

PART I Mekele

5.4	Network Improvement and Expansion Plan -----	I-33
5.4.1	Exchange Facilities -----	I-33
5.4.2	Transmission Facilities -----	I-37
5.4.3	Outside Plant -----	I-37
5.4.4	Power Supply System -----	I-41
5.4.5	Antenna and towers -----	I-42
5.4.6	Station Building facilities -----	I-42
5.4.7	Terminal Facilities -----	I-43
6.	OPERATION AND MAINTENANCE PLAN-----	I-49
6.1	Exchange Facility -----	I-49
6.1.1	Maintenance Formations and Maintenance staff -----	I-49
6.1.2	Training -----	I-49
6.2	Transmission/Radio Facilities -----	I-50
6.2.1	Maintenance Organization -----	I-50
6.2.2	Maintenance Formations and Maintenance Staff -----	I-51
6.2.3	Training -----	I-51
6.3	Outside Plans (Cables and Civil works) -----	I-52
6.3.1	Maintenance Level -----	I-52
6.3.2	Current situations of facilities -----	I-52
6.3.3	Current Situations of Maintenance -----	I-53
6.3.4	Improvement and Modernization of Facilities -----	I-53
6.3.5	Features of lineman center -----	I-54
6.3.6	Size of lineman center -----	I-54
6.3.7	Training -----	I-54
7.	IMPLEMENTATION PLAN-----	I-55
7.1	Project Implementation Plan -----	I-55
7.2	Implementation Policy -----	I-57
7.3	Demarcation of Scope of Works -----	I-60
7.4	Supervision and Management Plan -----	I-60
7.5	Materials/Equipment Procurement Plan -----	I-62
7.6	Additional tasks on the side of ETC -----	I-62
8.	PROJECT COST ESTIMATE-----	I-63
8.1	Initial Investment -----	I-63
8.2	Expenditure Plan -----	I-64
8.3	Operation and Maintenance Costs -----	I-64

9. PROJECT EVALUATION-----	I-66
9.1 Financial Analysis-----	I-66
9.1.1 Basic Assumptions for Financial Analysis -----	I-66
9.1.2 Investment Plan -----	I-68
9.1.3 Sales revenue projection -----	I-68
9.1.4 Operation and maintenance expenses -----	I-69
9.1.5 Financial Analysis -----	I-69
9.1.6 Major Financial Indicators -----	I-74
9.1.7 Sensitivity Analysis -----	I-74
9.1.8 Result of Financial Analysis -----	I-75
9.2 Economic Evaluation -----	I-76
9.3 Technical Evaluation -----	I-82
10 RECOMMENDATIONS-----	I-83

Attachment

Transmission System

1. Residential Area Access Network Drawings
2. VoIP Network Configuration in Mekele Area
3. Implementation Schedule
4. Technical Specification

Index for Tables

1. OVERVIEW

Table 1.1	Tasks and Schedule of This Feasibility Study-----	I-4
-----------	---	-----

2. SOCIO-ECONOMIC STATUS OF ETHIOPIA

Table 2.1	Gross Domestic Product of Ethiopia for Individual Production Sectors --	I-5
-----------	---	-----

Table 2.2	Population and Land Area of Individual Provinces (investigated in 2001)-----	I-6
-----------	--	-----

3. CURRENT STATUS OF TELECOMMUNICATIONS SERVICES IN THE F/S AREA

Table 3.1	Status of Automatic Exchanges in Terms of Stations and Facility Models-----	I-13
-----------	--	------

Table 3.2	Outside Plant (Cables) Status for F/S Applicable Project Stations-----	I-17
-----------	--	------

Table 3.3	Outside Plant (Civil Works) Status for F/S Area Stations-----	I-17
-----------	---	------

4. FORECAST OF TELEPHONE DEMANDS AND TRAFFIC

Table 4.1	Nationwide Macroscopic Demand Forecast Figures for Ethiopia (fixed telephones)-----	I-21
-----------	--	------

Table 4.2	F/S Applicable Project Regions Macroscopic Demand Forecast Figures (fixed telephones)-----	I-21
-----------	---	------

Table 4.3	Nationwide Microscopic Demand Forecast Figures for Ethiopia (fixed telephones)-----	I-22
-----------	--	------

Table 4.4	F/S Project Areas Microscopic Demand Forecast Figures (fixed telephones)-----	I-22
-----------	--	------

Table 4.5	Microscopic Demand Forecasting Values for New Residential Development at Adi-Sumdum-----	I-23
-----------	---	------

Table 4.6	Number of Calls Initiated and Transmission Circuit Lines-----	I-25
-----------	---	------

5. TELECOMMUNICATIONS NETWORK DEVELOPMENT PLAN

6. OPERATION AND MAINTENANCE PLAN

7. IMPLEMENTATION PLAN

Table 7.1	Implementation Schedule (Mekele Project) -----	I-56
-----------	--	------

8. PROJECT COST ESTIMATE

Table 8.1	Project Cost Estimate (Donor side expenses)	I-63
Table 8.1-1	Project Cost Estimate (Donor side expenses) Year 2003	I-63
Table 8.1-2	Project Cost Estimate (Donor side expenses) Year 2004	I-63
Table 8.2	Expenditure Plan (Expenses of Ethiopia Side)(2004)	I-64
Table 8.3	Maintenance and Operating Costs	I-65

9. PROJECT EVALUATION

Table 9.1-1	The Expected Collecting Ratio	I-67
Table 9.1-2	Depreciation Method	I-68
Table 9.1-3	Total Investment Cost	I-68
Table 9.1-4	Expenditure Schedule	I-69
Table 9.1-5	Total Annual Revenue for the project	I-70
Table 9.1-6	Total O&M Cost	I-70
Table 9.1-7	Assumption of Financing Plan	I-71
Table 9.1-8	Basic Data for Revenue Estimation	I-71
Table 9.1-9	Income Statement	I-72
Table 9.1-10	Cash Flow State Statement	I-73
Table 9.1-11	Balance Sheet	I-74
Table 9.1-12	Major Financial Index	I-75
Table 9.1-13	The Result of the Sensitivity Analysis	I-76
Table 9.2-1	Economic Benefit Streams	I-81
Table 9.2-2	Economic Cost Stream	I-81
Table 9.2-3	Economic Analysis	I-82
Table 9.2-3	Economic Analysis	I-82

10 RECOMMENDATIONS

Index for Figures

1. OVERVIEW

2. SOCIO-ECONOMIC STATUS OF ETHIOPIA

3. CURRENT STATUS OF TELECOMMUNICATIONS SERVICES

IN THE F/S AREA

Figure 3.1 Existing Transmission Lines Within F/S Area-----I-15

Figure 3-2 Composition of Local Access Network-----I-16

4. FORECAST OF TELEPHONE DEMANDS AND TRAFFIC

5. TELECOMMUNICATIONS NETWORK DEVELOPMENT PLAN

Figure 5.2.2-1 Network Configuration.-----I-29

Figure 5.2.2-2 Wukro Area PCO Network-----I-31

Figure 5.1 VoIP Network Configuration Diagram-----I-35

Figure 5.2 VoIP Network Configuration Diagram -----I-36

Figure 5.5 Floor Layout of Mekele Transmission Room (Existing Facilities)-----I-44

Figure 5.6 Floor Layout of Transmission

in Messobo Repeater Station (Existing Facilities)-----I-45

Figure 5.7 Typical Floor Layout Plan for PCO Base Station-----I-46

Figure 5.8 Floor Layout of Transmission Room in Wukro Exchange (Existing Facilities)---I-47

Figure 5.9 Typical Floor Layout Plan for PCO Subscriber Station-----I-48

6. OPERATION AND MAINTENANCE PLAN

7. IMPLEMENTATION PLAN

Figure 7.2 Mekele Project Implementation Management -----I-59

8. PROJECT COST ESTIMATE

9. PROJECT EVALUATION

10. RECOMMENDATIONS

1. OVERVIEW

1.1 Background of the Feasibility Study

The Federal Democratic Republic of Ethiopia is located in the eastern part of the African continent, commonly referred to as the Horn of Africa. In the past the country was facing Saudi Arabia across the Red Sea, but with the independence of the State of Eritrea, the country became landlocked.

The country borders the Republic of Djibouti to the east, the Republic of the Sudan to the west, the Republic of Kenya to the south, the Somali Democratic Republic to the southeast, and Eritrea to the north.

The total area of the country is 1.12 million square kilometers, which is roughly three times of Japan. The total population is 65 million.

The penetration rate of telephone is 0.5 units per 100 persons, while the rate is much lower in the regional areas, with 0.07 units per 100 persons (as of December 1996). Most of the telecommunications facilities have been installed 20 or more years ago, and these have passed their expected service life.

The operating organization of telecommunications, namely the Ethiopian Telecommunications Corporation (ETC) had established its seventh 5-year plan, and was expected to increase the telephone penetration rate to 1.28 units per 100 persons by the year 2000, the final year of the plan, with its own funds as well as through financial cooperation provided by various international organizations.

When this study was requested in September of 1999, there were no long-term development plans beyond the seventh 5-year plan described above. It was obviously essential that the telecommunications expansion plan (a master plan) be established, especially such a plan that includes expansion of telecommunications networks to the regions where the telephone penetration rate is low.

This is the background that the government of the Federal Democratic Republic of Ethiopia made an official request to the Government of Japan for the establishment of telecommunications networks development plan (master plan) and execution of feasibility study (F/S) concerning the prioritized projects.

The government of Ethiopia then established the second 5-year economic development plan (covering years 2001 to 2005), and in conjunction with this plan, the ETC established their eighth telecommunications development plan. For this reason, the ETC requested for additions and modifications of the plan made to the Government of Japan in March of 2001, although this new request was made on unofficial level.

Upon the receipt of the aforementioned request, the Government of Japan evaluated the request, conducted discussions, and as a result decided to conduct a study for the establishment of the master

plan (M/P) with the scope of the entire nation and for a feasibility study concerning the prioritized projects, as requested by the Ethiopian Government.

1.2 Objective of the Feasibility Study

The purpose of this feasibility study (F/S) is to conduct a study for the region (the Mekele region) selected according to the criteria applied in the master plan (M/P), and to conduct technical transfer to the counterpart (CP) through the F/S processes.

1.3 Target Area

The Mekele region, that is as the project region for the F/S, was selected from among regions listed in the prioritized projects of the ETC, according to the selection standard stipulated by the M/P that considers such factors as the existence or nonexistence of national development plans and public sector investment plans, demand for telephones in the region, and the scale of current fulfillment rate.

1.4 Study Policy and Schedule

For this study, the following plans of the Ethiopian government were examined to establish the basic policy for the development of telecommunications networks for the target area of F/S:

- 1) Second 5-Year Economic Development Plan (2000/1 to 2004/5)
- 2) Public Sector Investment Plans (2000/1 to 2004/5)
- 3) Eighth Telecommunications Development Plan of the ETC (2000/1 to 2004/5)
- 4) Telecommunications Development Master Plan (2003/4 to 2020/21)
- 5) Socio-economic status as well as state of existing telecommunications networks in the target area of F/S.

The basic policy calls for the construction of telecommunications networks that provide both qualitative and quantitative improvements for the project area, along with social and economic revitalization of the selected regions, and to narrow the gap of telecommunications services offered in larger cities and rural areas. These policies are established with consideration for applying them for the future development of telecommunications networks in other regions. The established policies are outlined below:

1) The Mekele Station Area

Provision of telecommunication services to the areas that are currently not receiving telecommunications services (such as Adi-Sumduhum Region) in the study area.

2) Wukro Station Area

New public call offices (PCO) are to be installed in order to decrease the areas without telephone service.

Based on the basic policies described above, the main items proposed by this F/S report are as follows:

- a) Establishment of telecommunications networks plan for areas subject to the F/S
- b) Establishment of implementation plans for the above.
- c) Estimation of implementation costs and expenses for the above.
- d) Evaluation of organization and O/M system feasibility based on financial and economic analysis.

Tasks and schedule of this investigation are shown in Table 1.1.

1.5 Organization of the F/S Team

(1) JICA Study Team

1) Study Team

Team Leader:	Ryoji Sasaki
Outside Plant / Demand Forecast:	Shinichi Shoji
Switching System and Traffic Forecast:	Takashi Yamamoto
Outside Plant:	Tetsuya Sakamoto
Transmission System:	Hiroshi Fujii
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Operation and Maintenance:	Kiyofumi Yamamura
Economical/ Financial Analysis:	Tomoyuki Kuroda
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2) JICA Advisor / Committee

Chairman: Takashi Miyashita

Member: Tsuyoshi Hirose

3) JICA Head Office

Task Manger: Miss Miki Inaoka

(2) ETC Staff Members

Names of staff members at the ETC, who have provided the JICA Study Team with variable opinions and cooperation for the local investigation and collection of necessary materials/documents within and outside the ETC, throughout the duration of the entire investigative process, are listed below:

1) ETC Headquarters

Mr. Tespsye Ketema

Mr. Kassahum Wonoimu

Mr. Teklemariam Laeke

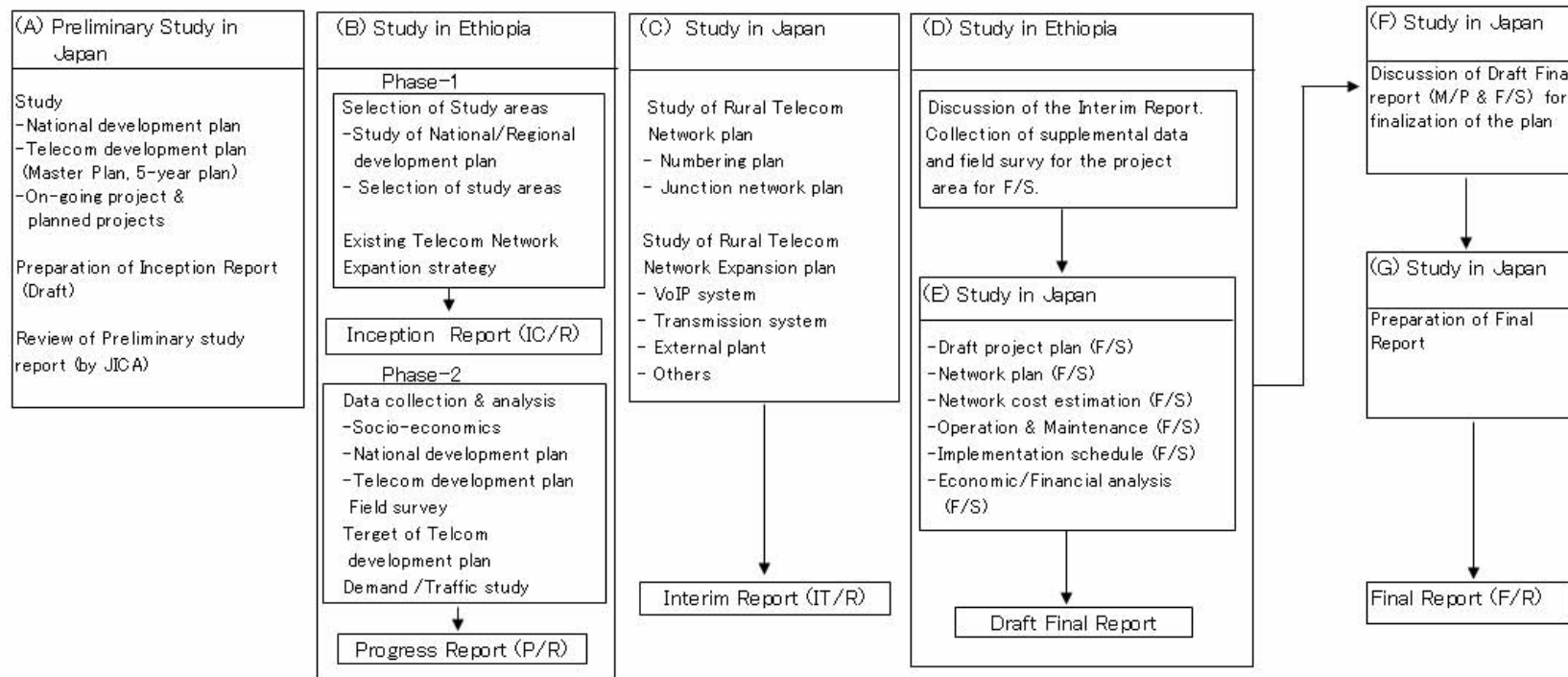
2) Regional Office

Mr. Gephone Gmesuke (RDM)

Mr. Kassaya Abrmba (SW/TRX/TR)

Table 1.1 Tasks and Schedule of This Feasibility Study

Year / Month	2001		2002												2003
	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1
Submission of Report					P/R				IT/R			DF/R		F/R	
Phase															
Work Schedule	(A)	(B)				(C)				(D)	(E)	(F)	(G)		



2. SOCIO-ECONOMIC STATUS OF ETHIOPIA

The economy of Ethiopia and per capita income are growing according to agricultural yield. In the past eight years, however, the gross domestic product (GDP) has been sluggish, with its growth being lower than that of the population. As a principal cause of this phenomenon, the influence of the drought in 1997 can be identified.

2.1 Gross Domestic Product (GDP)

GDP real growth rate has averaged 5.24% during 1993/94 – 1999/2000 according to Ethiopian and IMF data. However, these aggregate figures reflect favourable climate and harvests rather than the discernible, unambiguous impact of policy changes. Table 2.1 indicated that Growth of 10.6% in 1995/96 has been undermined since 1997/98 by drought and war.

Table 2.1 Production Output of Individual Production Sectors and Gross Domestic Product of Ethiopia

Unit: Birr million

Sector	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/2000
1. Agriculture, Fishing	6,078.0	6,284.0	7,206.2	7,453.9	6,648.9	6,904.2	7,052.8
2. Industry	1,307.0	1,412.5	1,488.9	1,593.8	1,630.9	1,815.7	1,870.9
3. Distributive Service	1,650.9	1,757.3	1,914.7	2,062.1	2,177.9	2,253.9	2,423.1
4. Other Service	2,963.3	3,190.5	3,377.3	3,603.8	4,084.9	4,487.1	4,955.0
5. GDP	11,999.2	12,644.4	13,987.1	14,713.6	14,542.6	15,460.9	16,301.8
6. Growth Rate	1.70%	5.37%	10.60%	5.19%	-1.16%	6.31%	5.43%

Note: 1980/1981 Factor cost
Source: MOFED (MEDaC)

2.2 Population

According to the Statistical Abstract of Central Statistical Authority of Ethiopia, the overall population of the country in 2001 was approximately 65 million, with the average annual growth between 1995 and 2000 being 3.02%.

The average number of people in a household for the year 1994 was 4.8.

Further, 85% of the overall population live in the rural areas, while about half of the remaining 15% live concentrated in Addis Ababa and larger regional cities.

Population distribution obtained as a result of the national census is shown in Table 2.2 “Population Distribution.”

Table 2.2 Population and Land Area of Individual Provinces (investigated in 2001)

Province	Population	Urban Pop.	Rural Pop.	Land Area (Sq.km)
Tigray	3,803,000	638,904	3,164,096	50,078.64
Affar	1,246,000	100,926	1,145,074	n.a.
Amhara	16,773,000	1,727,619	15,045,381	159,173.66
Oromia	23,058,000	2,720,844	20,337,156	353,006.81
Somali	3,708,000	561,391	3,146,609	n.a.
Bnishangul	552,000	48,576	503,424	49,289.46
S.N.N.P.	12,916,000	994,532	11,921,468	112,343.19
Gambela	217,000	36,890	180,110	25,802.01
Addis Ababa	2,574,000	2,574,000	0	530.14
Dire Dawa	331,000	238,320	92,680	1,213.20
Harar	166,000	100,596	65,404	311.25
Total	65,344,000	9,742,598	55,601,402	1,098,000.00

Source: Central Statistical Authority

Note: All localities with population less than 1,000 persons should be considered as rural.

2.3 Current Conditions of the Project Site

1) Natural Conditions

a) Climate

The Mekele region subject to this project is located approximately 2,500m above seal level. The climate is mild and the annual precipitation is approximately 1,500mm. The region is comparatively blessed with natural conditions.

b) Ground conditions

The regions subject to this project are hilly places. Exposed rocks are observed along roads and residential areas. The strata are generally composed of soft arenaceous rocks. In the heavy rain season, floods may easily occur at slopes of hills.

2) Aspect of the Area

a) Mekele Area

In the Mekele region, the local administration agency is promoting urban development according to a long-term plan.

Though the urban development plan specifies the land use for residential area, commercial area, industrial area and administrative area, urban development is not proceeding as planned in the old urban area.

In the new residential area where telecommunications facilities are newly installed in this

project, construction is proceeding according to the city plan, many houses have already been built, and water supply and power supply services have been provided, but telephone services are not available yet.

The old urban area is dotted with a few low-rise buildings (four or five-stories) containing government agencies, offices, banks, shops, hotels and so on. Shopping areas are observed along roads, but more than 90% of buildings are one-story houses.

With respect to communications facilities, many cables are directly buried underground and aerial cables are being used in residential areas.

b) Wukro Area

Wukro region is a typical agrarian community.

Photos 2.1 to 2.9 show the aspects of these two areas.

3) Road Traffic Condition

Since greater part of the areas of this project is residential areas with small volume of car traffic during daytime, there seems no serious difficulty in the construction work. However, it is vital to pay attention to nearby people when carrying materials, equipment, and surplus soil are carried or when parking vehicles.

(1) Social Infrastructure Improvement Status

1) Transportation and Traffic

Ethiopian transportation and road traffic infrastructure is quite poor when the land scale of Ethiopia is considered. Therefore, the country is not able to play a role for implementation of the national development project. Even at present, most of the nation's land (agrarian community in particular) is still isolated from transportation and communications.

a) Marine Transportation

Ports and harbors that Ethiopia used were Assab Port and Massawa Port in Eritrea and Djibouti Port in the Republic of Djibouti. Assab and Addis Ababa are connected with Addis Ababa by the 860km paved road. The volume of distribution of goods using Assab Port was accounting for about 80% of the total trade volume of Ethiopia.

However, Ethiopia lost Assab Port and Massawa Port due to the independence of Eritrea. For this reason, materials and equipment used in this project will be transported by trucks via Djibouti Port.

b) Land Transportation

90% of the domestic transportation volume in Ethiopia relies on roads for both passengers and cargoes. Though poor maintenance and management of roads due to

the shortage of fund caused by the civil war temporarily deteriorated road networks, recent financial aids by international organizations and between two countries have considerably developed and improved the major loads.

2) Situation of Electric Power

In Ethiopia, the national power corporation “Ethiopian Electric Power Corporation” (EEPSCO) takes charge of electric power supply. In the Mekere region, power failure rarely occurs except for cases of lightning or accidents. Development plan for major transmission lines is steadily going, and electricity seems to be supplied to all villages and hamlets in the next step.

The standard power voltage of Ethiopia is 220VAC.

(2) Impacts on the Environment

1) Protection of forests

In Ethiopia, environmental degradation due to forest destruction, excessive grazing, and cultivation on sloping ground has become a serious problem. At present, however, the environmental protection research and development program is being promoted with international technical cooperation, focusing on reduction of deforestation and protection of the nature.

To avoid adverse effects on environmental destruction and changes in ecosystem as much as possible, this project decided to use concrete poles or steel poles in stead of wooden poles.

2) Construction materials and surplus dug soil

Since the Mekele project site has already become an urban area, sites to be excavated are roads in principle. Because the construction in this area is small-scale engineering work, the volume of gravel and sand for construction, and surplus dug soil will not much affect environmental contamination and the environment of nearby inhabitants.



Photo 2.1 PCO-No.1, Site Photo, Gemad



Photo 2.2 PCO-No.2, Site Photo, Debre Tsion



Photo 2.3 PCO-No.3, Site Photo, Habes



Photo 2.4 Wukro PCO-No.4, Site Photo, May Kuha



Photo 2.7 PCO-No.5, Site Photo, Abne Gerima



Photo 2.8 Wukro PCO-No.6 Site Photo, Hadnet



Photo 2.9 Wukro PCO No.7, Site Photo, Kalesh Imuni

3. CURRENT STATUS OF TELECOMMUNICATIONS FACILITIES IN THE F/S AREA

The telephone penetration rates per 100 persons (as of year 2000) in the F/S area are 6.47 for the Mekele Area and 0.37 for the Wukro Area. In the case of the Wukro Area, in particular, the penetration rate is lower than those of large cities, and a urgent implementation of the project is desirable.

While the majority of telecommunications services being offered within the F/S area are telephone services, a very few non-telephone services such as data communications and Internet services are also being offered in the Mekele Station Area.

Each F/S area already has automatic exchanges in services.

Only a limited number of subscribers (some of the banks) are using non-telephone services, and such services are being offered by leased telephone circuit.

3.1 Mekele Area

(1) Current Status of Switching Facilities

The existing switching facilities in the F/S area are of crossbar exchange and digital exchange.

All exchanges have been automated by the end of August 2002.

Status of automatic switching facilities is shown in Table 3.1.

Table 3.1 Status of Automatic Exchanges in Terms of Stations and Facility Models

Station name	Model	Switching method	Manufacturer	Capacity
Mekele (I)	ARF-101	XB	Ericsson	5,000
Mekele (II)	DMS-100	Digital	Northern Tel	6,000
Mekele (Total)				11,000

(2) Current Status of Transmission and Radio Facilities

Since Ethiopia is a mountainous country, mainly wireless methods are being used for transmissions due to the speedy and economical construction of infrastructure.

As there are some delays in deliveries of facility funds, maintenance and repair have not been implemented in a satisfactory manner for transmission facilities that have been deteriorated or damaged by disasters. Therefore, communications are not available in some regions. Long-distance transmission lines and local lines as well, have not roundabout ways, and no measures have been taken to assure reliability in the event of transmission line failures.

1) Back-bone Transmission Lines

Backbone transmission lines are configured with 4, 5, and 6 GHz bands analog as well as digital radio systems.

2) Spur or rural Transmission Lines

Spur transmission lines of regions are configured with digital radio systems of DRAMASS.

3) Current Status of Existing Transmission Lines

Current status of existing transmission lines within the F/S area is shown in Figure 3.1.

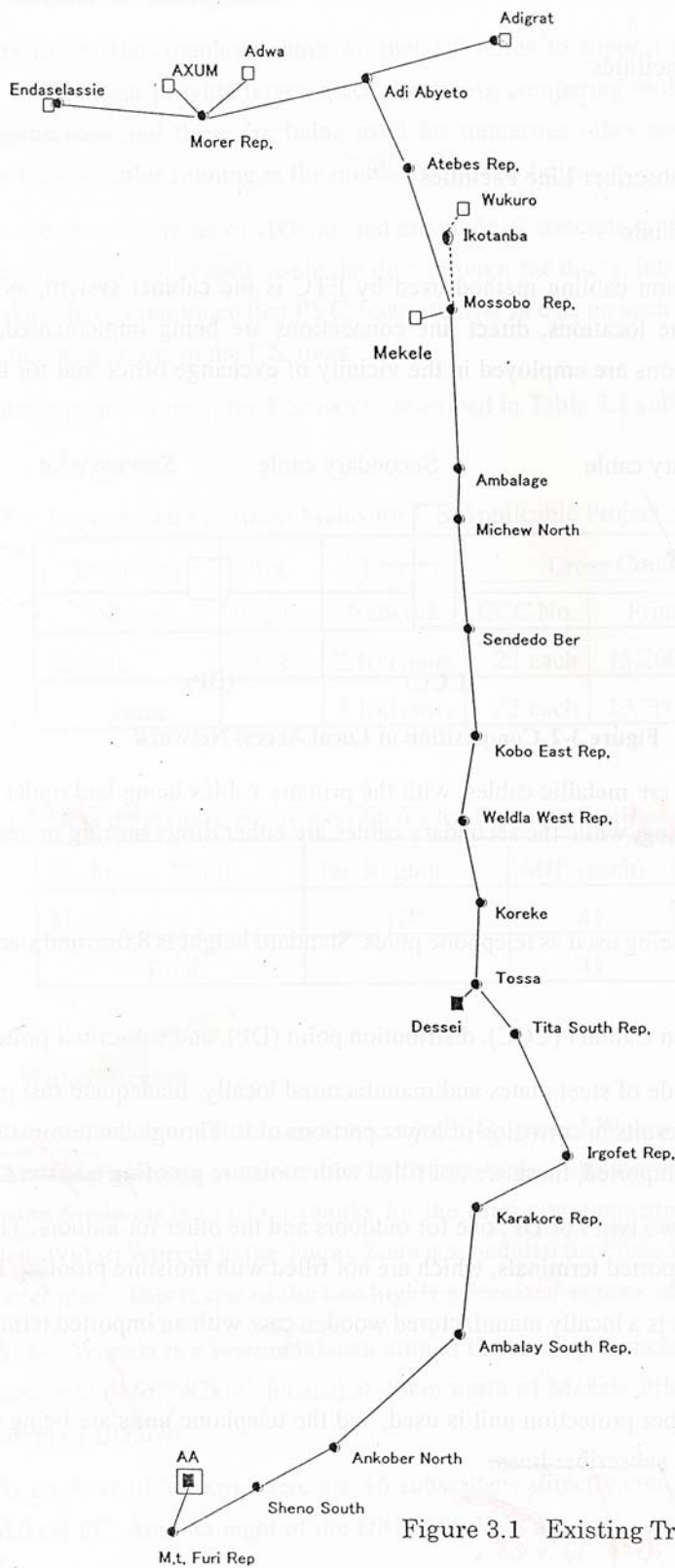


Figure 3.1 Existing Transmission Lines within F/S area

(3) Outside Plant Facilities

1) Conditions of Subscriber Line Facilities

a) Cabling methods

The most common cabling method used by ETC is the cabinet system, as shown in Figure 3-2. In some locations, direct line connections are being implemented, but such direct line connections are employed in the vicinity of exchange office and for stable demand area.

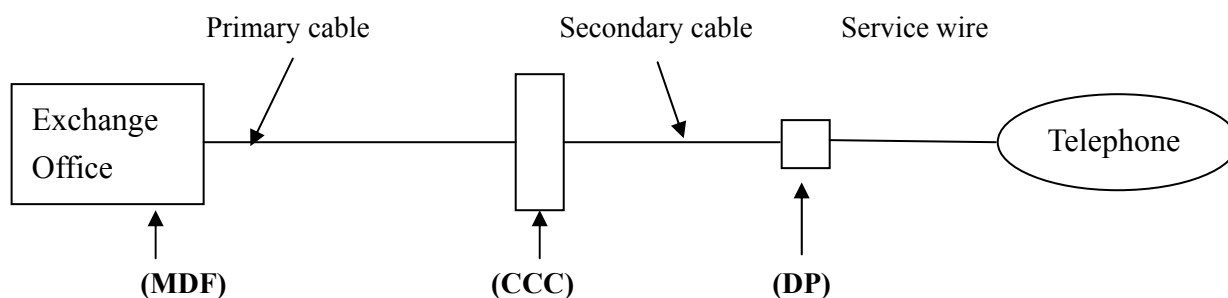


Figure 3-2 Composition of Local Access Network

b) Subscriber lines are metallic cables, with the primary cables being laid under ground in ducts or direct buried, while the secondary cables are either direct buried or aerial cable.

c) Telephone poles

Wooden poles are being used as telephone poles. Standard height is 8.0m, and standard span is 45m.

d) Cross Connection Cabinet (CCC), distribution point (DP), and subscriber protection unit

- CCC is made of steel plates and manufactured locally. Inadequate rust proofing of the cabinet results in corrosion of lower portions of it. Though the terminals mounted in CCC are imported, these are not filled with moisture proof compound.
- There are two types of DP; one for outdoors and the other for indoors. The outdoor type uses imported terminals, which are not filled with moisture proof compound.
- The indoor type is a locally manufactured wooden case with an imported terminal board.
- No subscriber protection unit is used, and the telephone sets are being connected directly with drop wires.

2) Current Status of Civil Works

Majority of existing manholes has no metal fixtures to support cables and joint closures. While these provide larger space for wiring comparing with the number of ducts, and these are being used for numerous other purposes, often with the directly buried cables running in the center of the manhole.

Ducts have inner diameter of 100mm, and are made of concrete with multiple holes. There are occasions where dirt enters inside the duct through the duct joints, resulting in clogging. While it

has been mentioned that PVC ducts are now in use, no such ducts could be verified during the inspections in the F/S areas.

The outside plant status of the F/S area is described in Table 3.1 and Table 3.2.

Table 3.2 Outside Plant (Cables) Status for F/S Applicable Project Stations

Exchange Name	Tel. Region	Direct Network	Cross Connection Cabinet		
			CCC No.	Primary	Secondary
Mekele	NR	2,100 pairs	22 each	13,200 pairs	16,100 pairs
Total		2,100 pairs	22 each	13,200 pairs	16,100 pairs

Table 3.3 Outside Plant (Civil Works) Status for F/S Area Stations

Exchange Name	Tel Region	MH (each)	Duct (km)
Mekele	NR	41	2.5
Total		41	2.5

3.2 Wukro Area

Conditions of telecommunications services in PCO areas of Wukro Woreda are as follows.

- The PCO networks for the rural communications of Wukro area is one of the key element of F/S. Wukro Woreda in the Tigray Zone is scheduled for the implementation under Phase I (by 2005) according to the master plan.
- Wukro Woreda is a rural area around the small provincial center city of Wukro, with land area of 987.83km² located at 40km north of Mekele Primary Center (PC), with population of 105,076.
- At the City of Wukro, there are 16 subscribers directly connected via DRMASS to Mekele PC. Another eight of the DRMASS lines are being used as the junction lines for 192 subscribers of the automatic exchange with capacity of 500 lines. The problem is that increasing number of subscribers on these eight function lines would result in serious deterioration of service.
- Moreover, existing digital exchange has problem with billing and signaling function.
- In rural village areas, telephone services are almost not available, thus PCO network for providing communications services have become essential.

Photos 3.1 to 3.6 show the Wukro area existing facilities.