# THE FEASIBILITY STUDY

## ON

# THE RURAL TELELCOMMUNICATIONS NETWORK PROJECT

## IN

# THE REPUBLIC OF ZIMBABWE

**FINAL REPORT**

**MAIN**

October 1992

## JAPAN INTERNATIONAL COOPERATION AGENCY

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# PREFACE

In response to a request from the Government of the Republic of Zimbabwe, the Government of Japan decided to conduct a feasibility study on the Rural Telecommunications Network Project and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Zimbabwe a study team headed by Mr. Takashi Yamamoto, Nippon Telecommunications Consulting Co., Ltd., twice between November 1991 and August 1992.

The team held discussions with the officials concerned of the Government of Zimbabwe, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

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

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Zimbabwe for their close cooperation extended to the team.
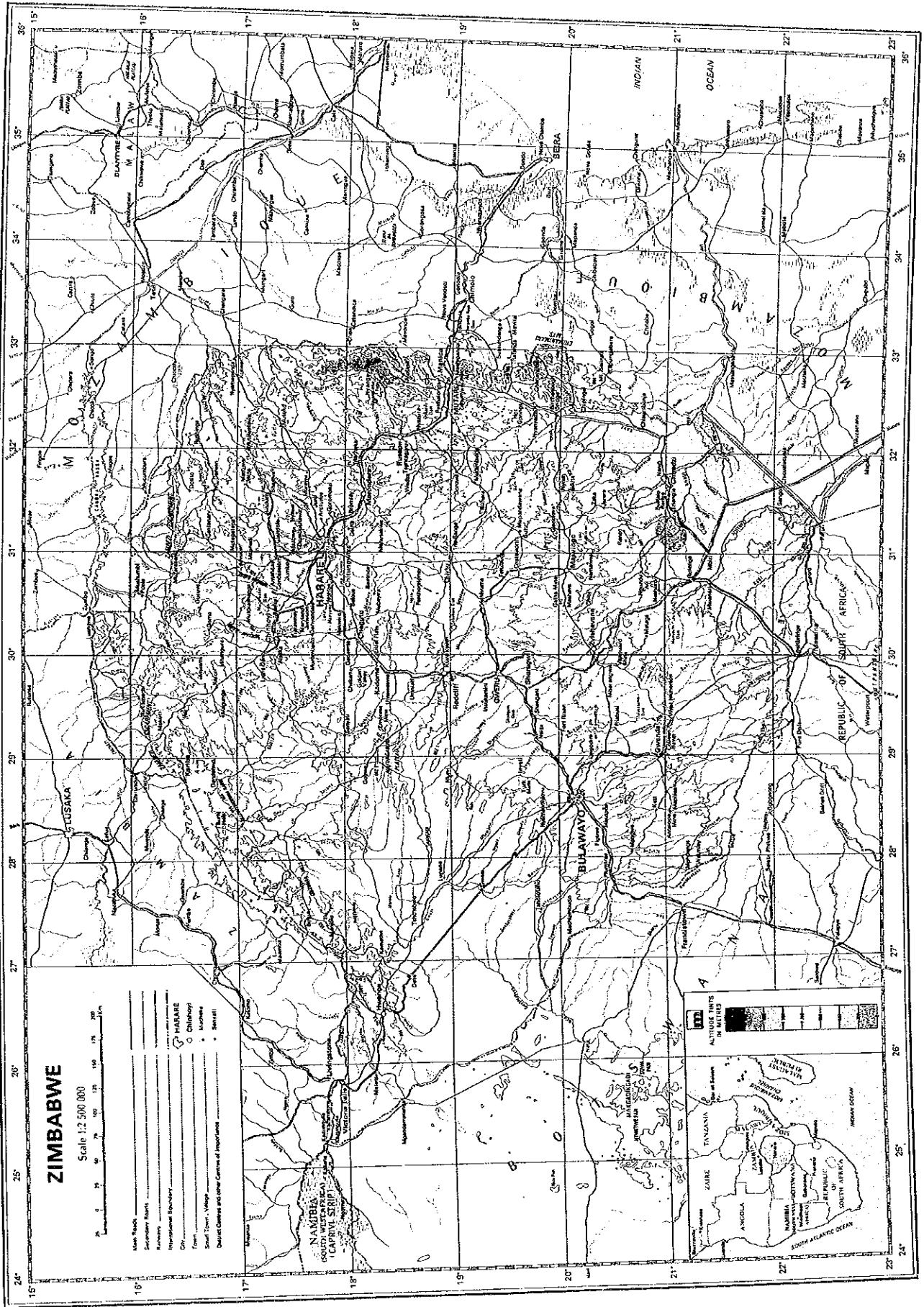
October, 1992

Kensuke Yanagiya
President
Japan International Cooperation Agency

# THE REPUBLIC OF ZIMBABWE

## ZIMBABWE

Scale 1:2 500 000

25   0   25   50   75   100   125   150   175   200
Km

Main Roads
Secondary Roads
Railways
International Boundary
City ............................................ HARARE
Town ............................................ ○ Chiadzwa
Small Town • Village ............................ • Mazhou
District Centres and other Centres of Importance ............ ● Sewati

ALTITUDE TINTS
IN METRES

# CONTENTS (1/3)

# CONTENTS (2/3)

# CONTENTS (3/3)

# CONTENTS OF FIGURE

# CONTENTS OF TABLE (1/3)

# CONTENTS OF TABLE (2/3)

## CONTENTS OF TABLE (3/3)

# ACRONYMS AND INITIALS

APL          : Automatic Party Line
BEP          : Break Even Points
BER          : Bit Error Ratio
BHA          : Basic Human Needs
BRA          : Basic Rental Area
BHC          : Busy Hour Call
CCIR         : The International Radio Consultative Committee
CCITT        : The International Telegraph & Telephone Consultative
               Committee
CIF          : Cost Insurance and Freight
COMC         : Centralized Operation and Maintenance Control System
DAMA         : Demand Assigned Multiple Access
DEL          : Direct Exchange Line
DFR          : Demand Fulfillment Ratio
DIR          : Demand Increase Ratio
EIB          : European Investment Bank
EIRR         : Economic Internal Rate of Return
EPL          : Electronic Party Line
FAX          : Facsimile
FOB          : Free On Board
FIRR         : Financial Internal Rate of Return
GDP          : Gross Domestic Product
GFR          : Gross Fertility Rate
GRDP         : Gross Regional Domestic Product
GRR          : Gross Reproduction Rate
GW           : General Worker
IC           : Incomming Call/Traffic
IDN          : Integrated Digital Network
IMF          : International Monetary Fund
IMR          : Infant Mortality Rate
IRROE        : Internal Rate of Return On Equity

| ISDN     | : Integrated Service Digital Network |
|----------|--------------------------------------|
| ITU      | : International Telecommunication Union |
| IWC      | : Initial Working Capital |
| JICA     | : Japan International Cooperation Agency |
| LT Loan  | : Long Term Loan |
| MARS     | : Multi-Access Radio System |
| MDF      | : Main distribution Frame |
| MIPT     | : Ministry of Information, Posts & Telecommunications |
| MPL      | : Manual Party Line |
| NA       | : Not Applicable |
| OECF     | : Overseas Economic Cooperation Fund |
| OG       | : Out-Going Call/Traffic |
| OLR      | : Overall Loudness Rating |
| PCM      | : Pulse Code Modulation |
| PCO      | : Public Call Office |
| P/L      | : Party-Line |
| PSIP     | : Public Sector Investment Programme |
| PSTN     | : Public Switched Telephone Network |
| PTC      | : Posts and Telecommunications Corporation |
| RLC      | : Remote Line Concentrator |
| RLR      | : Receiving Loudness Rating |
| RLU      | : Remote Line Unit |
| SCF      | : Standard Conversion Factor |
| SLR      | : Sending Loudness Rating |
| STD      | : Subscriber Toll Dialling |
| TE       | : Terminal Exchange |
| TFR      | : Total Fertility Rate |
| TT       | : Telecoms Technician |
| TW       | : Telecoms Worker |
| UDI      | : Unilateral Declaration of Independents |
| WARC     | : World Administrative Radio Conference |
| WTP      | : Willingness To Pay |

# SECTION 1   INTRODUCTION

## SECTION 1  INTRODUCTION

### 1.1  Background of the Study

After the independence, development of rural areas has been implemented at various areas in the country, i.e., 55 "Growth Points/District Service Centres" and at 460 "Rural Service Centres" defined by the Ministry of Local Governments and Town Planning based on the National Development Plan aiming at stimulating economic activities and improving living standards in the rural areas.

Thereby, demands for telecommunications services have been increased in those rural areas along with the growth of socio-economic activities. However, provision of telecommunications services is still limited in terms of quantity and quality, and difference of the services is getting wider between major cities and rural areas.

The telephone penetration ratio in Zimbabwe is 1.4 per 100 inhabitants on average, which is fairly high among African nations.  And the telephone automatization ratio also is very high (98%).

In the rural areas, however, the penetration ratio is 0.3 per 100 inhabitants, which is still very low compared with the high ratio of 13.2 per 100 inhabitants in the major cities.

The availability of telephone services is of prime importance in promoting the welfare of people living in the rural areas.  The expansion of telecommunication services in rural areas is being proposed in the 5-year Telecommunication Development Plan. (1988-1992).

Despite the efforts made by the Posts and Telecommunications Corporation (hereinafter referred to as "PTC"), it would still be very difficult to establish the rural telecommunications network due to financial constraints.  At present, disparity between urban and rural living standards is getting wider.

In view of the above, on January 11, 1990, the Government of Zimbabwe requested the Government of Japan to provide technical assistance for the execution of a feasibility study on the Rural Telecommunications

Network Project.

In response to this request, the Government of Japan decided to dispatch a JICA Study Team (hereinafter referred to as "Study Team") for the execution of the Feasibility Study.

## 1.2    Objective of the Study

The objective of the Study was to conduct a feasibility study on rural telecommunications network for the 6 priority-given rural exchange areas, i.e., Beatrice (BTR; Mashonaland), Kezi (KEZ; Matabeleland), Murambinda (MRB; Manicaland), Nkayi (NKI; Midlands), Gutu (GTU; Masvingo) and Chatsworth (CHS; Masvingo).
Exchange location of Kezi exchange area is to be moved from the existing Kezi exchange to Maphisa under the exchange relocation plan of PTC.

## 1.3    Method of Approach

### 1.3.1  Strategy for Rural Telecommunication Development Plan

Strategy mentioned below was applied for formulating the Rural Telecommunication Development Plan, which was prepared with reference to the following plans:

a) National Development Plan (1986-1990)
b) Telecommunication Development Plan (1986-2005) prepared by ITU
c) Public Sector Investment Program (1991-1996)
d) Socio-economic condition and existing telecommunication conditions

The strategy is to improve telecommunication services of the rural areas in terms of quantity and quality, i.e.,

- To expand telecommunication services to "Growth Points/District Service Centres" and "Rural Service Centres" which were designated by the Ministry of Local Government for development of rural area based on National Development Plan,

- To reduce waiting applicants and number of subscribers sharing the same party-line, and

- To provide more public telephones in the rural areas to increase accessibility for the people without telephone.

The above strategy was prepared in accordance with the concepts of the National Development Plan. Consequently, it can be expected to support the socio-economic activities and rural development program, and also to decrease a gap in telephone services between the major cities and the rural areas by adopting the above strategy.

## 1.3.2 Development Target

### (1) Telecommunication Services

The study has been made for the services to be provided, telephone services including public telephone, facsimile, data communication, etc., taking into consideration the Zimbabwean telecommunications development policy.

In the study, existing services which are being provided in the area has been surveyed for the purpose of familiarization with existing telecommunication services and also collecting data of the existing services.

### (2) Provision Policy and Planning Period

Provision of facilities is decided by the demand fulfillment ratio (i.e., number of lines in-service to total demand), Zimbabwean facility provision policy and financial constraints.

Planning period to be considered in the study is defined for making the telecommunication network expansion plan in the course of the study.

## 1.3.3 Demand and Traffic Forecast

The subscriber demand forecasts and traffic forecasts for telecommunication services have been studied not only from the statistical data of Gross Domestic Product (GDP) but also as a result of field surveys in the areas concerned.
A forecast for new services has been done taking into consideration the

requirements of the Telecommunication Development Plan (1986-2005).

## (1) Demand Forecast

Demand forecast for respective study areas has been made by using the
collected statistical data and results of questionnaires which were be
obtained during the field survey:

- Population,
- Number of households,
- Number of public offices,
- Income increase rate,
- Economic growth rate,
- Number of telephones to be required in relation to
  implementation of new development plan in the areas concerned.

Estimation of the demands for residents and small-scale businesses are
based on the inhabitants' possessions (for instance: automobile, TV
sets, etc.) which has been investigated by using questionnaires during
field survey.  The Check List and Questionnaire used for Field Survey
are shown in a separate book, "DATA FILE".
Besides the above, the number of public call offices has been estimated
on the requirements of the Telecommunication Development Plan (1986-
2005).
Future demands in the study area concerned are calculated by utilizing
the nationwide demand growth rate and demand obtained for the area.

While, for the purpose of verifying the demand forecasted based on
microscopic demand forecast, nationwide macroscopic demand has been
estimated with the same methods applied in the Telecommunication
Development Plan (1986-2005) by applying the latest data; GDP,
population and telephone density in other countries.

## (2) Traffic Forecast

For assuming traffic pattern which are used in traffic forecast, traffic
data of the existing rural networks has been analyzed for our reference,
such as calling rate, traffic distribution of originating calls and
terminating calls.

## 1.3.4 Rural Telecommunication Development Plan

### (1) Telecommunication Network Plan

For telecommunication network plan, the study has been made for the following taking into consideration the Zimbabwean telecommunications development policy mentioned in the Telecommunication Development Plan (1986-2005), technical standards, and services to be provided.

- Transition from analog to digital network,
- Numbering plan,
- Routing plan, etc.

### (2) Telecommunication Network Expansion Plan

The expansion of the rural network plan within the area concerned has been prepared based on the provision policy mentioned in Section 1.3.2 (2). Namely, provision of facilities will be made along with the increasing demand.
Meanwhile, based on the telecommunication network plan formulated and demand/traffic forecast results, systems to be introduced for each study area have been studied, namely for exchange system, transmission system (cable and radio), external plant, and other supporting facilities.

For selection of systems to be introduced, a study has been made not only for one system but for other alternatives in order to select an optimum system from both technical and economical viewpoints.

### (3) Construction Schedule and Cost Estimate

Construction schedule has been prepared for the respective study areas based on the telecommunication network expansion plan, and project cost, such as investment costs, operation costs, financial charge, depreciation and amortization, has been estimated for each year within the planning period of the project.

## (4) Operation and Maintenance

Organization of operation and maintenance and number of staffs required have been studied from viewpoints of maintaining the telecommunication service quality in a good condition.

## 1.3.5 Financial and Socio-economic Analysis

### (1) Financial Analysis

Financial analysis has been made for the Rural Telecommunication Development Plan of the study areas to clarify the financial aspects of the Rural Telecommunication Development Plan through estimation of costs and revenues and preparing a cash flow of the Plan.

#### a) Revenue Estimate

- Call charges (local calls, trunk calls, international calls, etc.)
- Installation fees
- Annual rentals

#### b) Costs Estimate

- Investments costs
- Operation costs (personnel expenses, maintenance, utilities, etc.)
- Financial charges (principal repayments, interests, etc.)
- Depreciation and amortization

#### c) Project Feasibility

The financial soundness of the Rural Telecommunication Development Plan has been studied through the projection of the profits/losses, cash flows, etc. The output of the analyses are as follows:

- Profit and loss statement
- Cash flow statement
- Projected balance sheet
- FIRR (financial internal rate of return) by DC Method
        (discounted cash flow method)

- Major financial indicators (debt service coverage ratio, break-even points, payout period, etc.)

## (2) Socio-Economic Analysis

The Rural Telecommunication Development Plan has been analyzed from the socio-economic viewpoint of Zimbabwe. That is, social benefits and costs has been analyzed and the expected socio-economic contribution of the Telecommunication Development Plan to the nation has also been studied.

### a) Economic Benefits

In order to evaluate the contribution of the Rural Telecommunication Development Plan to the national economy, the cash flow obtained from the financial analysis is converted to the economic value using shadow price factors instead of market prices. The direct benefits from the Rural Telecommunication Development Plan is largely dependant upon the economic value of telecommunication charges. This is because the market value of telecommunication charges are determined by a monopolistic supplier which does not necessarily present the true value of economic resources.

The economic value of telecommunication charges has been estimated as "consumers' surplus" which is determined through demand projection and premium factor of "willingness to pay."

Step 1: Demand project
Step 2: Estimation of maximum payable rate (willingness to pay) per client
Step 3: Forecast of consumers' surplus per client
Step 4: Conciliation with Supply Scenario
Step 5: Determination of total consumers' surplus

The parameters to estimate consumers' surplus are investigated, based on the results of questionnaire surveys made in the first field work for 100 inhabitants (50 household users/50 office users).

b) Economic Cost

As for the cost items projected through the financial analyses, the financial worth is converted to the economic value using the following premium factors.

- Foreign exchange premium   (SCF: Standard Conversion Factor)
- Skilled labour premium
- Unskilled labour premium

c) EIRR

The analyses have estimated the economic cash flows to determine the expected EIRR (Economic Internal Rate of Return), based on the projected benefits and costs which can be weighed quantitywise.

d) Indirect Socio-Economic Benefits

The improvement of a telecommunications network will contribute a great deal to the promotion of national well-being not only simply in the form of economic benefits but also in terms of social benefits. Such indirect benefits conceivable are:

- Greater ease in emergency access to medical institutions
- Improved emergency communication serving for protection and rescue of human lives
- Improved efficiency in communication, leading to upgrading and diversification of government and private services
- Economic effects to enhance business activities
- Increase in employment opportunities, improvement in security, etc.

These indirect benefits have been analyzed unquantifiably in consideration of social and economic conditions in Zimbabwe.

## 1.3.6 Implementation Plan

Implementation program is prepared for the Rural Telecommunication Development Plan formulated for the respective study areas after completing project evaluation study, i.e., socio-economic and financial evaluation based on the plans formulated; the telecommunication network plan, telecommunication network expansion plan, maintenance and operation plan, and project cost estimate.

In the implementation program, the following items are described:
- Fund planning, detail designing and preparation of tender documents, construction schedule,
- Necessary arrangements to be made by the PTC for implementing the project, such as procurement of site space, construction of station building, commercial power lead-in, manpower required for construction work.

## 1.4 Study Team Organization and Study Phase

### 1.4.1 Japanese Team

#### (1) JICA Study Team

| | |
|---|---|
| Mr. Takashi YAMAMOTO | : Team Leader (Switching) |
| Mr. Ryoji SASAKI | : Co-leader (Network Planning) |
| Mr. Masayuki OIKAWA | : Demand/Traffic, Operation & Maintenance |
| Mr. Akira IWAMI | : Transmission |
| Mr. Mitozo NAKAZAWA | : External Plant |
| Mr. Tomiyuki KURODA | : Economic/Financial Analysis |

#### (2) JICA Advisory Committee

Mr. Toru KIZUKA
: Chairman/Transmission System
Ministry of Posts and Telecommunications

Mr. Yoshihiko HINOUE
: Network Planning
Ministry of Posts and Telecommunications

Mr. Eiichi SAITO
: Switching System
Japan International Cooperation Agency

## 1.4.2 PTC Members

Some members of Posts and Telecommunications Corporation have acted as the counterpart to the JICA Study team and also as the coordinating body to the relevant organizations for the execution of the Study.
The persons who closely concerned with the Study are as shown below:

| | |
|---|---|
| Mr. Joshua CHIDEME | : Deputy Postmaster General |
| Mr. Philip MDIMU | : Assistant Chief Engineer Switching |
| Mr. Graham WOOD | : Manager Rural Exchange Planning |
| Mr. Simon NGOMA | : Section Manager Rural Exchange Planning |
| Mr. Abdullah MAHOMED | : Engineer Rural Exchange Planning |
| Mr. Musiyiwa ZANA | : Engineer Urban Exchange Planning |
| Mr. Lovemore NHUNZVI | : Senior Executive Officer Commercial |
| Mr. Samuel MABIKA | : Assistant Chief Engineer Local Network Development Transmission |
| Mr. Ken MAKUNURA | : Manager Rural Networks Transmission |
| Mr. Samuel KAMURIWO | : Engineer Rural Networks Transmission |

## 1.4.3 Work Itinerary

The work schedule of the Study is shown in Figure 1.1 "Flow Chart of the Study".

# Figure 1.1

# FLOW CHART OF THE STUDY

| YEAR/MONTH | 1991.10 | 11 | 12 | 1992.1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SUBMISSION OF REPORT | | IC/R | | | P/R | | | IT/R | | | DF/R | | | F/R | |
| | | ▽ | | | ▽ | | | ▽ | | | ▽ | | | ▽ | |
| PHASE | Phase 1 | | | Phase 2 | | | | | | | | | | | |
| WORK SCHEDULE | (A) | (B) | | (C) | | | | (D) | | | (E) | | (F) | (G) | |

**(A) PRELIMINARY STUDY IN JAPAN**

Study
- National development plan
- Telecom development plan
  (Master plan, 5-year plan)
- On-going project & planned projects

Preparation of Inception Report (Draft)

Review of Preliminary study Report (by JICA)

**(B) STUDY IN ZIMBABWE**

( PHASE 1 )
Selection of Study areas
- Study of National/Regional development plan
- Selection of Study areas

Rural Telecom Network, Expansion strategy

INCEPTION REPORT (IC/R)

( PHASE 2 )
Data collection & analysis
- Socio-economics
- National development plan
- Telecom development plan
- Field survey
Target of Telecom development plan
Demand/Traffic study

PROGRESS REPORT (P/R)

**(C) STUDY IN JAPAN**

Study of Rural Telecom Network plan
- Digitalization plan
- Exchange coverage area
- Numbering plan
- Junction network

Study of Rural Telecom Network Expansion plan
- Exchange system
- Transmission system
- External plant
- Others

INTERIM REPORT (IT/R)

**(D) STUDY IN ZIMBABWE**

Discussion of the Interim Report
Collection of supplemental data and field survey for the Rural Telecom Network Expansion plan

**(E) STUDY IN JAPAN**

Draft Rural Telecom development plan
- Network plan
- Network expansion & Cost estimation
- Operation & Maintenance
- Implementation schedule
- Economic/Financial analysis

DRAFT FINAL REPORT (DF/R)

**(F) STUDY IN ZIMBABWE**

Discussion of Draft Final report for finalization of the plan

**(G) STUDY IN JAPAN**

Preparation of Final Report

FINAL REPORT (F/R)

1 - 11

# SECTION 2 SOCIAL AND ECONOMIC ASPECTS

# SECTION 2   SOCIAL AND ECONOMIC ASPECTS

## 2.1   Social Aspect

### 2.1.1   General

#### (1) Landscape

Zimbabwe is situated in South Central Africa between latitudes 15°33'
and 22°24'S, with a maximum length of 835 km and a width of 725 km.  The
area of Zimbabwe is 390,345 km$^2$, nearly as large as Japan.  The central
plateau running diagonally northeast to south west forms the main
watershed.  This divides Zimbabwe's rivers into drainage systems - one
north bound into the Zambezi and the other south into the Save and
Limpopo rivers.
It borders with Zambia to the North, South Africa to the south,
Mozambique to the East and Botswana to the West.

#### (2) Climate

Zimbabwe is a temperate region of which climate is drier and cooler than
in the other tropics generally, due to its elevation and inland
position.  The average day temperature is 25 centigrade (77 deg. F).
During the evening the temperature drops substantially.  Table 2.1 shows
the regional temperature and rain fall.

Rainfall is highest in the Eastern Highlands and on the plateau, which
receive about 1,000 mm a year, while annual rainfall in the Lowbeld
region is often below 400 mm; Beitbridge, situated in an arid zone, may
sometimes receive less than 50 mm a year.  Table 2.1 shows the regional
temperature and rainfall.

Table 2.1    Regional Temperature and Rainfall

| Place<br>Lat., Long.<br>Altitude (m) | CHIRUNDU<br>16S,29E<br>400 | HARARE<br>18S,31E<br>1,473 | KWEKWE<br>19S,30E<br>1,180 | BULAWAYO<br>20S,29E<br>1,343 | BEITBRIDGE<br>22S,30E<br>306 |
|---|---|---|---|---|---|
| Monthly average<br>Temperature | 25.7 | 18.6 | 20.0 | 19.2 | 23.1 |
| Rainfall/days<br>(mm/annum) | 606/57 | 863/92 | 701/62 | 589/63 | 298/36 |

## (3) Drought

Drought of late, has become a permanent feature in Zimbabwe. This has been part of a cyclical pattern that the government has had to deal with. Zimbabwe suffered a terrible drought in 1983 and 1987 that severely affected agriculture, resulting in decline in exports. A drought caused in 1991 also severely affected agriculture.

## 2.1.2 Population

The population of Zimbabwe as of August 1982, was reported to be 7,608,432 in the 1982 census. The annual growth rate of the total population has declined from 3.3% per year during the period 1962-1969 to 3.0% in 1969-1982.

## (1) Population by Province (1982 Census)

| ITEMS | | Population | % |
|---|---|---|---|
| Zimbabwe | | 7,608,432 | 100.0 |
| Manicaland | | 1,103,837 | 14.6 |
| Mashonaland | Central | 560,847 | 7.5 |
| | East | 1,496,500 | 19.8 |
| | West | 854,098 | 11.4 |
| Matebeleland | North | 962,064 | 11.7 |
| | South | 515,298 | 6.7 |
| Midlands | | 1,086,284 | 14.5 |
| Masvingo | | 1,029,504 | 13.7 |

(Source : District Population Data Sheet 1987)

According to the 1982 census, the greater population of Zimbabwe, 74.3%, lived in rural areas. Only 25.7% lived in urban areas. The two largest cities, HARARE and BULAWAYO, recorded more than half the population in the urban areas.

## (2) Population by Local Authorities (1982 Census)

| Local Authorities | Population | (%) | Area(km2) |
|---|---|---|---|
| Zimbabwe | 7,608,432 | 100.0 | 390,759 |
| District Councils | 4,312,459 | 56.7 | 169,556 |
| Rural Councils | 1,584,076 | 20.8 | 167,442 |
| Municipalities | 1,686,789 | 22.2 | 1,921 |
| Other Areas | 25,108 | 0.3 | 51,840 |

Source: Statistical Year Book 1989

## (3) Population by Age-Structure

('000)

| Age | Males | | Females | | Total | |
|---|---|---|---|---|---|---|
| 0-14 | 1742 | 47.4% | 1803 | 47.1% | 3545 | 47.2% |
| 15-64 | 1825 | 49.7% | 1902 | 49.7% | 3727 | 49.7% |
| 65- | 107 | 2.9% | 123 | 3.2% | 230 | 3.1% |
| Total | 3674 | 100.0% | 3828 | 100.0% | 7502 | 100.0% |

Source: Statistical Year Book 1989

## (4) Population Density

The population density increased from 13.0 persons per $km^2$ in 1969 to 19.4 per $km^2$ in 1982.

| Local Authorities | 1969 | 1982 |
|---|---|---|
| Zimbabwe | 13.0 | 19.4 |
| District Councils | 17.8 | 25.4 |
| Rural Councils | 7.3 | 9.5 |
| Municipalities | 442.0 | 878.1 |
| Other Area | 0.3 | 0.5 |

(Persons per $km^2$ )

## (5) Future Population Trends

| YEAR | ('000) |
|------|--------|
| 1982 | 7,502 |
| 1985 | 8,175 |
| 1990 | 9,369 |
| 1995 | 10,633 |
| 2000 | 11,942 |
| 2005 | 13,321 |
| 2010 | 14,739 |

The Ministry of Health announced its future projections for life
expectancies at birth to increase for males from 55.7 years in 1982 to
62.7 in 1997 and 67.3 in 2017 and for females from 59.1 in 1982 to 65.9
in 1997 and to 72.1 in 2017.

(Source: Population Projections of Zimbabwe 1982 to 2032)


## 2.1.3  Zimbabwean Farmers

The study areas consist of three distinct types of socio-economic
communities:

- Large scale commercial farming
- Small scale commercial farming
- Communal land farming


## (1) Large Scale Commercial Farming

Large scale commercial farmer, the former European farmer, occupy close
to 0.1% of the total population of the study areas.  The average farm
size is approximately 2,200 hectares.  Large scale commercial farming is
well organized and financed and produces most of the market surplus.
The number of these large scale farms has decreased over the past decade
because of several heavy droughts and the government's policy of land
redistribution via the resettlement programme.


## (2) Small Scale Commercial Farming

Small scale commercial farmer, the former African farmer, occupy 1.1% of
the total population of the study area.  The average farm size is about
124 hectares.  The number of these farms have been fairly constant over

the past ten years. The conditions of production fall behind those in Large scale one.

## (3) Communal Land Farming

Communal land farming areas, the former tribal trust lands, occupy 89% of the total population of the study area. The great majority of these farmers are peasants. The population of the farmers is about 820,000 in 1992. The areas which have inferior infrastructure are located in regions that receive about 450 to 650 mm of annual rainfall. The marketability of the products is quite low since the business centres and growth points are not well linked. Second Five Year Development Plan said that Government will continue supporting the communal farming sector whose growth rate is projected at 4.0 per cent per annum.

## 2.2    Economic Aspect

Since Independence in 1980, Economic growth in Zimbabwe as well as income growth per capita have shown a fluctuating pattern, caused primarily by the fortunes of agriculture.

Real change rate in Gross Domestic Product (GDP) during the 1980 - 1990 period lagged behind population growth, thus GDP per capita has been on the decline.

Droughts in 1983 and 1987 incurred much damage on the economic growth, because most of communal farmers depend heavily on extensive water conservation.

## 2.2.1    Gross Domestic Product (GDP)

Per Capita GDP        : Z$ 1,236, US$ 544.5 in 1989.
Total GDP growth rate : 4.5% in 1988/89

GDP gives the useful index to be applied to the structural pattern of production in economy besides helping to measure the rate of growth. It is available both at current and constant prices which estimate a measure of the real change. The productive system of Zimbabwe in the last decade can be seen from the following Tables 2.2 and 2.3

In general, 1980 - 1984 indicated a real GDP change of over 2.3% which can be explained in the 1983 contraction in GDP of 4.0%, Agriculture was hit by drought, Mining by falling world prices and the relative strength of the Zimbabwe dollar. Zimbabwe remains in a cycle of low growth, declining investment, stagnant employment, and foreign-exchange shortages.

1985-1989 indicated a real GDP change of just over 3.3%, a rate maintained in the second half of the decade in which, apart from the 1987 drought year, growth was steadier. Fortunately, GDP real change in 1988 and 1989 has been higher, due to favorable weather conditions in 1988 and a considerable expansion of the Manufacturing sector related to enhanced availability of imports in 1989.

The newly published official estimate for GDP growth in 1991 was 4.3% (A Framework for Economic Reform (1991-1995)). However, the 1986-1990 Five Year Development Plan had, as major economic objectives, an average annual GDP rate of growth of 5.1%. The newly estimated GDP growth rate will be achieved by good weather and bumper harvests.

Table 2.2    GROSS DOMESTIC PRODUCT AT FACTOR COST

| ITEM | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1897 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| **AT CONSTANT PRICES(1980)** | | | | | | | | | | |
| AGRICULTURE & FORESTRY | 451 | 515 | 478 | 403 | 496 | 614 | 576 | 472 | 592 | 587 |
| MINING AND QUARRYING | 285 | 278 | 284 | 280 | 291 | 288 | 293 | 300 | 295 | 307 |
| MANUFACTURING | 802 | 881 | 877 | 852 | 809 | 902 | 933 | 949 | 996 | 1055 |
| ELECTRICITY & WATER | 70 | 70 | 63 | 68 | 70 | 79 | 94 | 123 | 127 | 150 |
| CONSTRUCTION | 91 | 105 | 101 | 93 | 86 | 64 | 67 | 62 | 69 | 61 |
| FINANCE AND INSURANCE | 159 | 174 | 208 | 203 | 189 | 187 | 181 | 200 | 211 | 231 |
| REAL ESTATE | 43 | 43 | 43 | 44 | 44 | 44 | 45 | 45 | 46 | 47 |
| DISTRIBUTIONS, HOTELS & RESTAURANTS | 451 | 456 | 451 | 392 | 366 | 386 | 418 | 428 | 449 | 481 |
| TRANSPORT & COMMUNICATIONS | 211 | 221 | 226 | 224 | 226 | 237 | 244 | 234 | 248 | 254 |
| PUBLIC ADMINISTRATION | 291 | 339 | 333 | 338 | 364 | 372 | 370 | 386 | 409 | 423 |
| EDUCATION | 169 | 236 | 284 | 310 | 335 | 358 | 375 | 386 | 390 | 412 |
| HEALTH | 71 | 76 | 88 | 89 | 93 | 97 | 100 | 103 | 107 | 110 |
| DOMESTIC SERVICES | 65 | 63 | 61 | 60 | 59 | 60 | 60 | 61 | 61 | 62 |
| OTHER SERVICES N.E.S | 173 | 186 | 204 | 215 | 217 | 235 | 247 | 245 | 272 | 283 |
| LESS IMPORTED BANKING SERVICE CHARGES | -108 | -106 | -112 | -110 | -105 | -120 | -122 | -133 | -128 | -131 |
| GDP AT FACTOR COST | 3224 | 3537 | 3589 | 3461 | 3540 | 3803 | 3881 | 3861 | 4144 | 4332 |
| NET INDIRECT TAXES | 217 | 336 | 385 | 576 | 420 | 432 | 466 | 441 | 556 | 628 |
| GDP AT MARKET PRICE | 3441 | 3873 | 3974 | 4037 | 3960 | 4235 | 4347 | 4302 | 4700 | 4960 |
| REAL CHANGE AT FACTOR COST (%) | 10.68 | 10.00 | 1.00 | -4.00 | 2.28 | 7.43 | 2.05 | -0.52 | 7.33 | 4.54 |

Table 2.3   GDP Real Change at Factor Cost

(Per Cent)

| ITEMS | 1980-1984 | 1985-1989 | 1980-1989 |
|---|---|---|---|
| AGRICULTURE | 2.41 | -1.13 | 2.97 |
| MINING AND QUARRYING | 0.52 | 1.61 | 0.83 |
| MANUFACTURING | 0.21 | 3.99 | 3.09 |
| ELECTRICITY AND WATER | 0.00 | 17.39 | 8.84 |
| CONSTRUCTION | -1.41 | -1.21 | -4.54 |
| FINANCE AND INSURANCE | 4.41 | 5.42 | 4.24 |
| REAL ESTATE | 0.58 | 1.66 | 0.99 |
| DISTRIBUTIONS, HOTEL | -5.36 | 5.66 | 0.72 |
| TRANSPORT, COMMUNICATIONS | 1.73 | 1.75 | 2.08 |
| PUBLIC ADMINISTRATION | 5.76 | 3.26 | 4.24 |
| EDUCATION | 18.66 | 3.57 | 10.41 |
| HEALTH | 6.98 | 3.20 | 4.99 |
| DOMESTIC SERVICES | -2.45 | 0.82 | -0.53 |
| OTHER SERVICES | 5.83 | 4.76 | 5.62 |
| LESS:IMPORTED BANKING SERVICE CHARGES | -0.71 | 2.22 | 2.17 |
| GROSS DOMESTIC PRODUCT AT FACTOR COST | 2.36 | 3.31 | 3.34 |
| GROSS DOMESTIC PRODUCT AT MARKET PRICE | 3.57 | 4.03 | 4.15 |

## 2.2.2  Currency

The Zimbabwean currency is the Zimbabwe dollar (Z$).  Its exchange rates
are shown in Table 2.4.  The exchange rate at end of JUN, 1992 was US$1
= Z$5.02.

Table 2.4   Average Exchange Rate (Z$/US$)

| YEAR | Ex. Rate |
|---|---|
| 1980 | 0.631 |
| 1981 | 0.712 |
| 1982 | 0.919 |
| 1983 | 1.100 |
| 1984 | 1.500 |
| 1985 | 1.640 |
| 1986 | 1.670 |
| 1987 | 1.660 |
| 1988 | 1.940 |
| 1989 | 2.270 |
| 1990 | 2.580 |
| 1991 | 5.020 |
| 1992 | 5.020 |

Source : Quarterly Economic & Statistical Review

## 2.2.3 Labour Situation

### (1) The Labour Force

The adult population of Zimbabwe totals about 4.3 million people (1987).
About 50% of this adult population were in communal land area.  2.2
million were female and 2.1 million were male.  The labour force
amounted to 3.3 million people, which represented 77% of the adult
population of Zimbabwe.

Table 2.5 indicates that there has been an increase in the labour force
of nearly 800,000 people and a decrease in the number of unemployed thus
causing the reduction in unemployment rate from 10.8% in 1982 to 7.2% in
1987.

Table 2.5    Results from the 1982 Census and the LFS 1986/87 ('000)

| ITEMS | 1982 | | 1987 | |
|---|---|---|---|---|
| Total Labour Force | 2484 | 100.0% | 3260 | 100.0 |
| Employed | 1177 | 47.4% | 1237 | 37.9 |
| Communal Farmers | 1038 | 41.8% | 1789 | 54.9 |
| Unemployed | 268 | 10.8% | 234 | 7.2 |

Source : Main Results of the Labour Force Survey 1986-1987

### (2) Employment by Sector

About 70% of the total employees were engaged in the agricultural
sector, indicating that Zimbabwe is primarily an agricultural economy.
It is considerably important that the agricultural field is the only
sector in which females were the majority.

Table 2.6    Employment by Sector

( '000 )

| Sector | Male | Female | Total |
|--------|------|--------|-------|
| Agriculture | 937 | 1,172 | 2,109 |
| Mining | 16 | 1 | 17 |
| Manufacturing | 141 | 26 | 167 |
| Electricity | 11 | 1 | 12 |
| Construction | 46 | 5 | 51 |
| Wholesale | 76 | 53 | 129 |
| Transport | 70 | 6 | 76 |
| Finance | 17 | 7 | 24 |
| Community and Social | 251 | 146 | 397 |
| Not stated | 25 | 19 | 44 |
| Total | 1,590 | 1,436 | 3,026 |

Source : Main Results of The Labour Force Survey 1986-1987

**(3) Unemployment**

The total number of unemployed persons was 234,000 in 1987 and this represented a national unemployment rate of about 7% including communal farmers (peasant farmers).
It should be noted that the prevalence of hidden unemployment rate might be drastically higher due to the jobless situation of communal farmers in dry season.  Most of the communal farmers turn into unemployed persons in the dry season, because it is impossible to get farm products during the dry season, and rural communities have quite limited formal employment opportunities.

**(4) Shortage of Skilled Labour**

Shortages of skilled labour arose when many professionals left the country as the Rhodesian government transferred power to the new Zimbabwean government.

**2.3    Current Financial Condition of PTC**

**2.3.1    Financial Results**

The income and expenditure account for the period 1985/86 - 1990/91 is shown in the Table 2.7.

Table 2.7   Income and Expenditure Account (Z$'000)

| Item | 85/86 | 86/87 | 87/88 | 88/89 | 89/90 | 90/91 |
|---|---|---|---|---|---|---|
| **Income** | | | | | | |
| Telephone | 112,462 | 139,923 | 195,136 | 226,693 | 262,258 | 344,887 |
| Telex | 13,159 | 17,513 | 21,967 | 21,639 | 22,616 | 23,894 |
| Telegraph | 2,323 | 2,656 | 3,104 | 3,219 | 3,338 | 3,546 |
| Miscellaneous | 1,779 | 1,485 | 3,444 | 6,638 | 7,150 | 6,785 |
| **Total** | 129,723 | 161,577 | 223,651 | 258,189 | 295,362 | 379,112 |
| **Expenditure** | | | | | | |
| Stuff Costs | 61,776 | 65,553 | 70,849 | 86,963 | 87,251 | 112,780 |
| Operating Costs | 30,177 | 38,750 | 45,603 | 57,545 | 108,049 | 145,782 |
| Depreciation | 11,871 | 14,808 | 17,784 | 20,252 | 23,010 | 27,373 |
| Financial Charges | 26,486 | 23,314 | 24,459 | 21,671 | 36,672 | 42,485 |
| **Total** | 130,310 | 142,425 | 158,695 | 186,431 | 254,982 | 328,420 |
| Profit/(Loss) | (587) | 19,152 | 64,956 | 71,758 | 40,380 | 50,692 |
| Exceptional Items | (780) | 1,661 | 479 | (7,745) | 4,745 | (343) |
| Profit/(Loss) | (1,367) | 20,813 | 65,435 | 64,013 | 45,125 | 50,349 |

( Source : A Quarterly Abstract )

The PTC financial results have not been possible to separate between Postal and Telecommunications services.   The total net book value of fixed assets was calculated to be Z$401,564,000 at the end of 1989/90 financial year.

Total on-lent long term local loans amounted to Z$90,030,000, and long term foreign loans amounted to Z$118,219,000 at the end of 1989/90 financial year.

Government said that "Telecommunication projects are capital intensive and approximately 60% of the investment is in foreign exchange, as described in Table 2.7.   This will constitute a serious constraint to the speedy implementation of projects in the sector.   It may, therefore, not be possible to implement some of the programmes and projects the PTC has planned in the Second Five Year National Development Plan.

PTC Investment                              (Z$'000)

| Period | Telecom Services | Postal Services | Admin. Others | Total | Foreign Exchange |
|---|---|---|---|---|---|
| 1981-85 | 193,046 | 2,654 | 10,129 | 205,829 | 157,846(ACT) |
| 1986-90 | 507,000 | 9,000 | 39,000 | 555,000 | 350,000(EST) |

ACT : Actual,   EST : Estimate,   Source : SFYNDP

# SECTION 3  SELECTION OF PROJECT LOCAL EXCHANGE AREA

# SECTION 3  SELECTION OF PROJECT LOCAL EXCHANGE AREA

Study areas have been selected from the exchange areas categorized as "Rural Exchange Area" at the initial stage of this project through discussions with the PTC and Study Team.

One exchange area was selected from each region, in principle, in accordance with the results of discussions between the MIPT/PTC authorities and JICA Preliminary Study Team in February 1991.

The Guidelines for Selection of Study Area are described below.

## 3.1    Criteria of Selection

Guidelines and evaluation method applied for selecting the Study Area are given below.

In evaluating the factors mentioned in the guidelines, "Scoring Method" was applied, i.e., 10 points at maximum were allocated to each item except item a), and as the results of evaluation, the area with the highest evaluated points was selected as the Study area in the region concerned.

### Guidelines for Selection of Study Areas

Study areas are the areas where improvement of telecommunication services are urgently required, taking into consideration the following factors so as to develop the Rural Telecommunication Development Plan in conformity with the Zimbabwean government's national and regional development policies.

## 3.1.1  Rural Exchange Area

The Study areas have been selected from the "Rural Exchange Areas" categorized by PTC.

The 51 out of 109 exchange areas in the whole country are categorized as the "Rural Exchange Area" by the PTC's criteria stated below.

Initially, an exchange area was categorized as "Rural Exchange Area", where no telecommunications service was available or the service was available only through manual switching boards.  Presently, however services were automatized in those "Rural Exchange Areas", and the same areas are still considered as the "Rural Exchange Areas".

### 3.1.2 Growth Point

The Study area includes the "Growth Points/District Service Centres", which were designated by the Ministry of Local Government based on the concepts of National Development Plan.

Those "Growth Points/District Service Centres" were designated to encourage the decentralization of development, in particular industrial development from the traditional urban locations to rural centres through the development of infrastructure, such as roads, water supply, telephones, electricity, etc., in rural centres.

For evaluating purpose, full (10) points was given for the area where "Growth Points" exists in the exchange area, otherwise, no point was given.

### 3.1.3 PSIP (Public Sector Investment Program)

The Study area is scheduled for telecommunication development during the current 5-Year PSIP (1991-1996). (The PSIP is an investment program for the public sector of the Government for 5 years, and is annually revised.)

For evaluating purpose, full (10) points was given for the area for which improvement of telecommunication service was scheduled under the current PSIP, otherwise no point was given.

### 3.1.4 Demand Fulfillment

The Study area is with a low demand fulfillment at present, i.e., high priority will be given to the area where demand fulfillment ratio is low.

The Demand Fulfillment Ratio (DFR) is expressed by:

DFR = (Number of present subscribers)/(Present telephone demand).

Allotment of evaluation points are based on the following 5 DFR classification:

- Grade A: 10 points for DFR range (0.25 or less), or for the
           area without telecommunication services,
- Grade B: 8 points for DFR range (0.26 - 0.50),

- Grade C: 6 points for DFR range (0.51 - 0.75),
- Grade D: 4 points for DFR range (0.76 - 1.00), and
- Grade E: 2 points for DFR range (1.01 or more).

### 3.1.5 Demand in the Year 2000 (D/2)

The area is an area with a large demand, i.e., priority is given to the area where large demand is expected in the year of 2000.

Demand in the year of 2000, (D/2) is based on the forecast data prepared by PTC in 1990 (Reference: TELEPHONE DEMAND FORECAST AND GROWTH RATES FOR ZIMBABWE 1986-2000, Network Planning Information Circular No.010 Issue 1, September 1991)

Allotment of evaluation points are based on the following 5 demand classification:

- Grade A: 10 points for D/2 range (2001 or more),
- Grade B:  8 points for D/2 range (1501 - 2000),
- Grade C:  6 points for D/2 range (1001 - 1500),
- Grade D:  4 points for D/2 range (701 - 1000), and
- Grade E:  2 points for D/2 range (700 or less).

### 3.1.6 Demand Increase

The Study area is an area with a large increase in demand, i.e., high priority is given to the area where rapid demand increase is expected.

Demand increase from the year of 1989 to the year of 2000 is considered for evaluation by using the Demand Increase Ratio (DIR) which is expressed by:

DIR = (Number of demand in 2000)/(Number of demand in 1989).

Allotment of evaluating points are based on the following 5 DIR classification:

- Grade A: 10 points for DIR range (3.6 or more),
- Grade B:  8 points for DIR range (2.3 - 3.5),
- Grade C:  6 points for DIR range (1.8 - 2.2),
- Grade D:  4 points for DIR range (1.3 - 1.7), and
- Grade E:  2 points for DIR range (1.2 or less).

## 3.2　Proposed Project Local Exchange Area

Selection of Study areas were carried out by the PTC and JICA Study Team based on the criteria and evaluation method given in Section 4.1.

As the results of the evaluation, the following 6 exchange areas were selected for the proposed Study areas:

| Exchange area | Region |
|---|---|
| Beatrice | Mashonaland |
| Kezi | Matabeleland |
| Murambinda | Manicaland |
| Nkayi | Midlands |
| Gutu & Chatsworth | Masvingo |

Evaluation result for each region is listed in Table 3.1 (1/5-5/5).　The following are the explanation for the selection of Study area in each region.

### 3.2.1　Mashonaland

As a result of evaluation of all exchange areas in the region, Beatrice exchange area was selected as a proposed Study Area.

### 3.2.2　Matabeleland

As a result of evaluation of all exchange areas in the region, Kezi exchange area was selected as a proposed Study Area.

### 3.2.3　Manicaland

As a result of evaluation of all exchange areas in the region, Murambinda exchange area was selected as a proposed Study Area.

### 3.2.4　Midlands

As a result of evaluation for all exchange areas in the region, Gokwe and Nkayi exchange areas got the first priority.　However, MARS (Multi-Access Radio System) has already been introduced in the Gokwe exchange area in

accordance with the PTC's plan.

Therefore, Nkayi exchange area was selected as a proposed Study Area.


## 3.2.5 Masvingo

As a result of evaluation for all exchange areas in the region, Gutu and Chatsworth exchange areas got the first and second priority, respectively.

However, in consideration of "Numbering plan for the nation" stated in the Telecommunication Development Plan prepared by ITU, these 2 exchanges are deemed to be in the same network configuration area, and these areas will be a good model for a case study.

Hence, 2 exchange areas were selected as a proposed Study Area in Masvingo region.


### Lists of Evaluation Result for Each Region

The following legends are used in the list.

U/R:      Urban area or Rural area, shown with U or R

G/P:      Growth point exists or not in an exchange area, shown with
          Y/Yes or N/Not

PSIP:     Investment is scheduled or not for the exchange area under
          the current PSIP, shown with Y/Yes or N/Not

D/F:      Demand fulfillment ratio, shown with 5 grades (A, B, C, D & E)
          depend on classification, or with N/S for the area without
          telecommunication services

D/2:      Demand in the year of 2000, shown with 5 grades (A, B, C, D & E)
          depending on classification

D/I:      Demand increase from the year of 1989 to 2000, shown with
          5 grades (A, B, C, D & E) depending on classification

T/SCORE:  Total evaluated score

Table 3.1 (1/5)     Evaluation Results for MASHONALAND Region

| EXCHANGE | U/R | G/P | PSIP | D/F | D/2 | D/I | T/SCORE | PRIORITY |
|---|---|---|---|---|---|---|---|---|
| AVONDALE | U | -- | -- | - | -- | -- | -- | - |
| BORROWDALE | U | -- | - | -- | -- | -- | -- | - |
| CRANBORNE | U | - | - | -- | - | -- | -- | -- |
| GLEN VIEW | U | - | -- | -- | - | - | - | -- |
| HARARE MAIN | U | - | -- | - | - | - | -- | -- |
| HIGHLAND | U | -- | -- | - | - | - | - | - |
| KUWADZANA | U | - | -- | -- | - | - | - | - |
| SOUTHERTON | U | - | - | - | -- | - | -- | - |
| WARREN PARK | U | -- | - | -- | -- | - | - | -- |
| ARCTURUS | U | -- | - | -- | - | -- | - | -- |
| BANKET | R | N | Y | B | C | C | 30 | 8 |
| BEATRICE | R | Y | Y | A | B | B | 46 | 1 |
| BINDURA | U | -- | -- | - | -- | - | - | - |
| CENTENARY | R | Y | Y | D | D | C | 32 | 6 |
| CHAKARI | R | N | Y | C | E | D | 22 | 12 |
| CHEGUTU | U | - | -- | - | -- | - | - | - |
| CHINHOYI | U | - | -- | - | - | - | - | - |
| CHIRUNDU | U | - | -- | - | - | - | - | -- |
| CHITUNGWIZA | U | -- | - | - | - | - | - | - |
| CONCESSION | U | - | - | - | - | - | -- | - |
| DARWENDALE | R | N | Y | C | E | D | 22 | 12 |
| GLENDALE | U | -- | - | -- | - | -- | - | - |
| GURUVE | R | Y | Y | B | C | C | 40 | 3 |
| KADOMA | U | - | - | - | - | -- | - | -- |
| KARIBA | U | - | -- | - | -- | - | - | - |
| KAROI | U | - | -- | - | - | - | - | - |
| MAKUTI | U | -- | -- | - | - | - | -- | -- |
| MARONDERA | U | - | - | - | - | - | -- | - |
| MAZOWE | U | - | --. | - | - | - | - | -- |
| MHANGURA | U | -- | -- | - | -- | - | - | -- |
| MT. DARWIN | R | Y | Y | B | B | B | 44 | 2 |
| MUREWA | R | Y | Y | D | C | C | 36 | 5 |
| MUROMBEDZI | U | - | - | - | -- | - | - | -- |
| MUTOKO | R | Y | Y | B | D | C | 38 | 4 |
| MUTORASHANGA | R | N | Y | D | E | D | 20 | 14 |
| MVURWI | U | - | - | -- | - | - | - | - |
| NORTON | U | -- | - | - | - | - | - | - |
| RAFFINGORA | R | N | Y | C | D | B | 28 | 11 |
| RUWA | R | N | Y | B | B | C | 32 | 6 |
| SANYATI | R | Y | Y | D | E | D | 30 | 8 |
| SELOUS | U | - | - | - | -- | - | - | - |
| SHIMVA | R | N | Y | C | C | B | 30 | 8 |
| TRELAWNEY | R | N | Y | D | E | D | 20 | 14 |

Table 3.1 (2/5)    Evaluation Results for MATABELELAND Region

| EXCHANGE | U/R | G/P | PSIP | D/F | D/2 | D/I | T/SCORE | PRIORITY |
|---|---|---|---|---|---|---|---|---|
| BELLEVUE | U | -- | - | - | -- | - | - | - |
| BULAWAYO MAIN | U | - | -- | - | - | - | - | - |
| HILLSIDE | U | -- | - | -- | -- | -- | -- | - |
| LUVEVE | U | -- | -- | - | - | - | -- | - |
| MABUTHWENI | U | - | -- | -- | -- | - | - | - |
| NKULUMANE | U | -- | - | - | - | -- | - | -- |
| BEITBRIDGE | U | - | - | - | - | -- | -- | - |
| BINGA | R | N | Y | B | C | B | 32 | 7 |
| DETE | R | N | Y | C | D | B | 28 | 10 |
| ESIGODINI | U | -- | -- | - | - | - | - | - |
| FIGTREE | R | N | Y | C | E | C | 24 | 11 |
| FILABUSI | U | - | -- | - | - | - | -- | - |
| GWANDA | U | - | -- | - | - | - | - | - |
| HWANGE | U | - | - | - | - | -- | - | - |
| JOTSHOLO | R | Y | Y | B | E | D | 34 | 3 |
| KEZI | R | Y | Y | C | C | A | 42 | 1 |
| LUPANE | R | Y | Y | D | E | D | 30 | 8 |
| MATOPOS | R | N | Y | E | E | D | 18 | 12 |
| NYAMANDLOVU | U | -- | - | - | - | - | -- | - |
| PLUMTREE | R | Y | Y | D | D | C | 34 | 3 |
| SHANGANI | R | Y | Y | C | E | C | 34 | 3 |
| TSHOLOTSHO | R | Y | Y | N/S | E | B | 40 | 2 |
| TURK MINE | R | Y | Y | D | E | B | 34 | 3 |
| VICTORIA FALLS | U | - | - | -- | - | - | - | - |
| WEST NICHOLSON | R | Y | Y | E | E | C | 30 | 8 |


Table 3.1 (3/5)    Evaluation Results for MIDLANDS Region

| EXCHANGE | U/R | G/P | PSIP | D/F | D/2 | D/I | T/SCORE | PRIORITY |
|---|---|---|---|---|---|---|---|---|
| CHIVHU | R | Y | Y | C | D | D | 34 | 3 |
| GOKWE | R | Y | Y | B | B | B | 44 | 1 |
| GWERU | U | -- | - | - | -- | - | - | -- |
| KWEKWE | U | -- | - | - | -- | - | - | - |
| LALAPANZI | U | - | - | -- | - | - | - | -- |
| MUNYATI | U | - | -- | - | - | -- | -- | - |
| MVUMA | R | Y | Y | D | E | D | 30 | 4 |
| NKAYI | R | Y | Y | N/S | C | B | 44 | 1 |
| REDCLIFE | U | - | -- | -- | - | -- | -- | - |
| SHURUGWI | U | -- | - | -- | - | -- | - | - |
| ZVISHAVANE | U | - | -- | -- | -- | -- | - | - |

## Table 3.1 (4/5)    Evaluation Results for MANICALAND Region

| EXCHANGE | U/R | G/P | PSIP | D/F | D/2 | D/I | T/SCORE | PRIORITY |
|----------|-----|-----|------|-----|-----|-----|---------|----------|
| BIRCH. BRIDGE | R | Y | Y | N/S | E | C | 38 | 2 |
| CHIMANIMANI | R | Y | Y | C | D | C | 36 | 4 |
| CHIPANGAYI | R | N | Y | C | E | C | 24 | 9 |
| CHIPINGE | U | - | - | - | - | - | - | - |
| HAUNA | R | Y | Y | N/S | E | C | 38 | 2 |
| HEADLANDS | R | N | Y | C | E | C | 24 | 9 |
| JULIASDALE | U | - | - | - | - | - | - | - |
| MACHEKE | R | Y | Y | E | E | D | 28 | 7 |
| MURAMBINDA | R | Y | Y | A | B | B | 46 | 1 |
| MUTARE | - | - | - | - | - | - | - | - |
| NYANGA | U | - | - | - | - | - | - | - |
| NYAZURA | R | Y | Y | C | D | C | 36 | 4 |
| ODZI | R | N | Y | C | D | C | 26 | 8 |
| PENHALONGA | U | - | - | - | - | - | - | - |
| RUSAPE | U | - | - | - | - | - | - | - |
| WEDZA | R | Y | Y | D | D | C | 34 | 6 |

## Table 3.1 (5/5)    Evaluation Results for MASVINGO Region

| EXCHANGE | U/R | G/P | PSIP | D/F | D/2 | D/I | T/SCORE | PRIORITY |
|----------|-----|-----|------|-----|-----|-----|---------|----------|
| CHATSWORTH | R | Y | Y | B | D | B | 40 | 2 |
| CHECHECHE | R | Y | Y | N/S | E | C | 38 | 3 |
| CHIREDZI | U | - | - | - | - | - | - | - |
| GUTU | R | Y | Y | C | A | A | 46 | 1 |
| JERERA | R | Y | Y | N/S | E | D | 36 | 8 |
| MASHAVA | U | - | - | - | - | - | - | - |
| MASVINGO | U | - | - | - | - | - | - | - |
| MATAGA | R | Y | Y | N/S | E | C | 38 | 3 |
| MBERENGWA | R | Y | Y | C | E | C | 34 | 10 |
| NGUNDU | R | Y | Y | N/S | E | C | 38 | 3 |
| NYANINGWE | R | Y | Y | N/S | E | C | 38 | 3 |
| NYIKA | R | Y | Y | N/S | E | D | 36 | 8 |
| RUTENGA | R | Y | Y | N/S | E | C | 38 | 3 |
| TRIANGLE | U | - | - | - | - | - | - | - |

# SECTION 4

# SIGNIFICANCE OF
# ZIMBABWE LOCAL TELEPHONE EXPANSION PLAN

SECTION 4    SIGNIFICANCE OF ZIMBABWE LOCAL TELEPHONE EXPANSION PLAN

## 4.1    General Conditions of Telecommunication Networks

Administratively, Zimbabwe is divided into eight provinces, however, telecommunication networkwise, PTC divides the whole country into five regions, namely Mashonaland, Manicaland, Matabeleland, Masvingo and Midlands as shown in Figure 4.1 "Exchange Area".

Development of the telecommunication networks in Zimbabwe is better than other developing countries, and the telephone penetration ratio is 1.4 per 100 inhabitants on average, which is fairly high among African nations. And telephone automatization ratio is also very high (98%).

In the rural area, however, the penetration ratio is 0.3 per 100 inhabitants, which is still very low compared with the high ratio of 13.2 per 100 inhabitants in the major cities.

Most of the telecommunication networks facilities have lasted for long time and are overage.  Besides, capacities of the current facilities such as switching equipment, transmission systems and external plant are not able to manage increasing number of subscribers and traffic sufficiently.
The number of telephone faults increased from 268,618 in 1989/90 to 297,701 in 1990/91.
Despite the constraint, PTC cleared an average of 66.4 % of faults within 48 hours of occurrence.

## 4.1.1    Network Hierarchy

The existing telecommunication networks in Zimbabwe has a 3-tier hierarchical structure, end-exchange, Group exchange and Zone centre.  But they also can be called terminal exchange, primary centre and secondary centre as well in common terminology of this field.

The respective zone centres in five zone areas are Harare, Bulawayo, Mutare, Gweru and Masvingo.

Number of the specified exchange areas in the country are 109 and number of the exchange areas categorized as the "Rural Exchange Area" by the PTC

are 51 out of the 109 exchange areas.

And each exchange area is given a particular office code.

## 4.1.2 Local Telephone Service

According to the statistics as of December 1991, status of telephone services in the whole country are as follows:

| | | |
|---|---|---|
| No. of DEL Auto Subscribers | : | 123,450 |
| No. of DEL Manual Subscribers | : | 287 |
| No. of APL Subscribers | : | 1,030 |
| No. of EPL Subscribers | : | 557 |
| No. of MPL Subscribers | : | 379 |
| No. of Public Call Offices | : | 1,075 |
| No. of Spare Capacity | : | 19,210 |
| Waiting List | : | 79,620 |

DEL: Direct Exchange Line

APL: Automatic Party Line

EPL: Electronic Party Line

MPL: Manual Party Line

A feature of telephone service in Zimbabwe is the existence of Multi-subscribers party line system where some subscribers share one physical subscriber line, some with more than 10 subscribers. Those with more than 6 are undergoing split to allow for target of maximum 6. And a large number of party lines exists particularly in rural areas.

The external plant in rural areas is mainly of the overhead type employing copper conductor open-wires and drop wires.

However, in city areas, underground cable system is employed, and type of cable both paper and polythene insulated are mainly used.

Telephone automatization in this country is very high whether it is in urban area or rural area, and majority type of switching equipment is Strowger and some EMDs also. Those switching equipment have lasted for long time, however, their workings are not very bad, because of good maintenance.

Current working Digital exchanges are Murewa UXD-5 for local service, Bulawayo FETEX-150 for mainly trunk switch and Masvingo AXE-10D for local and trunk switch.

Current development project being undertaken is Mashonaland Manicaland Digitalization Project which is funded by OECF (Overseas Economic Co-operation Fund) Japan and providing the telephone facilities with approximately 102000 capacity at initial stage mainly for Harare and Mutare. The project started in November 1989 and will be completed in March 1995.
For urban areas in other regions, PTC intends to install 15 digital exchanges with almost 120,000 total capacity by 1997.

## 4.1.3 Trunk Service

All trunk calls from an end exchange are routed to the group exchange and the trunk traffic from the group exchange is routed to the zone centre via either two routes. One route caters for traffic terminating in the zone center's own exchange area. The other route is composed of transitting traffic to other group and zone centres. The direct group-to-group routes exist between nearby group exchanges.

The zone centre is the distribution point for all trunk calls generated by group exchanges within that zone area. At present zone centres are not all interconnected, therefore, the calls do not pass through more than two zone centres.

Automatic trunk calls are on level "1" and national and international operator assistance calls on level "0" and level "96" respectively are also available.

An international telephone exchange of AXE-10D type is at Gweru and a standard A earth station is at Mazowe near Harare.
Direct dialling to international destinations is available in Harare, Bulawayo, Gweru, and all automatic exchange subscribers, access being obtained by dialling "110". And also service through international operators is available by dialling "96". For neighbouring countries, direct cross-border routes exist and direct dialling is available by dialling the access code "119" and the appropriate country code.

## 4.1.4 Telegraph, Telex and Data Services

There is one telex exchange of the EDX type at Harare, and one telex concentrator each in Bulawayo and Gweru, and the total equipped capacity at end of December 1991 was 4,720 and the waiting list was 927.

The telegraph service operates mainly over direct teleprinter links between stations with high traffic and utilizes the telex network working on Gentex principles, for smaller stations. For every traffic station messages are passed on by telephone on the "phonocom" service.

Data services are at present provided on a leased circuit basis, most modems operating at 9600 bit/s, and there is also data service over the PSTN (Public Switched Telephone Network) in major cities.
There is also a Facsimile service available in Harare and Bulawayo.

## 4.1.5 Transmission Network

The main transmission network consists of wide-band radio-relay links on the Harare - Bulawayo back bone route and certain other routes. The rest of the inter-zone network is covered by 300-channel radio-relay systems, while extensive use is also made of low-capacity radio-relay as well as single-channel links to subscriber terminals.
Overhead open-wire carrier systems are still in wide-spread use to link terminal exchanges with group centres, as well as for connections between group and zone centres.

In urban areas, PCM on cable is used and the introduction of optical fibre in the junction networks in Harare and Mutare is going on.
Circuits to nieghbouring countries are also provided over high- capacity radio-relay links, generally of the 960 channel type.

## 4.2 Existing Telecommunication Facilities in the Study Areas

Status of the existing telecommunication facilities in the respective exchange areas is summarized in Table 4.1.
The following are brief explanations on each telecommunications facility and subscribers.

### 4.2.1 Present Telecommunication Services

Telephone services are being mainly provided in each exchange area, besides the non-voice services like telex, data communication which are being provided to a few subscribers.

Telephone availability is extremely low in communal lands where the majority of people are habitated as seen in Figure 4.2 (1/6-6/6), "Existing subscribers' distribution/line" in each exchange area.

For distribution of telephone subscriber lines, there are two types, one is with DEL (Direct Exchange Line) which is applied for subscribers inside BRA (Basic Rental Area which is an area with a radius of 5 km from the exchange), and the other one is with Party-Line which is applied extensively for subscribers outside BRA.

### 4.2.2 Exchange

The existing automatic exchange at Beatrice was put in-service in 1985, and at other 4 exchange areas; Kezi, Murambinda, Gutu and Chatsworth, in 1987, respectively. "Strowger" exchange with 200-line capacity is being used exclusively at those exchanges, except Gutu where a 400-line capacity is used.

However, manual switching board for P/L subscribers is still being used in addition to the "Strowger" exchange at some exchange areas; Kezi, Gutu and Chatsworth, since EPL (Electronic Party-Line) units are not yet provided, which are required to accommodate such manual party-line subscribers to the automatic exchange. Provision of EPL is considered by PTC to those exchange areas gradually to automatize the services.

A Strowger exchange with 200-line capacity installed at Nkayi was not put in-service, owing to incompletion of junction route connecting the exchange to its parent exchange Kwekwe and subscriber lines. Therefore, telephone service in the area is provided manually with a switching board installed at Gweru which is Secondary Centre.

### 4.2.3 Subscribers' Line

Both cable and open wire are used for subscribers' lines, the cable is used within BRA, and open wire is used outside BRA, in principle.
For installation of cable, aerial installation method is generally used except in the center of town where underground installation method is applied.

Small capacity radio systems operating in either VHF or UHF band are utilized in exceptional cases for providing telephone lines to distant subscribers on DEL connection basis at 2 exchange areas; Beatrice and Murambinda.

In Nkayi, Murambinda, Beatrice, Gutu and Chatsworth exchange areas, there are some manual Party Lines (P/L) extended from adjacent exchange area(s) providing telephone connections to the existing subscribers in these areas.

Existing subscribers' distribution/line is given in Figure 4.2 (1/6 -6/6).

### 4.2.4 Trunk Circuits

An open-wire carrier system with 12-channel capacity is being entirely used for trunk circuits connecting terminal exchanges to their respective parent exchanges.
No other transmission system is employed presently. However, construction of digital transmission systems is expected for (Nkayi-Kwekwe), (Beatrice-Harare), (Chatsworth-Gutu-Masvingo) sections to be implemented as a part of national network digitalization program.
While, construction of new radio link is being envisaged for (Murambinda-Mutare) and (Kezi-Bulawayo) sections, however no concrete implementation plan exists yet.

Existing and planned trunk routes planned by other program are given in Figure 4.3.

### 4.2.5 Power Supply

Stable AC-mains supply are available at all exchange sites. DC power supply unit with storage battery and single-standby engine-generator having

3-phase, 7.5 or 9 kVA capacity for emergency use are at every exchange.

### 4.2.6 Station Building and Site

Prototype building exists at all exchange sites, but an inversive layout plan was applied for the building at Beatrice.
For equipment layout, the same pattern is employed for every station. 3 wall-mounted type air conditioners are installed in the equipment room. Typical floor layout is shown in attached Figure 4.4.

The present site spaces at respective exchange sites seem sufficient to erect antenna mast (self-supported type) which is required in case radio system is introduced for trunk system and/or subscriber network.

### 4.2.7 Operation and Maintenance

The existing telecommunications facilities are conventional analog type, but are normally functioning. Operation and maintenance are being done by 3-4 maintenance staff in each exchange area. Only few problems occur with the telecommunications facilities, mainly with subscriber lines due to lightning during rainy season.

### 4.3 Telecommunications Development Plan

The telecommunication development plan described in the Second Five- Year Plan period from 1991 to 1996, published in December 1991, is as follows.

### 4.3.1 Telephone Service

The demand for telephones is expected to grow rapidly during the plan period.
And the development programme includes the expansion of the telecommunication network through digitalization and network rehabilitation. The network capacity in the country is expected to increase from 125,000 connections in 1989 to over 250,000 by the year 1995. It is expected that by 1995-96, approximately 19 exchanges will have digital equipment, while another 65 exchanges will be refurbished. It is expected that these programmes will expand the exchange capacities to meet the project demand from 1994 onwards.

The digitalization programme will include Harare trunk, Julius Nyerere Way exchange, Mutare exchange and some exchanges in Midlands and Matabeleland North.

Similar developments will be planned for the future after assessment of the current programme in 1993.
Network capacities, particularly capacity to carry trunk traffic, will substantially expand and improve as a result of the installation of optical fibres.

After the installation of digital equipment the main activity will be the implementation of cable systems so as to expand the subscribers network.

### 4.3.2 Trunk Routes

About 60 trunk routes are targeted for upgrading including Gweru - Masvingo - Beitbridge and Prison farm - Kadoma which are rather critical as they are more than 15 years old and are unable to cope with the increased traffic. They may become major bottlenecks after digitalization of exchanges. Another important line is Mutare - Chimoio trunk line which provides link between Zimbabwe and Beira (Mozambique).

### 4.3.3 Telex Service

The planned programme for telex development envisages the installation of a 2500 line telex exchange in Bulawayo and shifting of the Bulawayo concentrator to Mutare.
The EDX exchange in Harare is also planned to be expanded to cater for extra subscribers. Telex concentrator will be installed in Masvingo, Gwanda, Chinhoyi and Hwange.
Additional subscriber terminal equipment and trunk facilities will be acquired to match with the envisaged expansion programme.

Under a loan agreement signed between the Government of Zimbabwe and the European Investment Bank (EIB), external financing was secured for purchase of one new telex exchange for Bulawayo, four concentrators for Masvingo, Gwanda, Chinhoyi and Gweru. A tender for supply of the equipment was issued and is under consideration. The development project will increase the capacity of the telex network by 3360 terminals.

### 4.3.4 New Services

#### (1) Facsimile Service

PTC provides facsimile bureau services at Harare, Gweru, Bulawayo, Kwekwe, Masvingo, and Mutare, Main Post offices for use by the public. The number of subscribers increased from 1487 in 1990 to 1782 in 1991.

#### (2) Data Service

External financing was secured from the Belgian Government and a supply contract was signed for an X25 Data Packet Switch Exchange. Up until the contract, PTC operated an interim data service consisting of a concentrator in Zimbabwe working into an international Switch in London via a dedicated satellite link. The demand for the interim service was limited due to the fact that the service provided access to only Overseas Networks and host computers.

The installation of the X25 equipment at the beginning of the calendar year 1992 will allow users to transmit data both nationally and internationally.

#### (3) Radiopaging and Mobile Telephony Services

PTC plans to incorporate provision of radiopaging and mobile telephony services. Result of a survey indicated a healthy market for both radiopaging and mobile telephony services. These projects are in the Public Sector Investment Plan seeking external financing.

### 4.4 Operating Entity and Organization

MIPT (Ministry of Information, Posts and Telecommunications) is an administrative organization which mainly manages Posts, Telecommunication and Broadcasting. And the management and operation of public telecommunication networks in Zimbabwe is monopoly of PTC (Posts and Telecommunications Corporation) which is one of the government organizations and is supervised by MIPT.

The organization chart of PTC is shown in Figure 4.5.

Figure 4.1   Exchange Area
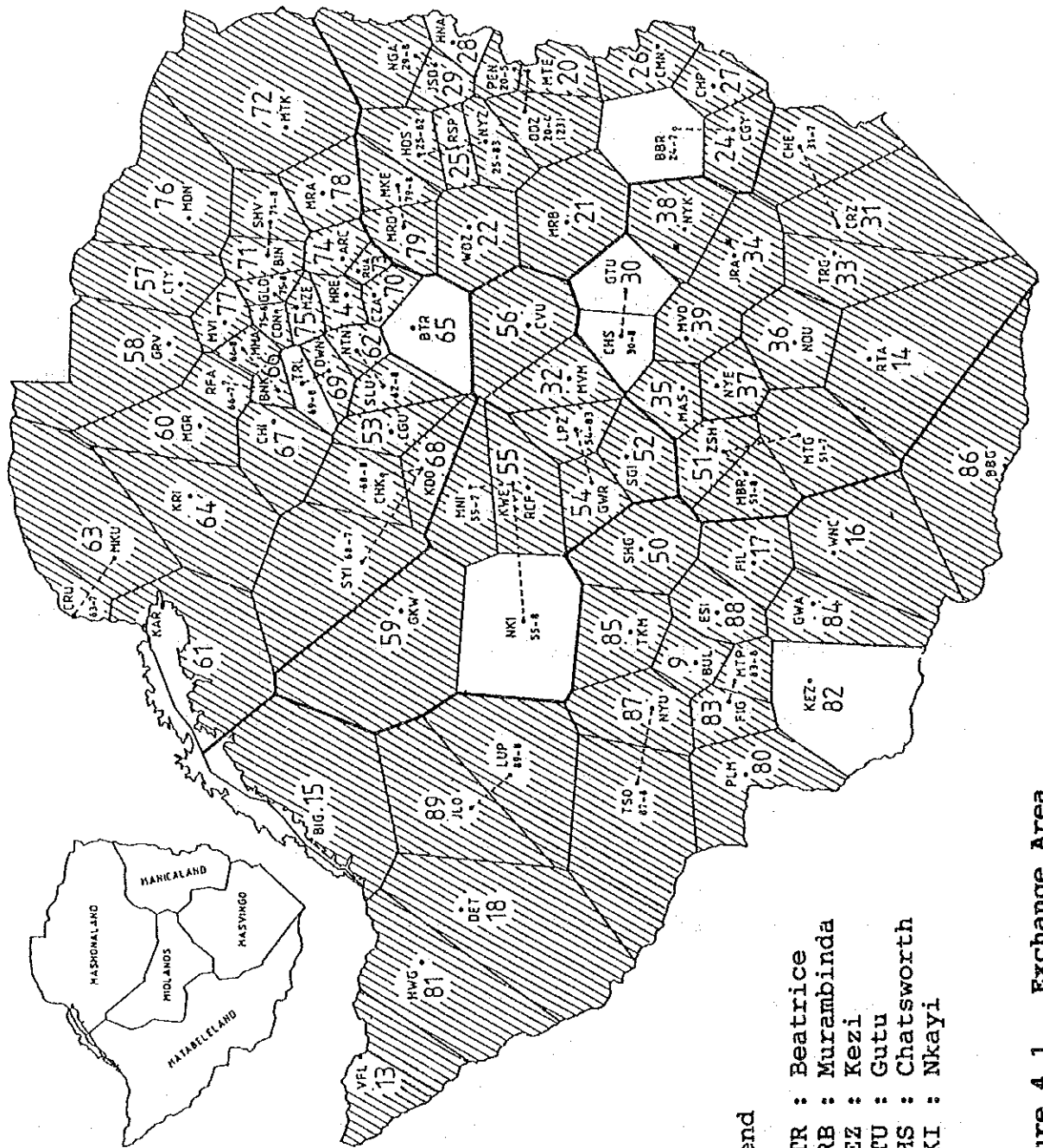
Legend

BTR : Beatrice
MRB : Murambinda
KEZ : Kezi
GTU : Gutu
CHS : Chatsworth
NKI : Nkayi

4 - 10

Table 4.1  The Status of the Existing Telecommunications Facilities in the Study Areas

| Exchange Name / Description | Beatrice | Murambinda | Kezi | Gutu | Chatsworth | Nkayi |
|---|---|---|---|---|---|---|
| Type of Switching Eq. | Strowger | Strowger | Strowger | Strowger | Strowger | Strowger |
| Capacity of Switching Eq. | 200 | 200 | 200 | 400 | 200 | 200 |
| Number of Subscribers | | | | | | |
| DEL(Business) | 48 | 53 | 39 | 114 | 25 | 0 |
| DEL(Residential) | 61 | 50 | 17 | 134 | 11 | 0 |
| Total DEL Subs. | 109 | 103 | 56 | 248 | 36 | 0 |
| Public Call Offices | 4 | 5 | 2 | 2 | 1 | 0 |
| P/L Circuits | EPL 33 | 0 | MPL 9 | MPL 12 | MPL 8 | 0 |
| P/L Subs.(Business) | 34 | 0 | 29 | 68 | 35 | 0 |
| P/L Subs.(Residential) | 184 | 0 | 21 | 67 | 34 | 0 |
| Total P/L Subs. | 218 | 0 | 50 | 135 | 69 | 0 |
| *(Other Subscribers) | *17 | *78 | *15 | *1 | *15 | *66 |
| Manual Switch Board | --- | --- | For Level 7 | For Level 7 | For Level 7 | --- |
| Commercial Power Supply | 220V | 220V | 220V | 220V | 220V | 220V |
| Standby Engine Generator | 9kVA,SS,3P | 7.5kVA,SS,3P | 9kVA,SS,3P | 9kVA,SS,3P | 7.5kVA,SS,3P | 9kVA,SS,3P |
| Subscriber Lines: | | | | | | |
| - Local Cable | | | | | | |
| Type of Cable | CCP/SD/OW | CCP/OW | CCP/OW | CCP/OW | CCP/OW | OW |
| No. of Pairs Terminated | 250 | 400 | 200 | 400 | 200 | 0 |
| Distribution System | Direct | Direct | Direct | Cabinet | Direct | Direct |
| Installation Method | Brd/Arl | Cdt/Brd/Arl | Brd/Arl | Cdt/Brd/Arl | Brd/Arl | Arl |
| - Radio System | UHF(4ch) | UHF(1ch) | - | - | - | - |
| Trunk Cable: | | | | | | |
| Section | HRE-BTR | MTE-MRB | BUL-KZE | MVO-GTU | GTU-CHS | KWE-NKI |
| Circuit Length (km) | 56 | 69(MTE-NYZ) 67(NYZ-MRB) | 107 | 66(MVO-CHS) 35(CHS-GTU) | 35 | 100 |
| System | OW Carrier | OW Carrier | OW Carrier | OW Carrier | OW Carrier | Not Exist |
| No. of Channels | 24 | 24 | 24 | 24 | 15 | Not Exist |
| (No. of Leased Circuits) | - | - | - | 3 | - | - |
| No. of Telex Terminals | 0 | 1 | 1 | 3 | 0 | 0 |
| Maintenance/Operation | | | | | | |
| No. of Staff | 9 | 3 | 3 | 6 | 2 | 0 |
| No. of Vehicles | 2 | 1 | 1 | 0 | 1 | 0 |

Remarks:

EPL : Electronic Party Line
MPL : Manual Party Line
SS,3P : Single Standby, 3-Phase
Cdt/Brd/Arl : Conduit/Buried/Aerial

CCP : Colour Coded Polyethylene Insulated and Polyethylene Sheathed Cable
SD : Self-Supporting Distribution Wire
OW : Open Wire

Note: Figure with * mark denotes number of subscribers who are being served from adjacent exchange areas.

Legend

BRA : Basic Rental Area
&bull; : Existing Subscribers
o : Waiting Applicants
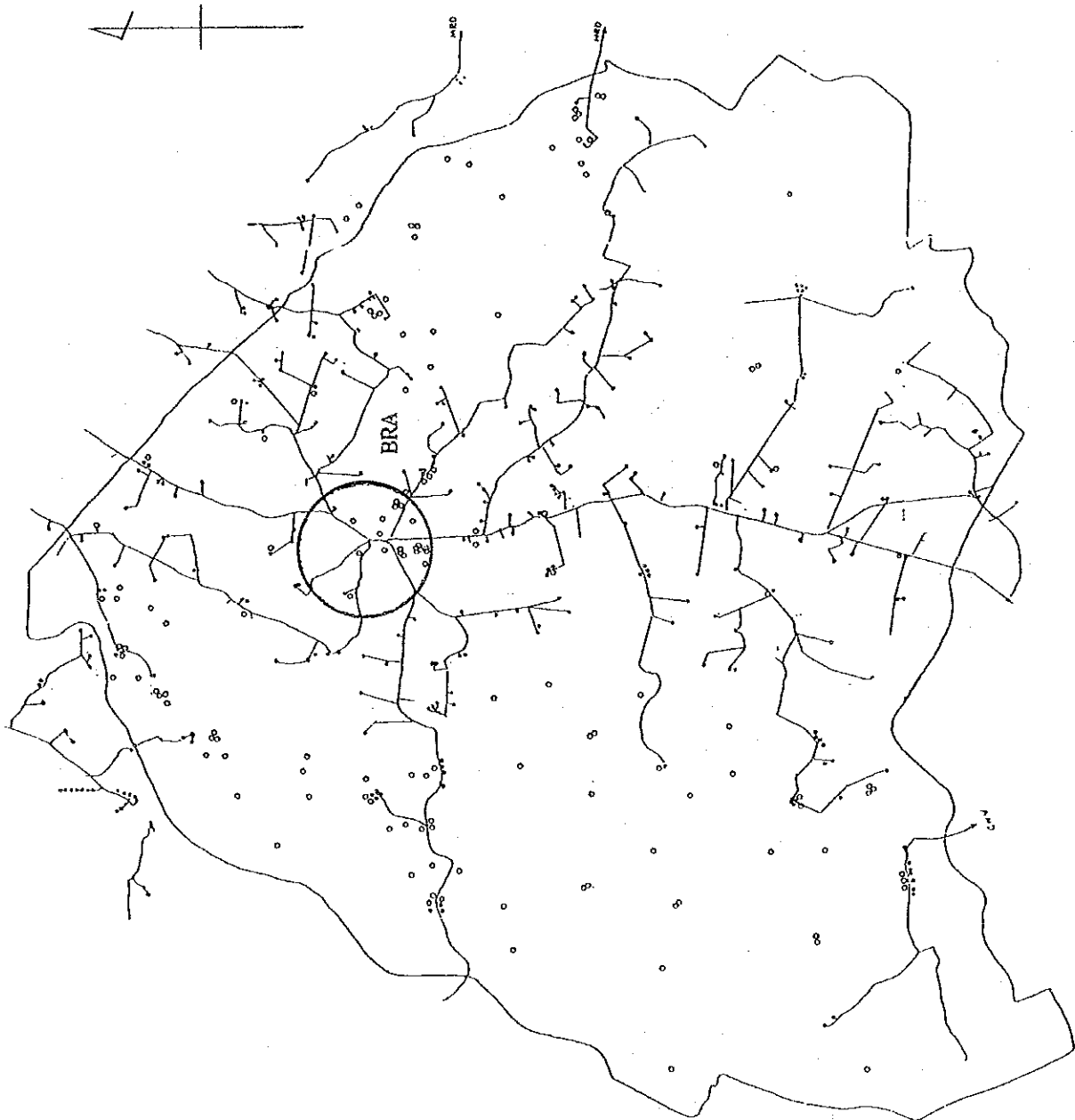
Figure 4.2 (1/6)    Existing Subscribers' Distribution/Line in Beatrice

BRA
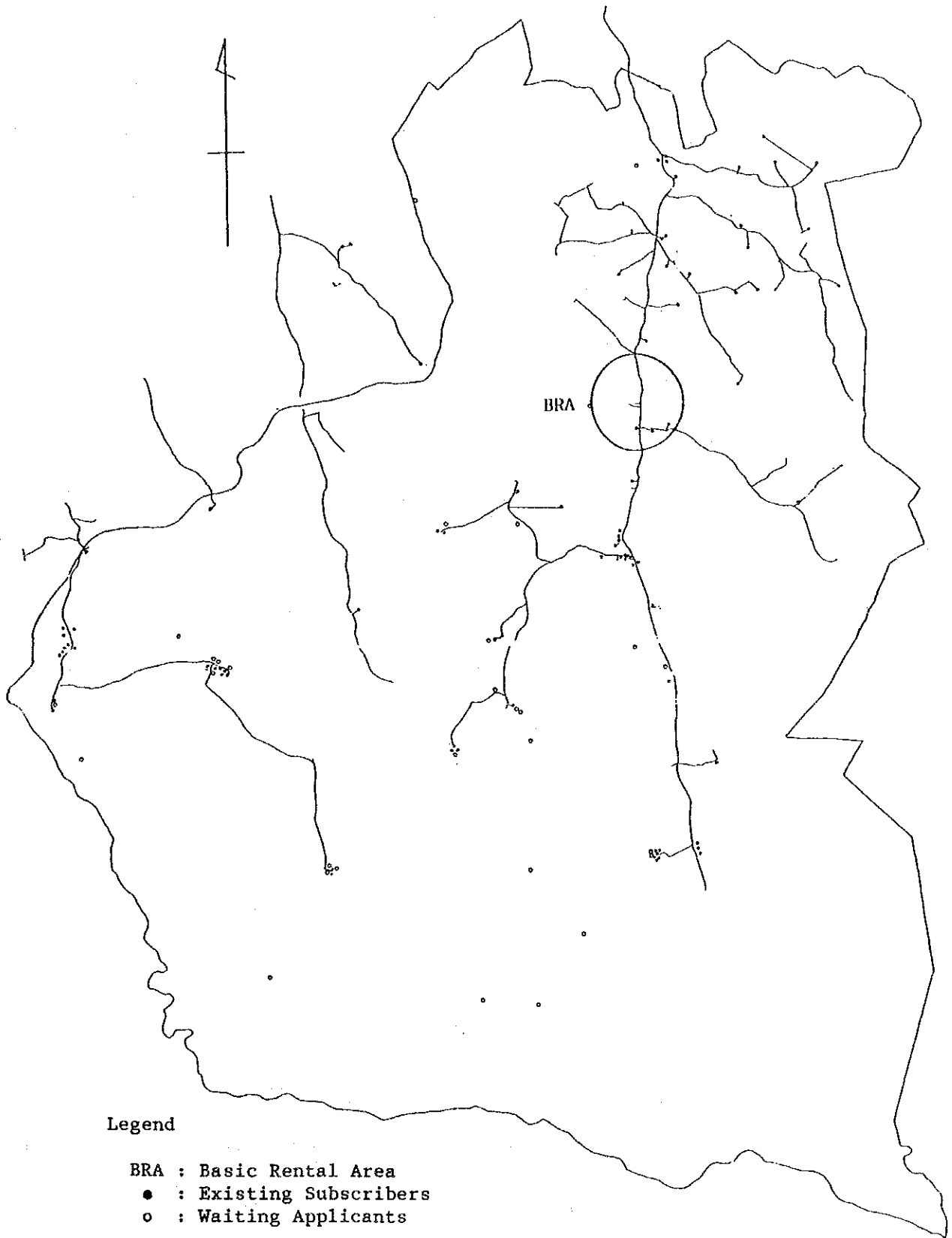
Legend

BRA : Basic Rental Area
● : Existing Subscribers
o : Waiting Applicants

**Figure 4.2 (2/6)　Existing Subscribers' Distribution/Line in Kezi**

BRA

Legend

BRA : Basic Rental Area
● : Existing Subscribers
o : Waiting Applicants
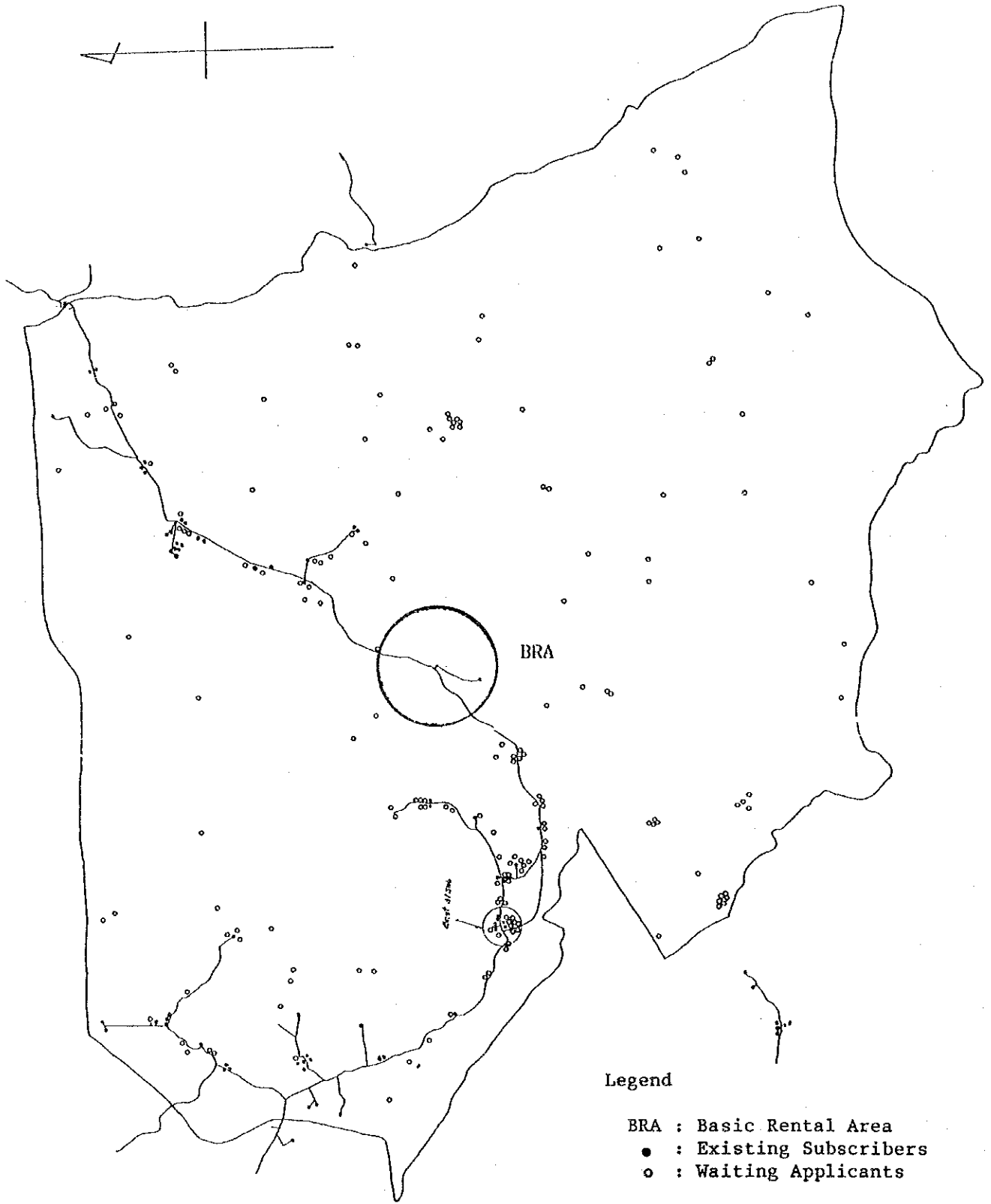
Figure 4.2 (3/6)    Existing Subscribers' Distribution/Line in Murambinda

Legend

BRA : Basic Rental Area
 ● : Existing Subscribers
 ○ : Waiting Applicants
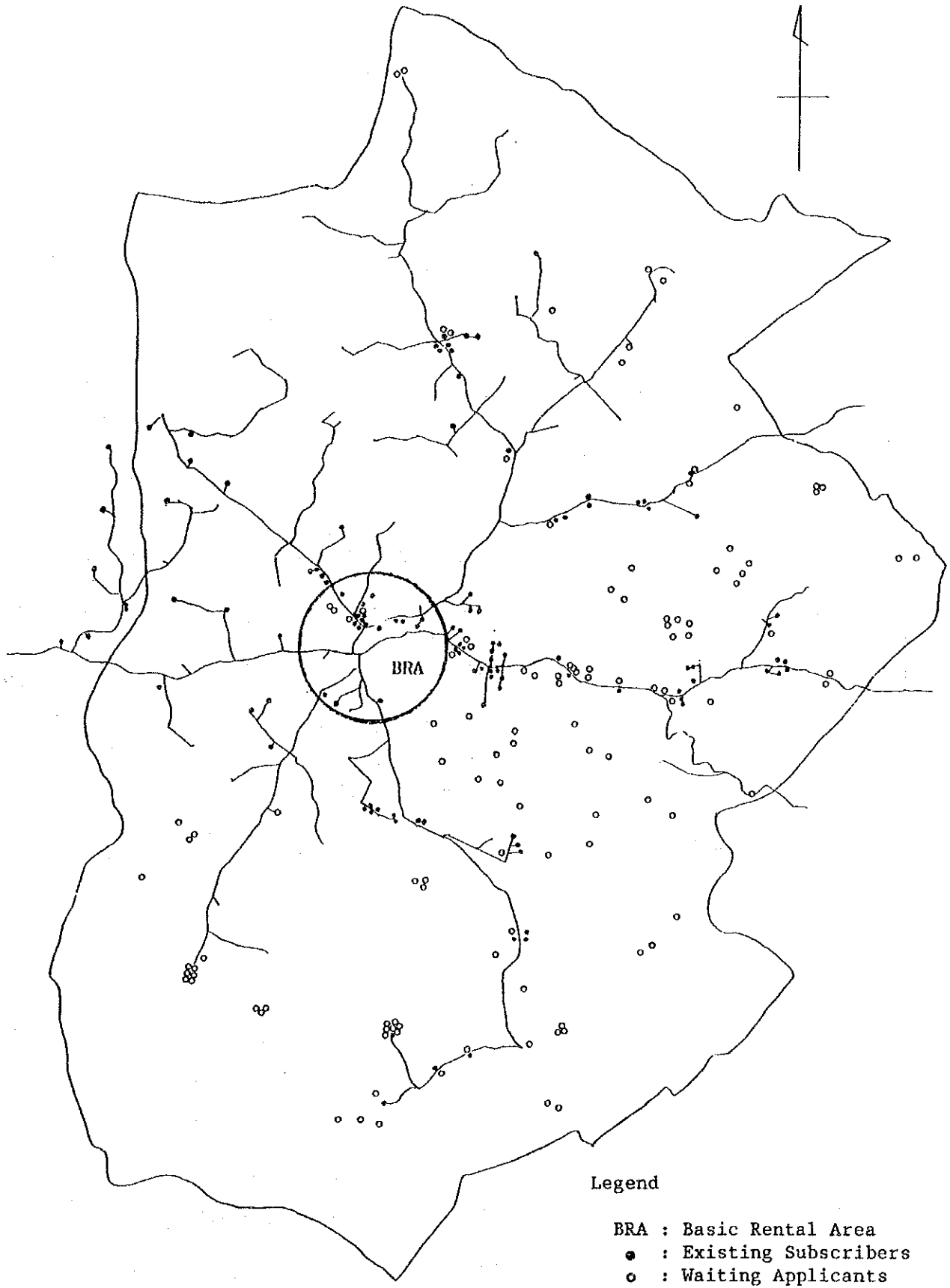
**Figure 4.2 (4/6)    Existing Subscribers' Distribution/Line in Gutu**

Legend

BRA : Basic Rental Area
 ● : Existing Subscribers
 ○ : Waiting Applicants
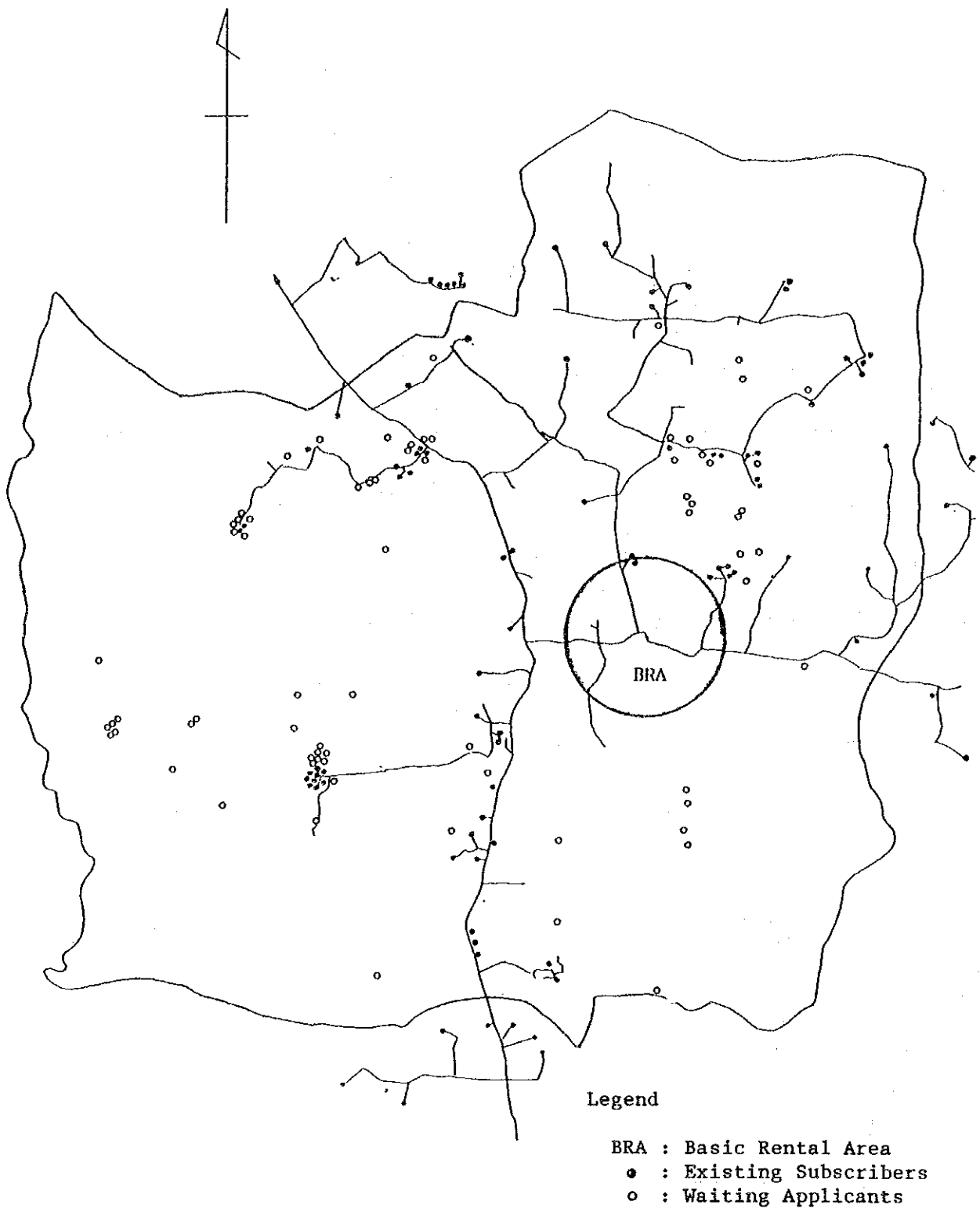
Figure 4.2 (5/6)    Existing Subscribers' Distribution/Line in Chatsworth

Legend

BRA : Basic Rental Area
● : Existing Subscribers
o : Waiting Applicants

**Figure 4.2 (6/6)    Existing Subscribers' Distribution/Line in Nkayi**
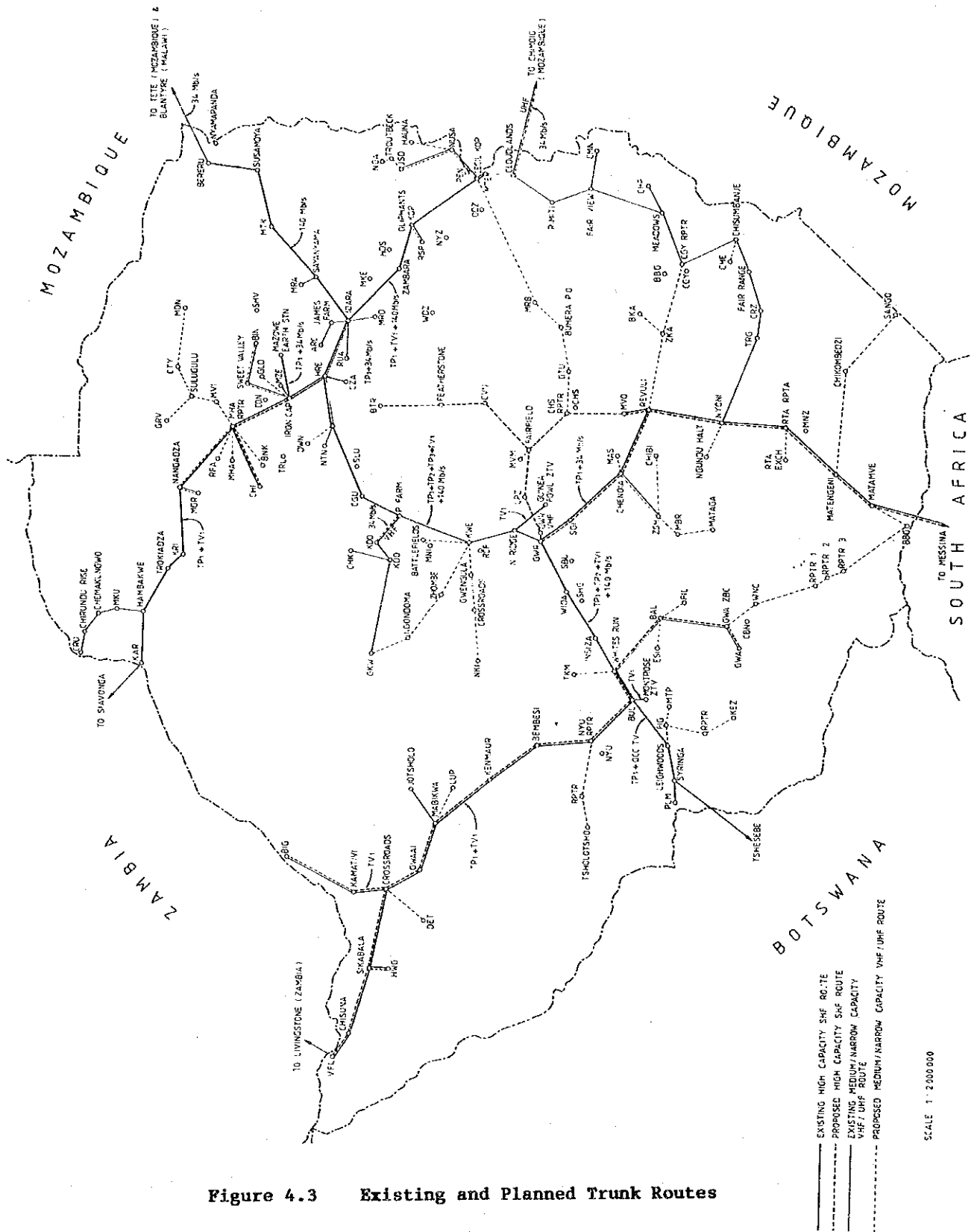
Figure 4.3    Existing and Planned Trunk Routes
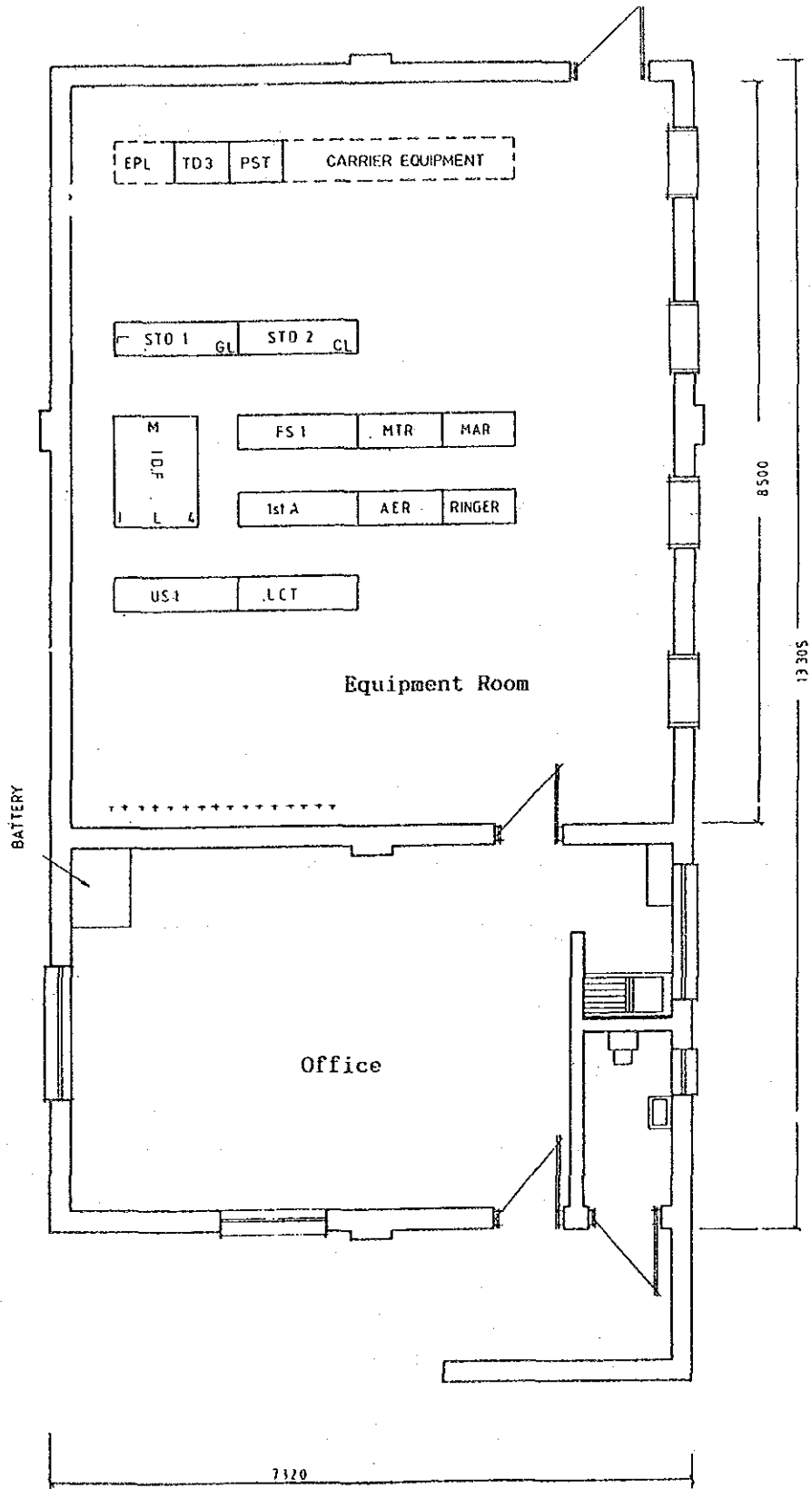
Figure 4.4   Typical Building Floor Layout
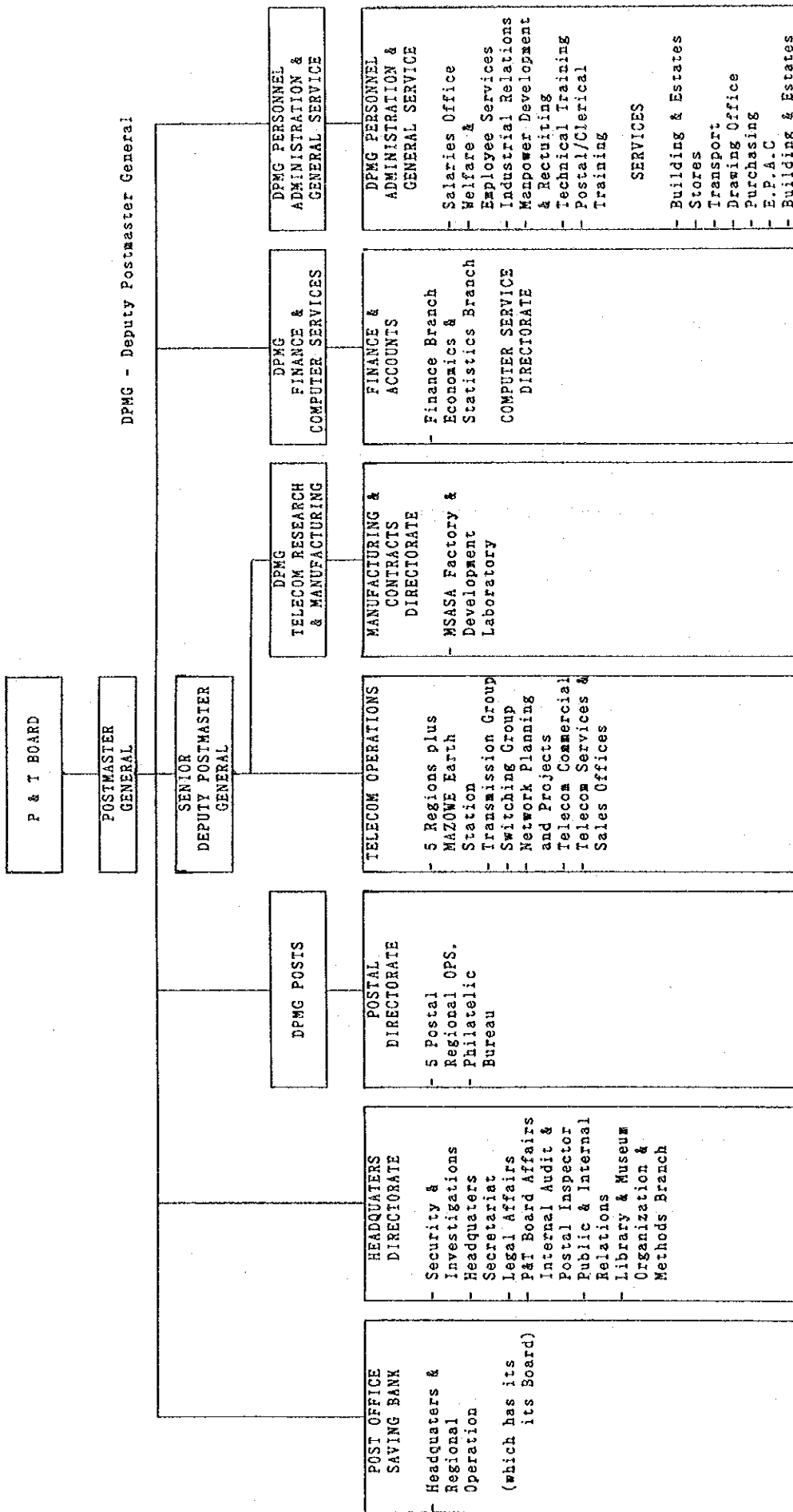
**Figure 4.5   Organization of PTC**

DPMG – Deputy Postmaster General

**P & T BOARD** → **POSTMASTER GENERAL** → **SENIOR DEPUTY POSTMASTER GENERAL**

**POST OFFICE SAVING BANK**
- Headquaters & Regional Operation

(which has its its Board)

**HEADQUATERS DIRECTORATE**
- Security & Investigations
- Headquaters Secretariat
- Legal Affairs
- P&T Board Affairs
- Internal Audit & Postal Inspector
- Public & Internal Relations
- Library & Museum
- Organization & Methods Branch

**DPMG POSTS**

**POSTAL DIRECTORATE**
- 5 Postal Regional OPS.
- Philatelic Bureau

**TELECOM OPERATIONS**
- 5 Regions plus MAZOWE Earth Station
- Transmission Group
- Switching Group
- Network Planning and Projects
- Telecom Commercial
- Telecom Services & Sales Offices

**DPMG TELECOM RESEARCH & MANUFACTURING**

**MANUFACTURING & CONTRACTS DIRECTORATE**
- MSASA Factory & Development Laboratory

**DPMG FINANCE & COMPUTER SERVICES**

**FINANCE & ACCOUNTS**
- Finance Branch
- Economics & Statistics Branch

COMPUTER SERVICE DIRECTORATE

**DPMG PERSONNEL ADMINISTRATION & GENERAL SERVICE**

**DPMG PERSONNEL ADMINISTRATION & GENERAL SERVICE**
- Salaries Office
- Welfare & Employee Services
- Industrial Relations
- Manpower Development & Recruiting
- Technical Training
- Postal/Clerical Training

SERVICES
- Building & Estates
- Stores
- Transport
- Drawing Office
- Purchasing
- E.P.A.C
- Building & Estates

# SECTION 5  DEMAND FORECAST

# SECTION 5 DEMAND FORECAST

## 5.1 Purpose

The main purpose of telephone demand forecasting in this study is to examine the growth in telephone subscriber demand and to provide the basis for the economic and technical study of telecommunications network development in the Study areas.

## 5.2 The Area to be Forecasted

The areas to be forecasted in this study are;

| | | | |
|---|---|---|---|
| a) BEATRICE | Exchange | MASHONALAND | Region |
| b) KEZI | Exchange | MATABELELAND | Region |
| c) MURAMBINDA | Exchange | MANICALAND | Region |
| d) CHATSWORTH | Exchange | MASVINGO | Region |
| e) GUTU | Exchange | MASVINGO | Region |
| f) NKAYI | Exchange | MIDLANDS | Region |

Refer to Figure 5.1 (1/6-6/6), "Study Area".

Prior to forecasting demand, the boundary of exchange area was reviewed based on the suggestion given in the Telecommunication Development Plan (1986-2005). Namely, present boundary which being artificially drawn midway between two adjacent exchanges was reviewed so as to correspond to administrative and/or physical boundary like big river, railway line, as much as possible.
And an area where extending uncultivated land or less people being habited without telephone was considered as a possible boundary.

Hence, slight modifications were made to the original ones as shown in Figure 5.1 (1/6-6/6), "Study Area".

## 5.3 Method of Forecasting

Telephone demand for each Study area is estimated by Microscopic (Bottom-up) forecast method and by Macroscopic (Top-down) to verify the demand estimated by the Microscopic method.

### 5.3.1 Macroscopic Forecast Method

Macroscopic demand forecast is conducted based on the historical data, e.g., telephone growth, nationwide population, Gross Domestic Product (GDP) and GDP per capita by applying 3 forecasting models; General economical model, Logistic curve model, and Model of relationship between telephone density and GDP per capita.
Nationwide macroscopic demand obtained are projected to respective provinces and exchanges based on the method applied in the Telecommunication Development Plan (1986-2005) issued by ITU.

### 5.3.2 Microscopic Forecast Method

Microscopic demand forecast for each Study area is conducted by estimating the inhabitants number and their incomes and average expenditure level which can be spent for telephone charges based on the present telephone tariff system. Thus, number of inhabitants who can afford service is considered as telephone demand. Statistical data is utilized for the forecasting.

### 5.4 Forecasted Year

Forecasting base year is set as 1991. Successive forecasts are made every 5-year interval up to 2011 for 20 years.

### 5.5 Macroscopic Forecast

### 5.5.1 Nationwide Macroscopic Demand

(1) Population Forecast

The population of each forecasted year is based on the data of National Census, "POPULATION PROJECTIONS OF ZIMBABWE (1982 to 2032)" issued by Central Statistical Office in 1986.
The population for each forecasted year is shown below;

| Year | 1991 | 1996 | 2001 | 2006 | 2011 |
|------|------|------|------|------|------|
| Population ('000) | 9,620 | 10,890 | 12,200 | 13,550 | 14,870 |

## (2) Gross Domestic Product (GDP) Forecast

According to the statistical data "National Income and Expenditure Report 1990" issued by Central Statistical Office, the growth of GDP (at 1980 factor cost) from 1986 to 1990 and GDP/capita on same years are as follows.

| Year | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|
| GDP (Z$ M) | 3,881 | 3,861 | 4,144 | 4,332 | 4,414 |
| GDP/capita (Z$) | 461.7 | 446.9 | 466.8 | 474.8 | 471.1 |

* 1988, 1989 and 1990 are provisional figure.

The average growth rate of GDP per annum is assumed at 3.9 % based on the consideration of above statistical data and the National Development Plan (1986-1990) stated that GDP growth rate will reach a level of 5 % per annum at the end of the Plan.

The estimated amount of GDP and GDP/capita for each forecasted year is shown below;

| Year | 1991 | 1996 | 2001 | 2006 | 2011 |
|---|---|---|---|---|---|
| GDP (Z$ M) | 4,591 | 5,657 | 6,911 | 8,299 | 9,871 |
| GDP/capita (Z$) | 477.2 | 519.3 | 566.3 | 612.4 | 663.6 |

## (3) Application of Model for Forecasting

Models applied for demand forecast are given below.

a) General Econometric Model

Generally, there is a good correlation between the GDP per capita and the telephone density, and the following is the expression which shows relation between the telephone density and GDP per capita;

$$Log_{10} (D_{t2}/D_{t1}) = a + b \, Log_{10} (I_2/I_1)$$

where,

$D_{t1}$, $D_{t2}$ are the telephone densities in the years, $t_1$ and $t_2$

$I_1$, $I_2$ are the GDP per capita in the years, $t_1$ and $t_2$

if,         $Y = Log_{10} (D_{t2}/D_{t1})$

            $X = Log_{10} (I_2/I_1)$

therefore,   $Y = a + (b*X)$

As a result, the constants obtained are, $a = (2.10259 \times 10^{-3})$ and $b = (1.3825719)$, and estimated demand is shown below;

| Year | 1991 | 1996 | 2001 | 2006 | 2011 |
|------|------|------|------|------|------|
| Demand Density/100 | 193,100 2.06 | 252,400 2.37 | 327,300 2.74 | 415,600 3.13 | 523,500 3.58 |

b) Logistic Curve Model

The Logistic curve model expression which describes telephone density in terms of the maximum expected density is given below;

The maximum density of 25 per 100 population is adopted, assuming that 1 (one) family could have 1 (one) telephone.

$$D_{tph} = D_{max}/(1+a*e^{(-b(T-To))})$$

where,    $D_{max}$ is the maximum expected density.
          a and b are constants to be calculated by past data.
          $T_o$ is the base Year for forecast 1991.
          T is the year to be forecasted.

if,     $Y = 1/D_{tph}$,   $D_{max} = 25$,   $X = (T-T_o)$

        $Y = (1+a*e^{(-b*X)})/25$

        $Y-1/25 = (a/25)e^{(-b*X)}$

        $Y-1/25 = Y"$

$$\ln(Y'') = \ln(a/25) - b*X$$

$$Y'' = \ln(Y''), \quad A = \ln(a/25), \quad B = -b$$

$$Y'' = A + B*X$$

$$D_{tph} = 1/Y = 1/(Y''+(1/25)) = 1/(e^{Y''}+1/25)$$

therefore, $\quad b = -B, \quad a = 25 * e^A$

As a result, the constants obtained are, $a = (14.829609)$ and $b = (0.03825)$, and estimated demand is shown below;

| Year | 1991 | 1996 | 2001 | 2006 | 2011 |
|---|---|---|---|---|---|
| Demand Density/100 | 157,500 1.64 | 213,000 1.95 | 284,200 2.33 | 374,700 2.77 | 486,600 3.27 |

c) Model of the Relationship between Telephone Density and GDP/Capita

The expression is given below;

$$D_{tph} = a*(GDP/Cap)^b$$

therefore, $\ln(D_{tph}) = \ln(a) + b*\ln(GDP/Cap)$

$$Y = \ln(D_{tph}), \quad A = \ln(a), \quad X = \ln(GDP/Cap)$$

then, $\quad Y = A + bX$

As a result, the constants obtained are, $a = (0.06)$ and $b = (0.6)$, and estimated demand is shown below;

| Year | 1991 | 1996 | 2001 | 2006 | 2011 |
|---|---|---|---|---|---|
| Demand Density/100 | 233,600 2.43 | 278,300 2.55 | 328,400 2.69 | 382,300 2.82 | 440,300 2.96 |

## (4) Total Macroscopic Demand

The growth curves obtained from the results of these 3 models are shown
in Figure 5.2 (1/3-3/3) and these 3 curves show almost good correlation
within a forecast period, thus the middle curve may reasonably be
adopted as a nationwide demand. And the other 2 curves are considered
as upper and lower cases. Inevitably, a possible margin of error is to
be considered in the long term forecast.

## 5.5.2 Projection of Macroscopic Demand

### (1) Projection of Demand to each Province Area

The method of demand projection to each province area is quoted as the
same proportion stated in the Telecommunication Development Plan 1986-
2005 and the results are mentioned below;

Demand for each Province

| Province | 1991 | 1996 | 2001 | 2006 | 2011 |
|----------|------|------|------|------|------|
| Manicaland | 8,700 | 12,200 | 15,400 | 19,500 | 25,300 |
| Mashonaland | 98,300 | 130,400 | 171,100 | 225,000 | 292,200 |
| Masvingo | 6,700 | 9,100 | 11,800 | 15,300 | 19,900 |
| Midlands | 12,100 | 16,900 | 22,200 | 30,200 | 39,200 |
| Matabeleland | 31,700 | 44,400 | 63,700 | 84,700 | 111,000 |
| Total | 157,500 | 213,000 | 284,200 | 374,700 | 486,600 |

### (2) Macroscopic Demand in each Study Area

The method of demand projection to each exchange area is quoted as the
same proportion stated in the Telecommunication Development Plan 1986 -
2005 and the results are mentioned below;

Demand for each Study Area

| Exchange | 1991 | 1996 | 2001 | 2006 | 2011 |
|----------|------|------|------|------|------|
| BEATRICE | 311 | 426 | 556 | 741 | 962 |
| KEZI | 149 | 206 | 275 | 399 | 518 |
| MURAMBINDA | 143 | 200 | 263 | 342 | 444 |
| CHATSWORTH | 152 | 206 | 281 | 370 | 481 |
| GUTU | 400 | 555 | 702 | 969 | 1,258 |
| NKAYI | 102 | 161 | 175 | 228 | 296 |
| Total | 1,257 | 1,754 | 2,252 | 3,049 | 3,959 |

## 5.6    Microscopic Forecast

### 5.6.1  Definition of Telephone Demand

In this study, the number of existing DELs (Direct Exchange Line), an applicant of DEL and a person having a financial capability to afford DEL connection are counted as the demand.  Therefore, subscribers of party line and applicants thereof are not counted as part of the demand.

As recommended in the Local Network Planning, party line system is considered as a temporary solution and not recommended for planning purpose and should be avoided wherever possible.

Therefore, party line subscribers will be transferred to DEL systems when additional equipment and facilities are provided in future, although these party line systems are making a great contribution to communications between people in this country at present.

Transfer plan from party line to DEL is given in Section 7.1, "Demand Fulfillment Plan".

### 5.6.2  Category of Telephone Demand

For forecasting the demand of each Study area, the telephone demands are classified into four categories as follows;

a) Residential : including residence, communal farmer, small scale farmer, large scale farmer and any habitants engaged with any works.

b) Business    : including bank, supermarket, shops, office, mines, factories, and any other home industries.

c) Governmental: including governmental office, police station, post office, hospitals, schools and any other public facilities.

d) PCO Demand  : Public call office.

## 5.6.3 Status Quo of the Study Areas

Social activities of the Study areas are mainly farming which consists of communal farmers, small scale commercial farmers and large scale commercial farmers and according to the statistical data, almost 90 % of the population in the area are classified into this industry, thus the remaining 10% are engaged in other industries, e.g., government office, small scale business and mining.

The present situation of telephone services stated in total number and telephone density per 100 persons are mentioned in Table 5.1.

The number of social facilities listed in Table 5.2 are the results based on the survey reports completed by PTC staff in May, 1991.

Table 5.1   Population/Household Number/Telephone Subscriber in 1991

| Items | BTR | KEZ | MRB | NKI | GTU | CHS |
|---|---|---|---|---|---|---|
| Area(km2) | 4,162 | 8,253 | 6,035 | 8,210 | 3,950 | 2,792 |
| Population | 127,200 | 149,800 | 253,400 | 206,700 | 154,800 | 86,900 |
| Density(Pop/km2) | 31 | 18 | 42 | 25 | 39 | 31 |
| Household number | 24,860 | 25,960 | 48,650 | 31,930 | 29,490 | 15,950 |
| - Farming | 22,040 | 23,760 | 44,580 | 28,960 | 26,820 | 14,060 |
| - Civil servant | 1,610 | 1,840 | 2,185 | 2,434 | 1,530 | 1,550 |
| - Others | 1,210 | 360 | 1,885 | 535 | 1,140 | 340 |
| Telephone- DEL | 113 | 58 | 108 | 0 | 250 | 37 |
| subscribers P/L | 235 | 65 | 78 | 66 | 136 | 84 |
| Total | 348 | 123 | 186 | 66 | 386 | 121 |
| Tel. Density/100 | 0.27 | 0.08 | 0.07 | 0.03 | 0.25 | 0.14 |
| Tel. Den. DEL only | 0.08 | 0.04 | 0.04 | 0.00 | 0.16 | 0.04 |

Table 5.2                Number of Social Facilities in 1991

| Exchange | G.O. | SCH. | HOS. | CLI. | POL. | POS. | SHOP | OFF. | MINE | FACT | HOT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BEATRICE | 41 | 90 | 3 | 16 | 3 | 2 | 331 | 4 | 2 | 0 | 0 |
| KEZI | 39 | 91 | 4 | 7 | 4 | 3 | 165 | 0 | 1 | 1 | 1 |
| MURAMBINDA | 41 | 205 | 4 | 22 | 3 | 4 | 637 | 2 | 1 | 0 | 0 |
| NKAYI | 34 | 113 | 3 | 14 | 4 | 1 | 168 | 4 | 1 | 0 | 0 |
| GUTU | 36 | 105 | 2 | 9 | 1 | 2 | 432 | 10 | 0 | 7 | 1 |
| CHATSWORTH | 23 | 62 | 4 | 4 | 1 | 5 | 178 | 0 | 0 | 0 | 0 |

\* G.O.: Government Office, SCH.: School, HOS.: Hospital, CLI.: Clinic, POL.: Police station, POS.: Post office, OFF.: Office, FACT: Factory, HOT.: Hotel

## 5.6.4 Forecasting Procedure

Forecasting procedure in this study is illustrated in Figure 5.3, "Flow Chart for Microscopic Demand Forecast".

## 5.6.5 Forecasting

### (1) Population Forecast of the Study Area

Population data for each Provincial, District Council (DC) and Rural Council (RC) was obtained from the National Census conducted in 1982 and "Population projection of ZIMBABWE (1982 to 2032)" issued by Central Statistical Office in 1986.

The study exchange area consists of several DC and RC, therefore, the area population was obtained by accumulating all related councils' population which was calculated in proportion to size of the concerned. For forecasting purposes, the dispersion of population is assumed equally distributed in the area. Refer to Figure 5.4 (1/6-6/6), "Administrations in the Study Area".

Assuming that the area population is growing at the same rate as mentioned above, the average growth rate per annum is estimated at 2.76 % from 1982 to 1991 and 2.25 % from 1991 to 2011, respectively. Forecast results are shown in Table 5.3, "Population Forecast".

Table 5.3    Population Forecast

| Exchange | 1991 | 1996 | 2001 | 2006 | 2011 |
|---|---|---|---|---|---|
| BEATRICE | 127,200 | 144,400 | 162,100 | 180,800 | 200,000 |
| KEZI | 149,800 | 170,100 | 191,000 | 212,900 | 235,500 |
| MURAMBINDA | 253,400 | 287,800 | 323,100 | 360,200 | 398,500 |
| NKAYI | 206,700 | 234,700 | 263,500 | 293,800 | 325,000 |
| GUTU | 154,800 | 175,800 | 197,300 | 220,000 | 243,400 |
| CHATSWORTH | 86,900 | 98,700 | 110,800 | 123,500 | 136,600 |

## (2) Household Number

Forecasting the household number in an area was done by dividing the figures of population obtained in item (1) above by standard household size (number) which was obtained from the National Census. It is assumed in this study that the size will not be changed in the near future because of the following reasons;

a) Regarding a household size of communal farmers and small scale commercial farmers which holds a high percentage of residents in the area, they normally grow in number within their premises which means a number of household does not change in view point of telephone demand.

b) In a rural area, many families are taking "Large family system". Forecasting results are shown in Table 5.4 (1/6-6/6), "Household number".

Table 5.4 (1/6)   Household Number (BEATRICE EXCHANGE)

| Area | | H/H size | Forecasted year | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1991 | 1996 | 2001 | 2006 | 2011 |
| B-H-SOUTH | RC | 3.94 | 4,800 | 5,452 | 6,120 | 6,824 | 7,549 |
| M-MARIRANGWE | RC | 4.82 | 560 | 636 | 714 | 796 | 881 |
| RUDHAKA | DC | 5.38 | 2,100 | 2,385 | 2,678 | 2,985 | 3,303 |
| FEATHERSTONE | RC | 3.83 | 600 | 681 | 765 | 853 | 944 |
| MHONDORO | DC | 5.48 | 10,800 | 12,267 | 13,771 | 15,354 | 16,985 |
| NGEZI | DC | 5.47 | 6,000 | 6,815 | 7,651 | 8,530 | 9,436 |
| TOTAL | | 5.12 | 24,860 | 28,237 | 31,699 | 35,342 | 39,097 |

Table 5.4 (2/6)    Household Number (KEZI EXCHANGE)

| Area | | H/H size | Forecasted year | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1991 | 1996 | 2001 | 2006 | 2011 |
| MATOBO | DC | 5.99 | 16,100 | 18,287 | 20,529 | 22,889 | 25,320 |
| S-MATOPOS | RC | 3.00 | 2,000 | 2,272 | 2,550 | 2,843 | 3,145 |
| B-MANGWE | DC | 6.11 | 7,200 | 8,178 | 9,181 | 10,236 | 11,323 |
| GWANDA | DC | 6.25 | 160 | 182 | 204 | 227 | 252 |
| B-MANGWE | RC | 4.60 | 500 | 568 | 638 | 711 | 786 |
| TOTAL | | 5.77 | 25,960 | 29,486 | 33,101 | 36,906 | 40,827 |

Table 5.4 (3/6)  Household Number (MURAMBINDA EXCHANGE)

| Area | | H/H size | Forecasted year | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1991 | 1996 | 2001 | 2006 | 2011 |
| BUHERA | DC | 5.21 | 32,700 | 37,142 | 41,695 | 46,488 | 51,427 |
| CHIKOMBA | DC | 5.02 | 9,800 | 11,131 | 12,496 | 13,932 | 15,412 |
| ZIYAMBE | RC | 5.92 | 1,300 | 1,477 | 1,658 | 1,848 | 2,045 |
| GUTU | DC | 5.33 | 4,800 | 5,452 | 6,120 | 6,824 | 7,549 |
| CHIVHU | RC | 8.00 | 50 | 57 | 64 | 71 | 79 |
| TOTAL | | 5.21 | 48,650 | 55,258 | 62,033 | 69,164 | 76,512 |

Table 5.4 (4/6)  Household Number (NKAYI EXCHANGE)

| Area | | H/H size | Forecasted year | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1991 | 1996 | 2001 | 2006 | 2011 |
| NKAYI | DC | 6.68 | 16,700 | 18,968 | 21,294 | 23,742 | 26,264 |
| BUBI | RC | 5.33 | 150 | 170 | 191 | 213 | 236 |
| MASHAMBAHOU | DC | 6.28 | 14,000 | 15,902 | 17,851 | 19,903 | 22,018 |
| KWEKWE | RC | 3.85 | 130 | 148 | 166 | 185 | 204 |
| V-U-NGEZI | RC | 6.00 | 150 | 170 | 191 | 213 | 236 |
| GHEZIA-GOKWE | DC | 6.25 | 800 | 909 | 1,020 | 1,137 | 1,258 |
| GWAMURA | F.L. | - | - | - | - | - | - |
| LAKE ALICE | F.L. | - | - | - | - | - | - |
| TOTAL | | 6.47 | 31,930 | 36,267 | 40,714 | 45,393 | 50,216 |

Table 5.4 (5/6)  Household Number (GUTU EXCHANGE)

| Area | | H/H size | Forecasted year | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1991 | 1996 | 2001 | 2006 | 2011 |
| GUTU | DC | 5.28 | 28,700 | 32,598 | 36,595 | 40,801 | 45,137 |
| G-CHATSWORTH | RC | 4.30 | 790 | 897 | 1,007 | 1,123 | 1,242 |
| TOTAL | | 5.25 | 29,490 | 33,496 | 37,602 | 41,925 | 46,379 |

Table 5.4 (6/6)  Household Number (CHATSWORTH EXCHANGE)

| Area | | H/H size | Forecasted year | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1991 | 1996 | 2001 | 2006 | 2011 |
| GUTU | DC | 5.37 | 1,900 | 2,158 | 2,423 | 2,701 | 2,988 |
| G-CHATSWORTH | RC | 4.32 | 950 | 1,079 | 1,211 | 1,351 | 1,195 |
| MASVINGO | DC | 5.76 | 3,400 | 3,862 | 4,335 | 4,834 | 5,347 |
| TAKAWIRA | DC | 5.46 | 9,700 | 11,018 | 12,368 | 13,790 | 15,255 |
| TOTAL | | 5.45 | 15,950 | 18,116 | 20,338 | 22,675 | 25,085 |

## (3) Income Level of Study Area

### a) Present Income Level

Present average income level of each Study area is calculated based on the interview results which were carried out during the field survey and the results are shown in Table 5.5, "Annual Income Level by Categories".

Table 5.5    Annual Income Level by Categories

| Income Lev.(Z$) | BTR | KEZ | MRB | NKI | GTU | CHS |
|---|---|---|---|---|---|---|
| Less than 1000 | 18,018 | 22,795 | 40,190 | 28,811 | 5,520 | 4,090 |
| - 2000 | 2,143 | 1,080 | 3,933 | 285 | 18,905 | 8,970 |
| - 3000 | 2,247 | 251 | 1,333 | 499 | 2,565 | 1,083 |
| - 4000 | 110 | 130 | 220 | 150 | 200 | 103 |
| - 5000 | 180 | 185 | 540 | 167 | 200 | - |
| - 10000 | 2,351 | 835 | 1,721 | 1,633 | 1,367 | 1,213 |
| - 15000 | 369 | 370 | 337 | - | 380 | 240 |
| - 20000 | 224 | 145 | 265 | 298 | 255 | 136 |
| - 25000 | 70 | 72 | 70 | 63 | 54 | 50 |
| - 30000 | 28 | 20 | 41 | 22 | 24 | 35 |
| - 35000 | - | - | - | - | - | - |
| More than 35000 | 120 | 77 | - | 2 | 20 | 30 |
| Total | 24,860 | 25,960 | 48,650 | 31,930 | 29,490 | 15,950 |

### b) Income Level for Forecasted Year

Generally, an income increases along with the growth of GDP (Gross Domestic Product). Based on the statistical data named "National Income and Expenditure Report 1990" issued by Central Statistical Office of Zimbabwe Government, the transition of GDP (at 1980 factor cost) from 1985 to 1990 is shown in Table 5.6, GRDP (Gross Regional Domestic Product) data is, however, not available at present.

In consideration of the different forms of economic activities between urban and rural areas, the income growth pattern of habitants in rural areas may not be applied to GDP growth patterns, directly. Since the economical activity is mainly farming, therefore, the growth rate of the agriculture production in the total GDP is observed in this study. Accordingly, the transition of the agriculture production (at 1980 factor cost) within the same period for the GDP is shown in Table 5.6.

Table 5.6    Growth Rate of GDP and Agriculture Production

| Z$ (M) | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | G.rate |
|--------|------|------|------|------|------|------|------|------|------|------|------|--------|
| GDP | 3224 | 3537 | 3589 | 3461 | 3540 | 3803 | 3881 | 3861 | 4144 | 4332 | 4414 | 3.19% |
| Agr.P. | 451 | 515 | 478 | 403 | 496 | 614 | 576 | 472 | 592 | 587 | 548 | 1.97% |

The Zimbabwe Government is making an endeavor to achieve the 5 year
National Development Plan (1991 to 1995).

In accordance with the Plan, GDP growth rate will reach a level of 5% at
the end of the Plan.

In consideration of the above, the income growth rate per annum in the
Study areas is given in Table 5.7.

Table 5.7    Income Growth Rate per Annum

| Year | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 – '11 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----------|
| Income G.rate(%) | 2.0 | 2.2 | 2.3 | 2.4 | 2.5 | 2.4 | 2.3 | 2.2 | 2.1 | 2.0 | ---- 2.0 |

## (4) Minimum Income Level for Subscriber

a) PTC's Tariff System

Present PTC's tariff system for telephone subscribers is summarized in
Table 5.8, "Tariff System".

Table 5.8        Tariff System

| Charges | BRA | | Out of BRA | | | |
|---------|-----|-----|------------|---|-----|---|
| Z$ | DEL | P/L | DEL | | P/L | |
| Installation Charges | 87.20 | 87.20 | First 16km from BRA | 87.20+ 199.20 per km | First 5km from BRA | 87.20+ 174.30 per km |
| | – | – | 16 – 32km | +99.60 per km | 5km over | +348.60 per km |
| | – | – | 32km over | +49.80 per km | – | – |
| Rental Charges/M. | 8.75 | 9.60 | From BRA Every 500m | 8.75+ +3.10 | From Ex.8km Over 8km Every 500m | 9.60 9.60 +0.70 |

* P/L :    The case of metered automatic, electronic, digital
           and radio telephone party lines.

Local call:    0.1665 per 3 minutes within an exchange area.
STD    call:   Depends on distance and duration.

b) Estimation of Average Payment

According to PTC's tariff system mentioned above, the effective demand varies by distance from the exchange.

Therefore, minimum required income level was estimated for the possible telephone subscribers by each distance range based on an average monthly payment or annual payment to PTC.

For the estimation purposes, the areas are divided into several zones by the distance from exchange and the value of middle points is considered as a representing point of the zone.

The installation charges and rental charges are estimated directly from the above Table 5.8.

The estimation of number of local calls and STD calls per subscriber in the Study areas are calculated based on the originating traffic volume, BHC (Busiest Hour Call) and call completion rate.

Calculation results are mentioned below.

| Ex. Name | Traffic | | | |
|---|---|---|---|---|
| | O.T. Volume | | No. of calls/day | |
| | L.C. | STD | L.C. | STD |
| BEATRICE | 1.25 Erl | 9.07 Erl | 1.46 | 7.95 |
| KEZI | 0.89 | 4.19 | 1.84 | 6.49 |
| MURAMBINDA | 2.61 | 8.39 | 5.39 | 8.39 |
| NKAYI | (Data is not available.) | | | |
| GUTU | 6.56 | 7.57 | 3.33 | 2.89 |
| CHATSWORTH | 0.96 | 3.85 | 3.65 | 10.95 |
| Average | - | - | 3.13 | 7.33 |

Considering the call completion rate of 60 % and 26 % for local and STD calls respectively, the number of local and STD calls are estimated at 1.9 and 2.0 per day respectively. Results are shown in Table 5.9.

Table 5.9          Estimation of Average Payments

| Area Distance (km) | Inst. Chrg. (Z$) | Rent. Chrg. (Z$) | No. Calls Loc STD (times) | | Av.Tariff Loc (Z$) | STD (Z$) | Total /month (Z$) | Total /year (Z$) |
|---|---|---|---|---|---|---|---|---|
| BRA(5km) | 87.2 | 8.8 | 57 | 60 | 9.49 | 76.8 | 95.0 | 1,140.5 |
| 5 - 25km | 2,079.2 | 70.8 | 57 | 60 | 9.49 | 76.8 | 157.0 | 1,884.5 |
| 25 - 45km | 4,668.8 | 194.8 | 57 | 60 | 9.49 | 76.8 | 281.0 | 3,372.5 |
| 45 - 65km | 5,764.4 | 318.8 | 57 | 60 | 9.49 | 76.8 | 405.0 | 4,860.5 |
| 65 - 85km | 6,760.4 | 442.8 | 57 | 60 | 9.49 | 76.8 | 529.0 | 6,348.5 |

c) Estimation of Minimum Income

The statistical data titled "The Economy of Household in ZIMBABWE 1985" issued by Central Statistical Office is used to estimate the minimum income level for telephone subscribers. Refer to Table 5.10, "Expenditures for Different Items as Percentage of Average".

Table 5.10    Expenditures for Different Items
as Percentage of Average

| Items | C.F | Re. | SSCF | U/Semi | Total |
|---|---|---|---|---|---|
| Food | 39 | 33 | 27 | 31 | 33 |
| Non alcohol | 1 | 0 | 0 | 0 | 0 |
| Alcohol | 1 | 1 | 1 | 1 | 1 |
| Tobacco | 0 | 0 | 0 | 0 | 0 |
| Clothing | 17 | 19 | 17 | 12 | 16 |
| Footwear | 4 | 4 | 4 | 3 | 4 |
| Rent, Fuel | 2 | 3 | 4 | 17 | 7 |
| Furniture | 11 | 9 | 18 | 10 | 12 |
| Medical | 2 | 2 | 1 | 3 | 2 |
| *Transport | 5 | 12 | 13 | 6 | 9 |
| Education | 9 | 8 | 6 | 6 | 7 |
| *Recreation | 3 | 3 | 3 | 4 | 3 |
| *Personal | 4 | 3 | 2 | 4 | 3 |
| *Financial | 1 | 1 | 0 | 1 | 1 |
| Sub total | 99 | 98 | 96 | 98 | 98 |
| Gifts in kind | 1 | 2 | 4 | 2 | 2 |
| Total | 100 | 100 | 100 | 100 | 100 |

C.F : Communal farmer, U/Semi : Urban and Semi-urban
Re  : Resettlement, SSCF: Small scale commercial farmer

It is assumed that 60 % of the total expenditure of the items with * mark in Table 5.10 may be allocated for the payment of telephone charges. The estimation results are mentioned in Table 5.11.

Table 5.11  Minimum Income Level for Subscribers

| Distance | Av. Payment (Z$)/year | Minimum income (Z$)/year |
|---|---|---|
| BRA(5km) | 1,140.5 | 11,880.0 |
| 5 - 25km | 1,884.5 | 19,630.0 |
| 25 - 45km | 3,372.5 | 35,130.0 |
| 45 - 65km | 4,860.5 | 50,630.0 |
| 65 - 85km | 6,348.5 | 66,130.0 |

The estimated minimum incomes for all zones are applied to all income
level habitants. If habitants having less income than the minimum one,
they are not counted as telephone demand.
Habitants having more than the minimum income level are aggregated in
every forecasted year.

The estimated minimum income does not affect the change of telephone
tariff (increment), since such an increment will be absorbed within a
range of income increments.

## (5) Forecast for PCO Demand

As per PTC's guideline, PCO will be provided to the locations of
Hospitals, Clinics, Post offices and so on where first priority is given
in the rural area in consideration of public accessibility and
maintainability from any vandalism.

According to the above guideline, the number of PCOs is expected to be
the same number as these hospitals, clinics and post offices at present
in the Study areas. Therefore, the number of these public facilities is
taken into consideration for forecasting purposes and the estimation
result obtained at present is one PCO per 9,200.

The Population of each forecasting year in the Study area is divided by
this figure, and the results are PCO's demand.

## (6) Forecast for Governmental Demand

The telephone services for public facilities should be given high
priority than others especially in the rural area.
However, there are some difficulties to satisfy their demand owing to,
for instance, insufficient supply of telecommunication facilities and/or
limitation of budgetary measure of the government.

a) Maximum Telephone Demand

The maximum telephone demand for every public facility is assumed
considering the concepts mentioned above. The assumptions made are
mentioned below.

| Within BRA<br>* (Mostly for Main Office) | Out of BRA<br>* (for Branch Office) |
|---|---|
| Government Office --- x2 lines<br>  1 line for a head<br>  1 line for staff: telex/fax<br>School --------------- x1 line<br>Hospital ------------- x2 lines<br>  1 line for Doctor<br>  1 line for staff: telex/fax<br>Clinic --------------- x1 line<br>Police Station ------ x3 lines<br>  1 line for head police st.<br>  1 line for staff<br>  1 line for telex/fax<br>Post Office --------- x2 lines<br>  1 line for post master<br>  1 line for staff: telex/fax | Government Office --- x1 line<br>  1 line for a head: telex/fax<br><br>School --------------- x1 line<br>Hospital ------------- x2 lines<br>  1 line for Doctor<br>  1 line for staff: telex/fax<br>Clinic --------------- x1 line<br>Police Station ------ x2 lines<br>  1 line for head police st.<br>  1 line for staff: telex/fax<br><br>Post Office --------- x1 line<br>  1 line for post master: fax |

b) Growth Rate of Governmental Demand

A growth rate of 8 % per annum obtained from the past data of each Study area is applied for every governmental offices' demand until the demand reaches maximum telephone demand mentioned above.

c) Increment of Number of Offices

Increment of number of public facilities are not considered because foreseeable number of increase is rather limited which is negligible compared with total demand by the following concepts.

Considering the area in early stage, public facilities have to be established for habitants although an area population is rather small and sparsely habitated in a large area, for instance the establishment of a school, the local government office concerned must consider not only the number of pupils but also the distance from their houses, since, class rooms and staff may be increased in proportion to the growth of population but not the number of schools.

(7) Business Demand

Forecasting demand is separated into two categories one is for small scale business such as small shops, offices and home industry where the owner is living within the business premises. The other one is a large scale business such as Bank, Super market, Mining factory, etc.

a) Demand for Small Scale Businesses

The forecasting method of demand takes the same procedure as for
residential demand stated previously.

b) Demand for Large Scale Businesses

In accordance with the observation of each Study area, the existing
number of large scale businesses is very small compared with small scale
businesses as shown in Table 5.2 "Number of Social Facilities in 1991".

Also considering the constitution of population in the area, 90 % of
total inhabitants are engaged in agriculture therefore, the businesses
for supporting these inhabitants will be expected to increase in
proportion to the population growth in future.

It is assumed that the businesses to be increased are small scale
businesses rather than large scale due to the agricultural product scale
in the area and it will be continued in future.
The limited number of large scale businesses likely to increase in
future is not forecasted due to the demand which is assumed as
negligible compared with total demand of the area.
Thus, the existing large scale businesses are given a maximum demand
though they have no telephone at present.

The maximum demand for each type of business is listed below;

| | |
|---|---|
| Bank -------- x 3 lines: | 2 lines for telephone<br>1 line for telex/fax |
| Office ------ x 2 lines: | 1 line for telephone<br>1 line for telex/fax |
| Factory ----- x 2 lines: | 1 line for telephone<br>1 line for telex/fax |
| Supermarket - x 1 line : | 1 line for telephone |
| Hotel ------- x 1 line : | 1 line for telephone |
| Mine -------- x 3 line: | 2 lines for telephone<br>1 line for telex/fax |

## 5.6.6 Result of Microscopic Demand Forecast

### (1) Summary

Total telephone demand for each Study area is obtained by the summation of all results estimated in items mentioned above.
Summary of Forecasted Demand is shown in Table 5.12 (1/7-7/7).

Table 5.12 (1/7)  Summary of Forecasted Demand for Study Area

| Exchange | Forecasted year | | | | | | | | | |
|----------|------|------|------|------|------|------|------|------|------|------|
| | 1991 | | 1996 | | 2001 | | 2006 | | 2011 | |
| | In | BRA/Out | In | BRA/Out | In | BRA/Out | In | BRA/Out | In | BRA/Out |
| BEATRICE | 117 | 216 | 146 | 270 | 205 | 354 | 226 | 441 | 330 | 625 |
| KEZI | 97 | 133 | 130 | 150 | 165 | 192 | 334 | 235 | 357 | 327 |
| MURAMBINDA | 72 | 109 | 86 | 175 | 220 | 267 | 259 | 367 | 296 | 530 |
| CHATSWORTH | 53 | 107 | 70 | 147 | 121 | 218 | 136 | 306 | 149 | 444 |
| GUTU | 288 | 80 | 357 | 128 | 705 | 187 | 777 | 262 | 850 | 390 |
| NKAYI | 78 | 83 | 91 | 132 | 198 | 198 | 215 | 241 | 238 | 312 |
| SUB-TOTAL | 705 | 728 | 880 | 1002 | 1614 | 1416 | 1947 | 1852 | 2220 | 2628 |
| TOTAL | 1443 | | 1882 | | 3030 | | 3799 | | 4848 | |

Table 5.12 (2/7)  Summary of Forecasted Demand for Study Area
(BEATRICE Exchange)

| Categories | Forecasted year | | | | |
|-----------|------|------|------|------|------|
| | 1991 | 1996 | 2001 | 2006 | 2011 |
| 1) Residential | 246 | 294 | 358 | 431 | 664 |
| 2) Shop/Office/Mine | 33 | 47 | 99 | 107 | 122 |
| 3) Govern. office | 40 | 59 | 84 | 109 | 147 |
| 4) Business = 2)+3) | 73 | 106 | 183 | 216 | 269 |
| 5) PCO | 14 | 16 | 18 | 20 | 22 |
| 6) TOTAL = 1)+4)+5) | 333 | 416 | 559 | 667 | 955 |
| 7) Population/100 | 1272 | 1444 | 1621 | 1808 | 2000 |
| 8) Demand density | 0.26 | 0.29 | 0.34 | 0.36 | 0.48 |

Table 5.12 (3/7)   Summary of Forecasted Demand for Study Area
(KEZI Exchange)

| Categories | Forecasted year | | | | |
|---|---|---|---|---|---|
| | 1991 | 1996 | 2001 | 2006 | 2011 |
| 1) Residential | 154 | 178 | 210 | 396 | 473 |
| 2) Shop/Office/Mine | 15 | 18 | 41 | 45 | 50 |
| 3) Govern.office | 45 | 66 | 85 | 105 | 135 |
| 4) Business = 2)+3) | 60 | 84 | 126 | 150 | 185 |
| 5) PCO | 16 | 18 | 21 | 23 | 26 |
| 6) TOTAL = 1)+4)+5) | 230 | 280 | 357 | 569 | 684 |
| 7) Population/100 | 1498 | 1701 | 1910 | 2129 | 2355 |
| 8) Demand density | 0.15 | 0.16 | 0.19 | 0.28 | 0.29 |

Table 5.12 (4/7)   Summary of Forecasted Demand for Study Area
(MURAMBINDA Exchange)

| Categories | Forecasted year | | | | |
|---|---|---|---|---|---|
| | 1991 | 1996 | 2001 | 2006 | 2011 |
| 1) Residential | 53 | 79 | 143 | 217 | 317 |
| 2) Shop/Office/Mine | 57 | 86 | 217 | 244 | 291 |
| 3) Govern.office | 44 | 65 | 92 | 126 | 175 |
| 4) Business = 2)+3) | 101 | 151 | 309 | 370 | 466 |
| 5) PCO | 27 | 31 | 35 | 39 | 43 |
| 6) TOTAL = 1)+4)+5) | 181 | 261 | 487 | 626 | 826 |
| 7) Population/100 | 2534 | 2878 | 3231 | 3602 | 3985 |
| 8) Demand density | 0.07 | 0.09 | 0.15 | 0.17 | 0.21 |

Table 5.12 (5/7)   Summary of Forecasted Demand for Study Area
(CHATSWORTH Exchange)

| Categories | Forecasted year | | | | |
|---|---|---|---|---|---|
| | 1991 | 1996 | 2001 | 2006 | 2011 |
| 1) Residential | 120 | 157 | 250 | 328 | 445 |
| 2) Shop/Office/Mine | 5 | 11 | 21 | 23 | 28 |
| 3) Govern.office | 26 | 38 | 56 | 78 | 105 |
| 4) Business = 2)+3) | 31 | 49 | 77 | 101 | 133 |
| 5) PCO | 9 | 11 | 12 | 13 | 15 |
| 6) TOTAL = 1)+4)+5) | 160 | 217 | 339 | 442 | 593 |
| 7) Population/100 | 869 | 987 | 1108 | 1235 | 1366 |
| 8) Demand density | 0.18 | 0.22 | 0.31 | 0.36 | 0.43 |

Table 5.12 (6/7)  Summary of Forecasted Demand for Study Area
(GUTU Exchange)

| Categories | Forecasted year | | | | |
|---|---|---|---|---|---|
| | 1991 | 1996 | 2001 | 2006 | 2011 |
| 1) Residential | 198 | 269 | 435 | 524 | 661 |
| 2) Shop/Office/Mine | 91 | 110 | 337 | 374 | 410 |
| 3) Govern.office | 63 | 87 | 99 | 117 | 143 |
| 4) Business = 2)+3) | 154 | 197 | 436 | 491 | 553 |
| 5) PCO | 16 | 19 | 21 | 24 | 26 |
| 6) TOTAL = 1)+4)+5) | 368 | 485 | 892 | 1039 | 1240 |
| 7) Population/100 | 1548 | 1758 | 1973 | 2200 | 2434 |
| 8) Demand density | 0.24 | 0.28 | 0.45 | 0.47 | 0.51 |

Table 5.12 (7/7)  Summary of Forecasted Demand for Study Area
(NKAYI Exchange)

| Categories | Forecasted year | | | | |
|---|---|---|---|---|---|
| | 1991 | 1996 | 2001 | 2006 | 2011 |
| 1) Residential | 82 | 123 | 236 | 270 | 330 |
| 2) Shop/Office/Mine | 24 | 28 | 74 | 81 | 87 |
| 3) Govern.office | 33 | 47 | 57 | 73 | 98 |
| 4) Business = 2)+3) | 57 | 75 | 131 | 154 | 185 |
| 5) PCO | 22 | 25 | 29 | 32 | 35 |
| 6) TOTAL = 1)+4)+5) | 161 | 223 | 396 | 456 | 550 |
| 7) Population/100 | 2067 | 2347 | 2635 | 2938 | 3250 |
| 8) Demand density | 0.08 | 0.10 | 0.15 | 0.16 | 0.17 |

(2) Relevant Consideration of the Forecasted Demand

Since the forecasted demand is estimated based on the statistical socio-economic data, therefore, it may be affected when some unforeseeable events take place, such as a drastic change of the economic environment in future.

The forecasted demand is used for the feasibility study purpose on telecommunication network development as stated at the beginning of this Section.

A detail site survey for the confirmation of demand is required for the other purposes such as respective system design of telephone facilities, design for constructions, etc.