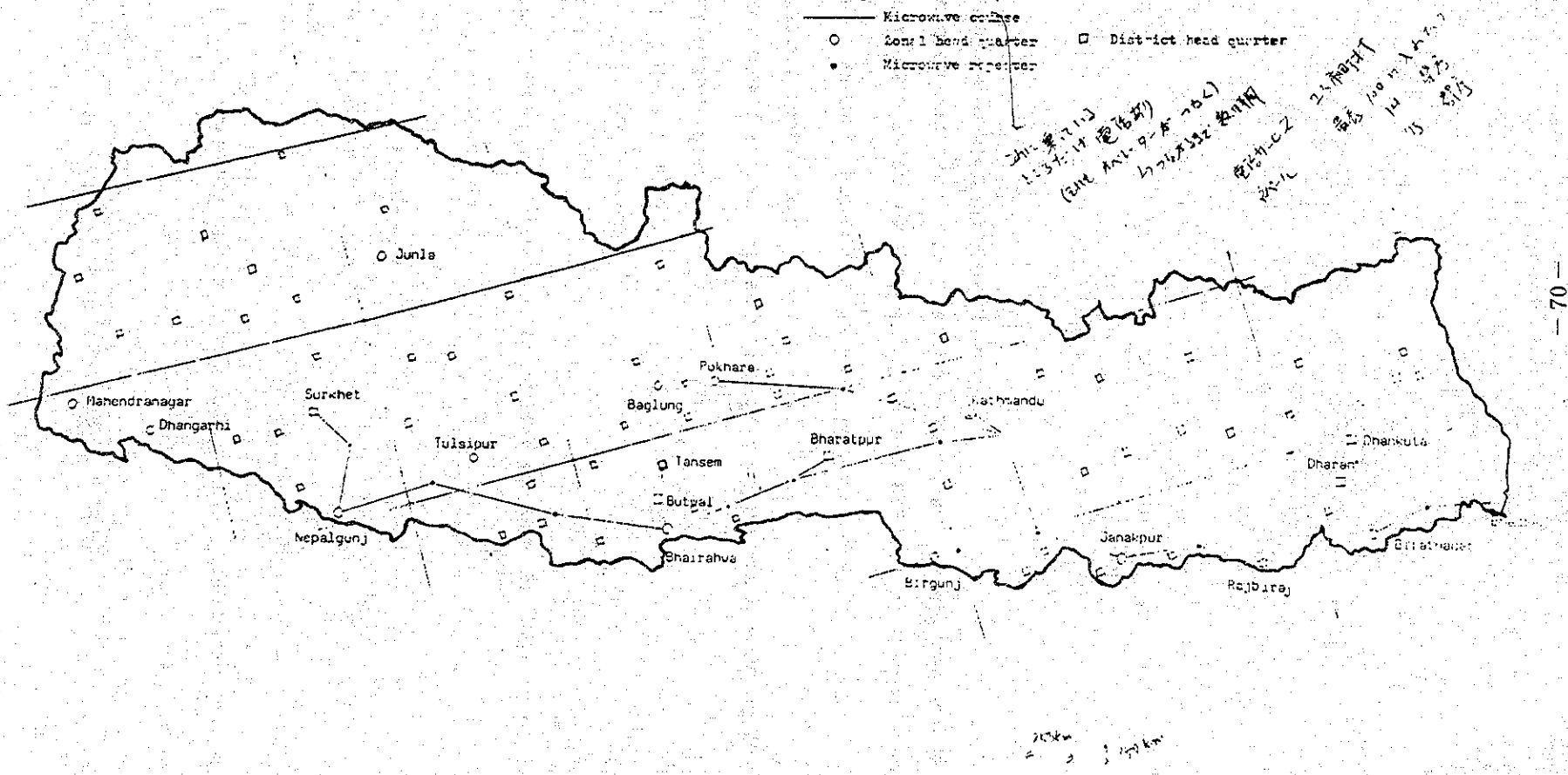
Out of 75 district headquarters, there are only 6 which are connected by a microwave radio link; these are,

Dhankuta, Dharan, Bharatpur, Butwal, Tansen, Surkhet

Fig. 1 shows situation, which zone or district are covered by a microwave network. It could be understood that so many important localities are still out of existing telecommunications network.

Fig. 1 /..

Fig. 1
Existing microwave telephone circuits



As stated above, 5 zonal headquarters out of 14, and 69 district headquarters out of 75 are isolated from existing telecommunications network. Furthermore, even the 14 zones have not enough capacity of telephone lines. Customers sometimes have to wait for long in case of trunk call to the zones. Therefore, NTC has now prepared HF rural telecommunications network. As shown on Table 1, HF tranceivers are placed on 14 zones and 66 districts or other important localities.

Zone	Base station	No. of Sub-station
Mechi	Bhadrapur	3
Koshi	Biratnagar	7
Sagarmatha	Rajbiraj	4
Janakpur	Janakpur	5
Bagmati	Kathmandu	3
Narayani	Birgunj	4
Gandaki	Pokhara	6
Lumbini	Bhairahwa	8
Dhauagiri	Baglung	3
Rapti	Tulsipur	6
Karnali	Jumla	4
Bheri	Nepalgunj	5
Seti	Dhangarhi	5
Mahakali	Mahendranagar	3
Total	14	66

Table 1

HF equipment installation locality

The existing rural telecommunications network by HF has inconveniences of

(a) only 5 radio channels in HF band assigned through out the country;

(b) independence from usual telephone network;

(c) simplex communication method.

Because of the above reasons, we cannot say, it is modern network and public use.

Inconveniency /..

Inconvenience based on (a) is that fundamental principle, whenever and wherever we should communicate, can not be established. And because of (b), coustomers are forced to come to the particular application counter. Therefore, it is not easy for public to use the network. The item (c) results that simultaneous bothway speaking is impossible. Simplex talking method is not familiar to public daily services and usual social activities.

Therefore, present HF rural telecommunications network can be concluded as follows. That is, the present primitive communications network system is less satisfied as the country of Nepal, which is paying an effort to modernize the country, require the improvement with top priority. Since the motorable road network seems to be not sufficient for the national activities, more reliable and stable telecommunication networks is essential for development of the country.

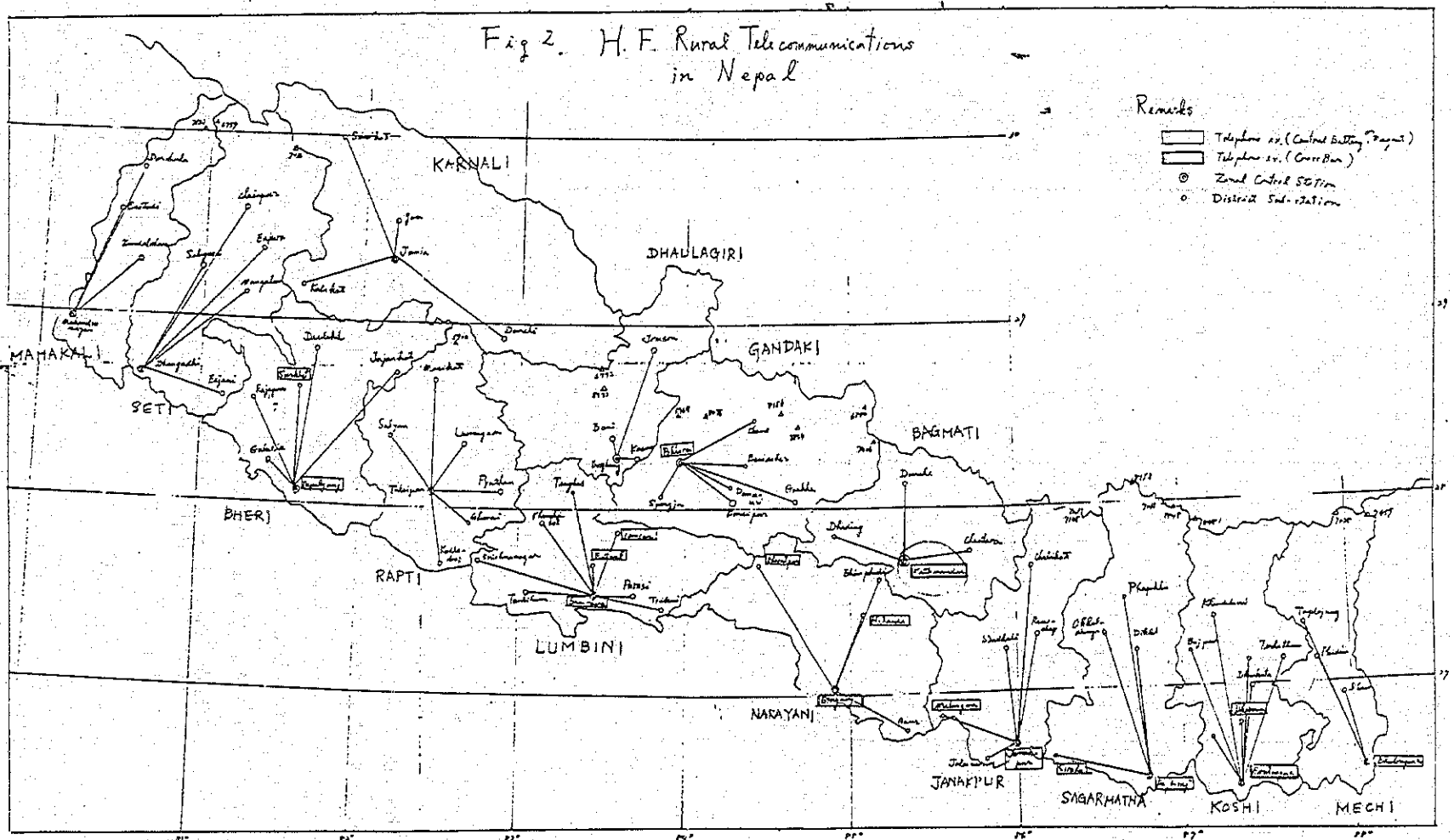
2.(2) Existing Rural Telecommunication Network

Fig. 2 shows existing rural telecommunication network of the country. The network is used for the communications among Kathmandu, zones and districts and actual equipment is installed at the places shown on Table 1. The hierarchy of the each station is as follows:

Kathmandu
↓ ↑
14 base stations (zonal headquarters)
↓ ↑
66 sub-stations (district headquarters)

The network has the communications categories shown below.

Fig 2. H.F. Rural Telecommunications in Nepal



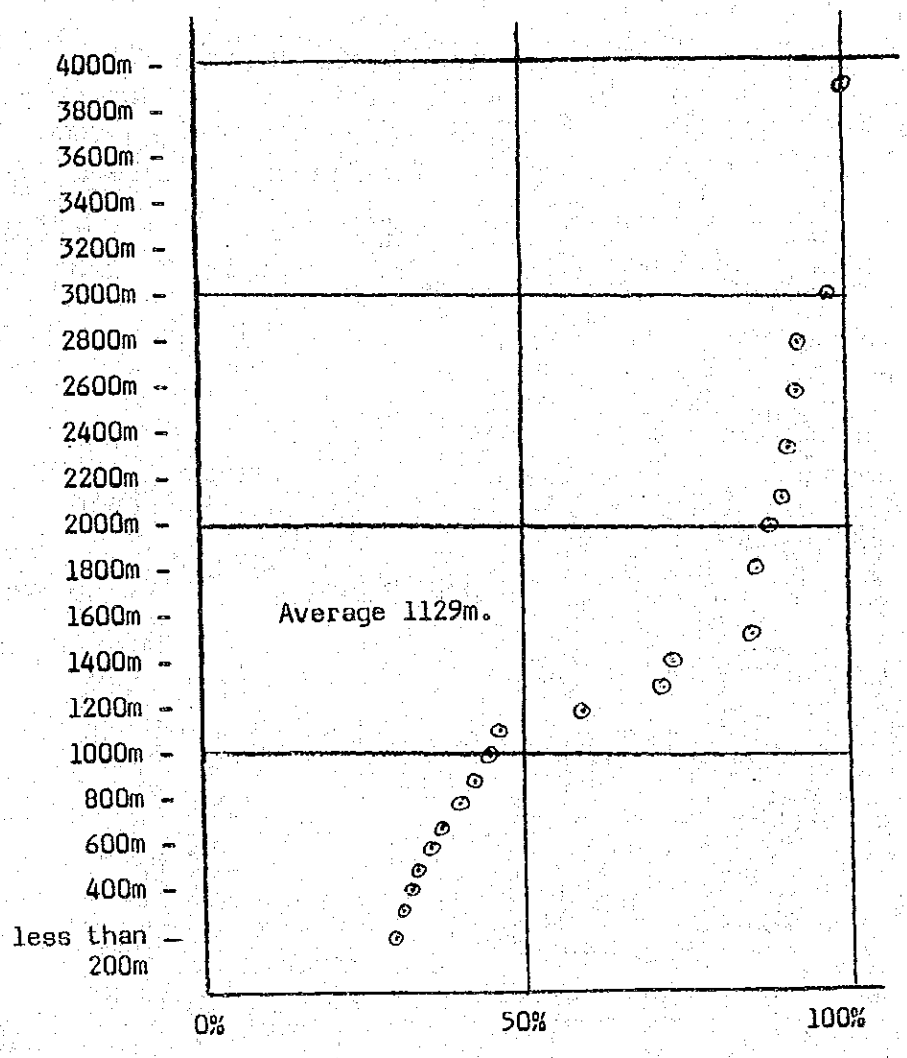
1 : 1,250,000

(a) Kathmandu ～ zone
(b) zone ～ zone
(c) zone ～ district
(d) district ～ district

Any communication consists of a combination of the categories. In the network, there is one good thing which we should follow,is the application of solar battery in the network. For instance, Fig. 3 shows a cumulative distribution of the district headquarters from lower to higher altitude from the sea level. According to the figure, an average altitude from sea level of all zonal and district headquarters amounts 1129 meters, and 70% value comes to 1400 meters,

Fig. 3

Cumulative distribution,
altitude from sea level of D.H.Q.



90% value to 2000 meters. Accordingly, if we consider that altitude of 2500 meters from sea level may be the highest with which the solar battery element can function even in winter season, at 95% of all district headquarters the solar element can be used.

2.(3) The HF Network Propagation Course Profile

Zonal headquarters ~ district headquarters propagation profiles show that UHF over-horizon communications system might be possible. But, according to an actual calculation, mountain ridge loss of radio wave propagation even on 400 MHz band reaches to 40 dB on many radio sections. Further, an availability of commercial electricity and an antenna installation site becomes a big problem in case of the over-horizon telecommunication method. Therefore the method is not taken as improvement plan.

Existing propagation course distance between zonal headquarters and district headquarters is analyzed on Fig. 4. The figure shows that the average propagation course distance is 55.1 Km and on 90% value it amount to about 90 Km. From these points of view, small capacity over-horizon transmission system looks possible, but practically it is not so due to steepness and complexity of topographical situation in the country.

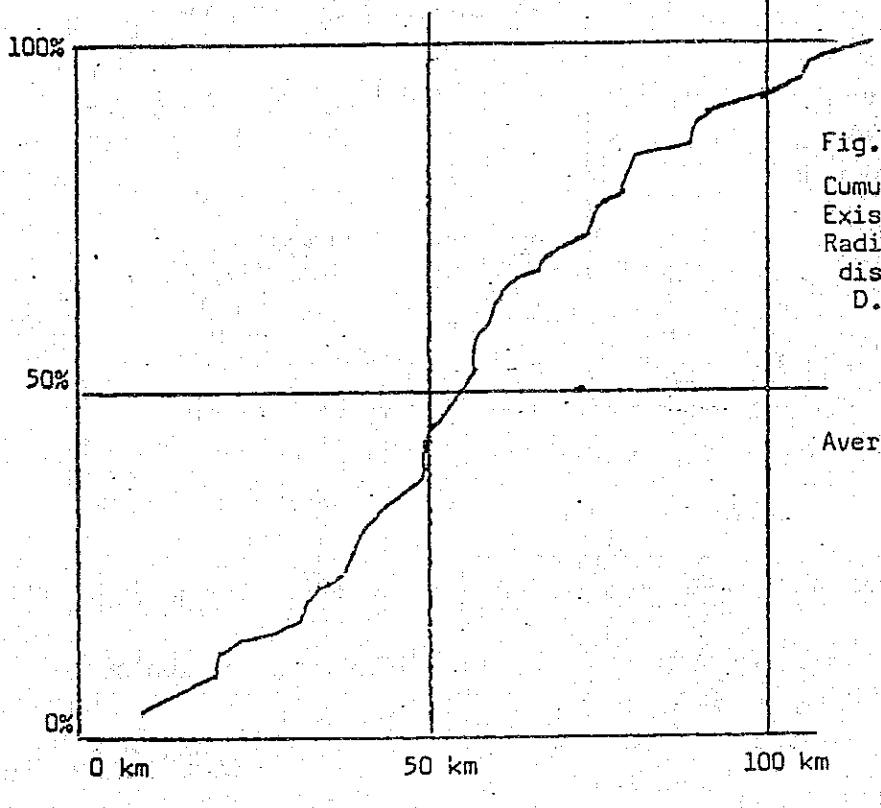


Fig. 4
Cumulative distribution
Existing HF network.
Radio section hop distance for Z.H.Q. D.H.Q.

Average 55.1 km

Anyhow /..

Anyhow, we are going to propose a modern telecommunication network over the Himalayan chain worthy of its name.

2.(4) Traffic of the Existing Network

Collection and analysis of traffic data of the HF network is very significant. But unfortunately the report could not collected the data through out the country. Only one traffic result has been collected. Table 2. shows an example of traffic data of Gandaki zone during the period of 16 July ~ 15 August 1981.

It seems to be a bit risky as this data is taken as a general case. The Table shows:

(a) 30 ~ 40% of all traffics fall into own zone

(b) 30 ~ 40% of that are for Kathmandu

(From Jul. 16 ~ Aug. 15 1981)

Zone	Incoming from	Outgoing to	Remarks
01	409	280	Kathmandu is in the zone
02	5	5	
03	11	11	
04	37	43	
05	16	33	
06	283	424	Own zone (Gandaki)
07	189	210	
08	35	54	
09	21	27	
Total	1006	1087	

Table 2.
Traffic of the HF System at Gandaki Zone (06 code)

(c) Rest of that, about 30%, are traffic to/from other zones.

3. PROPOSALS/..

3. PROPOSALS FOR IMPROVEMENT

3.(1) Target of the Improvement

As already stated on the last chapter, present rural telecommunications in Nepal cannot be said being satisfied even in case between Kathmandu ~ all zonal headquarters. Purpose of the report is to propose a fundamental rural telecommunications plan which can be use by everybody , and on every time of the people in Kathmandu, all zonal headquarters and district headquarters with reliable and stable conditions, and which can positively promote a modernization of the country.

3.(2) Basic Items

New proposal which improves the existing network is made along with following basic items:

(a) All zonal headquarters and district headquarters are connected by satisfied telecommunication network.

(b) The telecommunications basic items like network hierarchy and numbering plan follow

'NEPAL TELECOMMUNICATIONS CORPORATION BASIC PLANS FOR THE TELECOMMUNICATIONS NETWORK IN THE KINGDOM OF NEPAL'

(c) Circuits of inter-zonal headquarters are proposed to use existing microwave links and in case that is not available now, it is considered that the circuit for the zonal headquarters may be planned in future by other project.

(d) All transmission part-proposed are by V/UHF radio relay system. Economization is prior to all. Radio tower is estimated as low as possible. Therefore, radio wave propagation course on some sections must be slightly objected by mountain ridges. V/UHF band is proposed so that the inconvenience may be subsidized.

3.(3) Proposals of New Rural Telecommunication Network Plan

Fig. 5 shows the proposals in accordance with 3.(1) and 3.(2). The proposals mean at the final stage of the project and do not mean the installation of whole part of Fig. 5 at the first stage. Localities of

../local

local telephone offices follow an idea of the 4th telecommunication plan by NTC as much as possible. Therefore, on the way of the project execution, a final target should place on Fig. 5 and beginning stage planning scale should accord with social development and communications demand on those areas.

First characteristics of the proposals is, network in the proposals is digital. Not only an exchange equipment, transmission line, but also subscribers line in case of a degital type multi-access subscribers radio (MASR) should apply digital network.

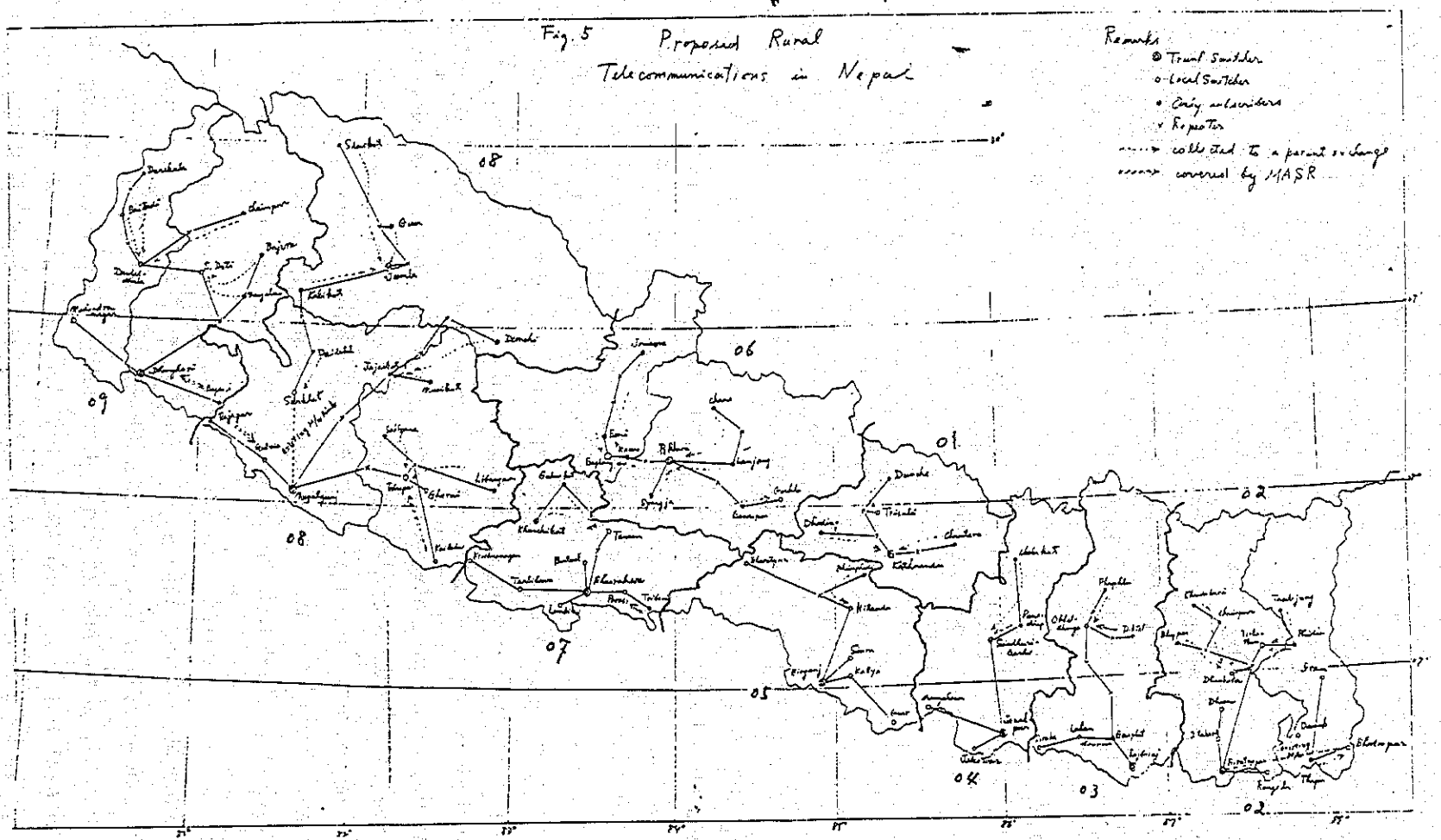
The resons of almost digital network are as follows:

(a) Digital network can realize more stable and economical circuit , due to further improvement of digital technique.

(b) Communication demand at district headquarters requires periodical data transmission and data processing. Namely a district headquarters needs a small type data transmission terminal and processing unit as well as facsimile or telex.

The demand requires data processing function with the network. But the function does not mean a high speed data communication system. Very small capacity and very slow processing function are meant. In some sense, such a communication system can be said as a new category of (data) communications system.

Fig. 5 Proposed Rural Telecommunications in Nepal



1 : 1,250,000

As mentioned above, rural communications should not be built on the bases of big capacity, high speed and instantaneous processing idea but it is stressed that system design to the rural network and manufacturing equipment should stand on the new concept not like urban telecommunications facility. Even now, it is said that rural telecommunications network is difficult for designing and building an economical system.

If rural network is designed and built on the bases of modification from a big capacity and high speed equipment, uneconomical result may be quite natural. And traditionally specification of rural network have been consiered as being exceptional and additonal to a big capacity system. In Nepal, communications idea of whole part is always based on being rural. Therefore, rural telecommunications specifications cannot be exceptional to the country. Regarding rural telecommunication network, that not only Nepal but also many developing countries are facing big problems, an introduction of economical one will open a new way if adopted the Fig. 5 proposal is projected with the idea of rural network oriented. It might be possible that in a developing country a digital communications network can be introduced and the network can become close to the ISDN (Integrated Services Digital Network) which every developed country is keen to introduce. In this sense, it is very significant that the proposals of Fig. 5 is designed as much fully digital technique as possible.

3.(4) Details of the New Proposals

3.(4).A Numbering plan and telephone office hierarchy.

Fig. 5 proposes to devide the country into nine parts of the toll switching areas. That is:

01 area is Bagmati zone
02 area is Mechi and Koshi zone
03 area is Sagarmatha zone
04 area is Janakpur zone
05 area is Narayani zone
06 area is Gandaki and Dhaulagiri zone
07 area is Lumbini zone
08 area is Karnali, Rapti and Bheri zone
09 area is Seti and Mahakali zone

Each /..

Each area has its own centralized telephone office in the area, which centralizes all subscribers through a local telephone office and which organizes toll trunk exchange fundtion. The centralized telephone offices are shown on Table 3. All local telephone offices, which connect telephone subscribers and data terminals, are under the areal toll centre shown on Table 3.

Main roles of the areal toll centre is:

(a) to exchange trunk calls

(b) to process data communications

(c) to manage a maintenance centre.

Area	Zone	Areal toll centre
01	Bagmati	Kathmandu
02	Mechi, Koshi	Bhadrapur
03	Sagarmatha	Rajbiraj
04	Janakpur	Janakpur
05	Narayani	Birgunj
06	Gandaki, Dhaulagiri	Pokhara
07	Lumbini	Bhairhwa
08	Karnali, Rapti, Bheri	Nepalgunj
09	Seti, Mahakali	Dhangarhi

Table 3.

Areal toll centre for each area

A district has two categories, one is a district which has a local telephone office at the district headquarters, and the other is a local one without telephone exchange in the district. In case that communications demand can be estimated many, a local telephone office is planned at the district headquarters. Several districts, in which communications demand of some extent is not expected, are collected to a parent exchange office. A list of district with and without a telephone office is shown on Table 3-2.

The list /..

The list means a situation on the final stage of the project. When many demand can not be estimated on beginning stage, a telephone office

Area	Localities		Remarks
	with L.S.	without L.S.	
01	7	3	Kathmandu Valley
02	9	6	
03	4	3	Comparatively developed zone
04	4	2	
05	6	1	
06	3	7	
07	7	3	
08	7	10	Behind development zone
09	4	6	
Total	51	41	92

Table 3-2.

District Head Office with L.S.
and without L.S. at final stage

is not needed and subscribers should be collected to a parent exchange near the district. Such local one is mentioned as below:

01 area	---
02 area	Damak, Ilam ⟶ Bhadrapur
	Itahari ⟶ Dharan
03 area	Lahan, Gaighat ⟶ Fajbiraj
04 area	Mangulsen, Jaleswar ⟶ Janakpur
05 area	Kalaiya, Gaur ⟶ Birgunj
06 area	---
07 area	Lumbini, Parasi, Tribeni ⟶ Bhairahwa
	Krishnanagar ⟶ Taulihawa
08 area	Ghorahi ⟶ Tulsipur
	Gulria, Rajapur ⟶ Nepalgunj
09 area	---

When/..

When communication demand grows enough, localities mentioned above come to have a local exchange in its own district. It is noticed that rural telecommunications network like Fig. 5 should have flexibility in accordance with changing demand and social activities. The flexibility is necessary condition for the project economization. The idea can delete 13 local exchange offices through out the country on beginning stage. This shows on Table 3-3.

Area	Locality	
	with L.S.	without L.S.
01	7	3
02	7	8
03	3	4
04	2	4
05	3	4
06	3	7
07	4	6
08	5	12
09	4	6
Total	38	54

Table 3-3

No. of the district head quarters with L.S. and without L.S. at the beginning stage

When we observe 51 of local exchange offices, we can find three categories of the offices. First one is a local exchange office which accommodates not only subscribers close to own office but also remote subscribers in different districts connected by means of radio relay system. On the project, this type of exchange equipment has three kinds, that is, two, three and four districts without a local exchange are collected by the parent exchange. Mainly the exchange equipment is used at mountainous area.

Second category is also same type of a local exchange office like the first category. But subscribers in non-exchange office area are collected by means of a digital type of MASR. The type of exchange equipment is mainly

../used

used at plain area.

Last one is a quite traditional type of exchange, namely the exchange accommodates only subscribers within 4∼5 Km distance from the exchange. Table 3-4 shows number of each type exchange mentioned above.

Zone	1st category			2nd category	3rd category	Total L.S.
	2 areas Collected	3 areas Collected	4 areas Collected			
01	1	1	-	-	5	7
02	-	1	1	1	6	9
03	-	1	-	1	2	4
04	-	1	-	-	3	4
05	1	-	-	-	5	6
06	1	-	2	-	-	3
07	-	1	-	1	5	7
08	1	1	2	1	2	7
09	-	1	1	1	1	4
Total	4	7	6	5	29	51

Table 3-4

Classification of a local exchange office on the final stage

In case of a district without a local telephone office, a manual exchange board is installed, and the board is connected to a parent exchange in other district by radio relay system. The board can be replaced by an automatic line concentlator or a small exchange unit when communications demand in the district reaches to a certain extent.

Every zonal and district headquarters hierarchy is shown on Table 4 ∼ Table 12. In these tables, local exchange maximum capacity at final demand is also shown. The exchange capacities on the tables are shown with reference to "The 4th Telecommunication Project, NTC", and to population of districts, localities and, profession also. And a locality without a telephone office is uniformly assigned with 50 line units. Further communication demand survey is necessary on the feasibility and detail survey. Table 13

../.. ../ shows

shows necessary exchange equipment numbers related to its capacity and a district. Table 13 says that majority of local exchange equipment for rural network is a capacity less than 500 line units. Key-point of rural network economization seems how to realize low cost exchange equipment less than 500 line units.

The project can install a maximum of 34250 line units. The number excludes existing and under installation telephone facilities, which amounts 31450 line units. Therefore, at the end of the project, total number of line unit through the country is

34250 + 31450 = 65700 line units

↑ by the project

↑ existing and under installation

Table 12-2 shows number of localities which can have communications facility by the project. The number amounts 90 localities according to the Table. The number is more than the number of district headquarters, 75.

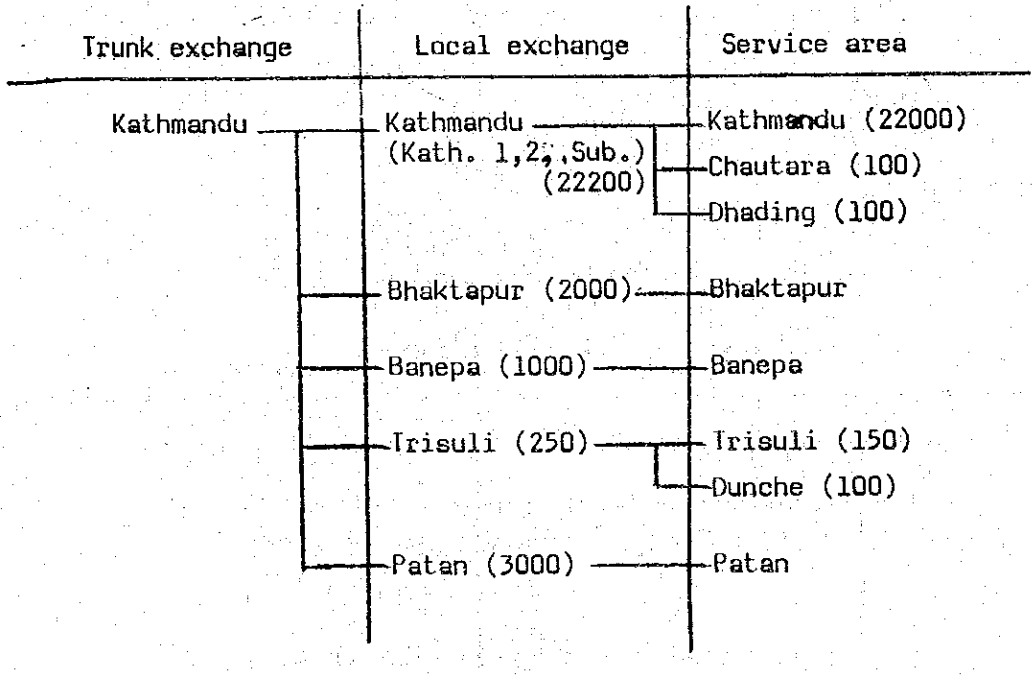


Table 4

Telephone office hierarchy (01 area)

Table 5. /..

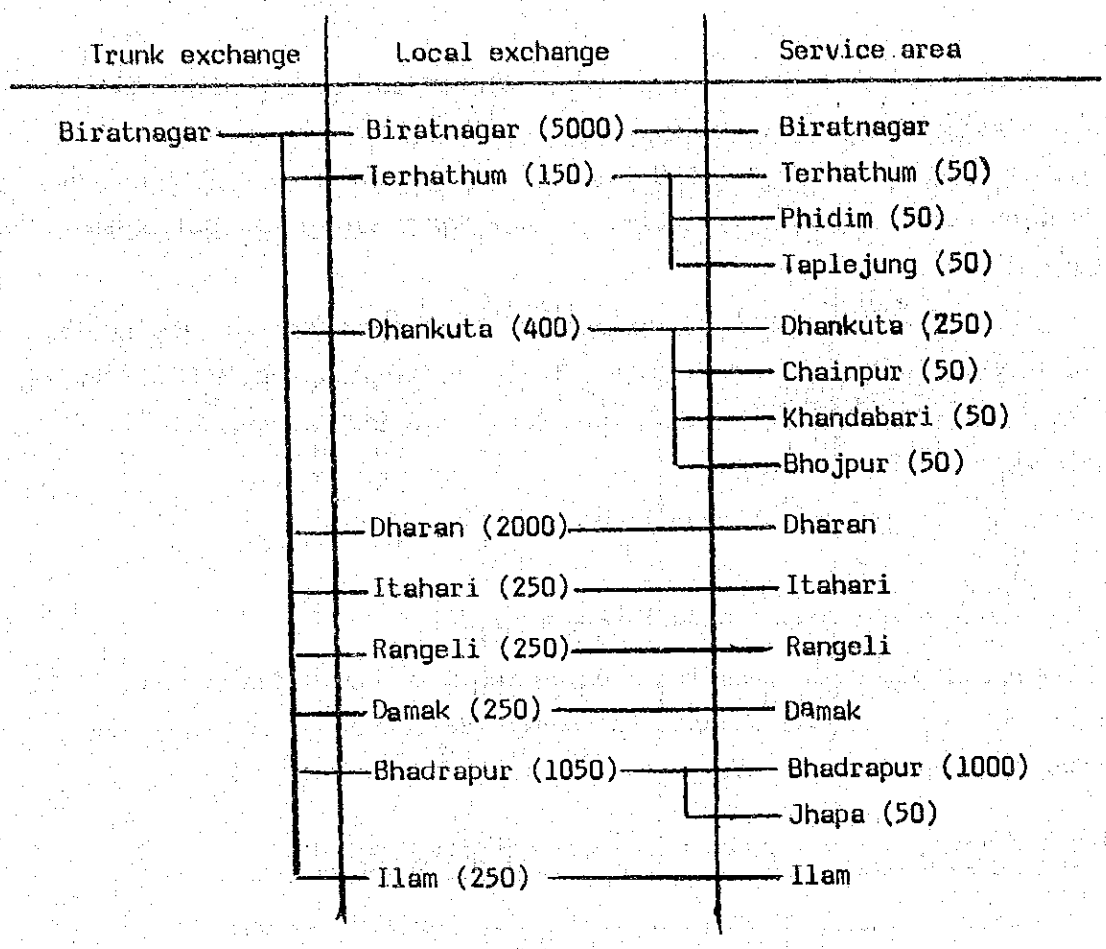


Table 5

Telephone office hierarchy (02 area)

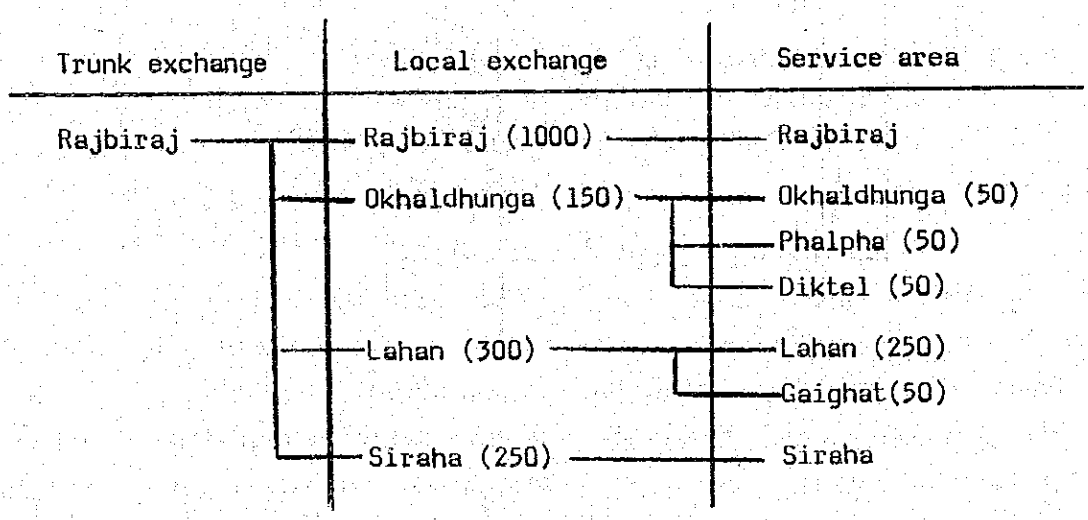


Table 6

Telephone office heirarchy (03 area)

Table 7 /..

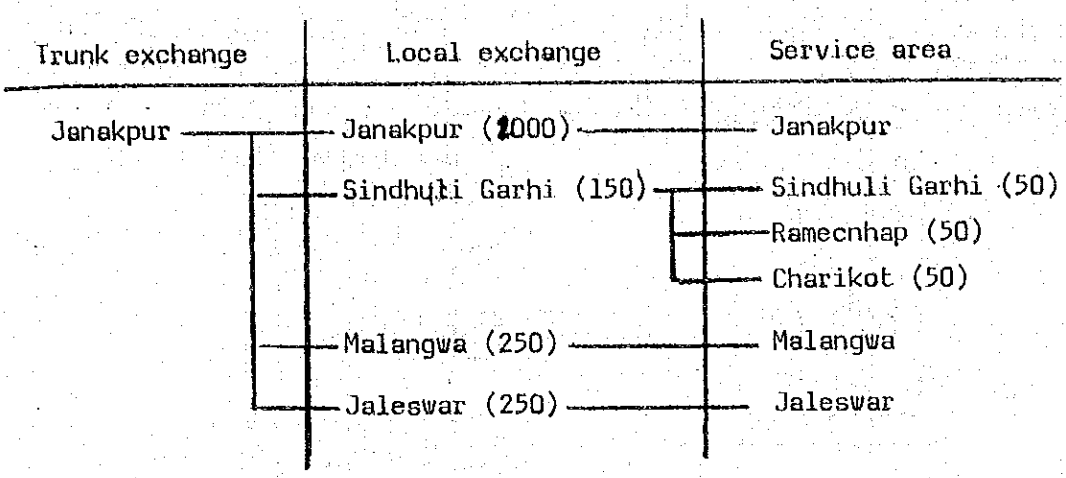


Table 7

Telephone office hierarchy (04 area)

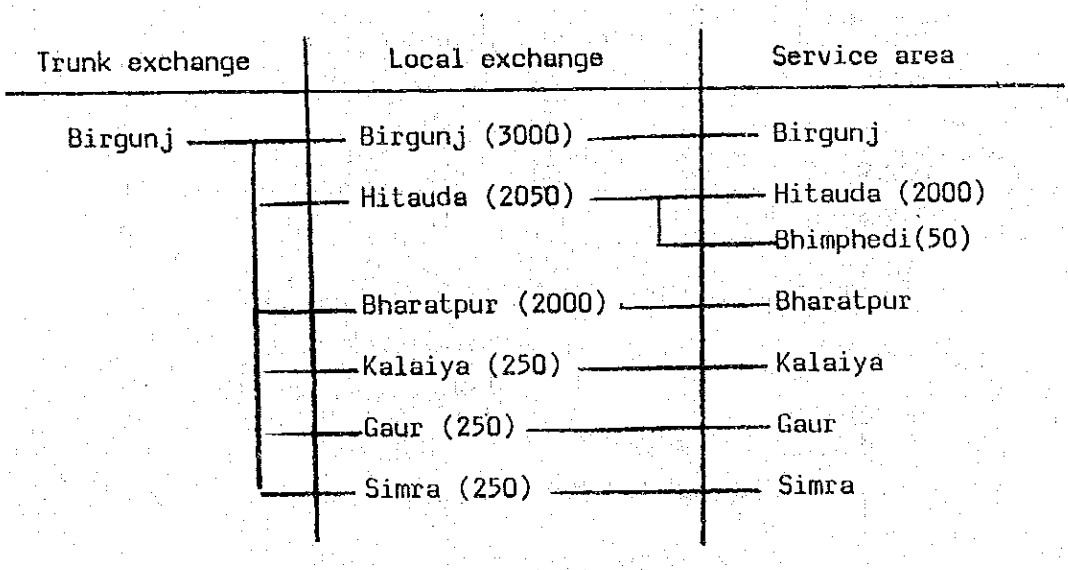


Table 8

Telephone office hierarchy (05 area)

Table 9 /..

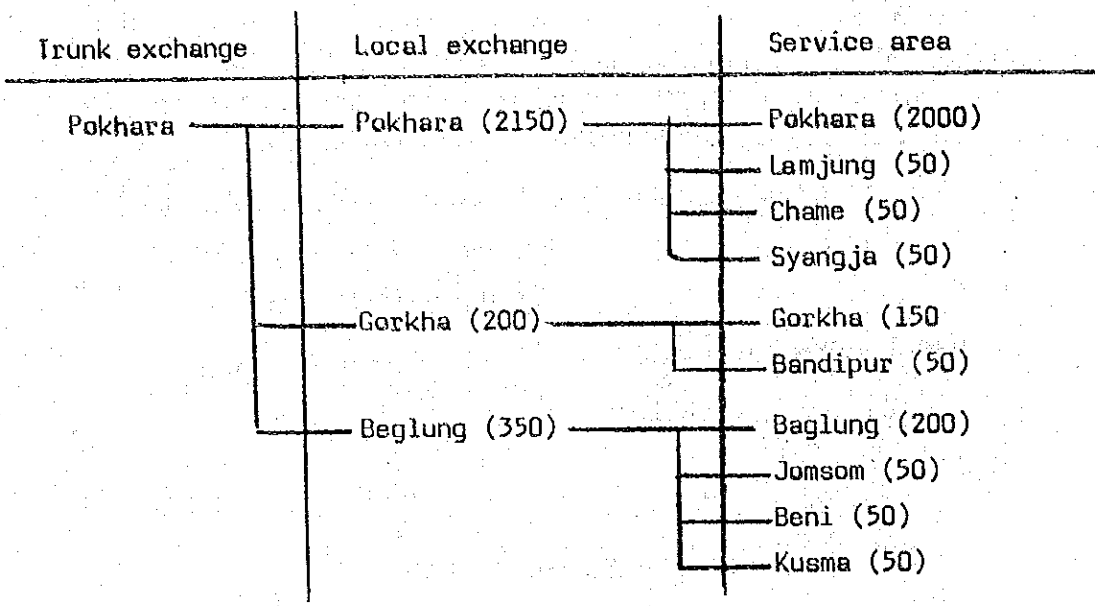


Table 9

Telephone office hierarchy (06 area)

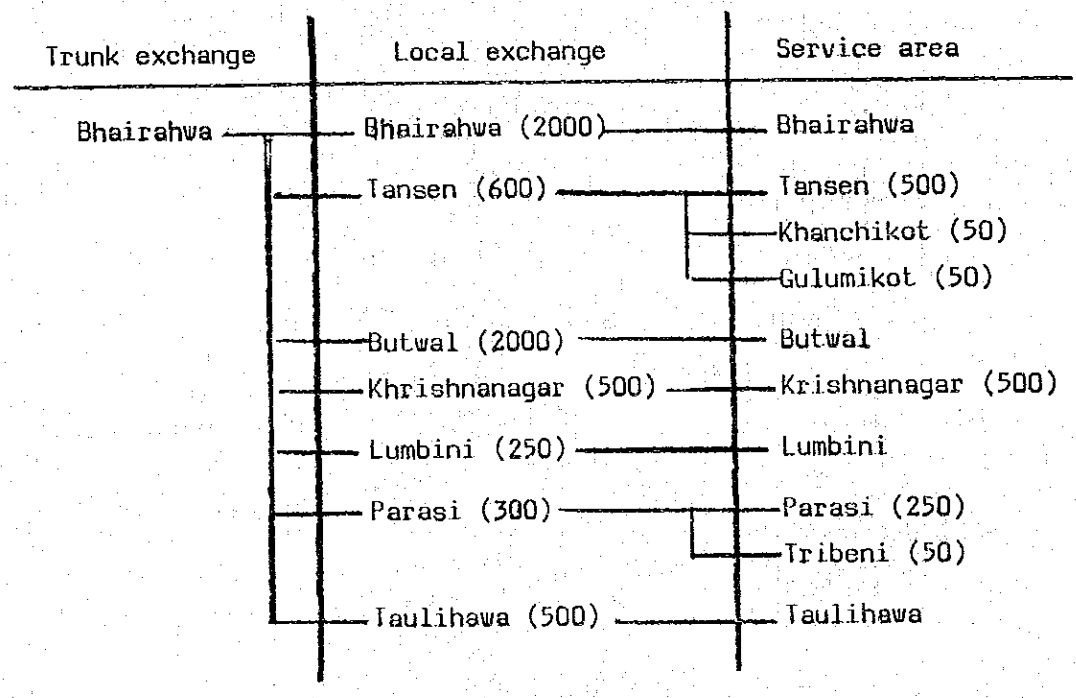


Table 10

Telephone office hierarchy (07 area)

Table 11 /..

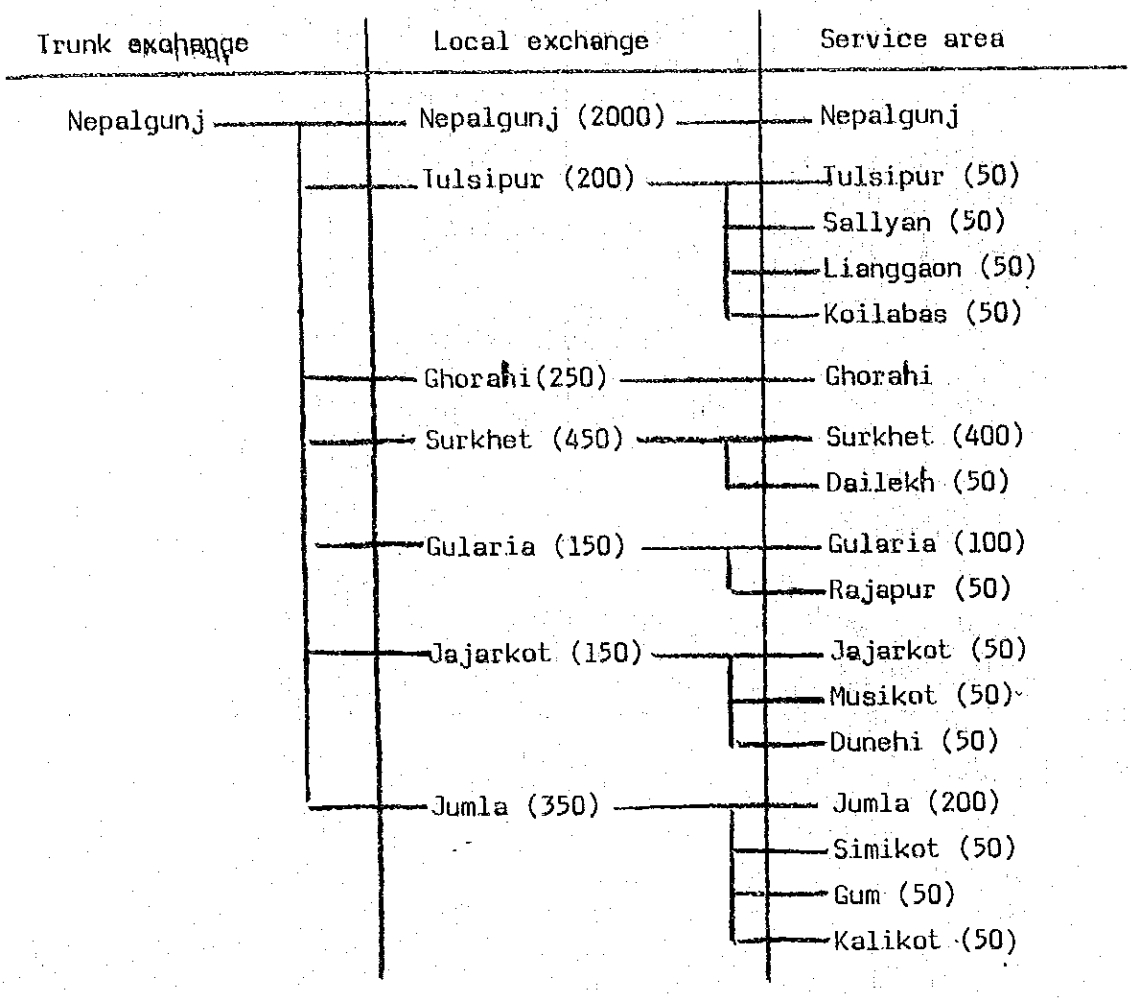


Table 11

Telephone office hierarchy (08 area)

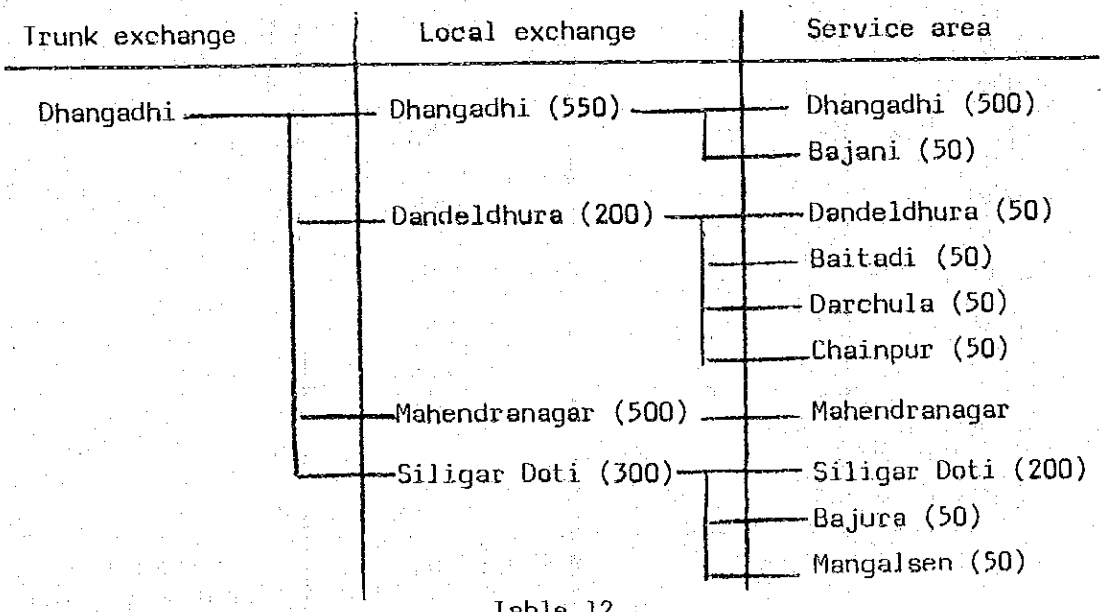


Table 12

Telephone office hierarchy (09 area)

Table 12-2 /..

Area	No. of the locality	No. of local exchange
01	8	7
02	15	9
03	7	4
04	6	4
05	7	6
06	10	3
07	10	7
08	17	7
09	10	4
Total	90	51

Table 12-2
No. of localities with telephone facilities

"A" Required capacity of L.S.	"B" No. of L.S.	"A" x "B"	Remarks
150	5	750	8 L.S.
200	3	600	
250	12	3000	12 L.S.
300	3	900	10 L.S.
350	2	700	
400	1	400	
450	1	450	
500	3	1500	
550	1	550	4 L.S.
600	1	600	
1000	2	2000	
1050	1	1050	9 L.S.
2000	8	16000	
2050	1	2050	4 L.S.
2150	1	2150	
3000	2	6000	
5000	1	5000	4 L.S.
6000	2	12000	
10000	1	10000	
Total	51	* 65700	* The number included existing line units

Table 13

3.(4).B Transmission Network

Fig. 6~Fig. 17 show transmission network based on the basic plan of Fig. 5. All transmission network are digitalized radio relay system. On this time, contour map cannot be available. Therefore, radiowave propagation course should be more elaborated by the feasibility survey or by the detail design.

A proposal of the transmission network has a scale shown on Table 14. In the network, some part of the transmission line is used as a subscriber line on beginning stage, then several years after that is used as a trunk circuit. Namely same circuit has a double purpose. Therefore, designers have to pay much attention for the noise budget and the availability design. Inter-zonal transmission line is proposed to use existing or planned microwave network.

Fig. 6 /..

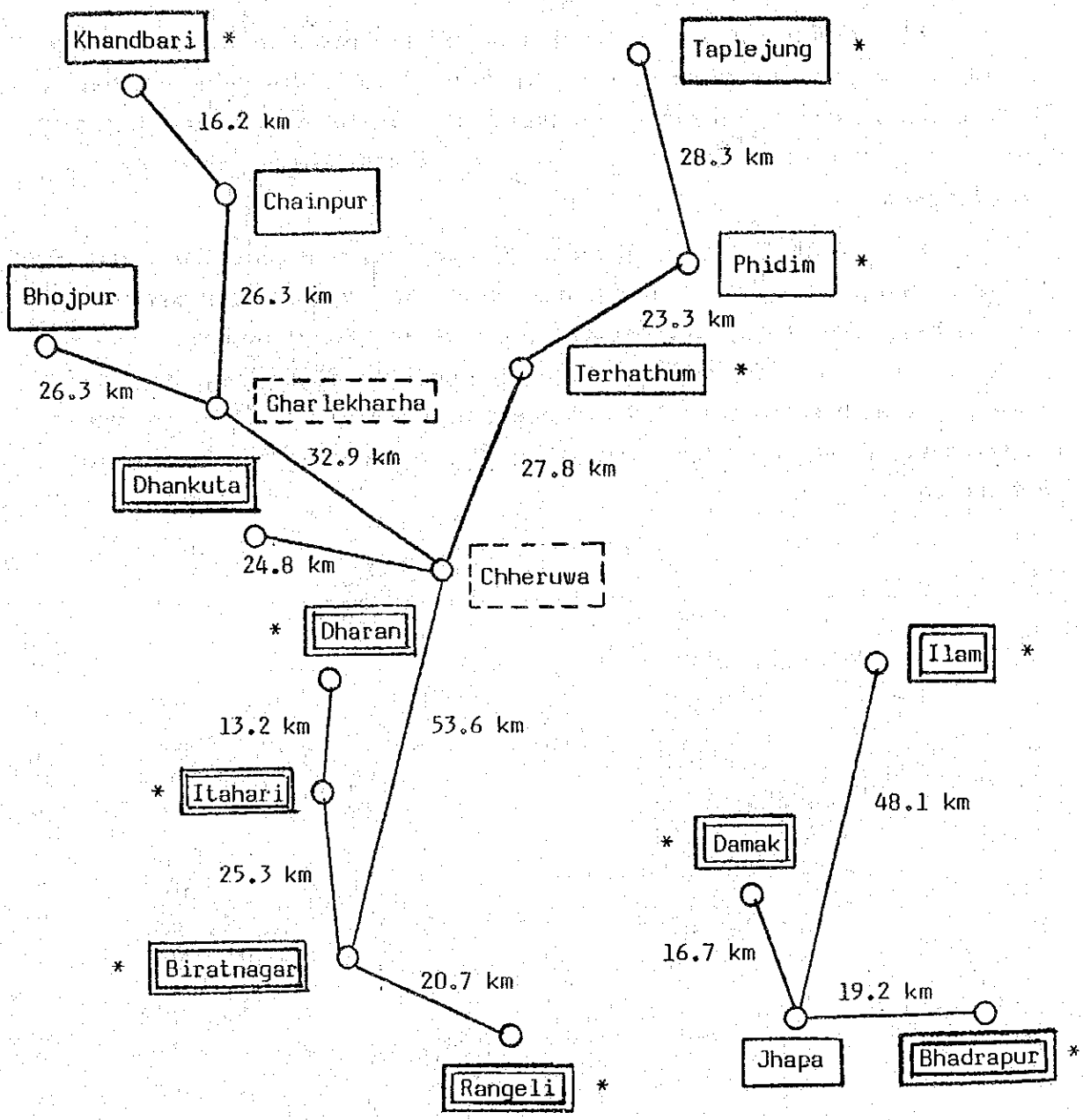


Fig. 6 Transmission Network in Area 02

Telephone exchange

District head quarter

Repeater

* Commercial power available

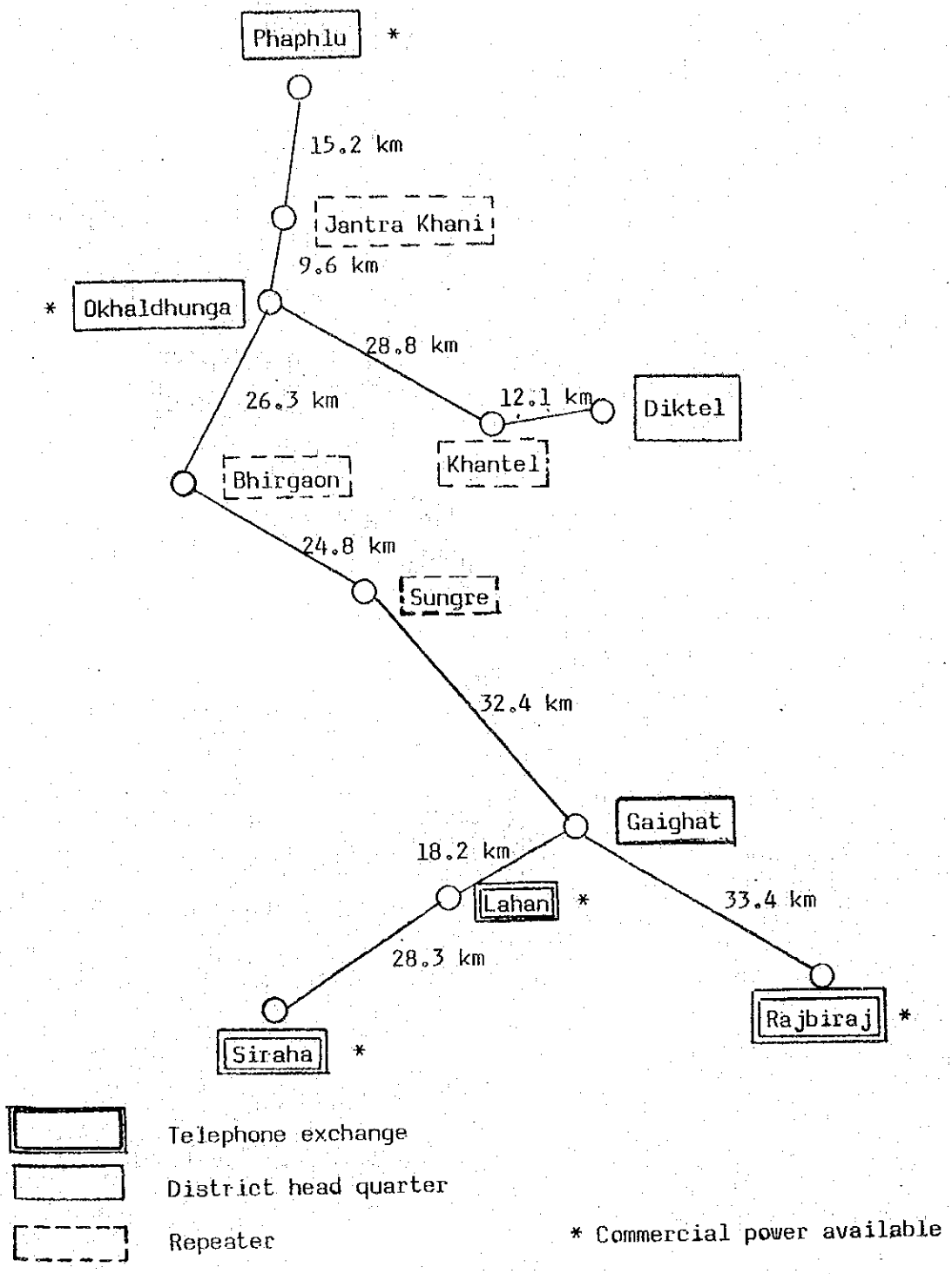


Fig. 7 Transmission Network in Area 03

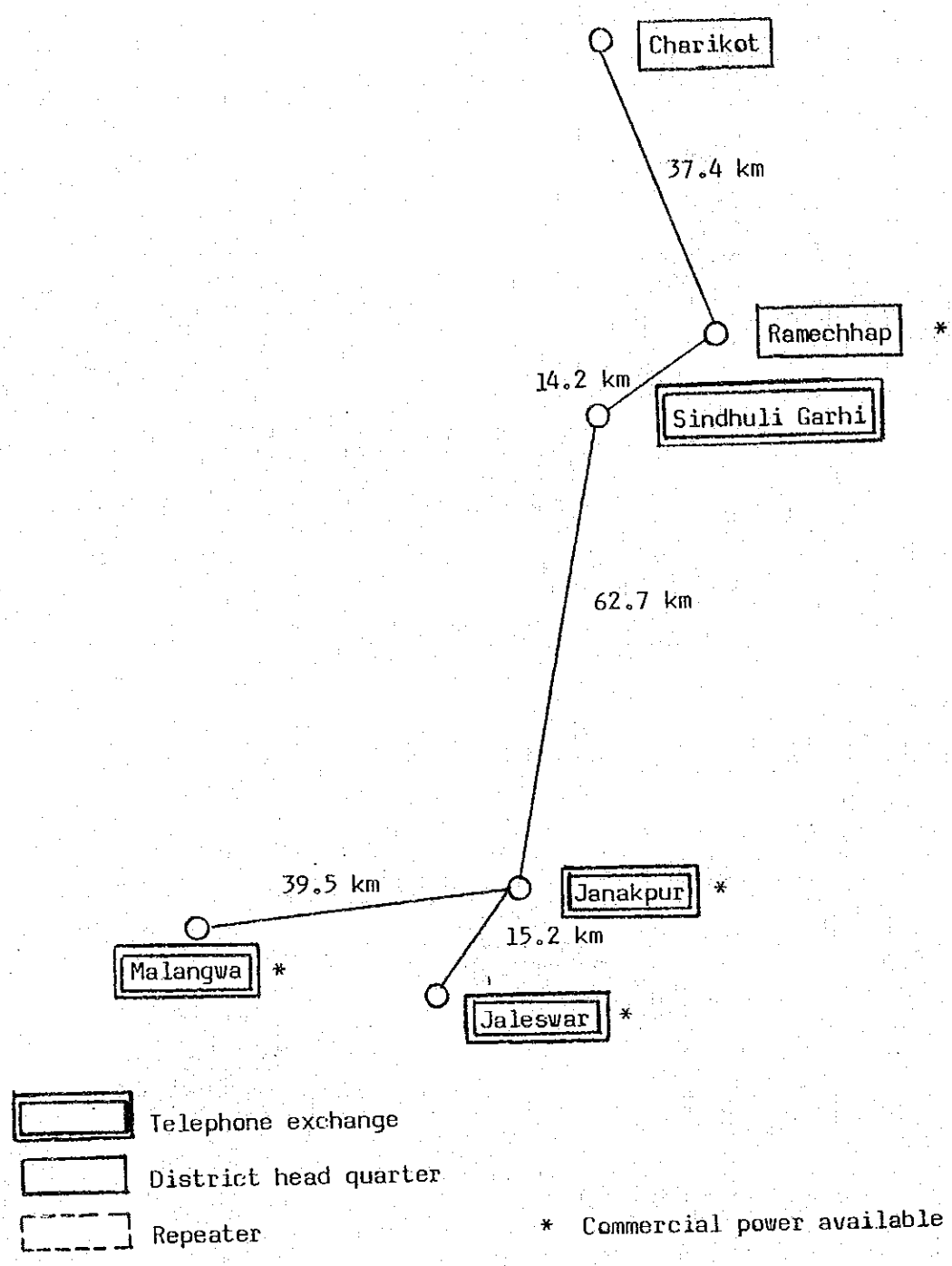


Fig. 8 Transmission Network in Area 04

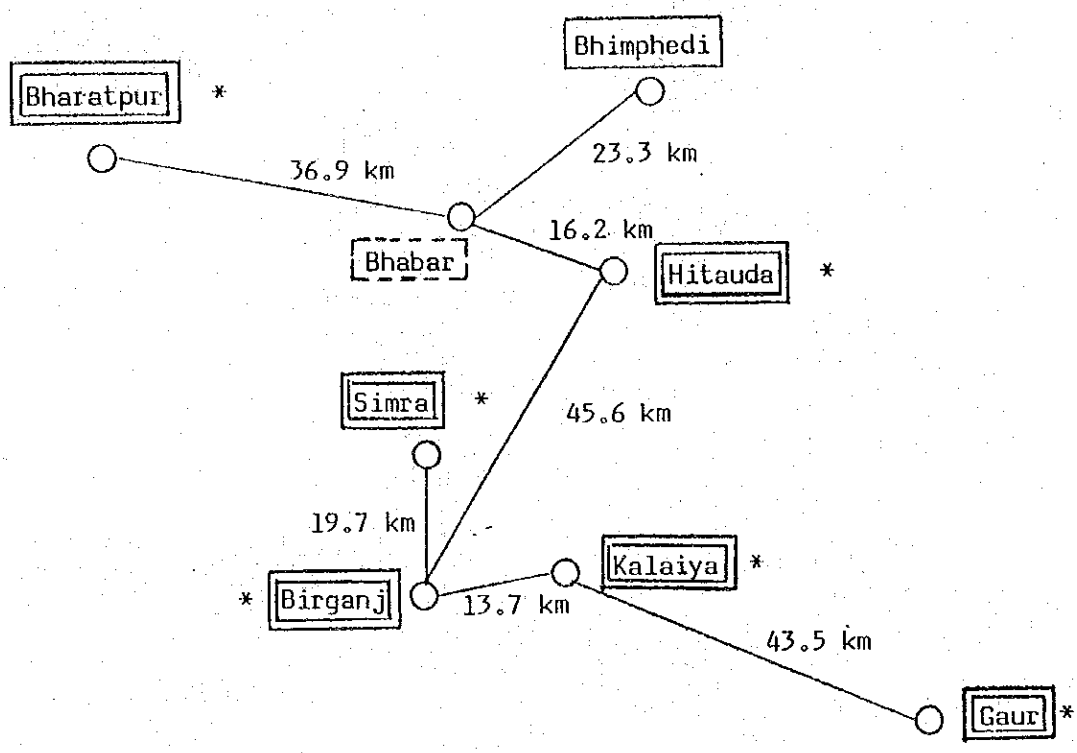


Fig. 9 Transmission Network in Area 05

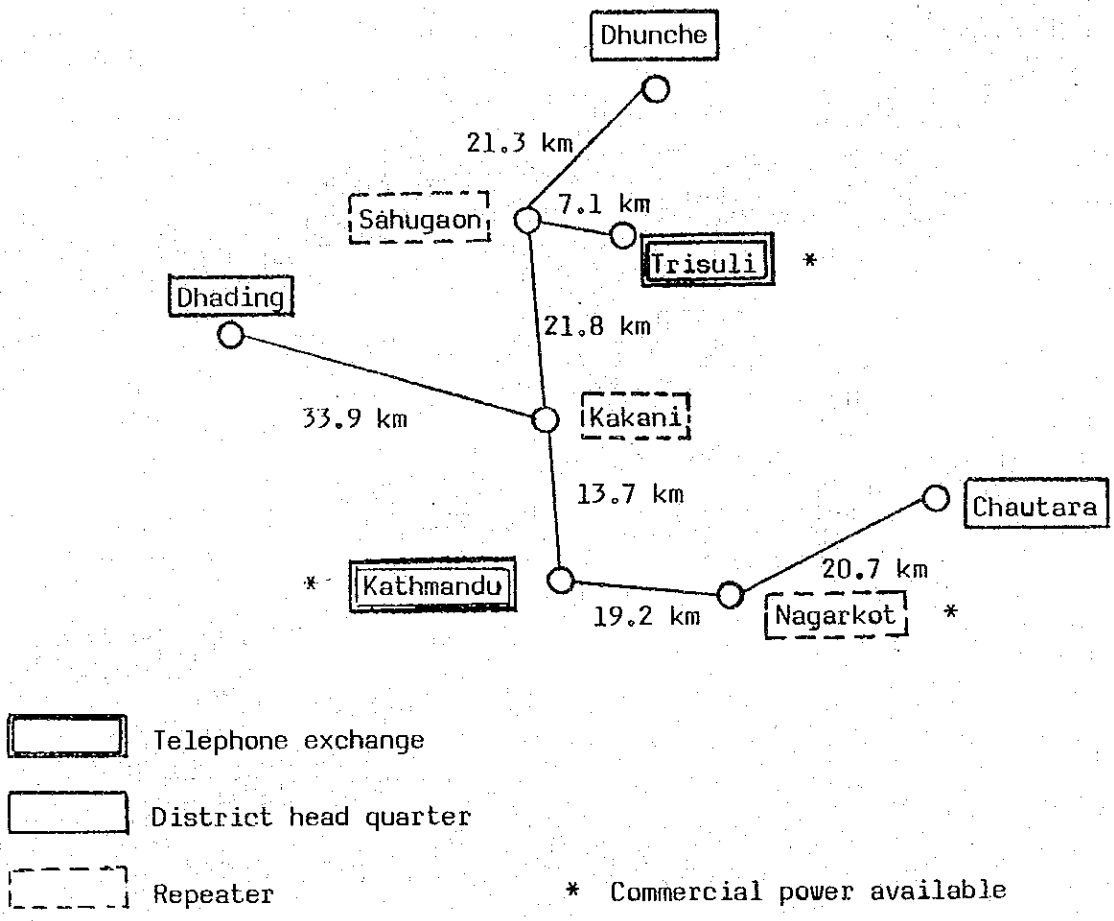


Fig. 10 Transmission Network in Area 01

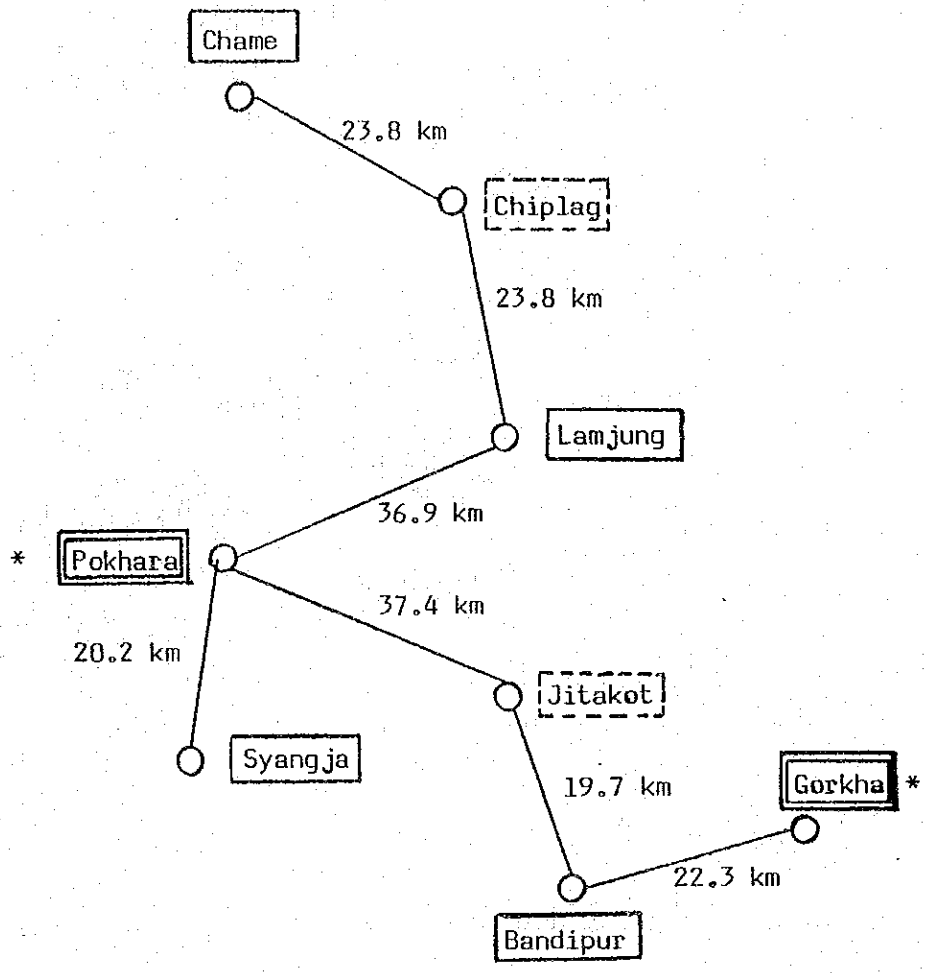
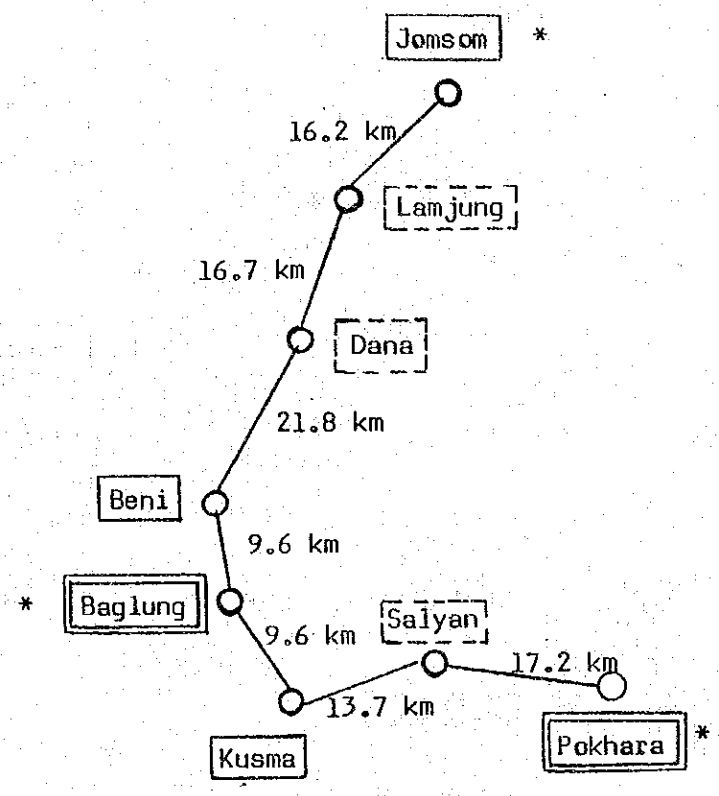


Fig. 11 Transmission Network in Area 06



Telephone exchange

District head quarter

Repeater

* Commercial power available

Fig. 12 Transmission Network in Area 06

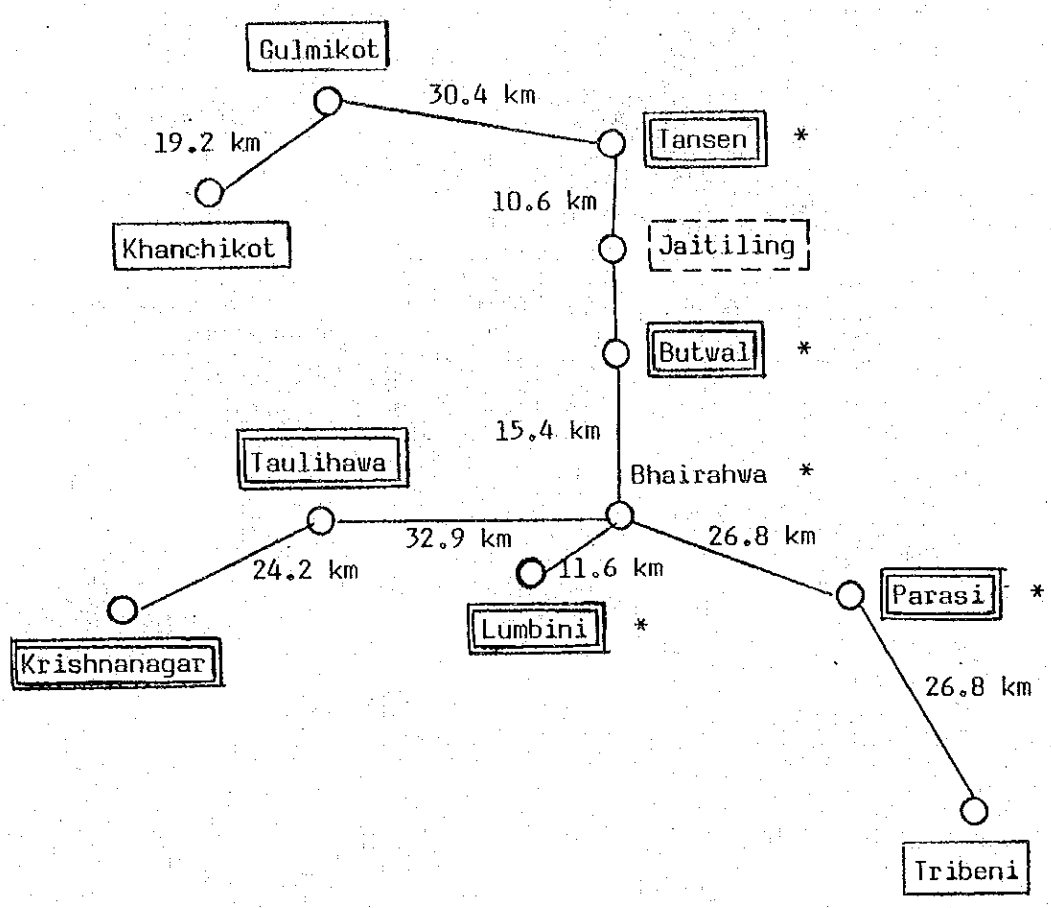


Fig. 13 Transmission Network in Area 07

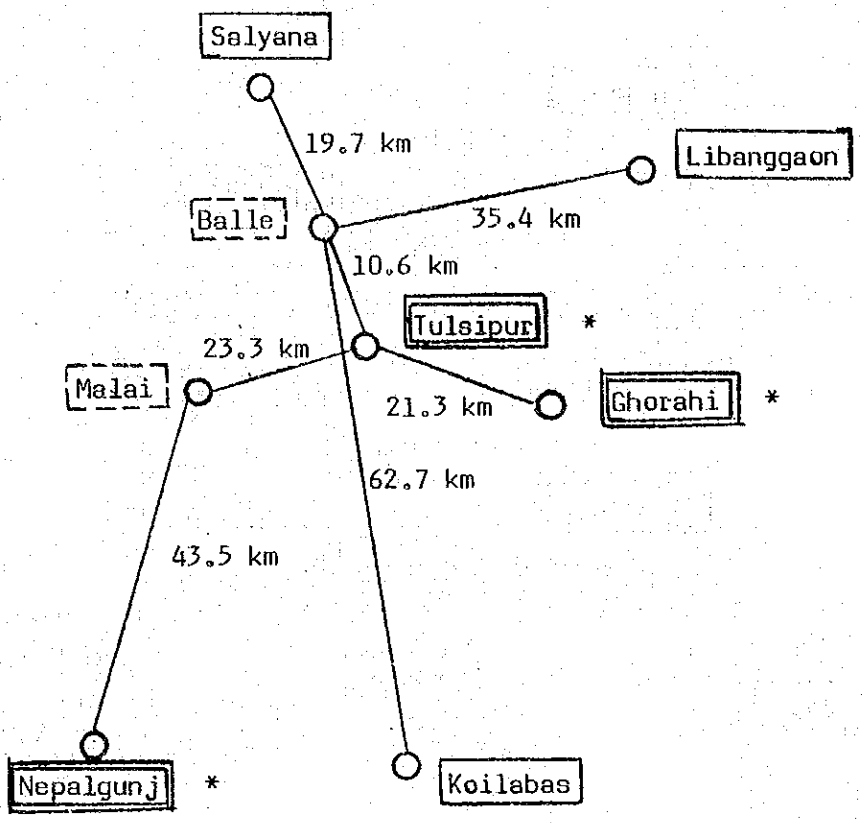


Fig. 14 Transmission Network in Area 08

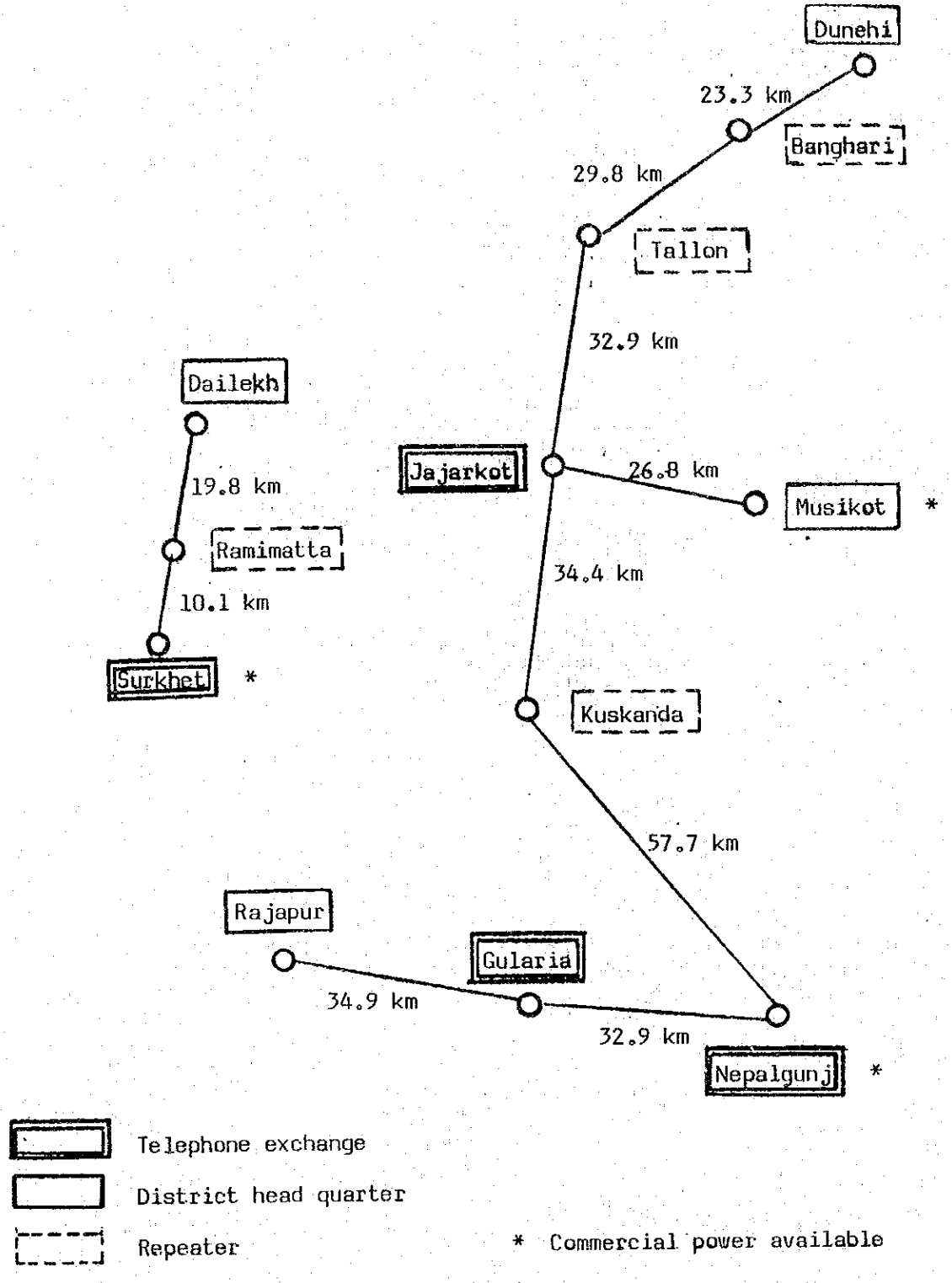


Fig. 15 Transmission Network in Area 08

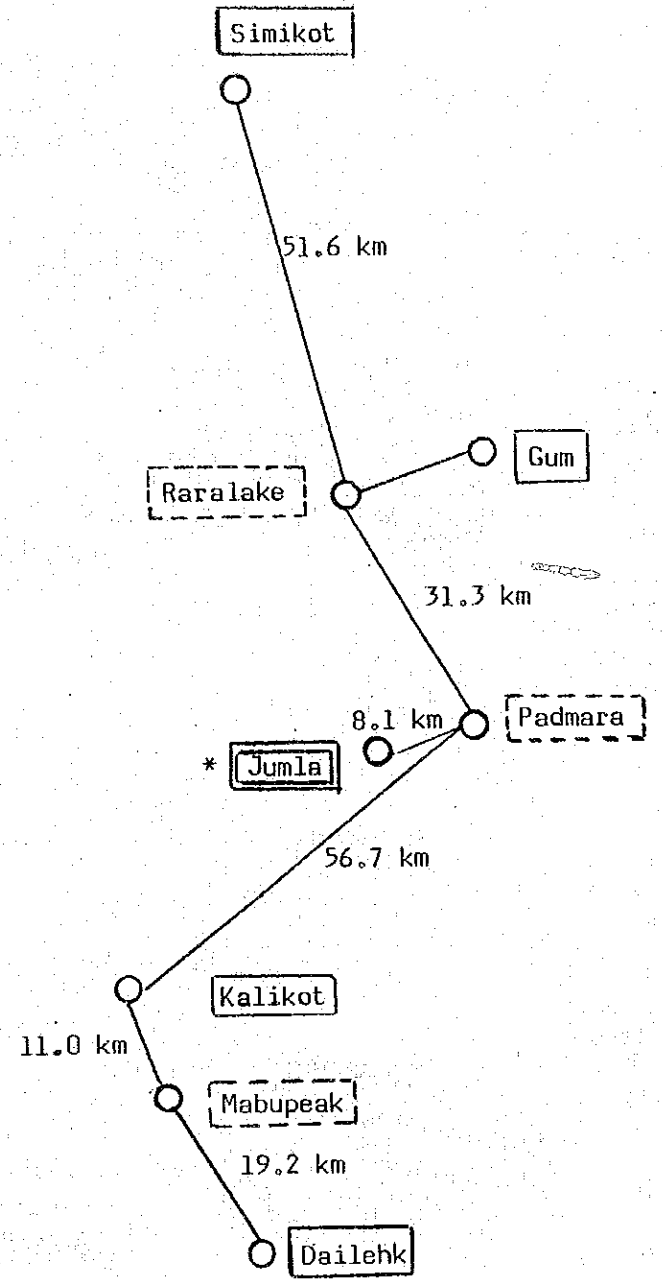


Fig. 16 Transmission Network in Area 09

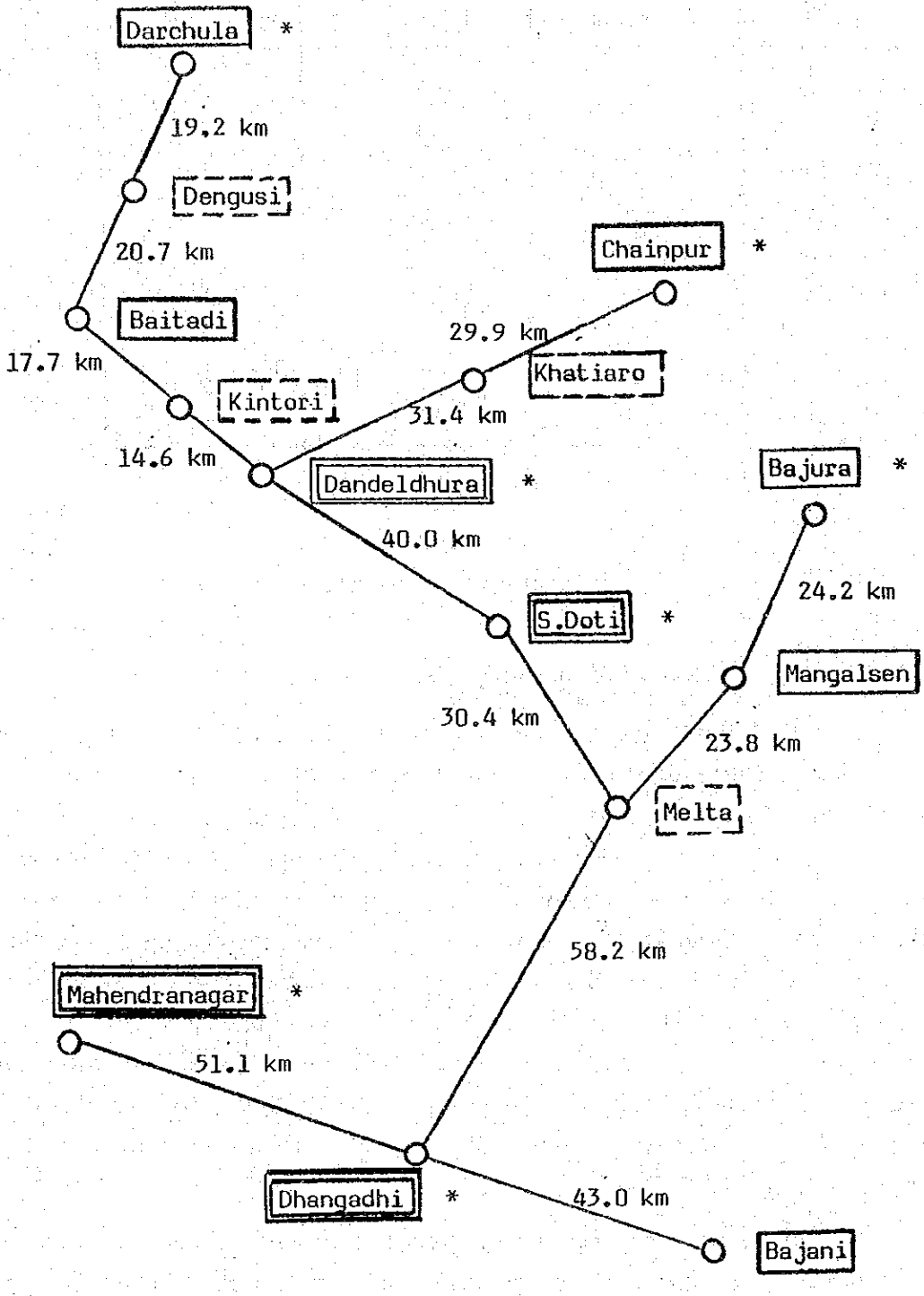


Fig. 17 Transmission Network in Area 09

Zone	No. of radio sections	No.of terminal stations	No. of repeaters	Remarks
01 zone	7	5	3	
02 zone	15	15	2	
03 zone	10	7	4	
04 zone	5	6	-	
05 zone	7	7	1	
06 zone	14	10	5	
07 zone	10	10	1	
08 zone	23	17	8	
09 zone	13	10	4	
Total	104	87	28	

Table 14

Scale of the transmission network

3.(4).C Transmission Reference Circuit

Propagation course profiles for existing HF network show pretty steep and severe topography. Metalic cable installation in the area definitely seems uneconomical. Therefore, transmission network through the country should be by radio relay system. Suitable radio frequency band and transmission channel capacity being mentioned on later sections, here the reference circuit for rural telecommunications transmission network by radio is discussed. System design and manufacturing equipment for rural network need the reference circuit idea. Table 14 shows that Fig. 5 project needs 104 radio sections. How is distribution of one hop radio section distance in kilo-meter? An analysis of the distribution results Fig. 18. Accordingly an average distance of one radio section is about 26 km and 45 km of 90% value.

Next, how many radio sections are necessary from a zonal headquarters to a district headquarters? An answer of this shows on Fig. 19. Namely 95% of radio transmission circuit between a zonal and a district headquarters comprises 6 radio sections at maximum.

Fig. 18 /..

Fig. 18

Cumulative Distribution

of

Radio section hop distance

From District Headquarters to Zonal Headquarters

(Remarks : Zonal Headquarters mostly have)
Trunk exchange

means 25.9 Km

Standard dev. 12.6 Km

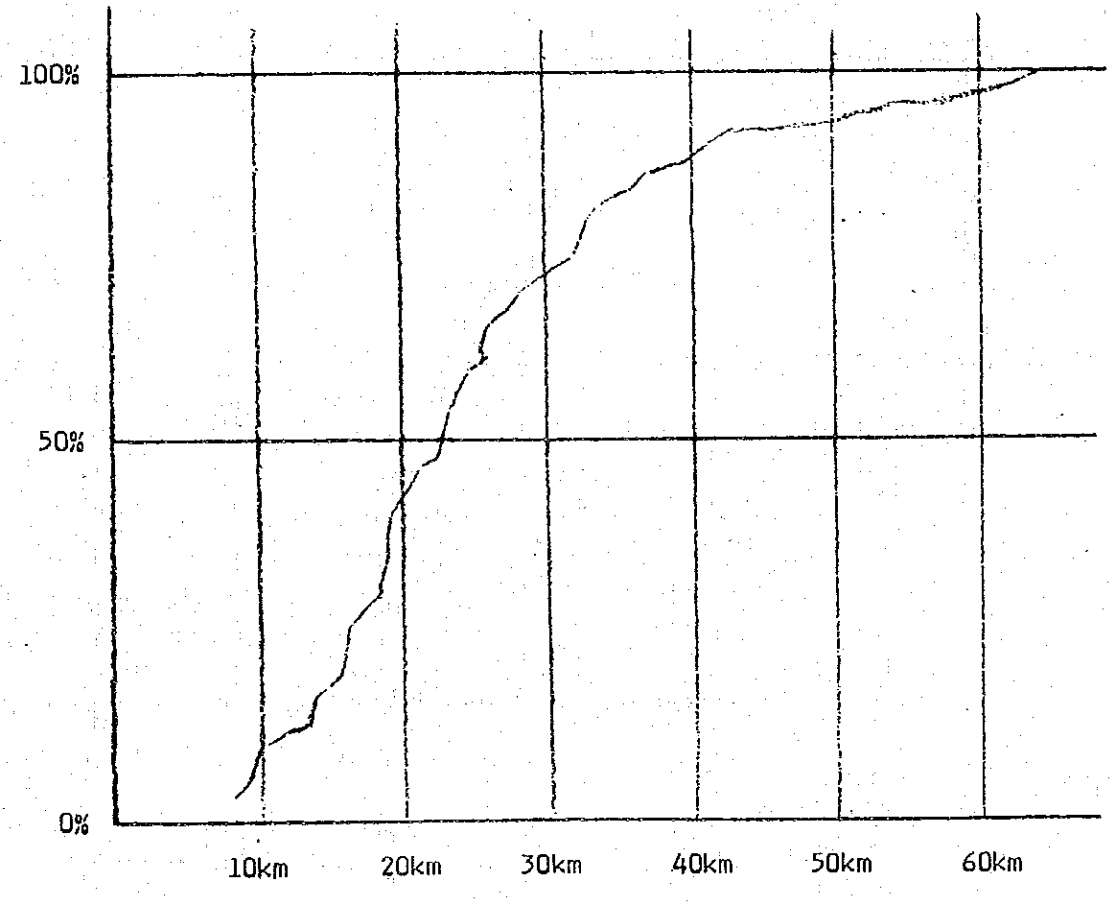
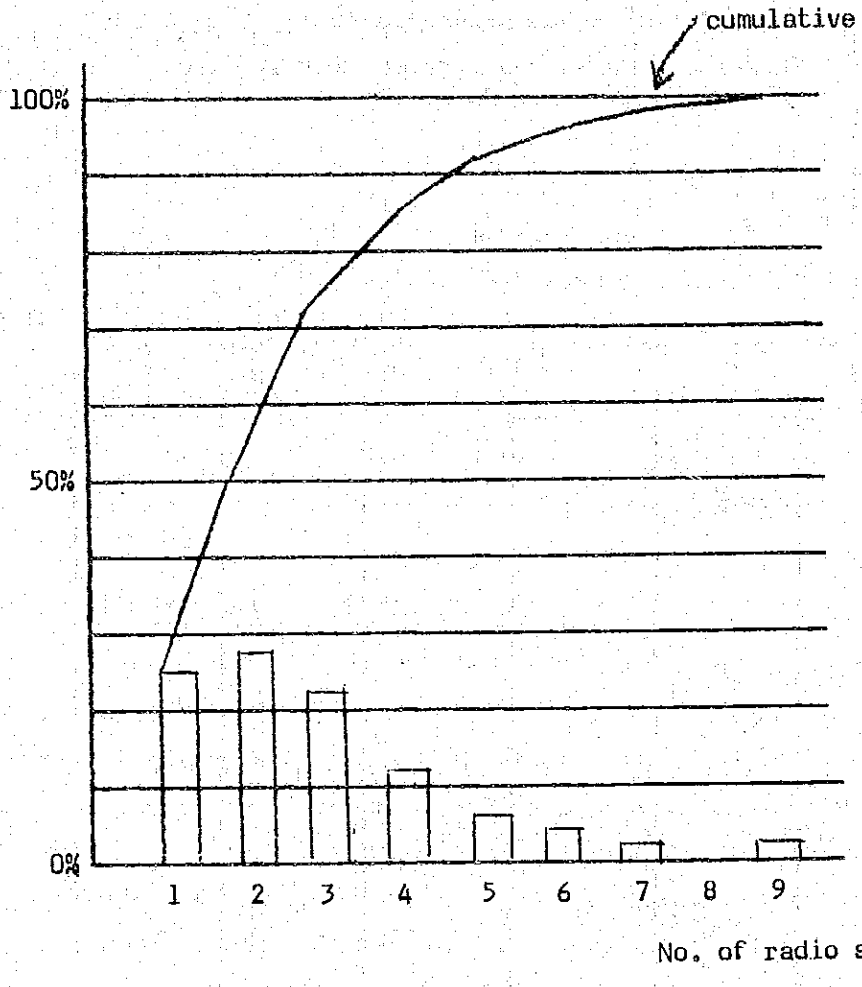
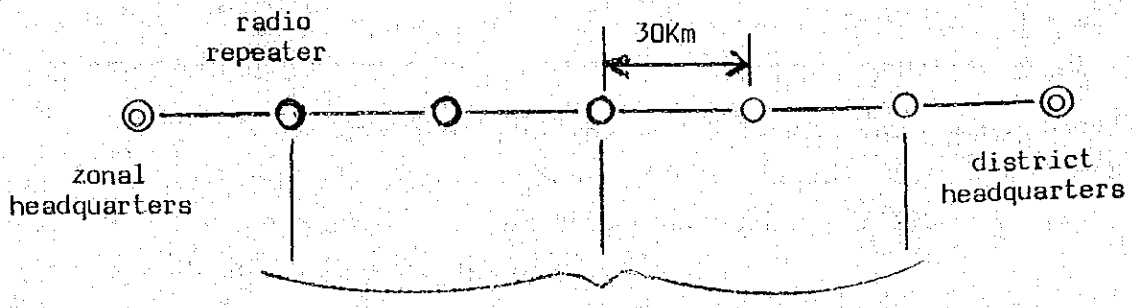


Fig. 19 /..

Fig. 19
Distribution
No. of radio sections
between District Headquarters and Zonal Headquarters



now we can conclude the reference circuit as follows:



It has three branch circuits

(case a)

Usual/..

Usual radio transmission route between a zonal and a district headquarter has six radio sections and one radio section hop distance is 30 Km.

54 district headquarters on beginning stage of the project, and 41 district headquarters on final stage of that , have no local exchange in its own district. (See Table 3-2,3) Subscribers in the districts are collected a parent exchange, being close to them. A circuit to these districts functions as a subscriber ~ local exchange line, which means a subscriber line by radio. Fig. 20 and 21 shows characteristics of a radio section which belongs to a subscriber circuit. An average radio hop distance between (a district without a local exchange) and (a nearest local exchange) is about 25Km and number of radio sections are 3 according to Fig. 20 and 21.

Fig. 20

Cumulative Distribution
of
Radio section hop distance
From District Headquarter to local exchange

Means 23.7 Km
Standard dev. 10.9 Km

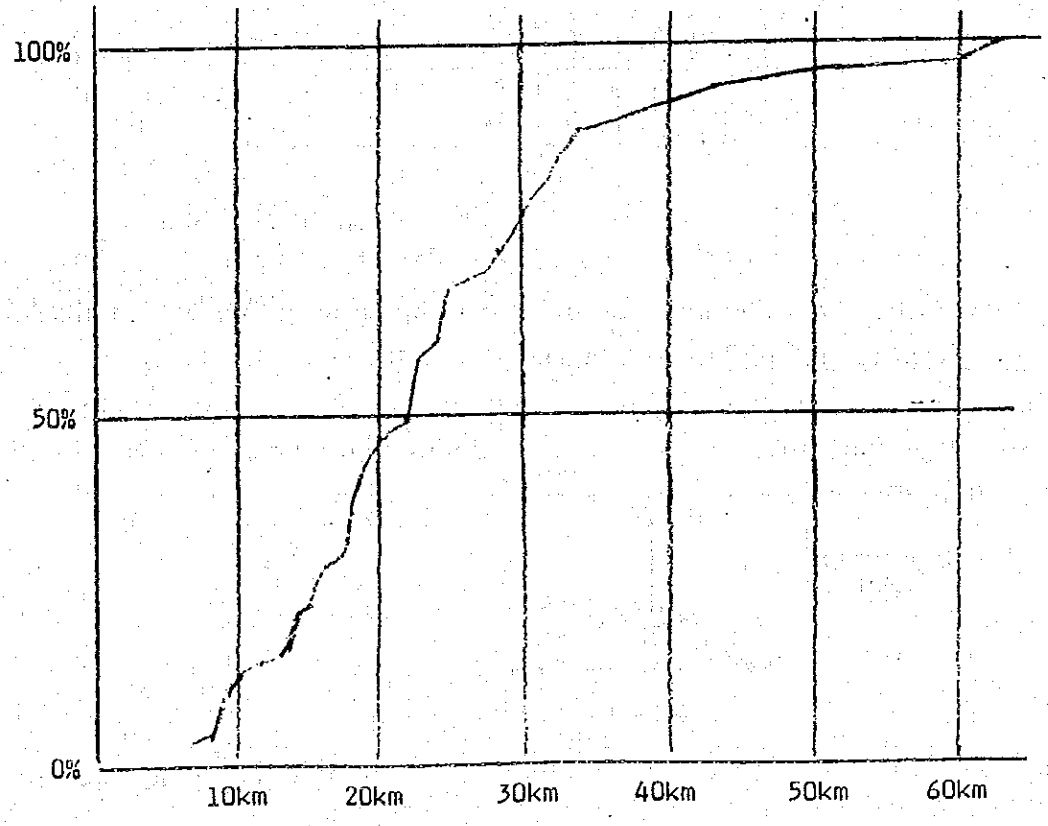


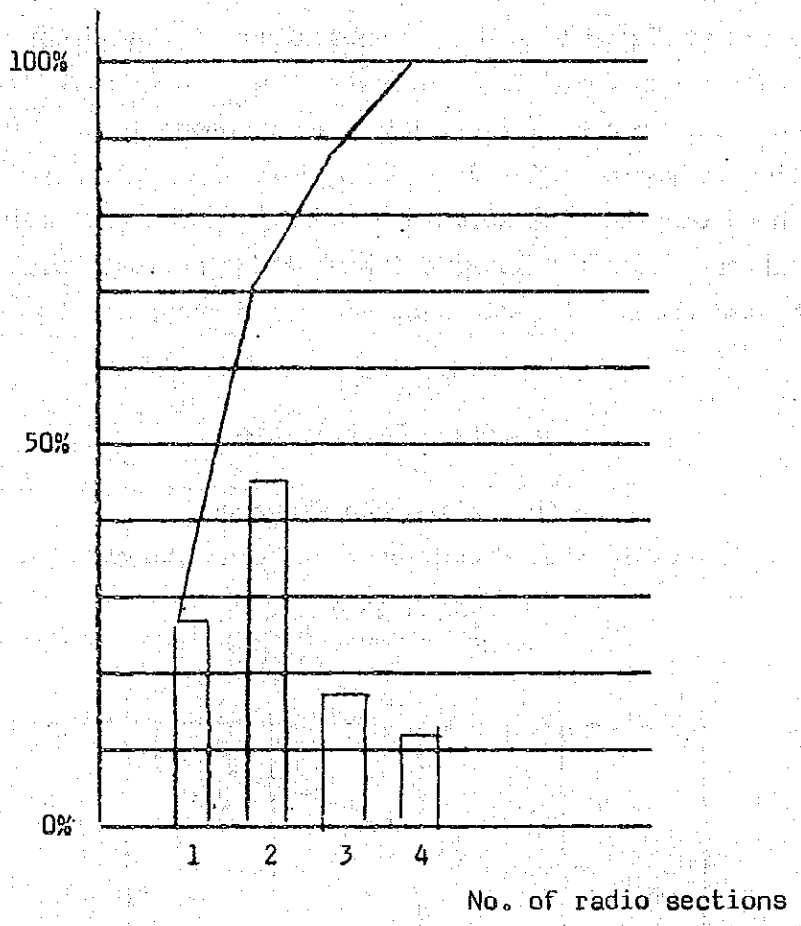
Fig. 21

Fig. 21

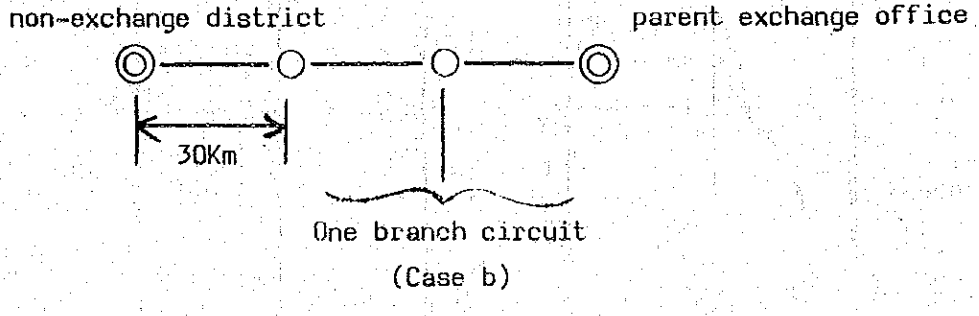
Distribution

No. of radio sections

from District Headquarter to local exchange



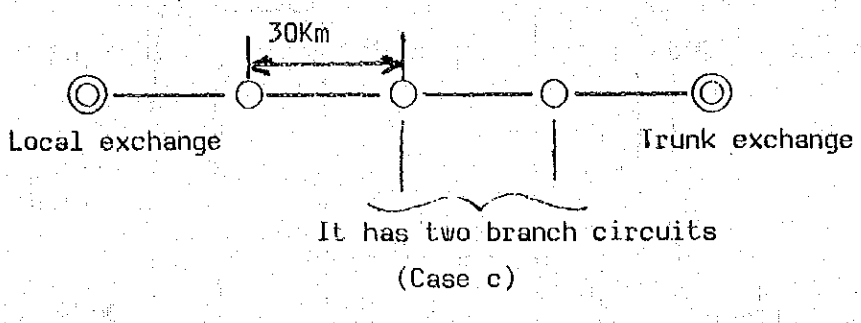
Therefore, the reference curcuit between non-exchange office district and a parent exchange office is as follows:



(Case b)

As third /..

As third case, about a reference circuit between a local (parent) exchange office and zonal headquarter (a trunk exchange office), as same procedure as mentioned above was made, then case c can be concluded as follows;



(Case c)

As a result, Table 3-2&3-3 , and the discussion above reaches to a conclusion as follows:

(a) On the beginning step of the project, there will be 38 local exchanges.

(b) On the final step, number of local exchanges come to 51.

(c) 13 district will introduce a local exchange office due to a growth of communication demand.

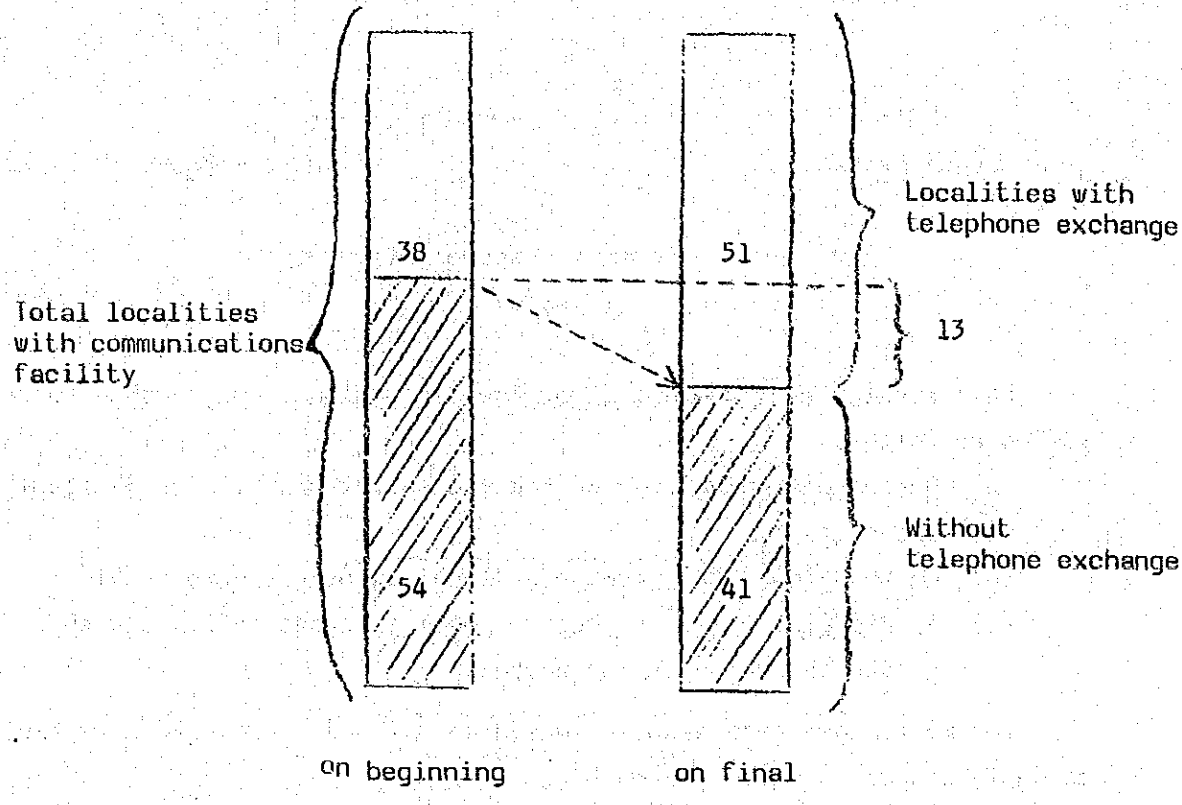
The matter has been also discussed on 3.(4).A. Fig. 22 shows the situation in connection with the matter.

District headquarters always with a local exchange, (there are 38 on Fig. 22), need radio equipment manufactured by an idea of the case c. 13 districts, which will start as non-exchange office, then will equip an exchange facility due to the demand growth, should have radio equipment with an idea of the case a.

Other districts, in which subscribers are connected through a line concentrator or through the MASR over the full period, require Case b equipment.

Fig. 22 /..

Fig. 22
Situation of districts without telephone exchange



3.(4).D Transmission Capacity of Radio Channel

Transmission capacity of a radio channel depends upon communications demand and traffic of each zone and district. The report could not discuss the demand and the traffic due to a short of time. Therefore, most of local exchange capacity follow "The 4th Telecommunication Plan" prepared by NTC, and the traffic is assumed as follows:

(a) Subscribers in a district with a local exchange,
0.03 erl./sub.
1% calling loss
50% of all traffics is trunk call

(b) Subscribers in a district without a local exchange,
50 line unit/a district
0.06 erl./sub.
1% calling loss
50% of all traffics is trunk call.

Results /..

Results of transmission capacity are mentioned on Table 15. According to the Table, 61% of radio transmission line requires 15 speech channels/radio frequency, and 28.6% 30 speech channels/RF (or 15 ch/RF x 2 radio channels), then 10.4% 30 ch/RF x 2 radio channels. Therefore, required radio relay equipment for Nepal rural network is 15 ch/RF and 30 ch/RF of maximum transmission capacity.

Table 15

Required R.F. channel capacity

Required CH. capacity	No. of radio section	Remarks
8	40	(61%) PCM 15 ch/RF
9	11	
10	2	
11	5	
13	1	
14	1	
15	4	
16	15	(28.6%) PCM 30 ch/RF or PCM 15 ch/RF 2 sys.
17	2	
18	5	
21	1	
23	1	
24	3	
26	2	
29	1	
32	1	(10.4%) PCM 30 ch/RF 2 sys.
37	2	
42	2	
48	1	
50	1	
51	1	
57	2	

From maximum/..

From maximum transmission capacity of radio channel point of view, 400 MHz ~ 800 MHz radio frequency band may be desirable. But from radiowave propagation in Nepal point of view, 150 MHz ~ 400 MHz band should be considered, (if possible even 60 MHz band also).

In order to execute the project as much economically as possible, the lower radio towers and the longer radio transmission course (the less repeaters) are necessary. Sometimes the course may be disturbed by mountain ridges with wave fresnel zones. For protection against that, the lower frequency band is useful.

In this connection, short period radio propagation testing is desirable to be conducted at the time of the feasibility survey.

3.(4).E Distribution of Subscribers

In case of rural communication demand, how does demand spread around a district headquarters building? According to survey on this time, every district in rural area, not only in plain area but also in mountain area, the communications demand in rural area is spread over a circular with 500 m ~ 1000 m dia-meter. Of course, centre point is a district headquarters building. This is one of remarkable characteristics of rural area in Nepal. Generally speaking, in plain area communicaiton demand develops along with roads, and in mountain area the demand may be apt to centralized around a building of a district headquarter or heart of the village. Therefore, communication demand around an exchange equipment or a concentrator (or a manual board) can be economically collected by means of areal cable.

But some districts have river or valley gap and the demand spreads over the river or the gap. In those area, people can communicate each other by a hanging bridge. If radio equipment for very short distance like above case can be developed, it is much helpful for rural telecommunication. Necessary specification is as follows:

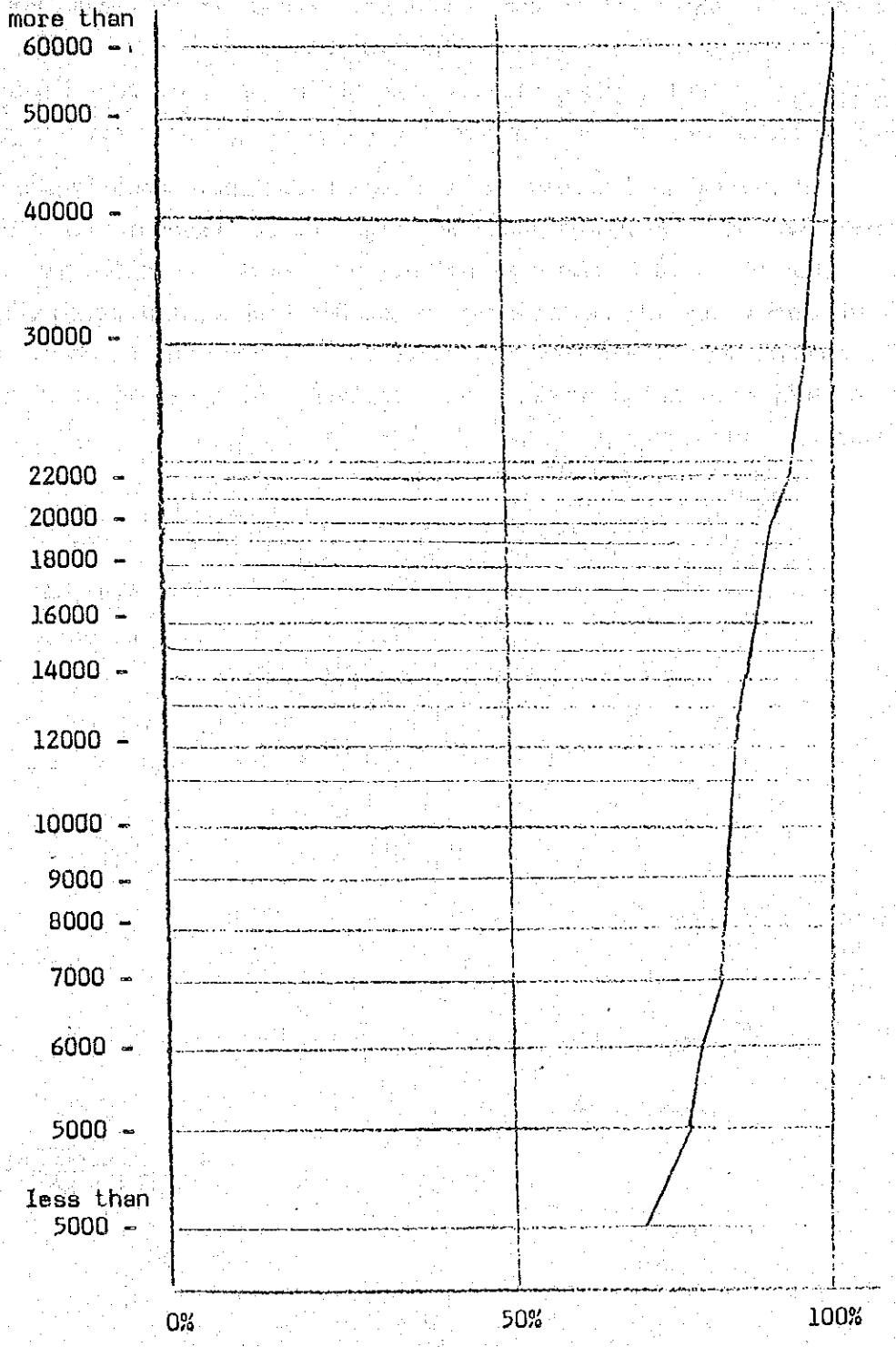
Maximum transmission length 200 meters
Simplified radio equipment with 6 speech channel of PCM
Less than 1000 $ of complete one pair set cost,

Fig. 23 shows population distribution of localities which have telecommunications facility by the project. Accordingly, 70% of the localities has population of less than 5000.

Fig. 23 /..

Fig. 23

Cumulative distribution,
Population of locality with telephone facility



3.(4).F /..

3.(4).F Communications Demand of Subscribers

As already discussed, a district headquarter has two kinds. One is with a local telephone office and the other, without the office. But from administration point of view, every district stands on a same level, and its function is equal. Especially, in the office of a distruct headquarter, not only telephony demand but information and data exchange are expected.

The demand just belong to data communications. Usually the data communications mean very high speed and big capacity transmission and process. But the data communications here need small capacity low transmission speed and slow process. An advantage of such a type communications system is that cost is much lower than a huge system. Therefore, it should be stressed that rural telecommunications itselves have a key point of social development in a country.

4. IMPLEMENTATION/..

4 IMPLEMENTATION PLAN

4.(1) Introduction Step of the Project

Rural telecommunications network shown on Fig. 5 requires an amount of local exchange equipment shown on Table 3-2 and Table 13, and of transmission equipment shown on Table 14. Necessary transmission facility capacity is shown on Table 15. Telecommunications network having these facilities mentioned above is basically necessary for the country. But simultaneous introduction of them seems too big job. Therefore, the introduction had better be made with priority of area and of function. A combination with area priority and function priority will make an installation, maintenance work and training easier as well as the project size economically become adequate.

4.(2) Area Priority for the Introduction

An idea of Fig. 5 shows that the country is shared into nine areas. Each area has own trunk code, and these are connected each other by existing and planned microwave link. All local exchanges in a district are collected to a trunk exchange in a zone. Therefore, a minimum implementation unit of the project is an area out of 01 ~ 09.

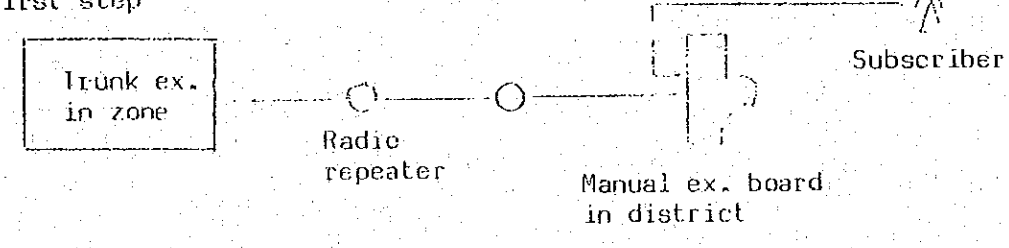
4.(3) Installation Plan with Circuit Function

Installation plan with developing function step is also possible. Some ideas are as follows.

4.(3).A Locality in Mountain Area without a Telephone Office

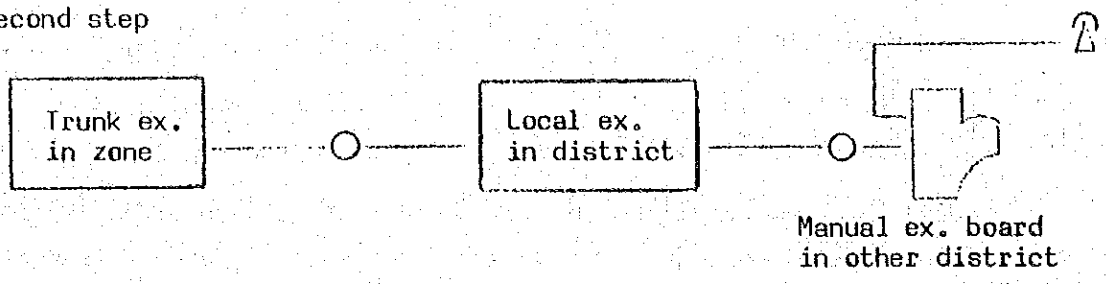
A typical example of the case is mentioned below.

On first step

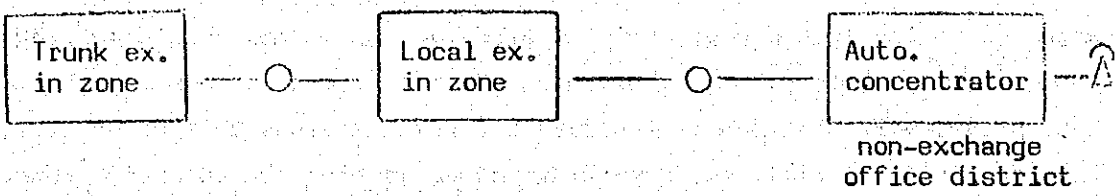


/On second

On second step



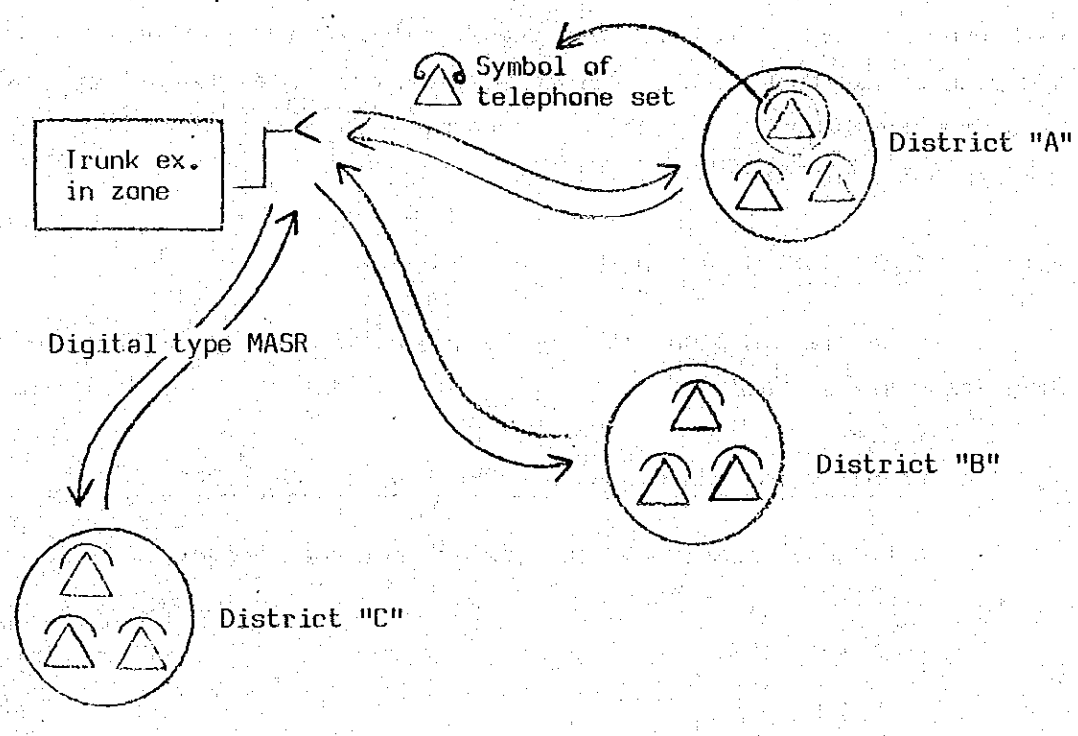
On third step



4.(3).B Locality in Plan Area without a Telephone Office

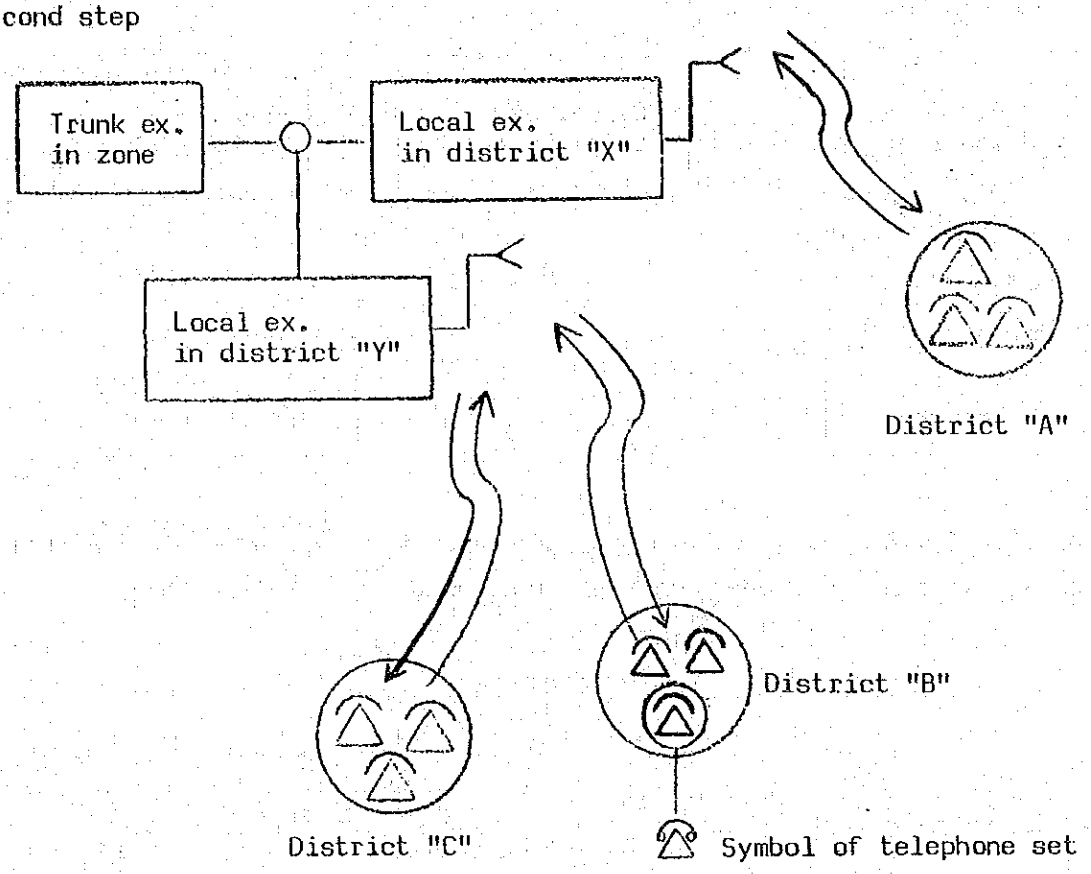
A typical case is as follows.

On first step



/On second

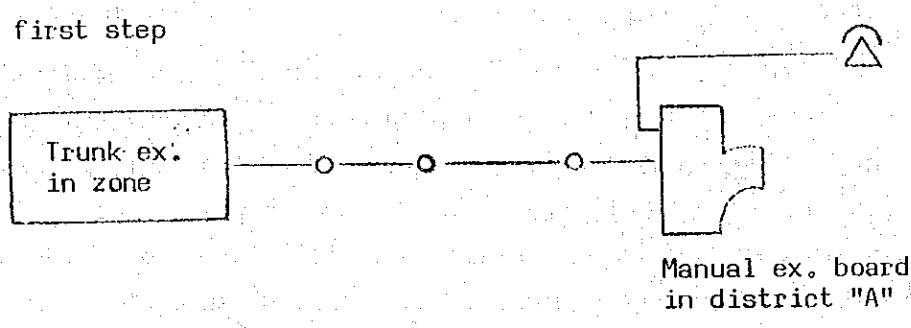
On second step



4.(3).C Others

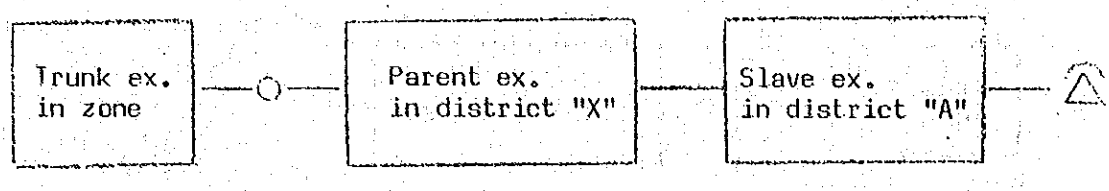
In case a district starts without a local exchange then several years after the exchange is introduced, the case in shown below.

On first step

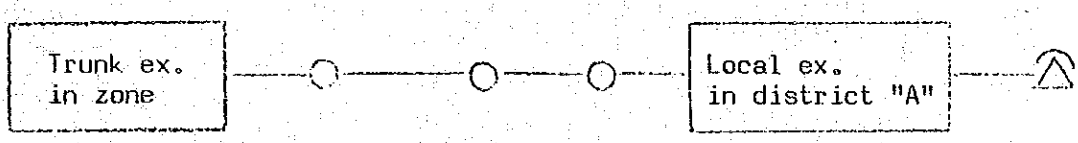


/On second

On second step



or



Case of 4.(3).A~ 4.(3).C have been shown as just typical style. Actually more variation is expected. Namely the network is very flexible.

4.(4) Necessary Conditions for Equipment

The project shown on Fig. 5 seems pretty big scale. Before starting the project, it is emphasized that we have to avoid only selection of equipment from a catalogue which have been prepared in the past by manufacturers in order to achieve economization.

Only unique key point by which the project can achieve the network sufficiently and economically is to design the system and to manufacture the equipment needed along with rural telecommunication network oriented policies. Until now, manufactures are apt to design and to make equipment for bigger demand and bigger capacity.

Of course, small capacity specification has been available. But that is prepared for an exceptional purpose. However, Fig. 5 plan needs quite opposite concept. That is to say, small demand, small traffic and low speed specification must be majority through the plan. Whole plan become big but an individual facility is small, and still the network is modern. Because not only exchange equipment but a part of subscriber line also are planned as a digital network and because communication demand at all districts include telephony and a kind of data communications with low speed.

Telecommunication network with such idea was few in the past. In this sense proposed rural telecommunications network can be revolutional one.

/On this

On this section, remarkable necessary conditions for the equipment are mentioned.

4.(4).A Exchange Equipment

As discussed on 3.(4).F and digital type MASR is proposed, the time division digital exchange equipment is advised. Usually a cost of the equipment seems very high. This network must become uneconomical if the equipment is introduced without any consideration. Therefore, the functions of a local exchange should be simplified. For the purpose, numbering plan and charging system might be re-considered so that simplified and economical equipment can be provided. This must be also one of the key point whether the rural network become successful or not.

4.(4).B Radio Relay Equipment

Required radio relay equipment has capacity of 3.(4).D. And of course, its modulation type is T.D.M.-P.C.M. Radio towers of guyed wiretype and 20 meters of its height is maximum are advised from economical point of view. Because of the demand above, some radio sections, probably, cannot obtain a clear 1st or higher fresnel zone. Radio propagation checking (or testing) of the sections by TDM-PCM is very necessary for system design and manufacturing radio equipment.

4.(4).C Solar Battery

On Fig. 6 ~ Fig. 17, commercial electricity availabilities at district headquarters are mentioned. The commercial source availability ratios at the all localities are as follows.

02	area	59 %
03	area	45 %
04	area	67 %
05	area	75 %
01	area	36 %
06	area	25 %
07	area	45 %
08	area	26 %
09	area	29 %

Average through the country 41%

/That is,

That is, on 41% of all localities in Fig. 5 where communications facilities will be introduced, commercial electricity will be available. When we consider motorable road situation in the country, the solar battery method is the most suitable to overcome the commercial power non-availability. Some useful and helpful results in connection with the solar battery have been already established by the existing HF network. Detail designer of the project can use the results.

4.(4).D Digital Type MASR

One of important element which build rural network is MASR (Multi-access Subscribers Radio). Usually the MASR equipment has been manufactured with F.D.M. method. When we are going to introduce the MASR through the country, we have to prepare a lot of carrier frequency. This causes fear of an interference. Digital type MASR is effective to delete number of carrier frequency in some extent, then is helpful to avoid the interference. Another advantage of the digital MASR is that a demand assignment technique by T.D.M. is employed, therefore network flexibility of future digital service expansion or development may be plenty. The digital MASR can be also easily connected to a time division electronic exchange.

As a result, this type of MASR is useful for the network. Actually some manufacturers already succeeded its development and manufacturing. At the time of implementation of the project, this must be familiar to digital network.

4.(4).E Incorporation with Exchange and Digital MASR

The MASR equipment cannot be independent upon exchange equipment. The MASR can function by incorporation with exchange equipment. If we can have a specification of small digital exchange equipment combined with the digital MASR, it become much helpful for the project. Of course, an unit expansion of exchange and capacity expansion upon the MASR part should be possible.

4.(4).F Compactness, Lightweight and Durability of Equipment

In Nepal, motorable roads for a zonal head quarter and a district

headquarters are behind due to severe topographic situations. Some zones and districts are completely isolated on communication for a rainy season. Therefore, from an installation work and maintenance operation work point of view, compact, lightweight and durable structure of equipment is emphasized on the project. Expecially maintenance free equipment or simplified maintenance equipment are significant because enough number of maintenance technician are too short now.

4.(4).G Building for Equipment

In rural area, building cost become very expensive due to poor motorable road communications. Exchange and radio equipment, sometimes, cannot help being installed at an office room or private house. Coexistence of telecommunications equipment and daily life of local people are inevitable. Such considerations are necessary for equipment manufacturing design and equipment installation plan.

Building materials of non-attended station should be easily carried through mountain area and constructed over a short period.

Building including equipment installation should harmonize an usual life style of local people.

4.(4).H Economization of Equipment

Economization of equipment needed by a project is always a common target through a project. But an idea of economization in the rural telecommunications network has another importance. That is to say, unnecessary high quality is not needed by the rural network, but future expansion or qualitative development is necessary to some extent. One of example is that subscribers dialing is not necessarily required. Problem is, satisfied short and reliable exchange is significant. In this sense, operator dialing method is actual and useful for the rural network.

Another example is, from business fashion in rural district headquarters point of view, data transmission does not need high speed nor instantaneous process. Data over a certain period can be stored and when a circuit and processor are free, then these data may be processed and communicated. Necessity in the rural network is reliability that every action

/can be

can be done so surely.

Generally rural telecommunications are disadvantageous on economical stands point. Actully rural telecommunications system design has been made by mere modification of big capacity and big demand equipment design.

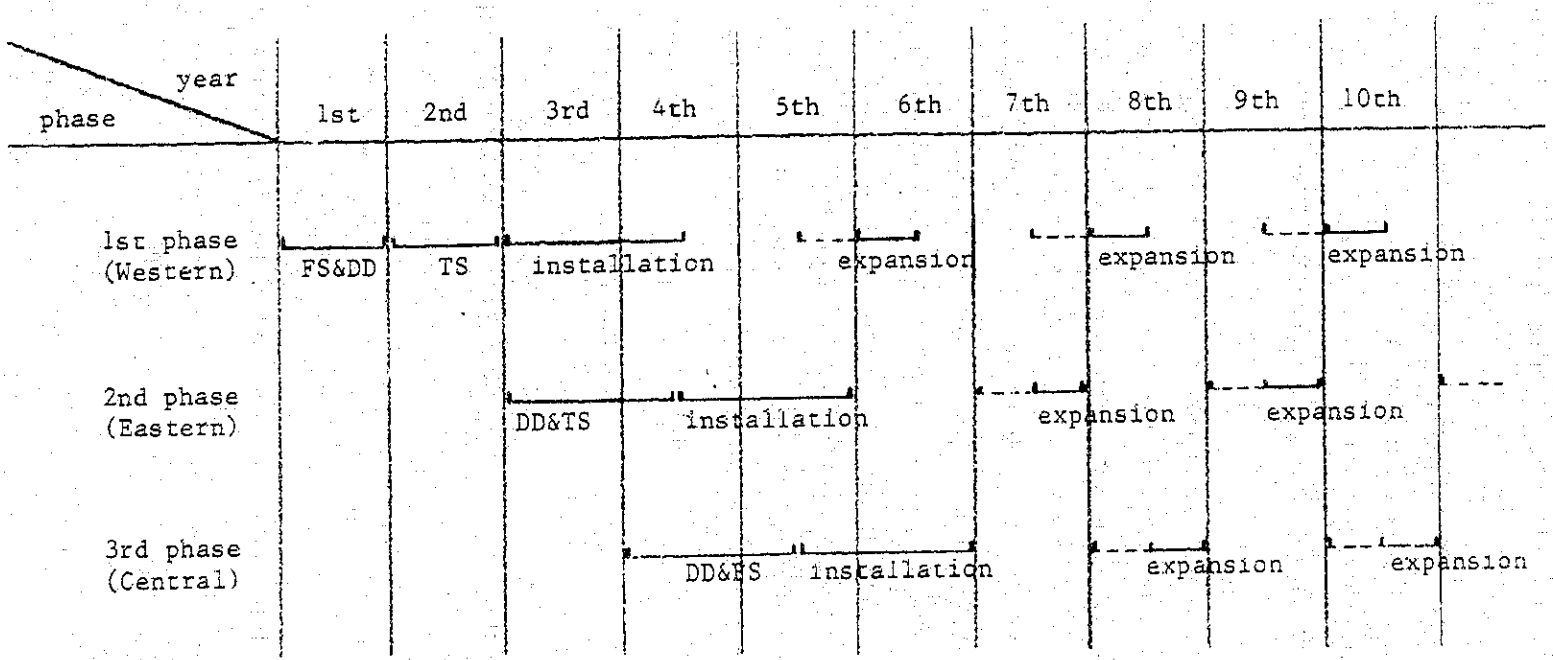
It must be natural that low grade of the rate of return may be resulted. If the system design and equipment manufacturing are made under reconsideration of necessary service grade and quality for the rural network, more advantageous rate of return must be possible. For the project, the network system design and feasibility survey merely picking up products from manufacturers catalogue should be avoided.

4.(5) Implementation Schedule

About 35,000 rural subscribers over the country can accommodate in the project (see 3.(4).A). It seems too big and wide to impliment the project simultaneously through the country. The project should be zonally split into three ~ four parts, then a part by part implementation is desirable. According to the idea, an implementation schedule is shown on Fig. 24. The schedule comprises three parts, Western region, Eastern region and Central region. The schedule shows that Western region, the earliest, will completed three and a half years after and even Central region, the latest, will cut over six and a half years after. Then an expansion will be made in accordance with a growth of demand.

/Fig. 24

Fig. 24 Implementation Schedule



Remarks: FS Feasibility study
DD Detail design
TS Tender document

5 MAINTENANCE AND TRAINING

5.(1) Maintenance

5.(1).A Organization Proposed

As already discussed, the project has various kinds of equipment, that is,

- digital trunk and local exchange,
- low speed data processing unit,
- digital transmission facility,
- terminal equipment,
- subscribers line facility, and
- power equipment

Total network system should be designed as maintenance free method from easy maintenance point of view. Therefore, maintenance staffs will be locally centralized at a maintenance centre except some operators. And they will maintain all equipment by maintenance patrols, regular patrols, and urgent patrols. In order to do that, centralized alarm watching system is advisable at the local maintenance centre. The centre will be placed at an areal toll centre shown Table 3. The maintenance centre will have two divisions, one will be for exchange and outside plant, the other for transmission, and two engineers for each divisions respectively will be assigned. Through the country, there are nine areas, so totally 18 engineers, 9 for exchange and outside plant and 9 for transmission will be necessary for maintenance of the project.

On the other hand, all technicians in the maintenance centre will be usually watching alarm which will be sent from slave stations under the centre. They will go out for routine maintenance patrols and pay a minor adjustment. If failure alarm comes to the centre, some technicians rush into the place to recover the failure.

Total number of facilities of the project are,

/Trunk

Trunk exchange and data processor	9 stations
Local exchange	51 "
Radio terminal station	87 "
Radio repeater	28 "
Locality which has telecommunications facilities	90 localities

These facilities will be managed by nine areas. Roughly one areas duty is,

Trunk exchange and data unit	1 station
Local exchange unit	5 ~ 6 stations
Radio terminal	9 ~ 10 "
Radio repeater	3 ~ 4 "
Locality with telephone facilities	9 ~ 10 localities

Necessary number of technician for each area are proposed as follows.

Data software technician	1	(1/ an area)
Exchange software technician	3	(1/2 stations)
Exchange hardware technician	3	(")
Outside plant technician	10	(1/a station)
Terminal equipment technician	10	(")
Radio technician	6	(6/an area)
Operator	30	(1/a locality) (x 3 shifts)

Total amount above are 63 technicians (including the operator). Therefore, the project at the final stage needs about 20 engineers and 570 technicians, and some other non-technical staffs.

5.(1).B Roles of the Maintenance Centre

The maintenance centres mentioned the last are proposed at every area. The main roles of the centre are as follows.

(a) The centre is headed by two engineers.

/(b) Complaint

(b) Complaint of subscriber lines and terminals is communicated through an operator to the centre.

(c) Data unit, exchange equipment and radio equipment are supervised by an automatic system supervisory. All information in connection with that are collected to the centre.

(d) Technicians go to maintenance patrol by an operator's information or by alarms of the automatic system supervisory as well as a periodic patrol.

(e) All spare parts and pannels for replacement and measuring equipment are totally stored at the centre.

(f) Inventory of these parts and equipment are managed by the centre.

5.(2) Training

The project needs a following training courses for engineer and technician.

(a) For engineer

- Engineering course for the maintenance centre.

(b) For technician

- Electronic exchange (and data unit)
- Digital radio equipment
- Digital MASR
- Power equipment
- Terminal equipment
- Operator

To obtain sufficient number and good quality of engineers and technicians for the project, standing training course mentioned above are necessary in the Telecommunication Training Institute in Kathmandu N.T.C.

Totally required training participants are mentioned on 5.(1).

6 TASKS AHEAD OF THE PROJECT

The report was prepared during August - November 1981, and indicates only basic items of Nepal rural telecommunications network. Further succeeding efforts and actions are much necessary for the country which urgently needs to build modern rural telecommunications network. Namely a feasibility and detail survey for the project should be organized as soon after the report as possible.

We cannot realize the rural network unless the servey starts. In the country, topography is too unfavourable, and there is almost no road communications to the proposed sites by the project. Easy-going method of system design and economic evaluation for the project should not be taken, like only picking up equipment from a ready made manufacture catalogue. An important role of the feasibility survey is not to define whether the project is feasible or not, but to find out how to achieve the project so that it may become feasible. Because the rural network is indispensable social facility for the country. The country can never accept the replay of "unfeasible" by the survey.

On the way of the feasibility and detail survey, some preparation works and coordinations between the survey team and N.T.C. or the His Majesties Government are necessary. The roles can be played by a standing expert to the country..

7 ACKNOWLEDGEMENT

The report could be fortunately completed during very short period. In spite of that, most of basic items could be mentioned on the report. This owes adequate orientation and advices by Mr. Ram Prasad Sharma, General Manager, Mr. Suresh K. Pudasaini, Chief Engineer, and other N.T.C. key staffs. Particularly, many important and useful data were collected under guidance of Mr. Gopal P. Shrestha, Service Manager, Kathmandu Regional Office N.T.C. And on the occasion of local area survey, many Nepalese friends were met and fully cooperated to the survey.

I can never forget fellowship and hospitality shown by all of them. Here, I would like to extend my heartful thanks for all their kindness.

Yasuo Suzuki
A.P.T. Expert to Nepal

November 1981