CHAPTER 3 PRESENT STATUS OF TELECOMMUNICATIONS SECTOR

3.1 Telecommunication Services

3.1.1 Present Status of Telecommunication Services

(1) General

The Ethiopian Telecommunication Authority (ETA) was appointed under management of the Ministry of Transport and Communications. In 1996, it had been separated from the said Ministry under issue of the Proclamation No. 49, and then newly established as Ethiopian Telecommunication Agency (ETA), which is responsible for the Ministry of Communications.

The Ethiopian Telecommunications Corporation (ETC) has been established after getting transferred from Ethiopian Telecommunications Agency (ETA) by effectuation of the Proclamation No. 49.

ETC has been monopolistically providing nationwide telecommunications services since 1996 consisting of:

1) Telephone and telegraph services
2) Public telephone service
3) Cellular mobile service
4) Telex service (Domestic)
5) Public Data Network (Data Transmission Leased Line and Internet)
6) International service
7) TV Program Transmission Service

(2) Status of Telecommunications Services

(a) Telephone Service

The provision of nationwide telephone service to fulfill the waiting demand is current core activity for ETC and has been accelerated recent years. The number of subscriber lines (direct exchange lines) in whole country is approximately 291,000 as of the end of 2001 and brings 0.45 per 100 inhabitants, which is comparatively lower than world average. Capacity of automatic exchange totals 512,000 in whole country, in which analog switch contains 19. From a viewpoint of accessibility to the telephone service, most of the regions except certain areas (including rural areas) have been covered to some extent by the telephone network. At present, the effort for enhancement of telephone accessibility has been made up to 197 rural towns. However, the rural communication services are still insufficient for the residents in many remote areas. ETC is planning to increase the rural telephone service at 197 villages in the 8th 5 year Telecommunication Development Plan (2000-2004).

ETC will prepare 540,000 additional lines. The total lines will reach 800,000 lines in the year 2004. Comparing the number of switch facility and subscriber lines, subscriber lines are not

sufficient. To increase the penetration ratio it is a key to concentrate extensively providing more subscriber lines.

The following graph data are extracted from ETC 8th 5 year Telecommunications Development Plan at present and target in 2004. It is noted that there are some discrepancies between the graph data and ETC annual statistical bulletin.

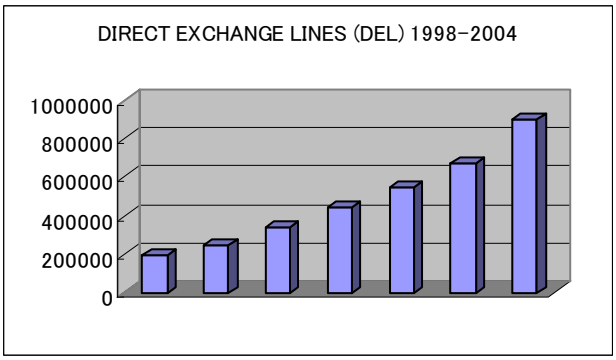


Figure 3.1-1 Direct Exchange Lines

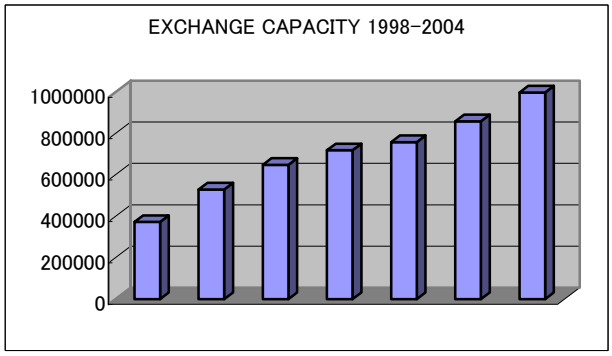
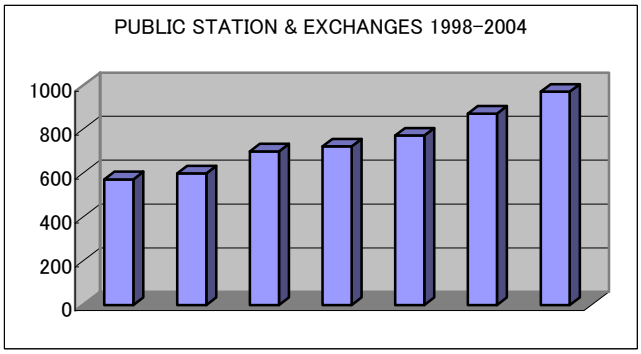


Figure 3.1-2 Exchange Capacity



Source: ETC 8th Telecom Development Plan

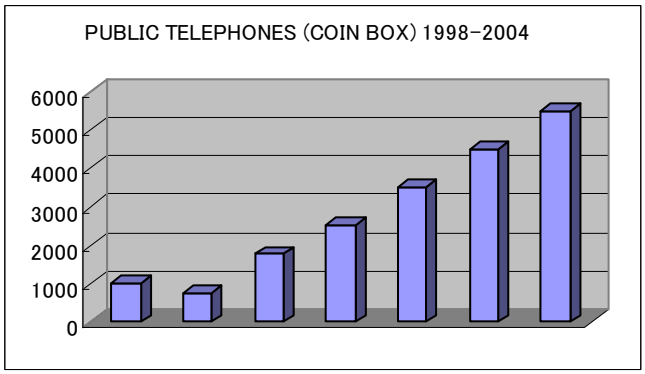
Figure 3.1-3 Public Station and Exchange

At present 248 DRCS stations are in operation. The Eighth 5-Year Development Plan expands rural areas up to approx. 140 additionally.

For the existing public call office (PCO), it is worth trying to have fax service and the Internet access service. These services will empower to promote employment opportunity as below mentioned.

(b) Public Telephone Service

ETC is providing public payphones in a nationwide basis. Since the start of the public payphone service, ETC established 935 coin telephones as of 2001, and starting card phone system in early 2002. However, the number of public telephones is insufficient. ETC planned 4,500 additional coin and card telephones in the Eighth 5-year Development plan.

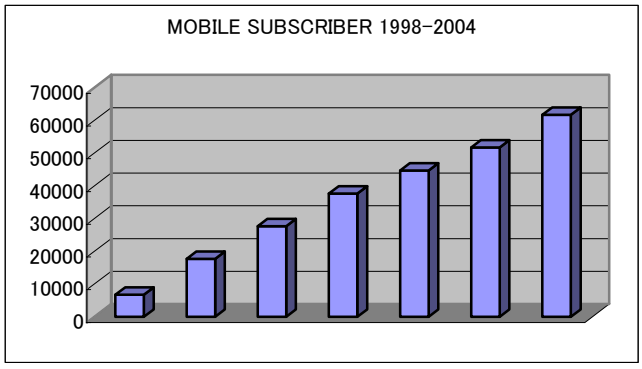


Source: ETC Eighth Telecomm Development Plan

Figure 3.1-4 Public Telephone

(c) Mobile-phone Service

In 1999 ETC entered into Mobile-phone Service. In 2001, the service covers urban and suburb areas of Addis Ababa and metropolitan i.e. Addis Ababa, Nazareth and Sodre. The total number of exchange lines has reached approximately 36,000. Within 3 years further expansion for 13 major cities including Addis Ababa are planned.

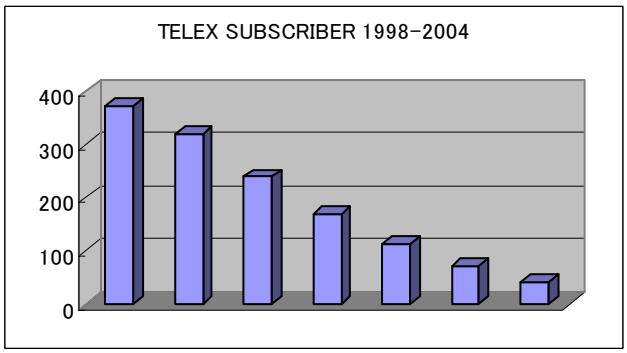


Source: ETC Eighth Telecomm Development Plan

Figure 3.1-5 Mobile Telephone Subscriber

(d) Telex Service

Telex service in terms of subscriber base has been shown a marginal increase since 1991, while international outgoing telex traffic had been declining in the recent years. The traffic decline is consistent with the globally observed trend where telex usage is declining due to inroads made by telefax and Internet services. The past trend in the number of telex subscribers during 1998 – 2004 is shown below.



Source: ETC Eighth Telecomm Development Plan

Figure 3.1-6 Telex Subscriber

(e) Internet Service

For the Internet service refer to 3.6 hereunder.

(f) International Telecommunications Service

International links are provided for 19 countries. Ethiopia has three major routes for overseas telecommunications, such as INTELSAT satellite, submarine cable via Djibouti and terrestrial microwave link with Kenya.

Each destination and number of circuits of international telecommunication are shown in the following table.

Table 3.1-1 Destination and Circuits of International Telecommunications

Destination	Route	Telephone	Telex & TG	Internet
USA (AT&T)	AOR	58	23	
USA (MCI)	AOR	88		
USA (Sprint)	AOR	30		2Mbit/s
UK	AOR	60	12	
Belgium	AOR	8		
Germany	IOR	29	6	
France	SMW2	25	8	
Italy	AOR	44	17	
Greece	AOR		6	
UAE	IOR	30		
Singapore	IOR	4		
Saudi Arabia	IOR	30		
Saudi Arabia	SMW2	30		
Sweden	AOR	23		
Canada	AOR	20		
Japan	IOR	8		
India	SMW2	8		
South Africa	IOR	11		
Djibouti	PANAFTEL	29	1	
Egypt	SME2	6		
Kenya	PANAFTEL	20	5	
Zambia	PANAFTEL	4		
Total		565	78	2Mbit/s

International TV program transmission is supported via AOR satellite by using 34Mbit/s CODEC.

ETC is planning to construct another terrestrial microwave system to Sudan by extending the Gonder-Dollar Hill microwave.

It should be noted that present international gateway is only located at Addis Ababa. In the future plan additional gateway exchange will be necessary (eg. Dire Dawa).

(g) TV program Transmission

ETC is providing Ethiopian TV Company with the TV program transmission via both microwave and satellite. From Addis Ababa to the following destinations the link is reserved.

Table 3.1-2 TV Program Transmission Service by ETC

Media	Destination	Signal	Remarks
Digital Microwave	Shashemene Dessie Mekele Jimma Dire Dawa Harer	34Mbit/s	
Analogue Microwave	Bahir Dar Gonder Gara Guda Arba Minch Jijiga	4MHz-band	
Satellite	25 TVRO stations	8Mbit/s	

3.2 Telephone Switching Network

3.2.1 Network Configuration

The hierarchy of the national telephone network is basically configured with 3 stages such as local exchange, primary center and secondary center.

Secondary center as AA TR-III is located in Addis Ababa and primary centers are located in the telecom regions.

Telephone Network configuration in Ethiopia is shown as follow:

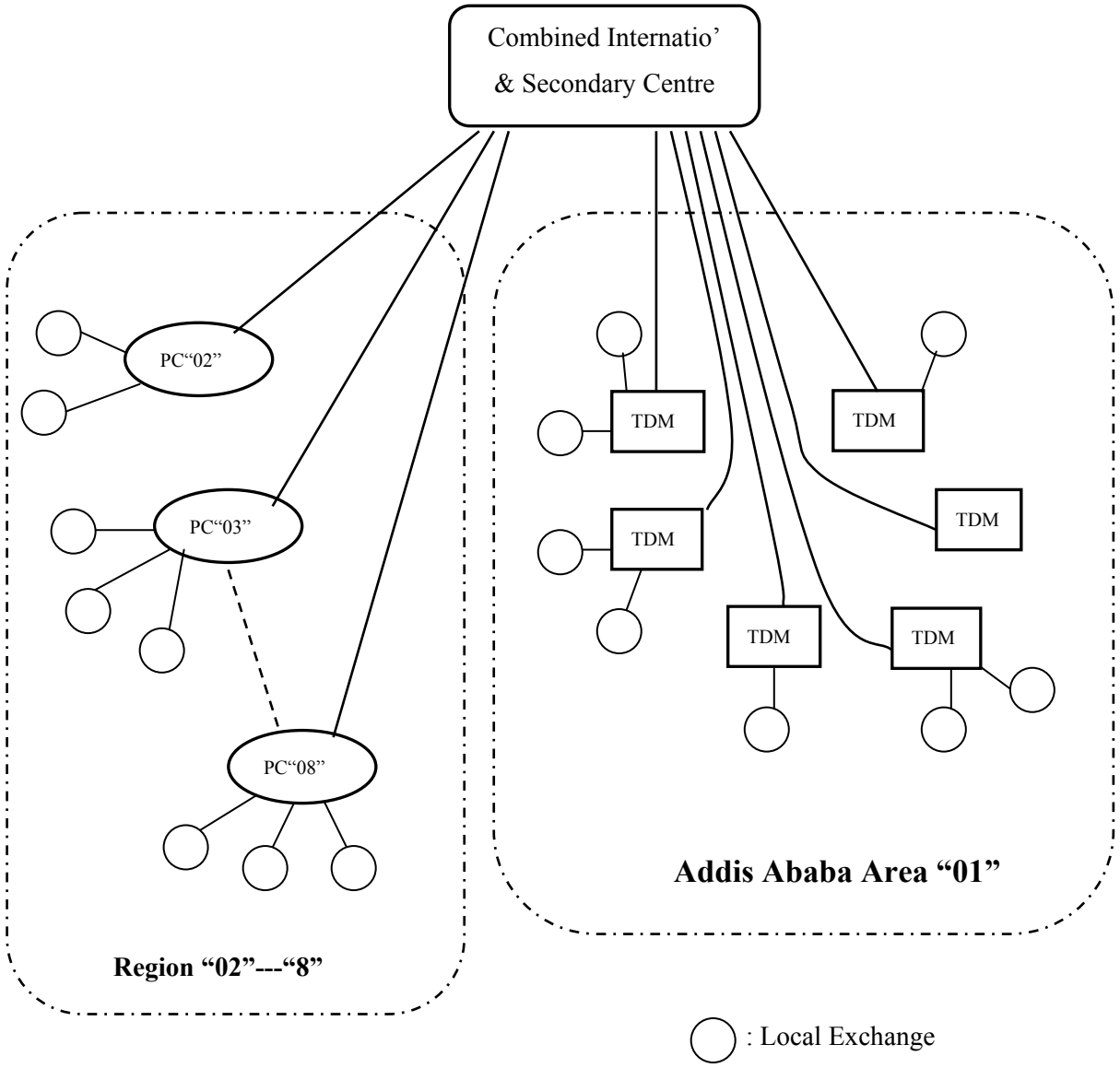


Figure 3.2-1 Network Configuration of ETC

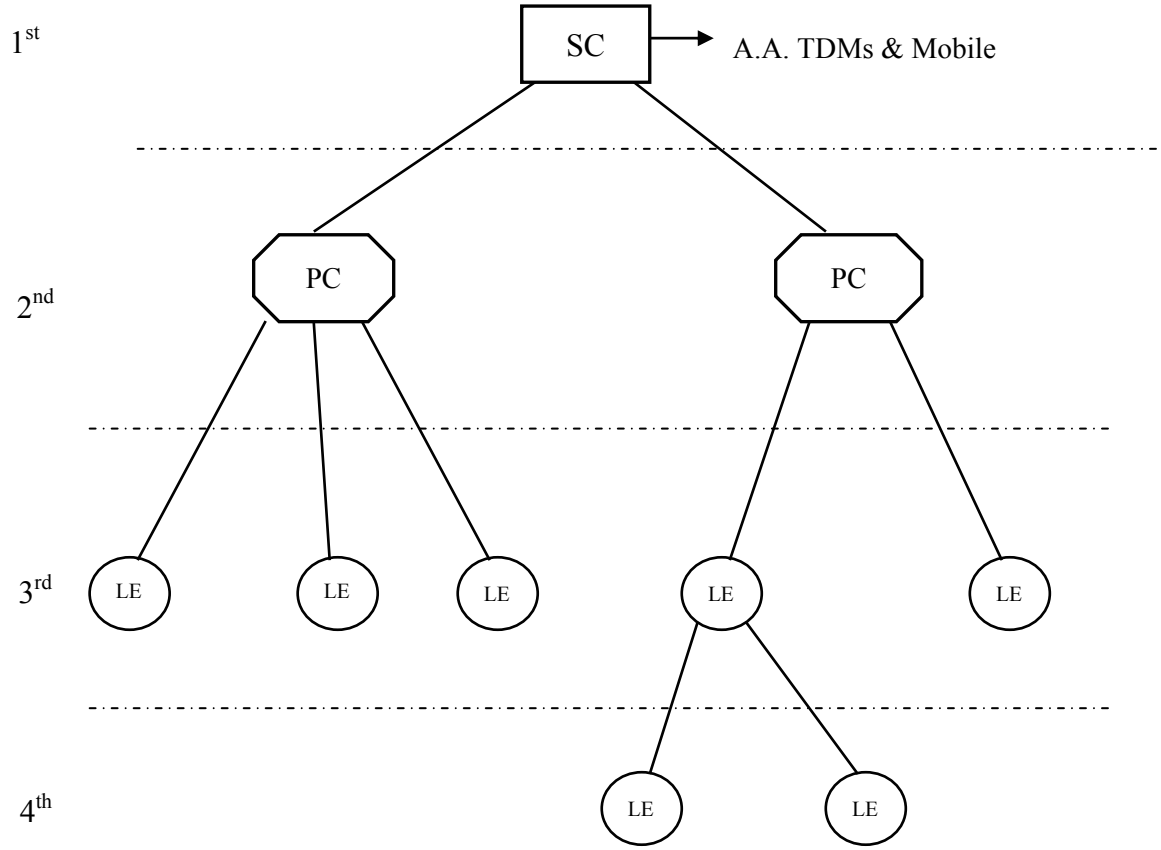


Figure 3.2-2 Switching Hierarchy

ETC divides the country into 8 regions and an individual Area Code is given to each region.

(1) Secondary Center

SC is a combined exchange and it's one unit exchange of AXE-10 with 8,712 trunk circuits including 524 international circuits, which was put into service in December 1998.

(2) Networks of Regions

(a) Region "01"

Addis Ababa MEA is situated in this region including some local exchanges in the provincial area of the region.

Addis Ababa MEA is divided into 6 telecom zones and each zone has TDM exchange. All TDMs are combined exchanges with local switch function.

TDMs in Addis Ababa Port are single unit of AXE-10 switching system respectively.

Under the TDMs except Filwoha, some local exchanges are connected and types of switching systems are AXE-10, DMS-10 and RAX, however, majority is DMS-10. Only one RAX switching system is employed for Kuyu.

Remote Switching System (RSS) does not seem to be common in Ethiopia; however, one AXE-10 RSS with 1,000 capacities is employed in Sebeta and subordinate to its host Keira TDM.

Some local exchanges exist in this region but located in the provincial areas such as Fitche, Ghion, Ambo and some others, are linked with SC and not TDM.

D.Table 3.2-1 shows details.

(b) Region "02" Nazareth

There is one (1) PC located in Nazareth. The PC is a combined exchange, which equip with local exchange and transit exchange functions. The PCs in other region are also combined exchanges.

Switching network in this region is basically simple and consists of 1 PC, 6 local exchanges and 1 RSS. However, quite unusual homing plan is seen on Modjo LE with 2,000 capacities that is not directly connected with any exchange in this region. Modjo LE is under Debre Zeit, which is under Keira TDM. Both of them are in region "01". This unusual homing plan should be corrected in near future. Switch types in this region are AXE-10 and its RSS, DMS-10 and RAX.

(c) Region "03" Dessie

The switching system of Primary Center in this region is DMS-10 and under the PC, there are 13 local exchanges, which are ten (10) DMS-10s, one (1) DMS-100, three (3) RAXs and one (1) ARF-102.
In fact, Primary Center consists of two switching units; one is DMS-10 mentioned above and another one is analogue switching system ARF-102, which is planned to remove under the Eighth Development Program.

The switching network configuration is simple in this region. Incidentally, there is a link between PC "03" Dessie and PC "04" Mekele.

(d) Region "04" Mekele

The switching system of Primary Center in this region is also DMS-10 and consists of 2 switching units with ARF-101. Major type of switching system in region is DMS-10, which are directly homing to the PC, and 1 RAX and four ARF-101 are exist as the LEs. Four (4) exchanges of Adwa, Axum, Adigrat and Shire exchanges consist of 2 units of ARF-101 and DMS-10.

The expansion of DMS-10 switching system of the above exchange are planned and the existing subscribers of the analogue switches are transferred to the expanded DMS-10. Then, the ARF-101 will be removed.

(e) Region "05" Dire Dawa

The network configuration in this area consists of one (1) PC and four LEs, and is not complicated.

AXE-10 switching system is used as the PC in Dire Dawa, and DMS-10, RAX, ARF-101 and ARF-102 are employed as the LEs.

Harar and Jijiga exchanges are 2-unit exchange and the combinations of switching types are DMS-10 and ARF-102, DMS-10 and ARF-102 respectively. No any difficulty and problem is seen on the network.

(f) Region "06" Shashemene

There are two units in Shashemene PC, which are DMS-100 and ARF-102. One (1) DMS-100, eight (8) DMS-10, nine (9) RAX, three (3) ARF-101 and two (2) ARF-102 exist in this region.

The number of exchanges in this region is 23 in total, which biggest number rather than that of other regions.

A feature of the network is that, there are many RAXs and some of them are directly connected with PC and some of them are linked with the local exchanges.

The exchanges of Goba, Robe, Ghinir and Dodola are now in "06" region, however, those exchanges should be in "02" geographically.

(g) Region "07" Nekempte & Jimma

Region "07" is divided into two areas of Nekempte and Jimma and there is a link between the both PCs and also an individual link to the SC from the both PCs respectively, namely, there are two PC network in the same region.

Nekempte area consists of one PC and seven (7) LEs. Switching system type of PC is AXE-10, and two (2) DMS-10s and five (5) RAXs are used as the LEs. The entire LEs are directly homing to the PC.

The network configuration of Jimma consists of one (1) PC, eight (8) LEs and one (1) RSS. The RSS belongs to AXE-10 of the PC and the Gore exchange is homing to Mettu LE, and the LEs other than Mettu are directly connected with the PC.

(h) Region "08" Bahir Dar

The network configuration in this region is different compared with that of other regions. The network consists of one (1) PC, two (2) local TDMs and twelve (12) LEs. The Local TDMs, which are Debre Markos and Gondar, and seven LEs are under Debre Markos and only one LE is under Gondar. Two LEs are directly connected with the PC.

The type of switching system of major exchanges such as Bahir Dar, Debre Markos and Gondar are AXE-10. LEs are DMS-10s and RAXs.

The details of exchange information are shown in D.Table 3.2-1.

(3) International Exchange

The secondary center, AA TR-III in Addis Ababa is to combine transit with international switching functions.

However, in consideration of increasing the number of international calls and an occurrence of unexpected failure on the exchange, another independent international exchange is required.

3.2.2 Switching System

The switching systems being operated are mostly digital as AXE-10, DMS-10, DMS-100 and RAX.

However, some analogue switching systems such as C400, ARF-101/102 are still in operation and all of those switching systems exist together with digital switching systems.

Refer to D.Table 3.2-1.

ETC intends to replace the analogue switching systems with the digital switching systems under the Eighth Development Program.

Other than the mentioned above, many small size PABXs and manual switchboards are used in the rural areas and such switching facilities are deemed as a part of Subscriber Access Network and connected to a local exchange through the transmission system such as DRMAS, Pair gain systems, etc.

3.2.3 Number of Exchanges and Line Capacity

The number of existing exchanges in the whole country is 159 with 585,832 capacity lines, which includes one combined international with transit exchange.

Details are as shown in D.Table 3.2-1.

3.2.4 Trunk Line Signalling

ITU-T R2 Signalling system is used between the analogue switching system and the digital switching system; however, in some cases this signaling system is adopted even between digital switching systems. Because, No.7 signalling function is not available on a few digital switching systems such as RAX.

ISUP of ITU-T No.7 Signalling system is used between the digital switching systems.

3.2.5 Numbering Plan

The numbering plan is structured with 7-digit based on the following conditions:

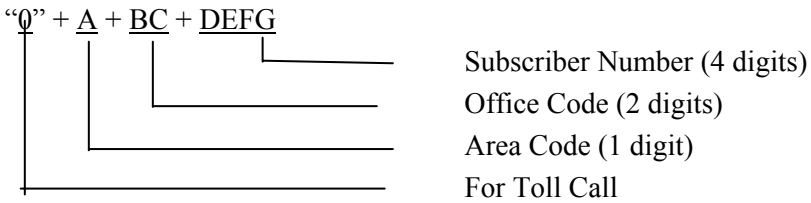
1) Ethiopia is given a 3-digit national number (251).
2) Not to exceed a 8-digit in order to follow ITU recommendation.
3) It is desirable that the plan keeps up with the number of subscriber in 30 years time.

4) It has to be possible that capacity of numbering plan easily be expanded without any change of the basic structure.

5) Not to be affected by the changing of metering system and routing plan.

6) Special call numbers have to be considered.

7) Structure of numbering plan



8) International Call

In order to make a IDD call, the subscribers connected to the digital exchange have to dial "00" + country code + area code + office code + subscriber number.

In case of the subscribers connected to the analogue exchange, it is necessary to access to the operator with dial "98" and the international call connection is made by the operator.

3.2.6 Charging System

Present charging system in the country is as follows:

(1) Local call

Subscriber's meter is given one pulse every 6 minutes in changeable duration.

(2) STD call

The charging system being used is K (Karlsson) system and the elements of charging are distance and duration.

(a) Analogue Exchange

The analogue exchange has no function for detailed charging system and receives the meter pulses from the transit exchange.

Therefore, no one can get detailed charging information such as a called subscriber number, charged duration, local call or STD call, etc.

(b) Digital Exchange

Digital exchange has detailed charging function and the charging data is stored on a Disk. The Disk is periodically sent to Billing Center for data processing.

However, there is no online system to transfer the charging data from the exchanges to Billing Center except the mobile telephone system.

(3) International Call

The subscribers of digital exchanges can make IDD call and its charging is automatically made at AA TR-III exchange.

However, the subscribers of analogue exchange have to access to the operator at first, which means the charging for international calls are done by the operator.

3.3 Transmission Network

Transmission system in Ethiopia has mainly been constructed by the means of radio system due to mountainous geography. The network is configured in star topology centering the capital of Addis Ababa. Recently the network is rapidly being expanded in capacity according to growing traffic and the analogue microwave is replaced by the digital one. Optical fiber cable is introduced into several big-traffic and short-distance links such as inter-exchange link in Addis Ababa.

3.3.1 Backbone Transmission System

(1) Domestic Backbone Transmission Network

There are six major backbones having the hub at Addis Ababa such as, 1) north to Dessie, Mekele and Morer, 2) east to Nazareth, Dire Dawa and Harar, 3) south to Shashemene, Awassa and Goba, 4) south west to Jimma, 5) west to Nekempte and Metu, and 6) north west to Bahir Dar and Gonder. The 6 routes are detailed in D.Figure 3.3-2.

South west and west backbones are connected between Jimma and Nekempte. Major routes and systems are shown in Table 3.3-1. The connection of network is shown in D.Figure 3.3-1.

Table 3.3-1 Existing Major Backbone Network (not less than 34Mbit/s or equivalent)

Direction	System	Stations	Capacity	Remarks
North	5G SDH 4G FDM 6G PDH 7G PDH 2G PDH	AA-Dessie Dessie-Musali Dessie-Tossa, Mekele-Mossobo Dessie-Weldia Dessie-(Mekele)-Morer	STM-1 x 1 960ch x 1 140M x 1 34M x 1 34M x 1	 6G upper
East	2G PDH 4G FDM 2G PDH	AA-(Dire Dawa)-Harer Harer-Jijiga Dire Dawa-Djibouti	34M x 2 960ch x 1 34M x 1	AA-Furi 11G 140M to Djibouti
South	5G SDH 6G FDM 4G FDM 2G FDM 2G PDH 7G PDH 7G PDH	AA-Shashemene Shashemene-Goba Shashemene-Marza Kurumi-Arba Minch Adama W-Asela Shashemene-Ziway Arba Minch-Jinka	STM-1 x 1 960ch x 1 960ch x 1 960ch x 1 34M x 1 34M x 1 34M x 1	 6G upper to Kenya
West and South-West	5G SDH 4G FDM 7G PDH 7G PDH 7G PDH	AA-Jimma Jimma-(Nekempte)-Gore AA-Nekempte Jimma-Bonga Gore-Metu	STM-1 x1 960ch x 1 34M x 1 34M x 1 34M x 1	
North-West	2G FDM 2G PDH 2G PDH	AA-(Bahir Dar)-Gonder Gara Kar-(Bahir Dar)-Hamsuit Debre Markos-Gara Jobel	960ch x 1 34M x 1 34M x 1	

In order to accommodate the increasing circuit requirements, digital SDH microwave links are under construction in the Eighth Development Program, and some of them have been constructed. Table 3.3-2 shows the further expansion plan under Eighth Development Plan.

Table 3.3-2 Planned Backbone Microwave of Eighth Development Program

Direction	System	Stations	Capacity	Remarks
North	7G SDH 7G SDH	Dessie-Musali (Bure), Asaita Dessie-Mekele-Morer Axum-Adigrat-Zalanbesa AA, D/Berhan, Fitche area Dessie-Woldia link Links from Mekele	STM-1 x 1 STM-1 x 1 STM-1 x 1 STM-1 x 1 34M 4 x 2M	 Upgrade or 34M & others or 34M and others and others
East	5G SDH	AA-Dire Dawa Dire Dawa-Harer-Jijiga	STM-1 x 2 STM-1 x 1	
South	5G SDH	Shashemene-Moyale Shashemene-Arba Minch Nazreth-Goba	STM-1 x 1 STM-1 x 1 STM-1 x 1	to Kenya
West and South West	7G SDH 5G SDH	Jimma-(Metu)-Gambela Nekemte-Assosa, Dembidolo Tibebilo-Fincha Nekemte-Ambo link	STM-1 x 1 STM-1 x 1	
North West	5G SDH 5G SDH	AA-(Bahir Dar)-Gonder Gonder-Metema Gonder-Shire	STM-1 x 3 STM-1 x 1 STM-1 x 1	STM-1 for Gonder to Sudan

Radio waves between Addis Ababa and Mt. Furi are very congested because the east, the south, the southwest and the north backbone links are concentrated on this point. The present status of the frequency use is shown in D.Figure 3.3-3.

(2) Spur and Junction Network

Spur link has been constructed by 2GHz and UHF (400MHz/900MHz band) systems. In recent expansion, 7GHz band besides 2GHz band is used. The spur links are also shown in D.Figure 3.3-1 "Connection Diagram of the existing microwave network".

Junction network connecting exchanges each other in Addis Ababa was constructed by microwave at first and is now modified to hybrid type of optical fiber and microwave. ETC is changing the network to the optical fiber oriented one by installing more optical-fiber cables. D.Figure 3.3-4 shows the junction network of Addis Ababa after completion of the on-going plan.

(3) International Transmission Network

Satellite communication facility for international telecommunication is located in Sululta, about 15 km north from Addis Ababa and is connected with International Transit Exchange in Addis Ababa by 7GHz microwave links of 140 Mbit/s digital and 960 ch analogue. Sululta earth station has four antennas accessing to 60-degree INTELSAT satellite in Indian Ocean, 335.5-degree and 342-degree satellites in Atlantic Ocean.

Table 3.3-3 Access Satellite and Ground Facility

Satellite	IOR 60-degree	AOR 355.5-degree		AOR 342-degree
Antenna	Sululta-2	Sululta-1	Sululta-4	Sululta-3
- Diameter	13m	32m	18m	3.8m
Carrier	IDR, SCPC	IDR, FDM, TDMA, TV		IBS
No. of Channels	112	331		2Mbit/s

Source:ETC

Digital 34Mbit/s terrestrial microwave link of 2GHz frequency-band is connected to Djibouti and 83 circuits are reserved for Ethiopian use in SE-ME-WE 2 cable, which is linking to Europe, Near East, South East Asia, Oceania and East Asia.

Analogue 960ch FDM microwave link of 4GHz-band is extended to Marza of Kenya from Tuka in south of Ethiopia. The link is connected to all over the east Africa via Nairobi. ETC plans to digitize the link in Ethiopia. And Kenya also has a digitizing plan.

In the Eighth Development Program ETC plans to construct a new SDH link to Sudan via Metema of north west Ethiopia and Dollar Hill of Sudan. This link will be connected to Khartoum, the capital of Sudan.

3.3.2 Rural Transmission System

Problems with installation and maintenance of outside plant (cables) have prompted the widespread use of wireless systems in rural areas, and there are several types of the system adopted.

In recent years, demand for Internet-based telecommunications applications in rural areas, particularly e-mail, has resulted in deploying the system with combinations of VSAT, VHF/UHF radio system, and wireless local loop system such as CDMA, PHS, DECT, etc. In Ethiopia ETC is also deploying positively to develop rural areas integrating with such new technologies.

Within ITU, Focus Group 7 (FG 7) was formed in March 1999 to carry out the activities of investigation and study on new technologies for rural and remote applications. Its report says that, as a method to promote the development of new communications technologies for rural areas, the combined system with packet exchange system and low cost radio access technology shall be necessary to make use of the Internet.

(1) Present Status of Telecommunications in Rural Areas of Ethiopia

The rural telecommunications network in Ethiopia depends largely upon radio systems. Analog and digital systems exist with VHF and UHF radio bands. DRMASS (Digital Radio Multi-Access Subscriber System) is basically adopted for scattered settlements, villages, or small towns; and VSAT for isolated areas.

References are given to D.Table 3.3-1 on Existing/Planned Transmission Systems for Rural Areas in each region.

In these tables, the rates (percentages) of serving through DRMASS and VSAT in rural telecommunications systems in each region are roughly resulted as follows:

Table 3.3-4 Use of DRMASS & VSAT for the Rural Communication

		DRMASS	VSAT	Total
1)	Northern Region	87 %	5 %	92 %
2)	North Eastern Region	30 %	16 %	46 %
3)	North Western Region	25 %	16 %	41 %
4)	Eastern Region	35 %	45 %	80 %
5)	Southern Region	53 %	11 %	64 %
6)	Western Region	22 %	51 %	73 %
7)	South Western Region	26 %	33 %	59 %
8)	South Eastern Region	26 %	18 %	44 %

In any given Region, more than 40 % of the subscribers are connected with the remote access via DRMASS and VSAT.

Regarding the power supply systems to support these telecommunications facilities, solar power systems are mainly adopted in the areas where the commercial power supply systems are not available.

(2) ETC's Project Implementation Schedule for the Eighth Development Program (1990 – 1994 E.F.Y.)

(a) DRMASS System

Candidate stations are listed in the Eighth Program for 109 stations in rural areas as referred to in the D.Table 3.3-2, "List of Candidate DRMASS Stations".

(b) Woradas without Telecommunications Services

There is an installation plan, in the Eighth Program Phase 2 for Woredas without telecommunications services, as referred to in D.Table 3.3-3, Candidate Stations for Universal Access Services (Phase 2).

The transmission systems to be applied will be DRMASS and VSAT.

(3) VSAT

Three systems of VSAT (Very Small Aperture Terminal), such as DialAway, FaraWay and DOMSAT, are operating now on the 72MHz-bandwidth transponder of 57-degree New Skies satellite (NSS 703).

DialAway and FaraWay supplied by Gilat in Israel are TDMA (time division multiple access) system while DOMSAT procured from NEC, Japan is SCPC (single channel per carrier) system. ETC planed to accommodate 179 stations in DialAway system and 133 stations in FaraWay system under the Eighth Development Program and the implementation is proceeding with a little delay. Theoretical maximum number of VSAT stations is calculated as 220 for FaraWay and 250 for DialAway. DialAway accommodates two channels per station and FaraWay does eight channels at maximum for each station.

Major parameters of each system are as follows at the completion of 1994 EC (2000/2001 GC) plan.

Table 3.3-5 Major Parameter of VSAT System

	FaraWay	DialAway	DOMSAT
Satellite & Frequency	New Skies 57-degree satellite, C-band (TX:6GHz, RX:4GHz)		
Bandwidth	4MHz approx.	3MHz approx.	1MHz approx.
Multiple Access	TDMA	TDMA	SCPC (FDMA)
Hub-station	Sululta		
- Antenna	11m diameter, G/T: 34dB		
Remote-station	127 stations	98 stations	5 stations
- Antenna	2.4m, 3.8m diameter	1.8m diameter	6m diameter
Telephone channels	8 maximum	2 maximum	4
Service or Customers	Public service & Government use	Public service & Leased service	Public service

Source:ETC

Though FaraWay configures the mesh network, DialAway has a network of star configuration. Many of VSAT customers have complain of the time delay of about 0.5 seconds in speech transmission due to double hop in case of the connection between deferent systems or the remote-to-remote connection of DialAway system.

In order to flow the traffic from increased remote stations the gateway capacity of both FaraWay and DialAway systems to the AA transit exchange was expanded from one E1 to five E1s in March 2002.

Number of stations by the end of 1994 EC is shown in the following table per service or customer.

Table 3.3-6 Number of VSAT Remote Station

	FaraWay	DialAway	DOMSAT
Public telecommunication service	114	85	5
Government use	13		
Leased service		13	

Source:ETC

ETC plans to cease DOMSAT operation and to re-use its antenna in FaraWay network under the Eighth Development Program, which benefits ETC to have a bigger-capacity (16 channels) remote station.

3.4 Subscriber Access Network

Ethiopia has been struggling in providing telecommunications accesses in two principal categories of rural and urban accesses. For the rural access, ETC plans to expand the access network in various media as DRMASS, UHF, VHF and VSAT in order to reduce the areas without telephone accesses in the country.

ETC makes it a rule to implement the rural access network as follows.

- Within 20-50km from the exchange: VHF or UHF link
- Within 60-300km from the exchange: DRMASS link
- Over 200-300km from the exchange: VSAT.

On the other hand, Ethiopia has constructed the metallic cable for the subscriber access lines close to the exchange.

As for the urban access, ETC plans to overcome the poor access areas by DRMASS, WLL and new cable facilities including Digital Pair Gain System.

3.4.1 Outside Plants

(1) General

ETC is expanding the subscriber access cable network using jelly-filled cable recently. However, the paper-insulated lead sheathed cables still remain in all areas.

Application of optical fiber cable is now under consideration by ETC to accommodate the customers in some congested areas in Addis Ababa and to grade up the junction route.

ETC has the network records of all over the country and compiled centrally in its head office. These documents are cable plans showing the installation method, network materials and installation year, which can be found in the Drafting & Surveying Section, while the detailed material, labor, transport & other costs are listed in proposals and filed in the Strategic Planning division. OSP cable network capacity record can be obtained from Project and Technical Planning Division or from Outside plant Project Division

There is no standard clearance between the telephone line and the power line due to the absence of joint-use system between ETC and EEPCO to protect telephone lines from power lines.

The plant record system of ETC is under poor management and does not update the plant record after the additional construction, extension and rehabilitation works. (Total lengths of primary and secondary cables, overhead cables, OFCs and conduits; numbers of MH, CCC, DP and pole, etc. are not registered.)

Stock control of spare parts, carried out by ETC, is not efficient for systematic and timely provision.

(2) Present Condition in Terms of Outside Plants (Equipment)

(a) Optical Fiber Cable

ETC has introduced optical fiber cable in around 1988 for inter exchange link in Addis Ababa and its application as transmission media has extended in other areas outside the capital. It is also under implementation process to introduce the optical fiber in subscriber access network. ETC is currently planning and designing to implement Optical Access Network (FTZ) in Addis Ababa to replace old cables and deliver additional services to customers.

The sub-duct system is not applied for laying the optical fiber cables.

Existing optical fiber cable is shown in Table 3.4-1.

Table 3.4-1 Existing of Optical Fiber Cable

	Exchange	EX, or MW	VIA	Cores	Duct (m)	Open Trench (m)	O.H. (m)	Total (m)	Project
1	Addis ketema	Shegole		6	2,000	350	150	2,500	ETC
2	Arada	French Legetion		6	.1,400	4,100	830	6,330	ETC
3	Bole	Gerge		6	2,000		3,500	5,500	ETC
4	Bole	Bole Michael		6	2,500		2,000	4,500	ETC
5	Filwoha	ECA		6	2,600	200		2,800	ETC
6	Old airport	Keranio		6	2,500			5,500	ETC
7	Filwoha	TR/ISC	Sengatera	12	1,600			1,600	TCIL
8	Filwoha	TR/ISC	National theater	12	2,000			2,000	TCIL
9	Filwoha	Arada		24	3,000			3,000	TCIL
10	Arada	Sidistkilo		12	4,400		800	5,200	TCIL
11	Arada	Addis Gebeya		12	4,000		800	4,800	TCIL
12	TR-III/ISC	Addis Ketama		24	3,600		0	3,600	TCIL
13	Addis Ketama	Asko		12	3,600		4,000	7,600	TCIL
14	Asko	Brayu		12			5,000	5,000	TCIL
15	Nifas Silk	Kaliti		12	2,000		5,400	7,400	TCIL
16	Sheno	Sheno MW		12			1,500	1,500	ETC
17	Hossaina	Hossaina MW		12			700	700	ETC
18	Ataye	Ataye MW		12			2,000	2,000	ETC
	Total				37,200	4,650	29,680	71,530	

TCIL Project was completed in Feb. 2002.
Source:ETC

(b) Primary Cable and Tip Cable

The protection of jointing closure (terminal joint) for Primary cable and PVC tip cable coming from MDF is not in a good condition for old existing cables. The cable name, cable wire diameter, cable pairs account and construction year are not indicated on the jointing closures. These problems are now being corrected in the new projects and new installation and construction standards have been adopted.

(c) Primary Cable

For distribution system in the local access network, a Cross Connection Cabinet (CCC) system is mostly applied. Cables in the cabinet are classified generally either Primary cable connected to exchange or Secondary cable connected to Distribution Points. For security purpose or in the closed vicinity of an exchange office, the cable pairs are directly distributed to the distribution Points. There are a lot of old paper insulated lead sheathed cables in use in the primary cccable network now, which will be replaced by the polyethylene insulated jelly filled cables or by FTZ by the end of year 2007. The dry air system for paper-insulated cables is not in use. The Primary cables are

mainly laid in concrete or PVC ducts or directly buried. The cables to be laid directly underground are of steel tape armored type. There is no indication of cable name, cable pair number, cable diameter and construction year on jointing parts.

(d) Secondary Cable

The secondary cables are laid either directly underground or aerial. These cables are mainly of jelly filled for the directly buried type and of air core polyethylene sheathed for the aerial type. The ratio of underground to aerial cable varies from place to place depending on the local condition.

The cable types used in ETC's local network are specified as follows (Refer also Table 3.4–2):

1) Duct: Fully filled foam skin polyethylene insulated Aluminum Laminated Sheathed copper pair cables.

2) Direct-buried:

Fully filled foam skin polyethylene insulated Aluminum Laminated Sheathed Armored copper pair cables.

3) Aerial: Polyethylene sheathed and air-cored solid polyethylene insulated self-supporting copper pair cable.

The types of metallic cable are shown in Table 3.4-2.

Table 3.4-2 Type of Metallic Cable

Type	Conductor gauge	Cable pairs
	0.4mm	2400,2000,1600,1000,800,600
Duct cable	0.5mm	1600,1000,800,600
	0.6mm	800,600
	0.4mm	600,400,300,250,200,150,100,50,30,20,10
Buried cable	0.5mm	600,400,300,250,200,150,100,50,30,20,10
	0.6mm	600,400,300,250,200,150,100,50,30,20,10
	0.4mm	100,50,30,20,10
Aerial cable	0.5mm	100,50,30,20,10
	0.6mm	100,50,30,20,10

DC Loop resistance limitation: 1,500 Ohms
Insertion loss limitation (Under 800 Hz): 7dB

(e) CCC (Cabinet)

In urban areas, the cabinet system is adopted, where primary cables from exchange and secondary cables from DPs are terminated. ETC is using 3 types of CCCs (2,400, 1,800 & 1,200 pair capacity). The cabinet body is mainly manufactured within Ethiopia. However, considerable amount of Cabinets with complete accessories are imported (Outsource projects).

A Cabinet area is totally served by the secondary cable extended from the cabinet, which is located mostly at the corner of the distribution area towards the exchange.

(f) DP or TB (Terminal Box)

All out door DPs are currently manufactured in Ethiopia. The terminal box is fixed on wooden pole with stainless steel band or nails. The numbering of the DP is indicated either written on the cover or plated with aluminum numbering plate. Outdoor DPs are only of 10 pair's capacity. ETC intends to import DPs in future due to the poor quality of the local made DPs.

(g) Drop Wire

Drop wire role volume is 250 m or 500m, and is imported.

(h) Telephone Pole

ETC used iron poles about 30 years ago, but nowadays uses eucalyptus poles with a standard pole interval of 40m. The telephone pole length is 7 m, 8 m or 9 m, mostly with no indication of telephone pole names on it.

(i) Telephone Terminal-set

ETC supplies the first basic telephone terminal and charges its rental fee, while the subscriber may connect the additional telephone set at his own cost.

(j) Civil facility: MH, HH

Although ETC has established a MH standard, the inside of MH and the cable hanger hardware are installed in a bad state, and no MH name is indicated at MH neck.

MH cover may be either of the two kinds: iron circular, or concrete rectangular. The statements written under the above topic are valid only for old networks.

ETC has standardized its Manholes and Hand holes completely with their accessories like cover, frame, fixing and supporting materials, which are now used in the new projects.

(k) Civil Facilities (Duct)

The ETC standard is 2- or 4-hole concrete conduit, each with a length of 1m.

However, ETC has introduced PVC duct of 6 meters length, 5.5-mm wall thickness and 100-mm internal diameter since 1997. These duct systems cover now about 50%of the total duct length. They will replace the old concrete ducts. These PVC pipes are manufactured locally.

(l) Civil Facilities (Sub Duct)

The sub duct system is not adopted for optical fiber cables.

(m) Civil Work (Direct Buried)

Standardization of cable protection board and warning tape usage has just been completed.

(n) Civil Facilities (Cable Chamber)

There is no water stopper at the opening of conduits, and water penetrates from adjacent MH. Some cable chambers are not clean and lighting arrangements inside are not suitable for work.

(3) Problem Issues

1) Paper-insulated, lead-sheathed cables are highly vulnerable during the rainy season; sometimes it takes 2 to 3months to repair.
2) The concrete duct jointing method has some problems. Construction of duct system using many pieces of short conduit is very difficult; their joints are vulnerable to heavy vehicles and other external forces.

   PVC duct system is now introduced to overcome these problems.
3) The sub duct system is not used for optical fiber cables, and the duct is not used efficiently.
4) The name and number of MH, HH, cable jointing part, pole, CCC, DP, etc., are not indicated on them clearly, inhibiting the maintenance personnel to quickly find fault points.
5) The plant record is not updated and is not available at site.

3.4.2 Wireless Local Loop

As a tendency during the recent years, the radio technology called Wireless Local Loop (WLL) system has become popular and is nowadays widely applied in the subscriber access network for its quick implementation and flexible network structure, instead of ordinary outside plant of metallic cables.

Present status of introduction of WLL in Ethiopia is as follows,

Area	Capacity	Operating (year)	System
Bole	1,500 L	2000	PHS
Addis Ketema	1,500 L	2000	PHS
Nefas Silk	1,500 L	2000	PHS
Old Airport	1,500 L	2000	PHS

Moreover, 30,000 lines will be introduced shortly by ICB (International Competitive Bid).

As described above, WLL has been introduced only to Addis Ababa zone, but it will be deployed to other regions of Ethiopia in the near future.

3.5 Mobile Communication Network

(1) General

Mobile telecommunications face overwhelmingly strong needs in potentiality and actuality for being irrespective of fixed location. Many kinds of diverged systems are offered in mobile telecommunications such as car telephones, handy phones, cordless phones, wireless LAN, communications on premises, business communications, satellite mobile communications. Mobile

phones are remarkably developed among them. The total mobile-phone subscribers through the world in 1998 were about 333 millions, and will be estimated one billion in 2005 which is three times in expansion.

In Ethiopia, as well, remarkable expansion will be expected, that is, total mobile-phone subscribers were 36,000 in the end of 2001. ETC planned to expand the network capacity to 400,000 lines within 5 years, which is more than ten times in expansion.

(2) Present Status of Mobile Telecommunications in Ethiopia

The mobile telecommunications network in Ethiopia is presently limited to the metropolitan area of Addis Ababa and its outskirts, Nazareth, and Sodore, which belong to YERER and KEREYU, respectively, both in Oromiya Region. The number of present subscriber is 48,000 as in July 2002. This status of implementation is confirmed in accordance with ETC's Seventh Development Program. Reference is provided in Fig. 3.5-2, and Fig.3.5-3 Existing Mobile Telecommunications Network in Ethiopia.

(3) Mobile Telecommunications Network Plan in ETC

ETC's plan on mobile network at present is as follows:

1) To be expanded to 60,000 subscribers within 3 months in the present area described in the above paragraph (1). (This figure is matched for the figure of 61,727 in 2005 of the Eighth Development Program.)

2) To be expanded to additional 200,000 subscriber lines within 3 years in 13 major regional cities including Addis Ababa area:

a) Addis Ababa	100,000	(200,000) subs.
b) Mekele	18,000	(36,000) subs.
c) Bahir Dar	6,000	(12,000) subs.
d) Diredawa	16,000	(32,000) subs.
e) Awassa	10,000	(20,000) subs.
f) Jimma	6,000	(12,000) subs.
g) Shashemene	5,000	(10,000) subs.
h) Dessie	5,000	(10,000) subs.
i) Harar	6,000	(12,000) subs.
j) Gondar	6,000	(12,000) subs.
k) Assela	4,000	(8,000) subs.
l) Nekempte	4,000	(8,000) subs.
m) Zwai	4,000	(8,000) subs.
Total	**200,000**	**(400,000) subs.**

The numbers in parentheses are revised ones from their preceding numbers.

Transmission Link Plan for 12 Major Cities is shown in Fig. 3.5-4 and Schematic Diagram for 200,000 subscribers Expansion Plan on GSM Network is shown in Fig. 3.5-5.

3) Other Plans

ETC has a plan to introduce a wireless fax/data, SMS (Short Message System), and e-mail services in the near future and enhance the data service to mobile Internet.

4) To be expanded to 400,000 subscribers in total within 5 years including other newly planned areas, which are not concrete yet.

ETC, however, revised its plan in April 2002 to reach 400,000 subscriber lines in total by the year of 2005 as drawn below in dotted lines

Reference is made to the following graph of Mobile Phone Expansion Plan, which is advanced for 3 years at the year of 2002.

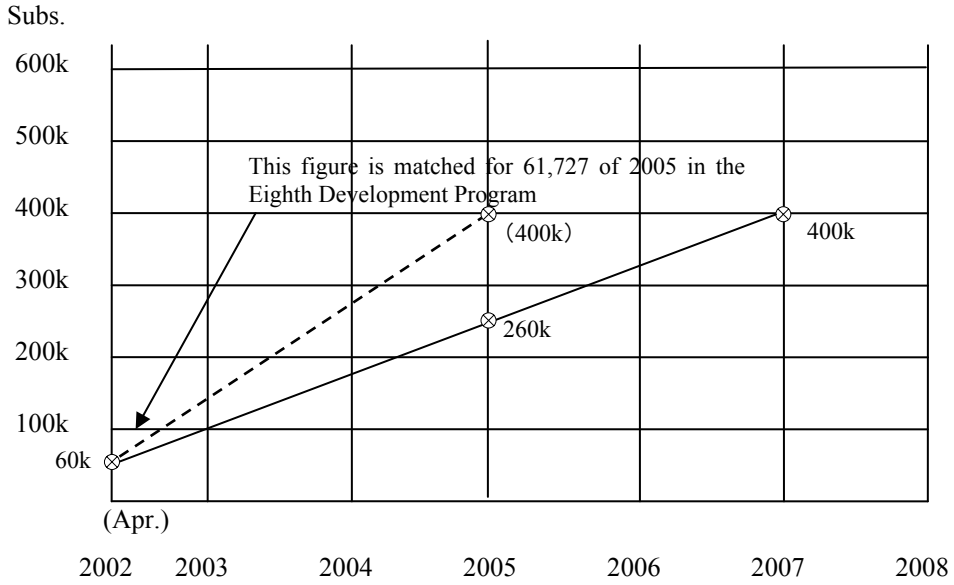


Figure 3.5-1 ETC's Mobile Telephone Expansion Plan

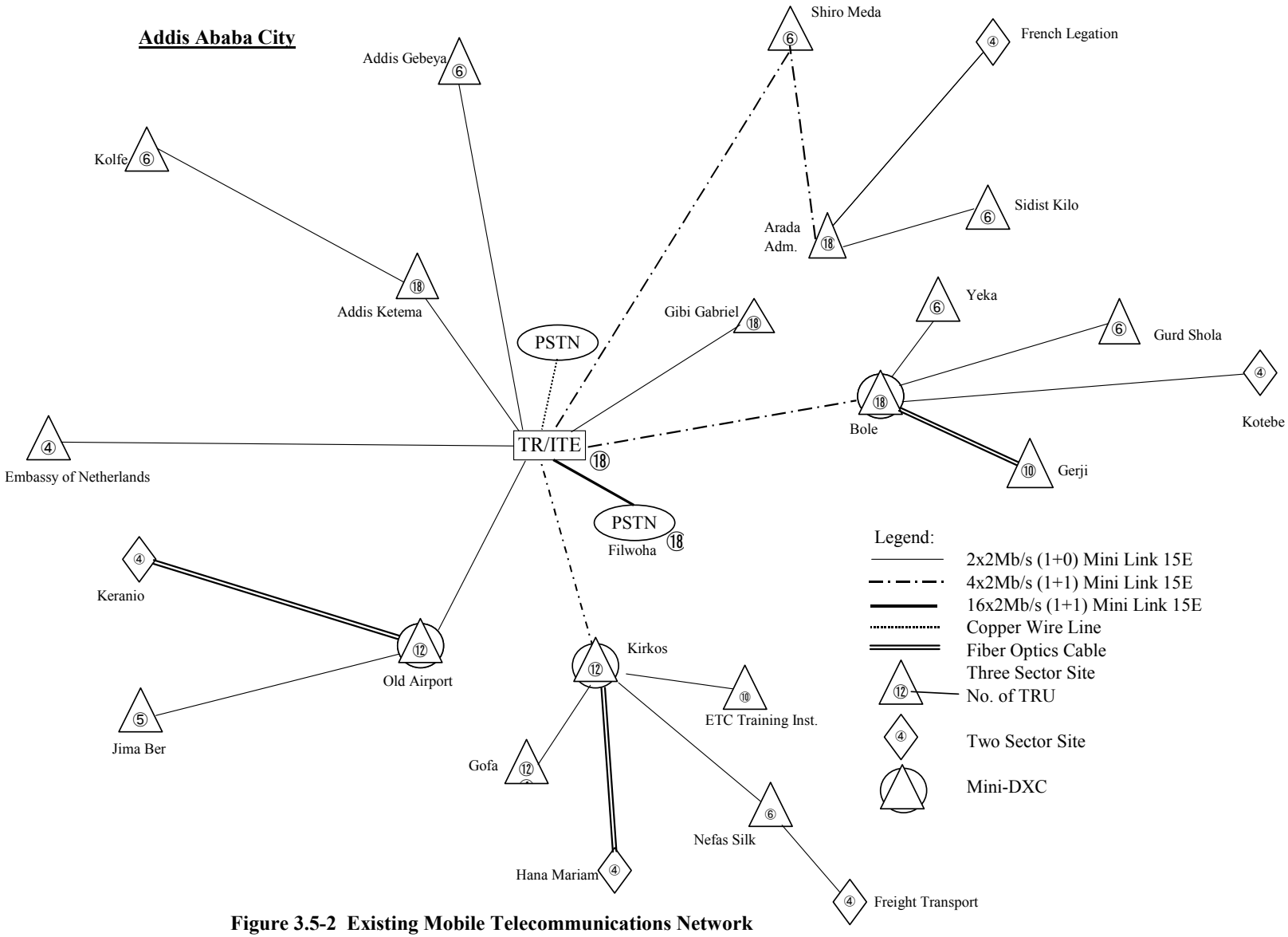


Figure 3.5-2 Existing Mobile Telecommunications Network

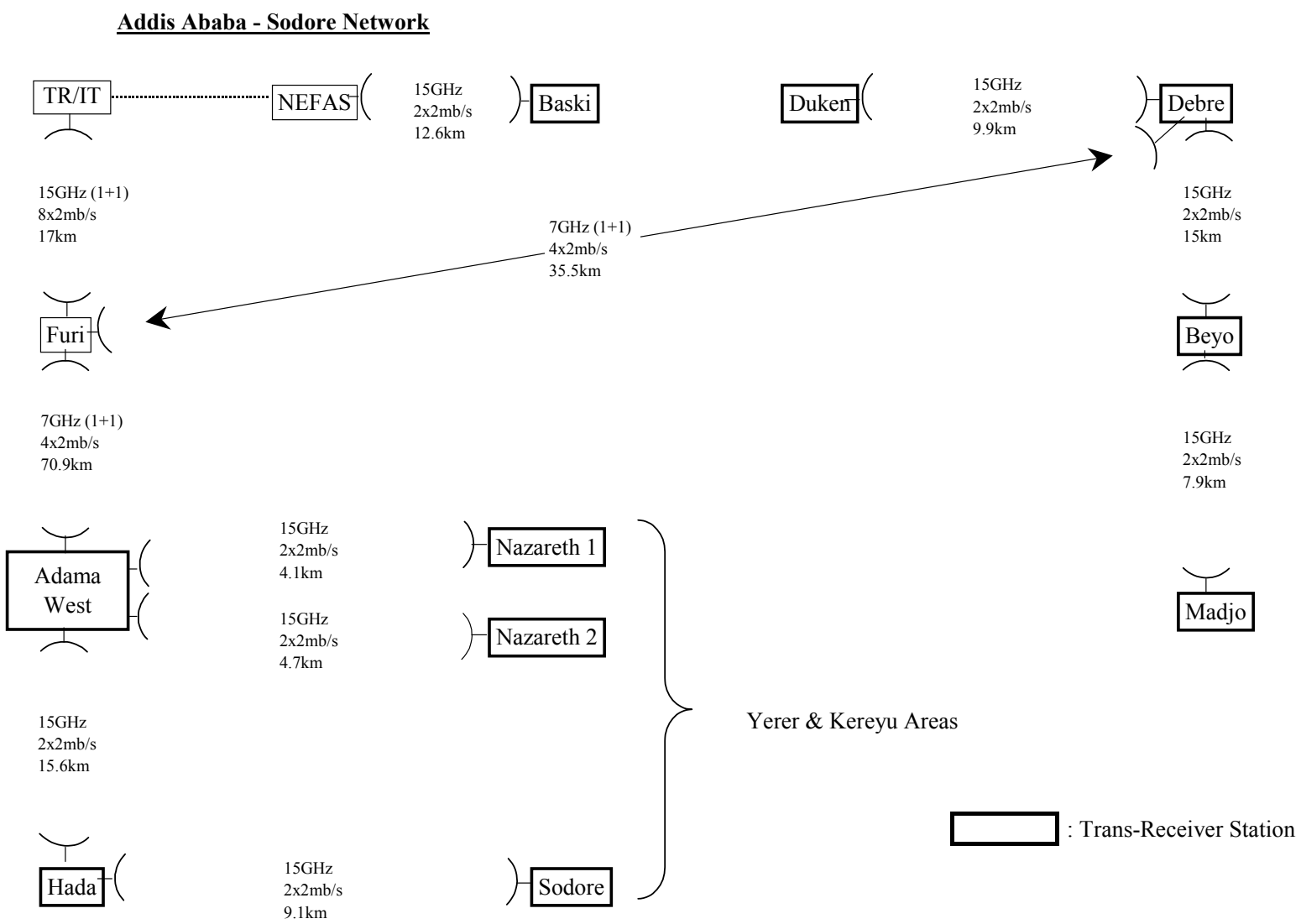


Figure 3.5-3 Existing Mobile Telecommunications Network

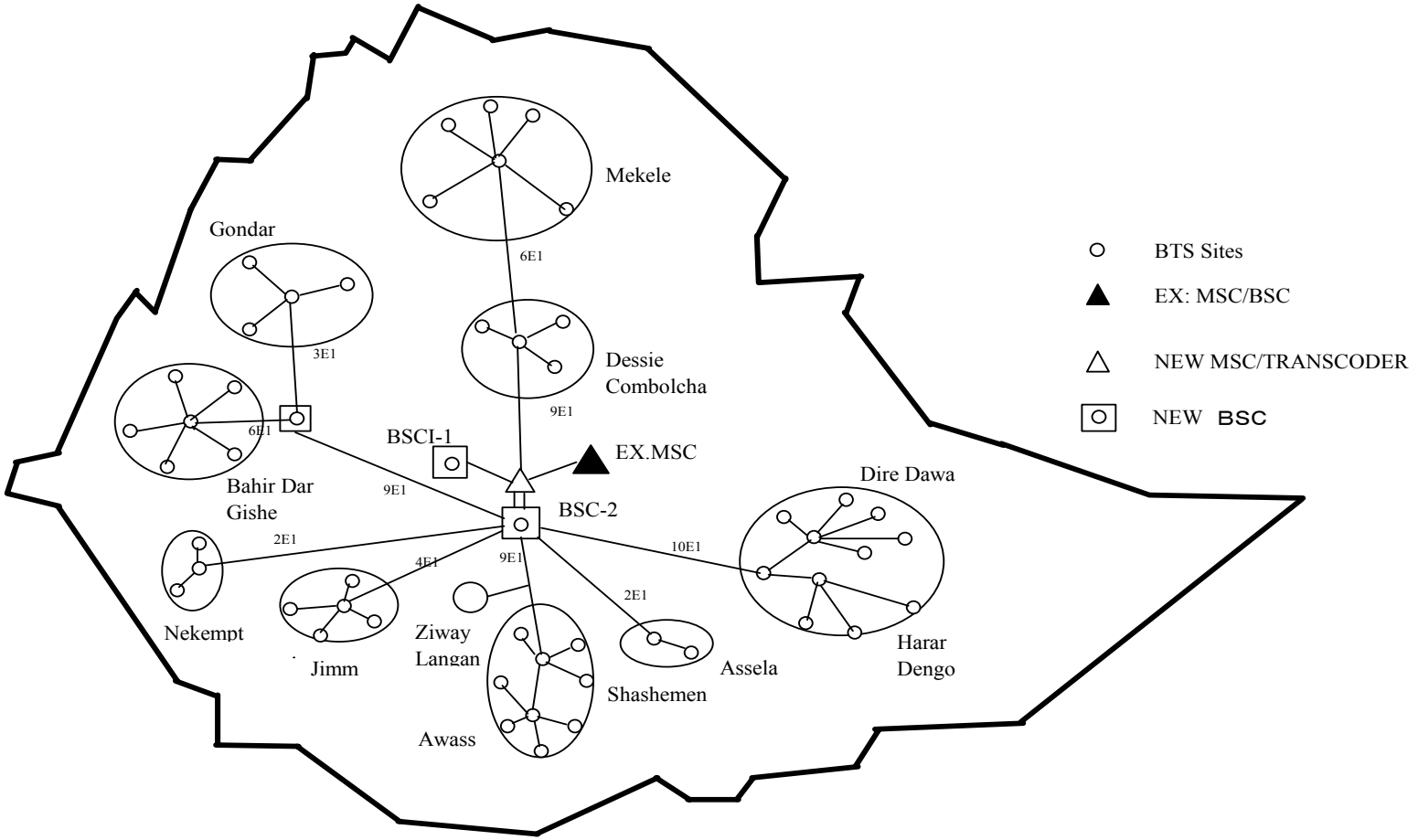


Figure 3.5-4 Transmission Link Plan for 12 Major Cities

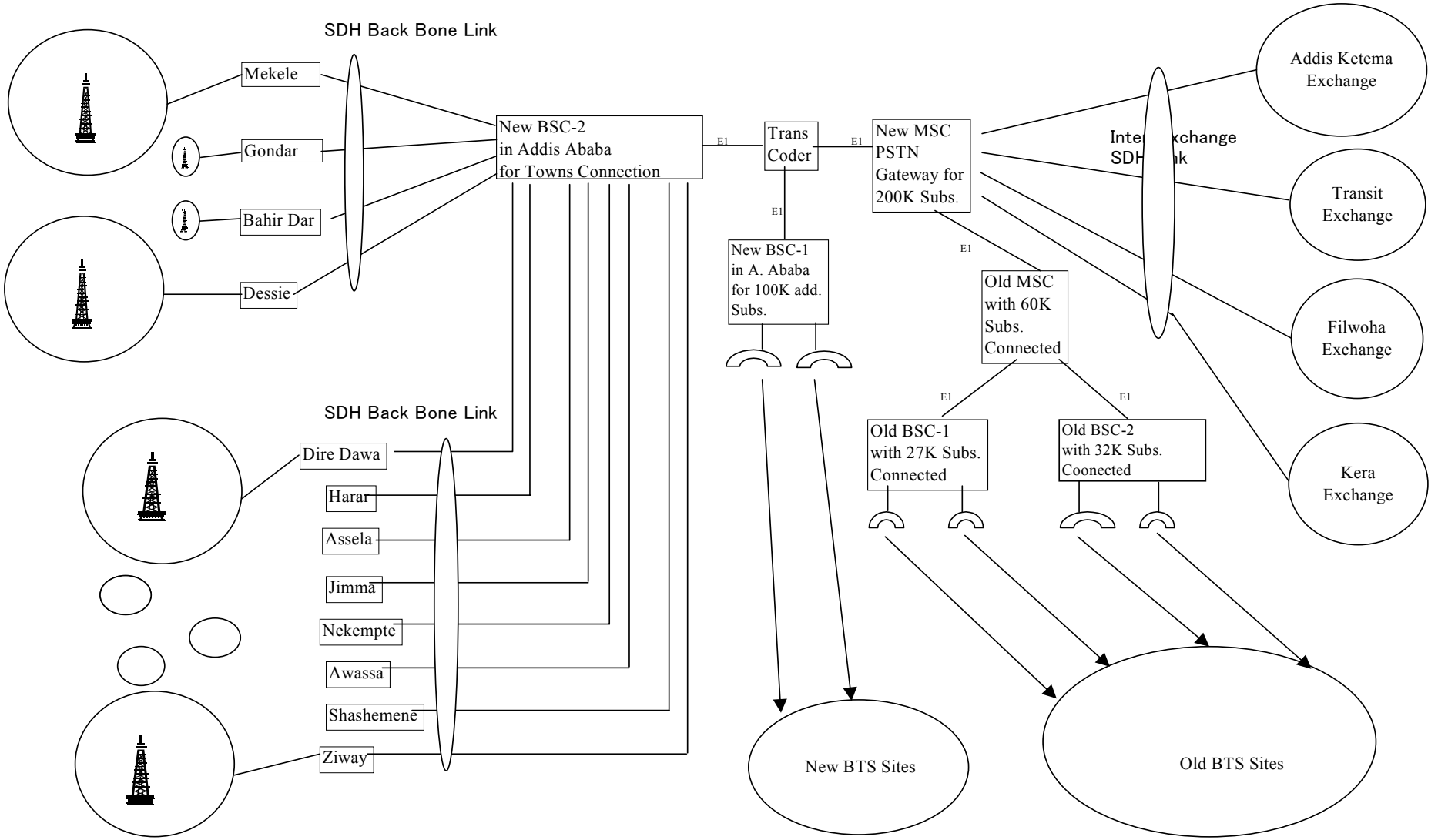


Figure 3.5-5 Schematic Diagram for 200, 000 Subscribers Expansion Plan in GSM Network