CHAPTER 5

DEMAND FORECAST

CHAPTER 5

DEMAND FORECAST

1. Introduction

The main purpose of this chapter is to estimate the growth in demand for telephone and other service and to provide the basis for an economic and technical study of the basic plan for the telecommunications network development in Ulaanbaatar city up to the year 2010. The forecasting base year is set at 1995, and successive forecasts are made in 2000, 2005 and 2010. In order to make realistic forecasts, emphasis is placed on collection of the most recent data.

Demand for telephone service is estimated by three methods in this study, i.e., Methods I, II and III. Method I is for macroscopic forecast for the whole country, based on the former socialist countries data. Method II is for semi-macroscopic forecast for Ulaanbaatar city, and Method III is microscopic forecast for 9 districts in Ulaanbaatar city. Demand for other services is estimated by a regression model obtained from other country's data. The following sections present the results of this study on demand forecast up to 2010, as well as assumptions and procedures adopted for the study.

2. Telephone Demand at the end of the Year 1995

As of the end of September 1995, the number of telephone subscriber lines in the Ulaanbaatar city is 44,082 and that of waiters, 23,174, with the total telephone demand amounting to 68,256. The Ulaanbaatar city consists of 9 districts, namely, Suhbaatar, Chingeltei, Bayangol, Songinohairhan, Bayansurh, Khan-Uul and 3 districts as enclaves which are Nalaih district which is 45 Km apart from the Ulaanbaatar city to the southeast, Baganuur district, 140 Km to the east, and Bagahangai district, 130 Km to the south.

Table 5-2-1 shows the number of telephone subscriber lines and waiters classified by exchange and Table 5-2-2 shows those by district. Similarly the total demand was classified by exchange and district, as shown in Table 5-2-3, based on the results of the detailed field survey conducted by "Study of the basic data of the Ulaanbaatar city telephone network" [N.Nansaljav, D.Dolgorsuren, Sh.Ganbold and M.Naranbaatar] in 1993.

According to MCAC, most of the waiters are residential ones except those in Baganuur district, because in most districts demand for administrative / business use telephones has almost been satisfied as they are given high priority over residential ones.

The demand in Ulaanbaatar city is **68,256**, which occupied 60.8% of the demand in whole Mongolia, i.e., **112,247**, at the end of September 1995. In this study, this is regarded as the demand at the end of 1995, which is the starting point of demand forecasting up to 2010.

Table 5-2-1 Number of Subscriber Lines and Waiters in Ulaanbaatar City by Exchange

At the end of 1995

Exchange	Subscriber Lines		Waiters	Demand	Remarks
	Admin. / Busi.	Resident			
ATC-2	307	1,279			ATC-73
ATC-32	6,187	6,180	7,144	21,097	Bio, Shuvuu
ATC-5	1,955	5,359			Gachuurt, Honhor
ATC-35	292	565	3,855	12,026	
ATC-33	1,156	1,148	965	3,269	Jargalant, ICC
ATC-34	1,474	1,804	1,709	4,987	
ATC-36	1,127	7,544	6,961	15,632	
ATC-37	246	414	400	1,060	
ATC-38	351	3,619	2,314	6,284	
ATC-76	88	57	0	145	
Nalaih	239	701	171	1,111	
Baganuur	327	1,600	* 655	2,582	
Bagahangai	48	15	0	63	
Sub-total	**13,797**	**30,285**	**24,174**	**68,256**	
Total		**44,082**	**24,174**	**68,256**	

Note : Bio - Biokombinat, Shuvuu - Shuvuun Fabric, ICC - International Children's Center Jargalant (Partizan)

* 200 waiters out of 655 in total are those for administrative/business use telephones.

Table 5-2-2 Number of Subscriber lines and Waiters in Ulaanbaatar City by District

At the end of 1995

District (Dureg)	Subscriber Lines		Waiters	Demand	Remarks
	Admin. / Busi.	Resident			
Suhbaatar	3,081	4,554	3,943	11,578	ATC-73
Chingeltei	4,040	3,139	4,183	11,362	ATC-73
Bayangol	1,099	7,159	6,072	14,330	
Songinohaihan	1,513	5,037	3,663	10,213	Jargalant, ICC
Bayansurh	1,642	5,805	3,378	10,825	Gachuurt, Honhor
Khan-Uul	1,808	2,275	2,109	6,192	Bio, Shuvuu
Nalaih	239	701	171	1,111	
Baganuur	327	1,600	* 655	2,582	
Bagahangai	48	15	0	63	
Sub-total	**13,797**	**30,285**	**24,174**	**68,256**	
Total		**44,082**	**24,174**	**68,256**	

Table 5-2-3 Results of Detailed Field Demand Survey in 1993
Study of the basic data of the Ulaanbaatar city telephone network
[N. Nansaljav, D.Dolgorsuren, Sh. Ganbold and M.Naranbaatar]

No.	District Name	Exchange/site Name	Population	Exchange/Site Share	Household	Exchange/Site Share	Telephone Lines				Demand Share
							Adi./Bus.	Resi.	Waiter	Demand	
1	Suhbaatar	ATC 32	45,597	61.92%	18,247	74.76%	1,407	3,390	1,907	6,704	76.92%
		ATC 5	14,401	19.56%	2,570	10.53%	662	93	684	1,439	16.51%
		ATC 73	13,635	18.52%	3,592	14.72%	22	75	475	572	6.56%
	Sub-Total		**73,633**	**14.49%**	**24,409**	**19.55%**	**2,091**	**3,558**	**3,066**	**8,715**	**16.04%**
2	Chingeltei	ATC 2	29,016	35.54%	7,280	37.41%	2,300	2,330	948	5,578	71.99%
		ATC 6	15,740	19.28%	3,451	17.74%	21	100	430	551	7.11%
		ATC 73	36,894	45.19%	8,727	44.85%	18	34	1,567	1,619	20.90%
	Sub-Total		**81,650**	**16.07%**	**19,458**	**15.58%**	**2,339**	**2,464**	**2,945**	**7,748**	**14.26%**
3	Bayangol	ATC 36	107,056	100.00%	24,572	100.00%	1,068	6,216	5,170	12,454	100.00%
	Sub-Total		**107,056**	**21.07%**	**24,572**	**19.68%**	**1,068**	**6,216**	**5,170**	**12,454**	**22.92%**
4	Songinohaihan	ATC 33	55,802	52.60%	11,742	51.65%	897	879	1,528	3,304	33.19%
		ATC 36	11,056	10.42%	2,455	10.80%	6	234	327	567	5.70%
		ATC 38	39,236	36.98%	8,535	37.55%	67	3,608	2,409	6,084	61.12%
	Sub-Total		**106,094**	**20.88%**	**22,732**	**18.20%**	**970**	**4,721**	**4,264**	**9,955**	**18.32%**
5	Bayansurh	ATC 5	92,335	100.00%	22,074	100.00%	1,797	4,533	4,844	11,174	100.00%
	Sub-Total		**92,335**	**18.17%**	**22,074**	**17.68%**	**1,797**	**4,533**	**4,844**	**11,174**	**20.57%**
6	Khan-Uul	ATC 34	19,114	40.40%	4,768	41.02%	1,003	1,180	1,114	3,297	76.89%
		ATC 37	21,425	45.28%	5,612	48.28%	218	349	406	973	18.43%
		Ulziit	3,306	6.99%	515	4.43%	0	0	8	8	0.01%
		Biokombinat	3,469	7.33%	728	6.26%	0	0	10	10	0.02%
	Sub-Total		**47,314**	**9.31%**	**11,623**	**9.31%**	**1,221**	**1,529**	**1,538**	**4,288**	**7.89%**
	Grand-Total		**508,082**	**100.00%**	**124,868**	**100.00%**	**9,486**	**23,021**	**21,827**	**54,334**	**100.00%**

3. Telephone Demand Forecast

3.1 Demand Forecast Procedures

Demand for telephones was projected by three methods, i.e., (I) macroscopic forecast method based on the former socialist countries data, (II) semi-macroscopic forecast method based on the Ulaanbaatar data, and (III) microscopic forecast method based on district data. Figure 5-3-1, -2 and -3 present procedures these three forecast models.

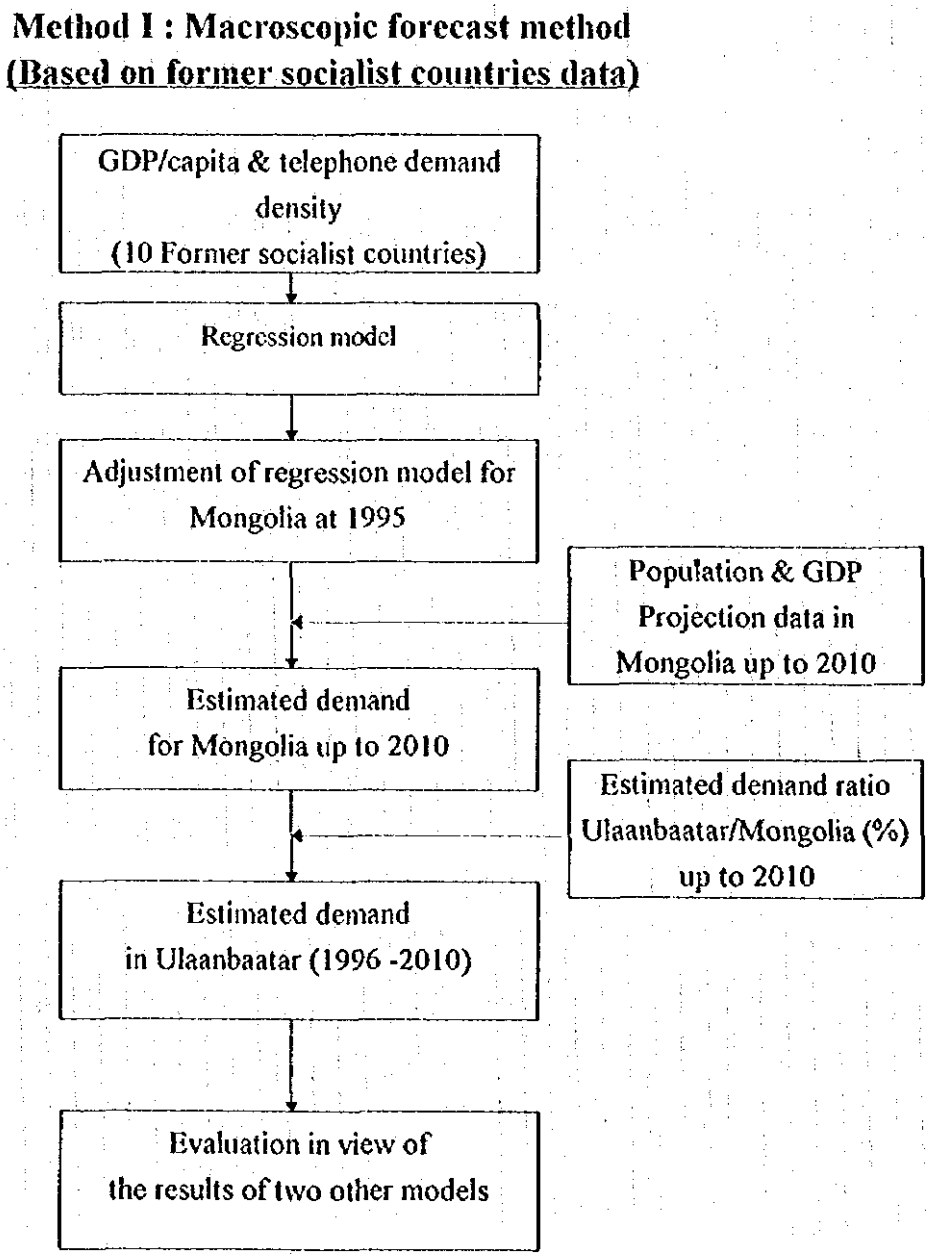

Figure 5-3-1 Macroscopic Forecast Method Procedure

Method II : Semi-macroscopic forecast method (Based on Ulaanbaatar data)

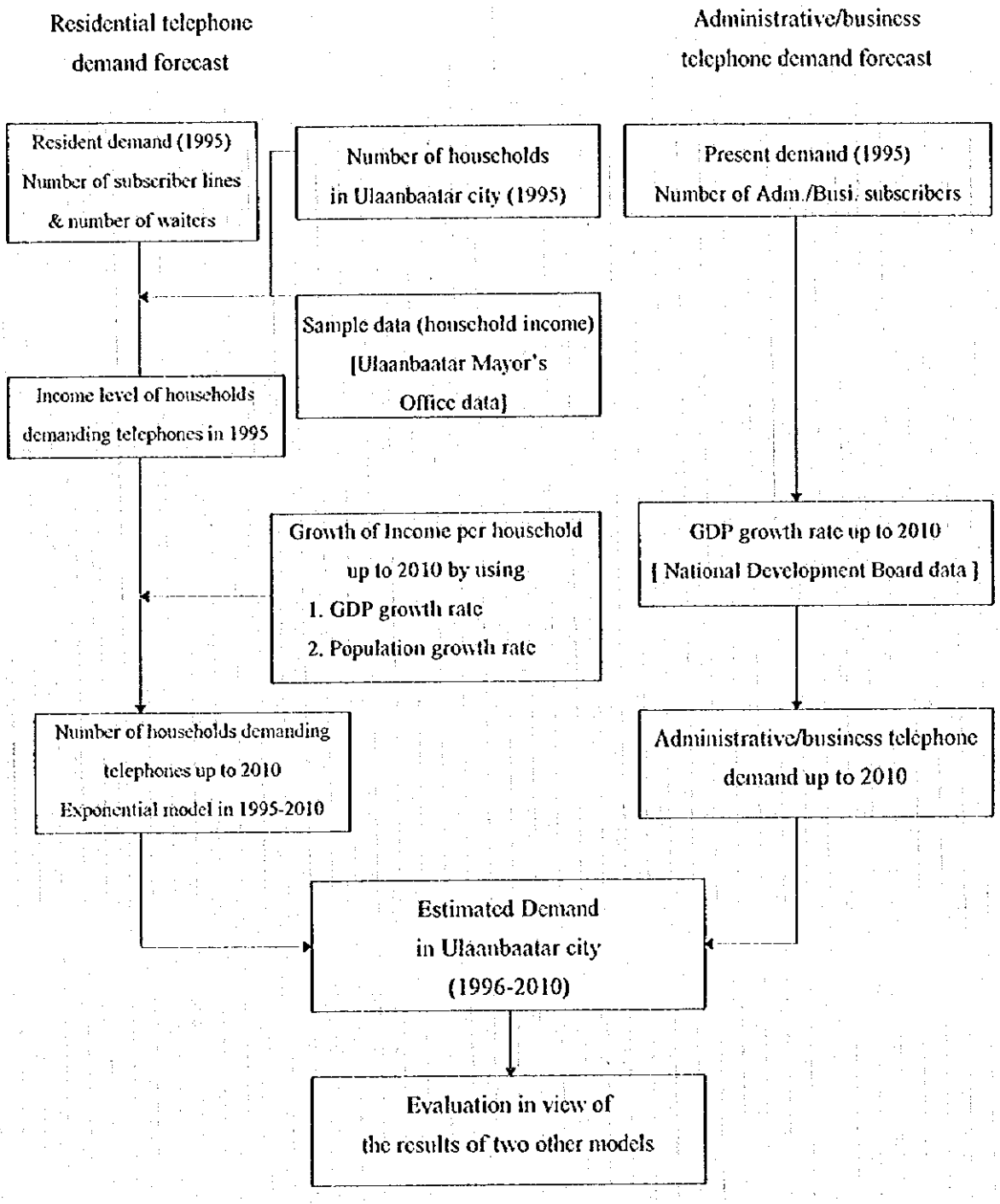

Figure 5-3-2 Semi-macroscopic forecast Method Procedure

Method III : Microscopic forecast method
(Based on district data in Ulaanbaatar city)

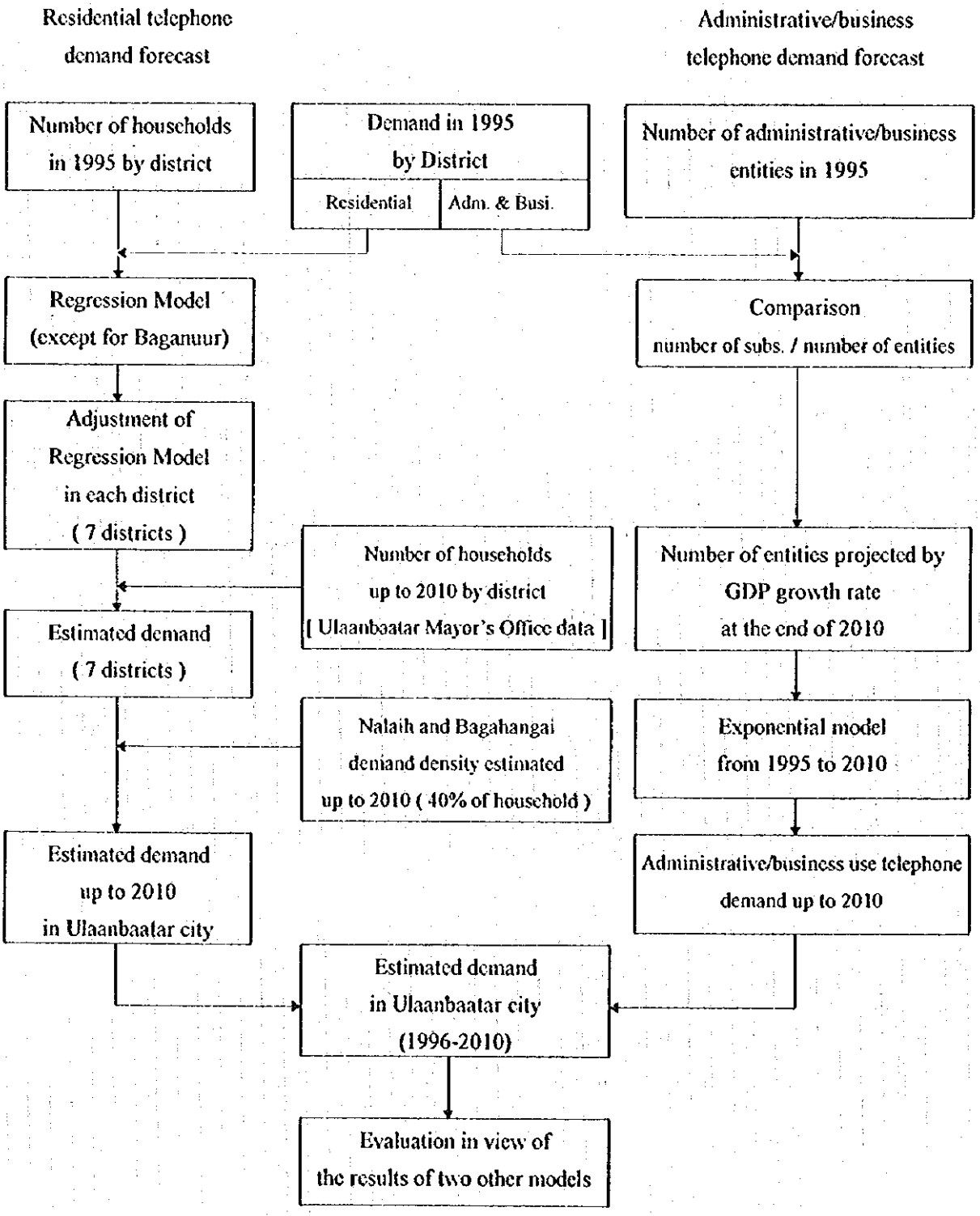

Figure 5-3-3 Microscopic Forecast Method Procedure

3.2 Socio-economic Growth Forecast

In order to forecast future telephone demand, socio-economic growth both in Ulaanbaatar city and Mongolia was estimated in terms of population, GDP and GDP per capita for each forecasting year. The population and GDP growth rate in Mongolia were estimated based on the data issued by National Development Department, and the population in Ulaanbaatar city, based on the data issued by Ulaanbaatar Mayor's Office.

The average growth rate of GDP in U.S. dollar was estimated to be 5.9% per annum from 1995 to 2010. GDP estimated by the constant price in 1992 based on the above average GDP growth rate was used for three forecast methods as mentioned above. In fact, GDP per capita in 1995 is lower than that in 1992 because of the negative growth rate in economic activities and the drop of exchange rate against U.S. dollar as follows:

GDP per Capita: 21,360 Tg./(40Tg./US$) = 534 US$ per Capita in 1992 constant price.
: 169,608 Tg./(450Tg./US$) = 377 US$ per Capita in 1995 constant price.

In macroscopic forecast method (Method I), the Study Team made a regression model by using the constant U.S. dollar price in 1992 because the latest telecommunications data in 50 countries over the world were available in 1992. The population, GDP and GDP per capita for each forecasting year are shown in Table 5-3-1.

Table 5-3-1 Population and GDP Projection

Year	1995	2000	2005	2010
Population				
Mongolia	2,317	2,508	2,770	3,058
Ulaanbaatar city	619.3	668.4	721.5	778.7
GDP (Million US$)	1,213	1,594	2,133	2,854
GDP/capita (US$)	523	636	770	933

Note : GDP and GDP per capita at 1992 constant price in US dollar

3.3 Method I : Macroscopic Forecast Method (Based on former socialist countries data)

For understanding the current telephone demand situation in Mongolia, the Study Team analyzed the Mongolian position in the world by applying the ITU regression model. This model was made by studying correlation between the expressed demand (Subscriber lines + Waiters) per 100 inhabitants and GDP per capita using statistical data of 50 countries over the world in 1992. The data used to develop the model consist of the number of existing subscriber lines and that of the waiting applicants registered. That is, the estimated demand does not include potential demand.

As a result of the analysis, the following regression model was obtained:

$$\text{Ln}((SL + WA)/POP \times 100) = -5.502 + 0.9692 \times \text{Ln}(GDP/POP) \quad (R \text{ squared} = 0.82)$$

where,

Ln	:	natural logarithmic operator
SL	:	the number of subscriber lines in 1992
WA	:	the number of registered waiters in 1992
POP	:	population in 1992
GDP	:	GDP in 1992

The data to obtain the regression model are given in Data book (Vol. V, Chapter 4, PP. 4-1) Figure 5-3-4 shows a demand regression expressing a correlation between telephone density and GDP per capita and a supply regression expressing a correlation between telephone supply density and GDP per capita. This figure indicates that telephone density per 100 inhabitants increases in line with the increase in GDP per capita.

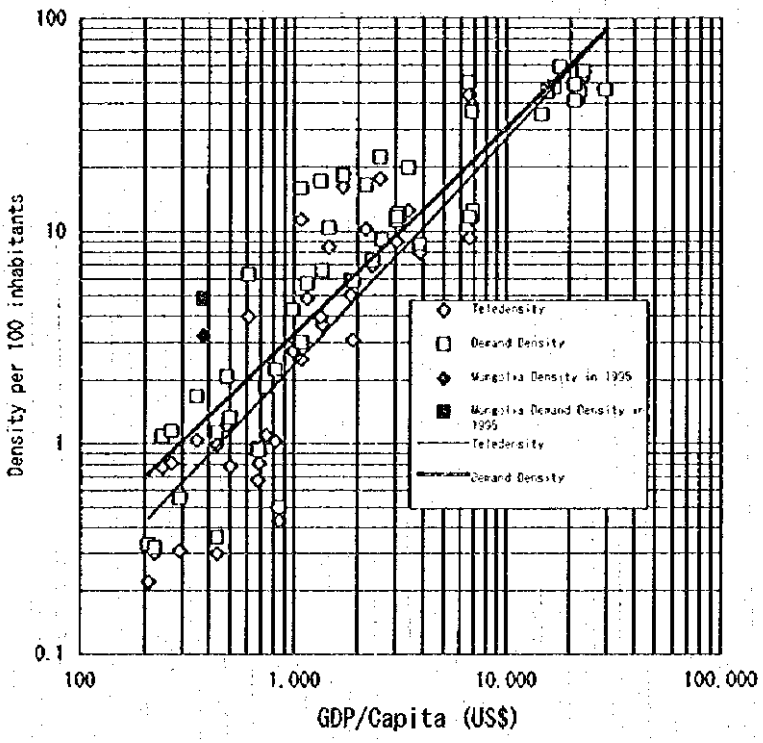

Figure 5-3-4 World Telephone Service in 1992

As can be seen Figure 5-3-4, Mongolia ranks higher, both in telephone demand and supply, than the average levels illustrated as the demand/supply regression curves obtained from 50 countries data in 1992. It means that the development level of telephone infrastructure in Mongolia is already high despite of rather low GDP per capita (US$ 534 per capita at 1992 constant price). It is assumed that this is because most former socialist countries have given high priority to the development of basic infrastructures such as telecommunications. Then, the Study Team made another regression model based on the data of former socialist countries in 1992 to forecast Mongolia telephone demand. Table 5-3-2 shows the former socialist countries data to develop the regression model.

Table 5-3-2 Former Socialist Countries Data in 1992

Country	GDP/capita (US$)	Population	Subscriber Lines	Waiters	Telephone Demand	Expressed Demand Density (100 per Pop.)
Mongolia	534	2,215,000	79,120	29,610	108,730	4.91
Geogia	847	5,500,000	572,700	290,050	862,750	15.69
Kasakhstan	1,681	17,000,000	787,200	2,658,700	3,445,900	20.27
Kyrgyzstan	814	4,500,000	338,700	80,780	419,480	9.32
Moldova	1,281	4,400,000	511,000	200,100	711,100	16.16
Romania	1,076	22,700,000	2,574,070	1,181,310	3,755,380	16.54
Tajikistan	677	5,600,000	268,900	77,710	346,610	6.19
Turkmenstan	591	3,900,000	243,580	85,850	329,430	8.45
Ukraine	1,820	52,100,000	7,577,900	3,685,400	11,263,300	21.62
Uzbekistan	692	21,500,000	1,439,510	326,580	1,766,090	8.21

Data Source : World Telecommunication Development Report, prepared by ITU in 1994
World Development Report 1994, prepared by the World Bank

As a result of the analysis of these data, the following regression model was obtained:

$$((SL + WA) / (POP \times 100)) = 0.006 \times (GDP / POP)^{1.1062} \quad \text{.....(1)}$$

(R squared = 0.83)

SL : the number of subscriber lines in 1992
WA : the number of waiting applicants registered in 1992
POP : population in 1992
GDP : GDP in 1992

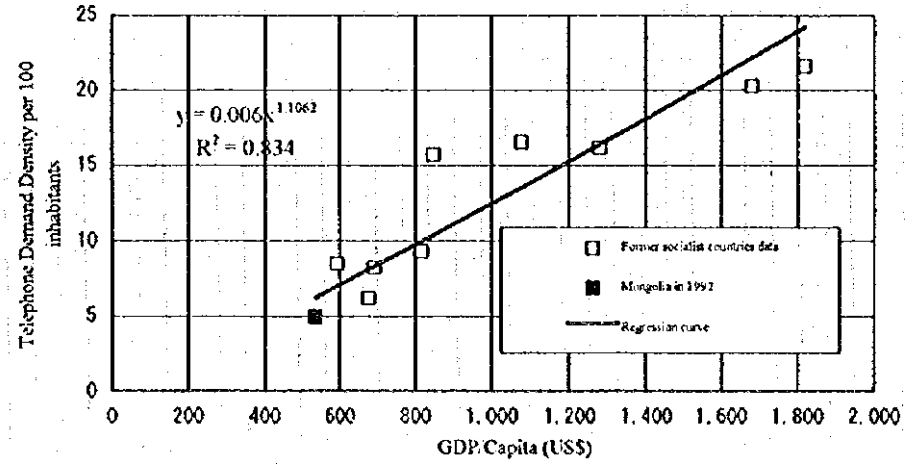

Figure 5-3-5 Former Socialist Countries in 1992

To apply the model to Mongolia in this study, the formula (1) was revised as follows, using the expressed demand of 68,256 at the end of 1995 in Ulaanbaatar city including the demand in Nalaih, Baganuur and Bagahangai.

$$(SL + WA - 29{,}099) / (POP \times 100) = 0.006 \times (GDP/POP)^{1.1062} \quad \ldots\ldots\ldots(2)$$

The Study Team adopted this formula (2) to estimate the telephone demand up to 2010 in Mongolia.

Table 5-3-3 shows the results of the above macroscopic forecast method (Method I).

Table 5-3-3 Results of Macroscopic Forecast Method (Method I)

Items	1995	2000	2005	2010
Mongolia				
Population	2,317,000	2,508,000	2,770,000	3,058,000
Demand	112,247	160,861	230,120	324,794
Demand Density	4.84	6.41	8.31	10.62
Ulaanbaatar city				
Population	619,300	668,400	721,500	778,700
Demand	68,256	96,326	135,697	188,602
Demand Density	11.02	14.41	18.81	24.22
Mongolia/Ulaanbaatar (%)	60.81%	59.88%	58.97%	58.07%

3.4 Method II : Semi-Macroscopic Forecast Method (Based on Ulaanbaatar data)

In order to estimate the residential telephone demand up to 2010 in the Ulaanbaatar city, the income level of households demanding telephones in 2010 was assumed by using sample income data provided by the Mayor's office in Ulaanbaatar city. This sample data is given in Supporting Document (Vol. IV, Chapter 3, PP. 3-4 - 3-7). The Study Team assumed that the richest portion of households is able to afford the telephone subscriptions. The share of this portion is estimated in 4 steps as described in the following section. Detail calculation procedure of semi-macroscopic forecast method are described in Supporting Document (Vol. IV, Chater 3, PP. 3-8 - 3-13).

3.4.1 Residential Telephone Demand

(1) First Step

In September 1995, the total residential telephone demand in Ulaanbaatar city is 54,259 consisting of the number of the existing residential subscriber lines and that of waiters (30,285 and 23,974 respectively), while the number of households is 137,600 according to the Mayor's Office in Ulaanbaatar city. The percentage of the richest portion of the households demanding telephones in 1995 is calculated as follows:

54,259 (residential telephone demand) / 137,600 (households) = 39.4%.

According to the above mentioned sample income survey, minimum income level of the highest 39.4% household is approximately 43,100 Tg. / month / household in September 1995.

(2) Second Step

Growth rate of income per household on average between 1995 and 2010 was calculated on the following conditions and by applying the following formula.

Economic growth rate of Ulaanbaatar city (same as the whole nation) :
Approx. 5.9% (5.8731 %) per year on average between 1995 to 2010

Population growth rate of Ulaanbaatar city :
Approx. 1.54% (1.5386 %)per year on average between 1995 to 2010

Growth rate of income per household : $((((1.059^{15})/(1.0154^{15}))^{(1/15)})-1) \times 100$
Approx. 4.3% (4.2688 %) per year on average between 1995 and 2010

(3) Third Step

Income level per household in 1995 that will reach 43,100 in 2010 was calculated by the following formula.

$43{,}100 \text{ Tg.} / (1.0426882^{15})$ = 23,022.92 Tg.
= 23,023 Tg. (Approximately)

Income distribution pattern in 1995 was assumed to remain unchanged until 2010 in this study. In this assumption, the number of households earning 22,023 Tg. / month / household in 1995 occupies 75.5% in the share of richest portion in all households.

(4) Final Step

The number of households and residential telephone demand in 2010 were calculated as follows:

619,300 (population in 1995) / 137,600 (housholds in 1995) = 4.5 persons / household
778,700 (population in 2010) / 4.5 (average household size)
= approx. 173,000 (households in Ulaanbaatar city in 2010)
173,000 x 75.5% = 130,615 (residential telephone demand in 2010)

The Study Team estimated the residential telephone demand is to be 130,615 in 2010 and made the following exponential formula to meet the above-mentioned figure in 2010 from the residential demand in 1995, i.e., 54,259.

$$RDt = 376.82 \times PHt^{1.357}$$

RDt : The number of Residential Demand in period t
PHt : The Percentage of Households in Ulaanbaatar city whose income will reach 43,100 Tg. /month /household in period t

Figure 5-3-6 shows the percentage of households in Ulaanbaatar city that will reach 43,100 Tg./ month / household in 1995, 2000, 2005 and 2010.

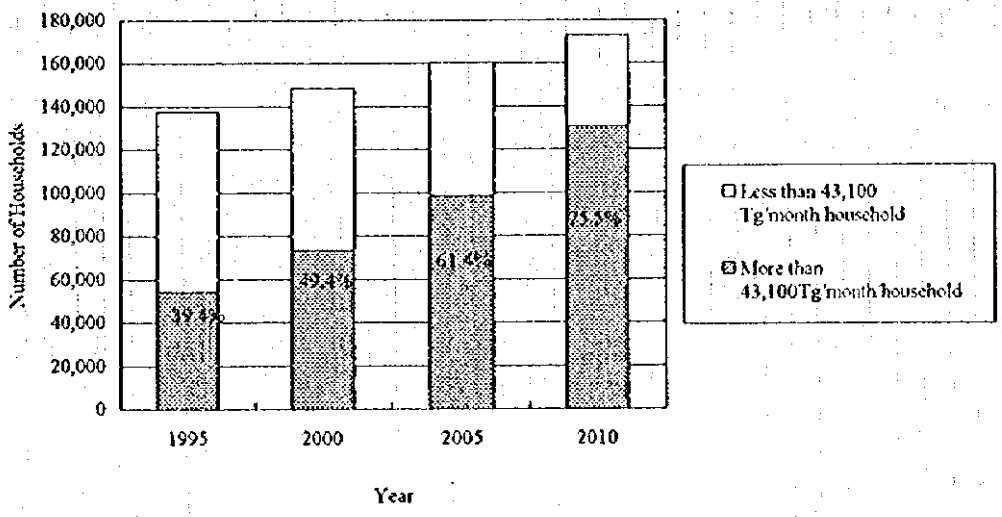

Figure 5-3-6 Number of Households Demanding Telephone in Ulaanbaatar City

3.4.2 Business Telephone Demand

Business demand was assumed to increase in line with the economic activity growth in Mongolia. Then, business demand forecast was made by using the GDP growth rate in Mongolia up to 2010, and the demand in 1995, i.e., 13,997 (13,797 subscriber lines and 200 waiters in Baganuur).

Table 5-3-4 shows the results of demand forecast in Ulaanbaatar city obtained by using the semi-macroscopic forecast method (Method II).

3.4.3 Total Telephone Demand

Table 5-3-4 Results of Semi-macroscopic Forecast Method (Method II)

	1995	2000	2005	2010
Residential demand	54,259	73,359	98,424	130,615
Business demand	13,997	18,398	24,620	32,947
Total demand	68,256	91,757	123,044	163,562

3.5 Method III : Microscopic Forecast Method (Based on district data in Ulaanbaatar city)

To estimate the residential telephone demand, the model was made by studying correlation between the number of households in districts in Ulaanbaatar city in 1995. Otherwise, it is assumed that the number of companies (big and medium size companies in 1995) well signifies business telephone demand in 1995. Therefore, the Study Team assumed that the number of companies (including small sized companies which will demand telephones during the forecasting years) estimated in 2010 based on the GDP growth rate is equal to business telephone demand in 2010.

3.5.1 Residential Telephone Demand

Residential telephone demand in 9 districts is shown in Table 5-3-5. Based on this data except for Baganuur, the following regression model is made. (In this table, an exceptional case is observed in Baganuur district where demand per 100 inhabitants accounts for as high as 49.5%, in spite of the fact there are only a small number households as compared with other districts.

Table 5-3-5 Household and Residential Telephone Demand by District in 1995

District	Population	No. of Household	Telephone Demand	Tel. Demand / house
Suhbaatar	80,200	16,822	8,711	51.8
Chingeltei	90,400	21,088	7,256	34.4
Bayangol	111,700	24,822	13,237	53.3
Songinohairhan	124,300	27,485	8,698	31.6
Bayansurh	105,300	23,400	9,031	38.6
Khan-Uul	60,900	13,533	4,384	32.4
Nalaih	23,400	5,200	872	16.8
Baganuur	16,900	4,150	2,055	(49.5)
Bagahangai	6,200	1,100	15	1.4
Total	619,300	137,600	54,259	39.4

Data source (No. of households and Population) : The Mayor's Office in Ulaanbaatar city

Figure 5-3-7 shows the regression obtained by using the above data except for Baganuur.

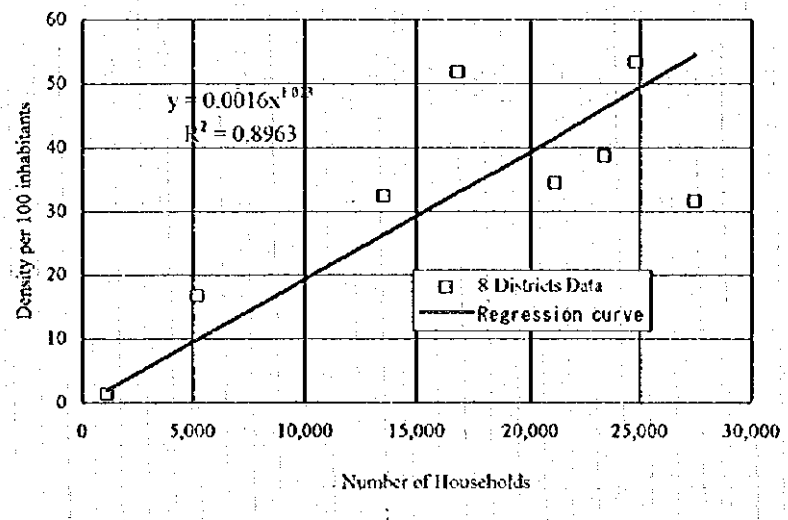

Figure 5-3-7 Regression Model for Residential Telephone Demand Forecast

As a result of the analysis, the following regression model was obtained:

(Residential telephone demand per 100 households) = 0.0016 x (Number of households)$^{1.023}$
(R squared = 0.89)

This model is adjusted to the demand level of each district in 1995 by district and is used for the residential telephone demand forecast up to 2010 in each district. However, the demand in Baganuur and Bagahangai obtained by this model is still low in 2010. Hence, the Study Team adopted such demand density as 40 per 100 households (Khan-Uul district level in 2010) for these districts in consideration of their importance in economic activities. Table 5-3-6 shows the results of residential demand forecasting in the year of 2000, 2005 and 2010.

Table 5-3-6 Residential Telephone Demand by District

District	1995	2000	2005	2010
Suhbaatar	8,711	10,171	11,962	13,755
Chingeltei	7,256	8,424	9,834	11,680
Bayangol	13,237	15,544	17,938	20,933
Songinohairhan	8,698	10,090	11,856	13,834
Bayansurh	9,031	10,612	12,270	14,428
Khan-Uul	4,384	5,110	5,987	6,970
Nalaih	872	1,288	1,692	2,604
Baganuur	2,055	2,369	2,792	3,213
Bagahangai	15	153	354	540
Total	54,259	63,761	74,685	87,957

3.5.2 Business Telephone Demand

To estimate the business telephone demand in each district up to 2010, the correlation between the business demand and the number of companies in each district was studied. As can easily be seen from Table 5-3-7, the larger the number of companies, the higher the business telephone demand.

Table 5-3-7 Number of Companies and Business Demand in 1995

District	Number of Companies	Business Demand
Suhbaatar	3,132	3,081
Chingeltei	3,250	4,040
Bayangol	4,586	1,099
Songinohairhan	3,112	1,513
Bayansurh	3,976	1,642
Khan-Uul	2,059	1,808
Nalaih	414	239
Baganuur	392	527
Bagahangai	212	48
Total	21,133	13,997

In September 1995, the number of companies is larger than the number of telephones in demand for business use because the number of companies includes the small sized ones which are not in need of telephones at present. At the end of 2010, the number of companies projected with the GDP growth rate will be equal to the required telephones for business use. The number of companies at the end of 2010 calculated based on the GDP growth rate will be 49,744 including the small sized. The exponential to reach this figure in 2010 is as follows:

$$BTDt = 0.0066 \times NCt^{1.4636}$$

BTDt : Business demand in period t
Nct : Number of companies in period t

The results of business telephone demand estimation is shown in Table 5-3-8.

Table 5-3-8 Business Telephone Demand by District

District	1995	2000	2005	2010
Suhbaatar	3,081	4,589	6,997	10,948
Chingeltei	4,040	6,019	9,176	14,359
Bayangol	1,099	1,637	2,496	3,905
Songinohairhan	1,513	2,255	3,438	5,378
Bayansurh	1,642	2,446	3,728	5,835
Khan-Uul	1,808	2,694	4,105	6,423
Nalaih	239	356	543	849
Baganuur	527	787	1,200	1,876
Bagahangai	48	70	109	171
Total	13,997	20,853	31,792	49,744

Table 5-3-9 shows the results of telephone demand forecast in Ulaanbaatar city obtained by using the microscopic forecast method (Method III).

Table 5-3-9 Results of Microscopic Forecast Method (Method III)

Item	1995	2000	2005	2010
Residential demand	54,259	63,761	74,685	87,957
Business demand	13,997	20,853	31,792	49,744
Total demand	68,256	84,614	106,477	137,701

3.6 Evaluation of Results of Telephone Demand Forecast

The results of telephone demand forecast obtained by Method-I, -II and -III are summarized in the Table 5-3-10, together with the forecast made by ADB (Asian Development Bank) Master Plan. The growth curves obtained from the three models in this study and the former master plan prepared by ADB, are shown in Figure 5-3-8.

Table 5-3-10 Summary of Estimated Telephone Demand in Ulaanbaatar City

Item	1995	2000	2005	2010
Population	619,300	668,400	721,500	778,700
Method I	68,256	96,326	135,697	188,602
Demand Density	11.02	14.41	18.81	24.22
Method II	68,256	91,757	123,044	163,562
Demand Density	11.02	13.73	17.05	21.00
Method III	68,256	84,614	106,477	137,701
Demand Density	11.02	12.66	14.76	17.68
ADB Master Plan	44,482	63,099	79,534	95,714
Demand Density	7.18	9.44	11.02	12.29

Speaking of the relation between telephone demand and supply, it is generally observed that the increase in supply of telephones is one of major factors which induce the increase in demand. That is, when much more telephones are supplied, much more demand is motivated.

As a result of the analysis of telephone demand obtained by three models, it was made clear that the demand forecast made by ADB Master Plan, in 1993 is not realistic at present because this forecast was made when Mongolia was still struggling with a significant reduction in budget due to less income from former USSR. However, from the beginning of 1995, several economic indicators in Mongolia began to recover and the nation's financial performance is becoming stable as compared with a past few years.

To enhance and continue this trend, telecommunication's role will become more and more important in the Mongolian society, and in Ulaanbaatar city , as the capital of the country, the telephone demand per 100 inhabitants is expected to exceed 20.0 in 2010.

On the other hand, the minimum target of GDP growth rate up to 2010 assumed by National Development Board in an average 5.9% per annum.

As a result of the above experiential and theoretical study, the forecast obtained by the semi-macroscopic model (Model II) is considered to be most reliable because the income level per household to demand telephone subscriber line in Ulaanbaatar city is taken into account in this model. Then, the telephone demand obtained by semi-macroscopic model (Method II) is adopted to use in this study.

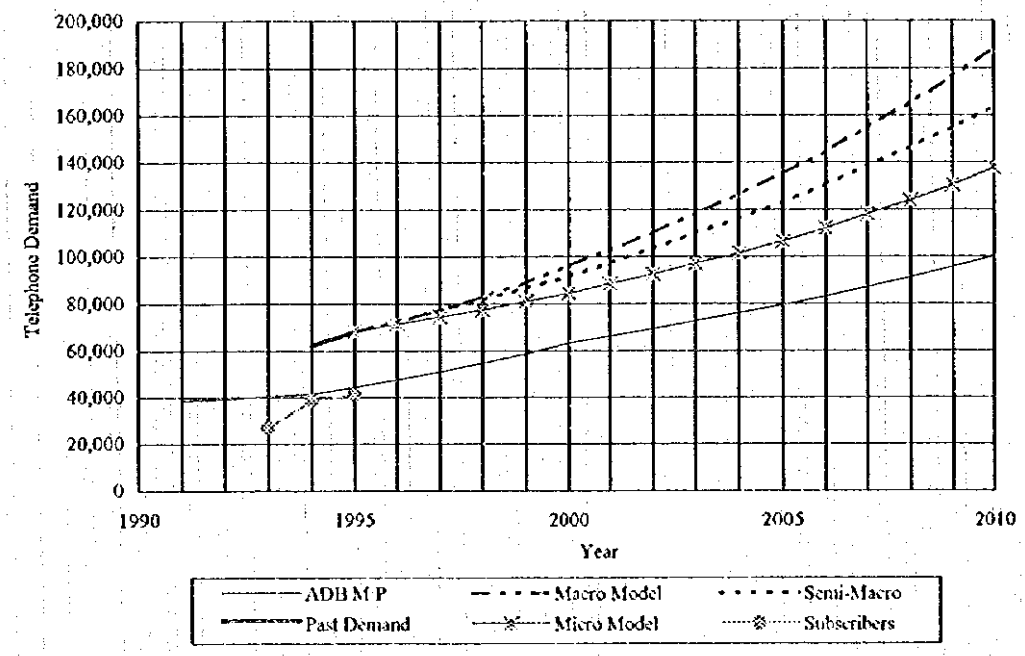

Figure 5-3-8 Telephone Demand Projection up to 2010

Figure 5-3-9 shows the administrative/business and residential demand in Ulaanbaatar city.

3.7 Telephone Demand Distribution to Exchanges

Semi-macroscopic demand in Ulaanbaatar city is distributed to the districts concerned in accordance with the distribution of microscopic demand projected on the district basis. Then the demand distributed to each district is further distributed to each horoo based on the results of the detail field survey conducted by "Study of the basic data of the Ulaanbaatar city telephone network" [N. Nansaljav, D. Dolgorsuren, Sh. Ganbold and M. Naranbaatar] in 1993 (refer to Data book, Vol. V, Chapter 4, PP. 4-4 - 4-27). Table 5-3-11 and Figure 5-3-10 present the demand by district and Table 5-3-12 and Figure 5-3-11 present the demand by exchange from 1995 to 2010 (on condition that the district and exchange boundaries not will change until 2010). The telephone demand by horoo up to 2010 is shows in Data book (Vol. V, Chapter 4, PP. 4-4 - 4-27). Table 5-3-13 present the demand by exchange rearranged in boundary up to 2010. New boundary of exchange is decided by Telecommunications Network Plan described in following Chapter 7.

Finally, in this basic plan, exchange boundaries in Ulaanbaatar city was planned to change up to 2010 through network planning described in Chapter 7 "Telecommunication Network Plan". Therefore, the telephone demand by exchange in present boundary were rearranged to adjust in planned exchange boundary planned in this study. Table 5-3-13 and Figure 5-3-12 show the telephone demand on planned exchange boundary up to 2010.

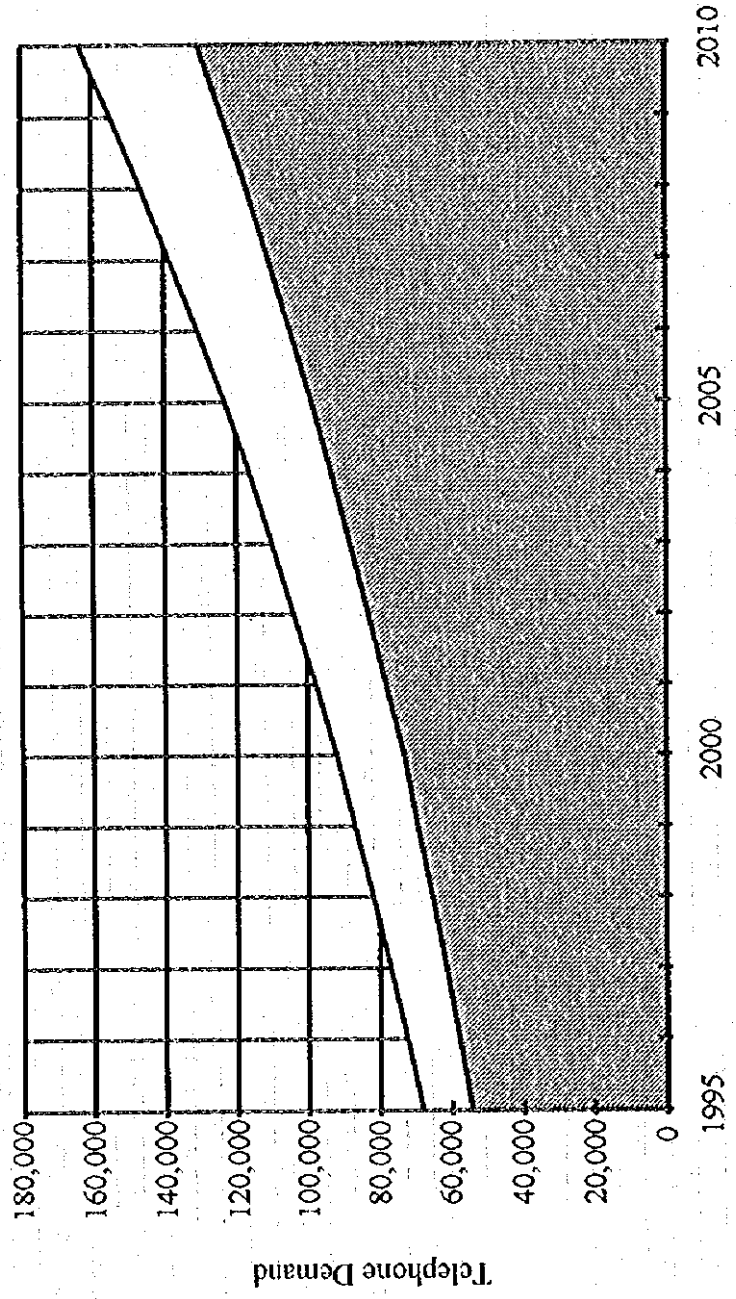

Figure 5-3-9 Demand of Administration / Business and Resident in Ulaanbaatar city

Table 5-3-11 Results of Demand Forecasting by District up to 2010 in Ulaanbaatar City

District	Subscriber Category	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Suhbaatar	Adm. / Business	3,081	3,244	3,422	3,610	3,820	4,049	4,292	4,549	4,823	5,112	5,418	5,744	6,089	6,453	6,841	7,252
	Resident	8,711	9,353	9,768	10,447	11,036	11,702	12,441	13,278	14,064	14,952	15,764	16,680	17,648	18,685	19,733	20,427
Chingeltei	Adm. / Business	4,040	4,254	4,487	4,735	5,010	5,310	5,629	5,966	6,325	6,704	7,107	7,533	7,985	8,464	8,971	9,511
	Resident	7,256	7,743	8,317	8,730	9,307	9,692	10,397	10,905	11,654	12,498	12,960	13,831	14,754	15,379	16,373	17,344
Bayangol	Adm. / Business	1,099	1,157	1,221	1,288	1,362	1,444	1,531	1,623	1,720	1,823	1,933	2,049	2,171	2,302	2,440	2,586
	Resident	13,237	14,062	14,958	15,986	16,876	17,884	19,002	20,266	21,103	22,430	23,641	25,012	26,459	28,012	29,579	31,086
Songinohairhan	Adm. / Business	1,513	1,594	1,681	1,774	1,876	1,990	2,108	2,235	2,369	2,511	2,662	2,821	2,991	3,171	3,361	3,562
	Resident	8,698	9,228	9,938	10,432	11,148	11,609	12,482	13,092	14,022	14,660	15,625	16,706	17,395	18,608	19,350	20,544
Bayanzurh	Adm. / Business	1,642	1,729	1,824	1,925	2,036	2,158	2,288	2,424	2,570	2,724	2,887	3,061	3,244	3,439	3,645	3,865
	Resident	9,031	9,574	10,256	10,765	11,445	12,210	12,751	13,691	14,586	15,248	16,170	17,210	18,311	19,087	20,273	21,425
Khan-Uul	Adm. / Business	1,808	1,904	2,009	2,119	2,241	2,377	2,518	2,670	2,829	2,998	3,179	3,370	3,572	3,787	4,014	4,254
	Resident	4,384	4,685	4,891	5,289	5,485	5,879	6,316	6,623	7,087	7,409	7,890	8,214	8,777	9,382	9,755	10,350
Nalaih	Adm. / Business	239	251	266	280	297	314	333	353	374	397	421	446	473	501	531	562
	Resident	872	981	1,081	1,194	1,300	1,482	1,615	1,765	1,910	2,074	2,230	2,486	2,847	3,145	3,551	3,867
Baganuur	Adm. / Business	527	555	586	618	655	694	736	780	827	877	929	984	1,044	1,106	1,173	1,242
	Resident	2,055	2,176	2,317	2,478	2,619	2,726	2,899	3,095	3,280	3,489	3,679	3,894	4,053	4,293	4,536	4,771
Baganhangai	Adm. / Business	48	51	53	56	59	62	66	71	75	80	84	89	94	100	106	113
	Resident	15	34	59	100	130	175	211	265	307	401	465	512	573	634	697	801
Total	Adm. / Business	13,997	14,739	15,549	16,405	17,356	18,396	19,501	20,671	21,912	23,226	24,620	26,097	27,663	29,323	31,082	32,947
	Resident	54,259	57,836	61,585	65,421	69,346	73,359	78,114	82,980	88,013	93,161	98,424	104,550	110,817	117,225	123,847	130,615
	Adm. / Busi. & Resi.	68,256	72,575	77,134	81,826	86,702	91,757	97,615	103,651	109,925	116,387	123,044	130,647	138,480	146,548	154,929	163,562

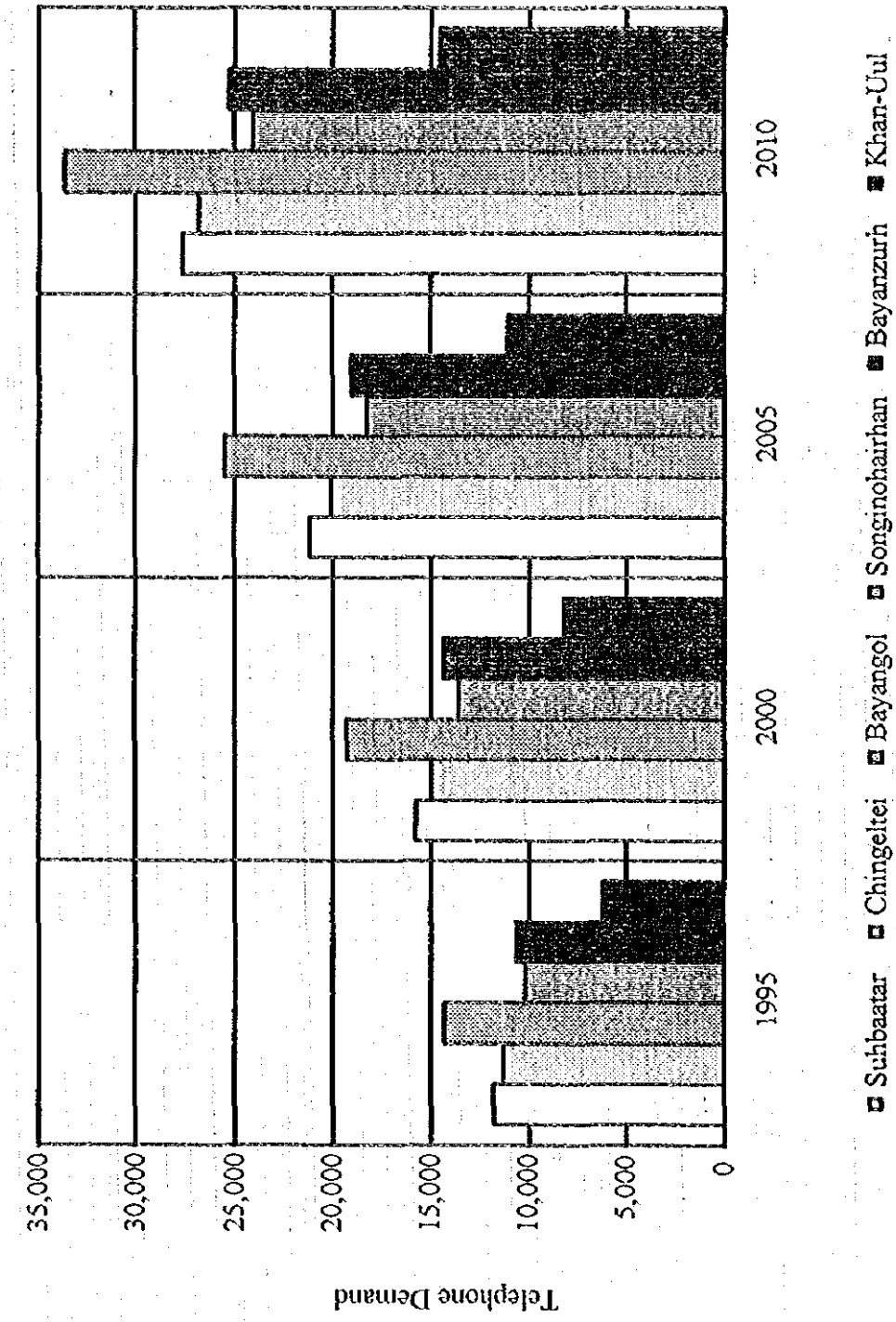

Figure 5-3-10 Results of Demand Forecasting by District
(6 Districts only)

Table 5-3-12 Results of Demand Forecasting by Exchange up to 2010 in Ulaanabatar City

(In case of district and exchange boundary not to be changed up to 2010)

Exchange Name	Subscriber Category	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
ATC2 / ATC32	Adm. / Business	6,047	6,366	6,716	7,085	7,496	7,945	8,423	8,927	9,463	10,031	10,633	11,272	11,948	12,665	13,424	14,232
	Resident	11,363	12,172	12,852	13,645	14,464	15,231	16,249	17,226	18,309	19,531	20,461	21,721	23,055	24,262	25,702	26,846
ATC5 / ATC35	Adm. / Business	2,617	2,756	2,907	3,068	3,245	3,440	3,647	3,864	4,097	4,342	4,602	4,880	5,172	5,482	5,811	6,161
	Resident	10,053	10,671	11,402	11,990	12,740	13,583	14,210	15,249	16,236	17,002	18,019	19,167	20,381	21,279	22,588	23,821
ATC33	Adm. / Business	1,399	1,474	1,554	1,640	1,735	1,840	1,949	2,067	2,191	2,322	2,462	2,609	2,766	2,932	3,108	3,294
	Resident	2,330	2,472	2,662	2,795	2,987	3,110	3,344	3,507	3,756	3,927	4,186	4,476	4,660	4,985	5,184	5,504
ATC34	Adm. / Business	1,485	1,564	1,650	1,741	1,841	1,953	2,069	2,193	2,324	2,463	2,612	2,768	2,934	3,111	3,298	3,495
	Resident	3,279	3,504	3,658	3,956	4,103	4,397	4,724	4,954	5,301	5,542	5,902	6,144	6,565	7,018	7,297	7,742
ATC36	Adm. / Business	1,144	1,205	1,271	1,342	1,419	1,504	1,595	1,691	1,792	1,899	2,014	2,134	2,262	2,398	2,542	2,694
	Resident	14,491	15,397	16,393	17,493	18,484	19,558	20,800	22,152	23,120	24,570	25,886	27,409	28,990	30,680	32,391	34,068
ATC37	Adm. / Business	302	318	336	353	374	396	420	446	472	500	530	563	597	632	669	710
	Resident	1,033	1,104	1,153	1,246	1,292	1,386	1,489	1,561	1,670	1,746	1,859	1,935	2,068	2,210	2,298	2,436
ATC38	Adm. / Business	105	110	116	123	130	138	146	154	164	174	184	195	207	219	232	246
	Resident	5,825	6,180	6,655	6,986	7,466	7,775	8,359	8,768	9,391	9,818	10,464	11,188	11,649	12,462	12,959	13,758
ATC73	Adm. / Business	63	67	71	74	79	84	89	94	100	106	112	118	125	133	141	149
	Resident	2,871	3,068	3,273	3,451	3,671	3,840	4,111	4,330	4,617	4,940	5,144	5,478	5,832	6,103	6,484	6,829
ATC76	Adm. / Business	21	22	23	25	26	28	29	31	33	35	37	39	41	44	47	49
	Resident	72	77	80	87	90	96	103	108	116	121	129	135	144	154	160	170
Nalaih	Adm. / Business	239	251	266	280	297	314	333	353	374	397	421	446	473	501	531	562
	Resident	872	981	1,081	1,194	1,300	1,482	1,615	1,765	1,910	2,074	2,230	2,486	2,847	3,145	3,551	3,867
Baganuur	Adm. / Business	527	555	586	618	655	694	736	780	827	877	929	984	1,044	1,106	1,173	1,242
	Resident	2,055	2,176	2,317	2,478	2,619	2,726	2,899	3,095	3,280	3,489	3,679	3,894	4,053	4,293	4,536	4,771
Bagahangai	Adm. / Business	48	51	53	56	59	62	66	71	75	80	84	89	94	100	106	113
	Resident	15	34	59	100	130	175	211	265	307	401	465	517	573	634	697	801
Total	Adm. / Business	13,997	14,739	15,549	16,405	17,356	18,398	19,501	20,671	21,912	23,226	24,620	26,097	27,663	29,323	31,082	32,947
	Resident	54,259	57,836	61,585	65,421	69,346	73,359	78,114	82,980	88,013	93,161	98,424	104,550	110,817	117,225	123,847	130,615
	Adm. / Busi. & Resi.	68,256	72,575	77,134	81,826	86,702	91,757	97,615	103,651	109,925	116,387	123,044	130,647	138,480	146,548	154,929	163,562

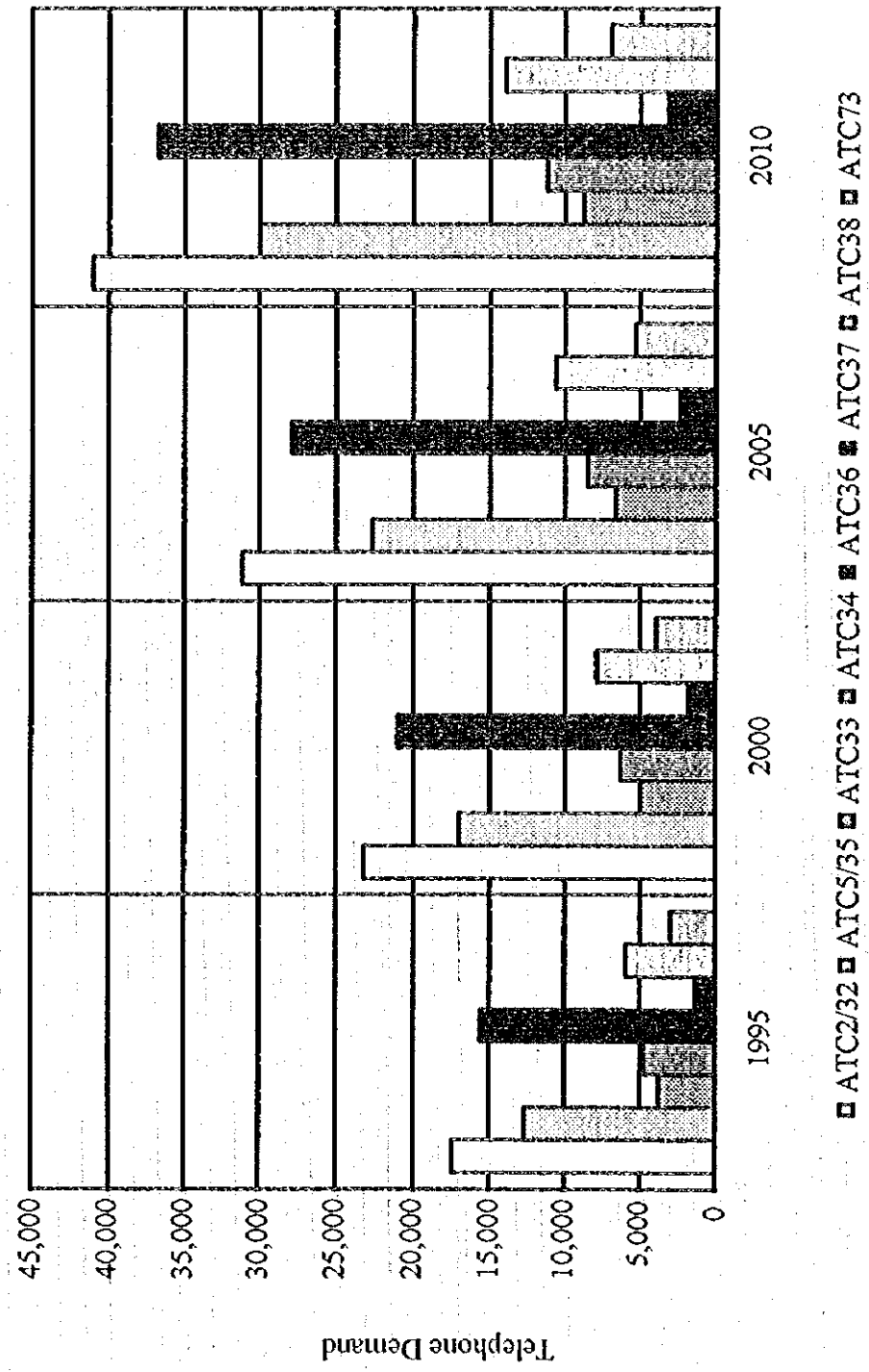

Figure 5-3-11 Results of Demand Forecasting by Exchange
(8 Exchanges only)

Table 5-3-13 Results of Demand Forecasting by Exchange up to 2010 in Ulaanbaatar City

(Demand are distributed by the new boundary planned in this basic plan up to 2010 except for the demand in 1995)

Exchange Name	Subscriber Category	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
ARC-3	A&B	5,872	6,186	6,523	6,886	7,285	7,722	8,186	8,673	9,195	9,747	10,338	10,954	11,612	12,304	13,041	13,824
	Resident	10,393	11,130	11,745	12,477	13,220	13,970	14,861	15,765	16,752	17,863	18,724	19,871	21,088	22,201	23,514	24,538
ARC-4	A&B	1,350	1,422	1,500	1,585	1,673	1,775	1,881	1,994	2,113	2,239	2,374	2,517	2,668	2,828	2,998	3,177
(ARC-35)	Resident	3,175	3,370	3,542	3,829	3,971	4,256	4,572	4,795	5,129	5,363	5,711	5,915	6,353	6,792	7,061	7,402
ARC-37A	A&B	294	309	326	344	364	386	410	435	461	489	518	547	581	615	651	691
(Airport)	Resident	508	543	566	612	635	681	731	767	820	858	913	951	1,016	1,087	1,131	1,172
ARC-37Y	A&B	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(Yarmag)	Resident	548	580	620	662	685	734	780	827	886	923	987	1,027	1,098	1,170	1,219	1,264
ARC-7	A&B	358	379	397	415	441	467	495	527	559	592	626	663	703	747	794	838
(ARC-73)	Resident	3,727	4,069	4,321	4,565	4,850	5,079	5,431	5,782	6,167	6,531	6,890	7,247	7,708	8,077	8,577	9,016
ARC-5	A&B	1,537	1,618	1,700	1,803	1,907	2,021	2,144	2,271	2,407	2,553	2,705	2,868	3,039	3,222	3,414	3,619
	Resident	8,395	8,899	9,532	10,066	10,638	11,348	11,854	12,726	13,557	14,172	15,001	15,997	17,023	17,741	18,842	19,915
ARC-51	A&B	9	9	9	9	10	11	11	12	13	13	14	15	16	17	18	20
(Shuluu)	Resident	339	361	385	416	431	459	488	515	548	573	618	647	688	728	768	806
ARC-52	A&B	83	88	92	98	103	109	116	123	130	138	146	155	164	174	185	196
(Angilin)	Resident	235	249	267	281	298	315	332	350	380	398	421	448	477	497	528	558
ARC-6	A&B	1,734	1,826	1,925	2,031	2,147	2,272	2,414	2,561	2,713	2,875	3,048	3,231	3,425	3,631	3,848	4,079
(ARC-39)	Resident	12,254	13,081	13,858	14,788	15,625	16,533	17,583	18,728	19,562	20,808	21,918	23,190	24,551	25,956	27,427	28,821
ARC-2	A&B	1,603	1,688	1,781	1,879	1,987	2,105	2,233	2,368	2,509	2,663	2,824	2,992	3,173	3,367	3,569	3,785
(ARC-33)	Resident	4,999	5,206	5,632	5,972	6,335	6,665	7,118	7,530	7,945	8,385	8,843	9,340	9,915	10,545	11,069	11,678
ARC-38	A&B	107	113	119	127	134	141	150	158	169	178	188	201	213	225	239	252
(Ondorkhaan)	Resident	5,681	6,031	6,401	6,816	7,285	7,585	8,150	8,555	9,163	9,573	10,210	10,916	11,367	12,153	12,641	13,422
ARC-21	A&B	21	22	23	24	25	26	27	31	33	35	37	39	41	43	45	48
(Darkhan)	Resident	726	841	903	955	1,021	1,062	1,142	1,198	1,283	1,341	1,430	1,528	1,591	1,703	1,771	1,880
Ingett	A&B	8	8	9	9	10	11	11	12	13	13	14	15	16	17	18	19
	Resident	19	21	22	23	25	26	28	29	31	33	35	37	39	41	43	46
Hirhir	A&B	5	5	5	5	6	6	6	7	7	7	8	8	9	9	10	11
	Resident	43	46	49	51	55	58	61	65	70	73	77	82	87	91	97	102
Chuluut	A&B	8	9	9	10	10	11	11	12	13	13	14	15	16	17	18	19
	Resident	19	21	22	23	24	26	27	29	31	33	34	36	39	41	43	45
Bayanzurkh	A&B	110	116	123	129	137	145	154	163	173	183	194	206	218	231	245	260
(ARC-76)	Resident	85	92	96	103	107	115	124	131	139	145	154	161	172	181	192	202
Sukhbaatar	A&B	54	57	60	63	67	71	75	81	84	89	95	101	107	113	121	127
	Resident	69	73	77	83	89	93	101	104	112	117	124	130	138	145	154	163
Ist Children	A&B	30	32	34	36	38	41	43	46	49	52	55	58	62	65	69	73
	Resident	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nisah	A&B	239	251	266	280	297	314	333	353	374	397	421	447	473	501	531	563
	Resident	872	981	1,081	1,194	1,301	1,482	1,615	1,765	1,910	2,074	2,230	2,485	2,817	3,145	3,551	3,867
Bayanur	A&B	527	555	588	618	655	694	736	781	827	877	929	984	1,044	1,106	1,173	1,243
	Resident	2,165	2,178	2,317	2,478	2,619	2,720	2,892	3,025	3,281	3,489	3,673	3,894	4,053	4,229	4,530	4,771
Baghanga	A&B	48	51	53	56	59	62	66	71	75	81	84	89	94	101	107	113
	Resident	15	34	52	101	130	178	211	265	307	401	465	517	578	634	697	801
Total	A&B	13,977	14,730	15,543	16,405	17,356	18,398	19,501	20,671	21,912	23,228	24,631	26,097	27,663	29,328	31,083	32,947
	Resident	54,259	57,830	61,585	65,421	69,316	73,359	78,114	82,980	88,013	93,161	98,424	104,553	110,817	117,225	123,841	130,615
	A&B&R	68,236	72,575	77,134	81,826	86,702	91,757	97,615	103,651	109,925	116,389	123,044	130,647	138,480	146,553	154,925	163,562

Note: A&B, Administration and Business

4. Demand Forecast of Other Services (Value-Added Services)

Demands for other services, i.e., telex, mobile, radio paging, leased circuit, and data communication services, are estimated in this study. At present, MCAC/MTC provides telex and leased circuit services and DATACOM provides data communication services throughout the country, while MonCom provides data communication services throughout the country, while MonCom provides paging service and MobiCom provides mobile telephone service in Ulaanbaatar city.

The latter two services have been introduced just recently and, therefore, the past trend data on the demand increase are not applicable for demand estimation for them. Usually estimation of demand for these services at an initial stage needs detailed market surveys including interviews for collection of fairly reliable data. The regression model obtained based on the data in other countries are adopted for demand projection for these services in this study.

4.1 Telex Service

Table 5-4-1 presents historical growth of telex services in Mongolia. According to MCAC/MTC staff, most of users are administrative offices in Ulaanbaatar city. Telex subscribers are classified into two groups : those connected to the host telex exchange in Hong Kong, and those connected to the host telex exchange in Moscow.

Demand for telex services will decrease rapidly in coming years, as is the case with a lot of countries where telex service demand is being transferred to other service media, i.e., facsimile, data communication, etc. It is observed that the average annual decreasing rate of telex subscribers is approx. 15.5% from the end of 1991 to Sep. 1995. The study team assumed that this same rate can be applied in the future demand.

Table 5-4-1 Historical Data of Telex

Item	Host Exchange	1991	1992	1993	1994	1995
Subscriber lines	to Hong kong	40	* 38	* 36	* 34	32
	to Moscow	138	* 116	* 97	* 81	68
Total		178	* 154	* 133	* 115	100

Note * : These figures were estimated by the study team.

4.2 Cellular Mobile Telephone Service Demand

Mobile telephone service demand is estimated by the regression model drawn up, based on the relation between mobile telephone subscriber per 1,000 inhabitants and main telephone subscriber per 100 inhabitants at the end of 1993 in 70 countries. The data used for obtaining the regression model in these 70 countries are attached in Data book (Vol. V, Chapter 4, PP. 4-4). As a result of the analysis, the following regression model was obtained:

$$MTt/POPt \times 1{,}000 = 0.185 \times (MLt / POPt \times 100)^{1.2215} \quad \ldots\ldots (1)$$

$$(R^2 = 0.79)$$

where,

MTt : the number of mobile telephones in period t
MLt : the number of main lines (telephone subscriber lines) in period t
POPt : population in period t

At present, MobiCom is planning to operate the mobile service in Ulaanbaatar city under the license of Mongolian Government. Within six months from the issue of the license, the whole city of Ulaanbaatar, including its suburbs and Buyant-Uhaa airport, will be covered by the cellular service. Up to the end of the fifth year from the commencement, the cellular mobile service network will cover five cities, i.e., Ulaanbaatar, Darkhan, Erdenet, Nalaih and Zuunmod, with the estimated total subscriber demand amounting to 930.

The study team assumed that the commencement year would be 1997 and the formula (1) was modified, based on the number of mobile subscribers mentioned above in the initial stage at the end of 1997. Modified regression model is shown below and this model is used to forecast the demand in Mongolia in future.

$$(MTt-1{,}784)/POPt \times 1{,}000 = 0.185 \times (MLt / POPt \times 100)^{1.2215} \quad \ldots\ldots (2)$$

The results of the demand forecast are shown in Table 5-4-2. And it is noted that cellular mobile telephone demand will depend on future tariff system and socio-economic activities in Mongolia. Hence, the detail market surveys are to be conducted for further expansion.

Table 5-4-2 Mobile Telephone Demand Forecast

Year	2000	2005	2010
Mobile Subscribers	1,280	3,372	7,179

4.3 Radio Paging Service Demand

Generally, the demand for radio paging service is closely linked to the diffusion of public pay-phone and telephone subscriber lines. Recently, in the low telephone density countries, the number of paging subscribers are rapidly increasing as that the price of paging terminal and tariff of paging service are relatively low as compared with other communication services, such as mobile telephone etc.. In consequence, radio paging service demand is estimated by the regression model based on the relation between telephone subscriber density and radio paging terminal density. The data in 16 countries were used for analysis and the data used for obtaining the regression model in these countries are attached in Data book. The conditions of 16 countries selected are as follows:

(1) The number of radio paging terminals in 1993 are available,
(2) Telephone density is less than 20.0 per 100 inhabitants in 1993.

(In this study, the telephone subscribers per 100 inhabitants in Mongolia in 2010 is estimated more than 20.0.)

As a result of analysis, the following regression model was obtained:

$$PGTt / POPt \times 1000 = 0.1166 \times (MLt / POPt \times 100)^{1.5125} \quad \ldots\ldots (1)$$

$$(R^2 = 0.63)$$

where,

PGTt : the number of radio paging terminals in period t
MLt : the number of main lines (telephone subscriber lines) in period t
POPt : population in period t

The formula (1) was modified as follows, based on the number of radio paging terminals amounting to 1,500 at the end of 1995.

$$(PGTt+94)/POPt \times 1000 = 0.1166 \times (MLt/POPt \times 100)^{3.5125} \quad \ldots\ldots (2)$$

For the forecast of demand for radio paging service in the future, the formula (2) regression model was applied. The result of the demand forecast for radio paging service up to 2010 in Mongolia is shown in Table 5-4-3.

Table 5-4-3 Radio Paging Service Demand Forecast

Year	2000	2005	2010
Radio paging Terminals	2,554	4,733	9,171
Radio paging Density (per 1,000 pop.)	3.7	6.4	11.7

4.4 Leased Circuit Services Demand

At present, the number of leased circuits in the MCAC/MTC network is 300. According to MCAC/MTC staff in the marketing and economic division, most of the leased circuits users are those living in Ulaanbaatar mainly using the service for voice transmission. Table 5-4-4 presents the categories of leased circuits users.

Table 5-4-4 Categories of Leased Circuit Users

No.	User Category	No. of Organizations	No. of Leased Circuits	Share of Circuits (%)
1	Government	30	188	62.6%
2	N.G.O.	2	2	0.7%
3	International Org.	1	3	1.0%
4	Transports	2	2	0.7%
5	Bank	4	4	1.3%
6	Service	8	27	9.0%
7	Industry	4	10	3.3%
8	Other Business Co.	37	62	20.7%
9	Others	2	2	0.7%
Total		90	300	100.0%

As can be seen in Table 5-4-4, the total number of leased circuits used by governmental agencies, N.G.O. and international organizations accounts for approximately 65%, while that by business users, approximately 35%. It means that main users of leased circuits are the administrative / business users. To estimate the leased circuit demand in each forecasting year up to 2010, the Study Team assumed that the leased circuit demand will increase in line with the number of business activities as mentioned in section 3.5.2. Table 5-4-5 shows the result of leased circuit demand forecast in Ulaanbaatar city.

Table 5-4-5 Leased Circuit Demand Forecast

Item	1995	2000	2005	2010
No. of Companies	13,997	20,853	31,792	49,744
No. of Leased Circuits	300	447	681	1,066

4.5 Data Communication Demand

As mentioned in Chapter 4, DATACOM provides the following four types of data communications services with 400 users at the end of 1995. According to DATACOM, the users of these services are connected to the MCAC/MTC telephone network through the modem terminal. In this study, the demand of data communications users in Ulaanbaatar city is included in the business telephone demand already discussed in the previous section.

(1) Domestic PC-Mail Services;
(2) International PC-Fax Services;
(3) Internet E-Mail Services; and
(4) Packet Switching Services.

To estimate the data communications lines demand in each forecasting year up to 2010, the study team assumed that the data communication lines demand will be increase in line with the number of business companies as mentioned in Section 3.5.2. Table 5-4-6 presents the results of data communication lines demand forecast in Ulaanbaatar city. In consideration of the recent trend in data communication field in the world, it is assumed that half of the following data communication lines will become the potential lines of ISDN services.

Table 5-4-6 Data Communication Lines Demand Forecast

Item	1995	2000	2005	2010
No. of Company	13,997	20,853	31,792	49,744
No. of Data Communication Lines	400	596	909	1,422

CHAPTER 6

DEVELOPMENT FRAMEWORK & STRATEGIES

CHAPTER 6

DEVELOPMENT FRAMEWORK & STRATEGIES

1. Concept of Basic Plan

1.1 World Trend on Telecommunications Needs

Recent technological development in telecommunications, transportation, data processing and various production process allows us the world-wide socio-economic activities. In consequence, international economic relationships have been increasingly become complex and tightly connected.

In these circumstances, volume of information transactions in economic entities, especially in industrial and service sectors, has significantly increased. To support these transaction requirements, not only enhancement of conventional telecommunications means by increasing voice telephony but also introduction of new type telecommunications means including data communication, facsimile and utilization of data / information processing equipment are essential. Accordingly, telecommunications network has been indispensable infrastructure for those activities.

1.2 Telecommunications Needs in Mongolia

To realize higher economic growth and equitable distribution of social benefits, the Government of Mongolia has been strongly emphasizing the needs for adequate, efficient and reliable infrastructures in the development policy. In the policy, telecommunications development is placed as a highest priority for the industrial development, higher productivity of pasturage and agriculture and enhancing efficiency in the service sector.

The National Development Program states that public investment would be needed to build the infrastructure which is required as a necessary complement rapid private sector growth and socio-economic activities.

The Public Investment Program (PIP) in the National Development Program is an important instrument of Government policy. It aims at contributing to the establishment of conditions for

economic growth, hand in hand with improved social facilities and poverty reduction. The highest priority is placed on the energy, transport and telecommunications sector.

1.3 Telecommunications Policy and Objectives in Mongolia

This basic plan for the development of the telecommunications network in Ulaanbaatar city aims to fulfill the telephone demand in the city by the year 2010, upgrading its network structure for more reliable and efficient one and also preparing for the introduction of new type of telecommunications means. For the realization of the above, new technologies such as digitalization optical fiber transmission systems, SDH, and so forth, are used.

The Telecommunications Policy in Mongolia is framed as follows.

(Reference : Record of the discussion among MOID, MCAC and JICA Study team on March 18, 1996.)

<u>The Telecommunications Policy.</u>

a) Telecommunications facilities should be provided to all, at cost-based tariffs.

b) Universal service should cover the whole country's territory. This implies easy access to basic telecommunications services to all at affordable and reasonable prices.

c) Acceptable quality of service should be attained for basic supplementary services for national and international communications.

d) Waiting lists for telecommunications facilities should be eliminated.

e) Prompt and effective attention should be focused on customer complaints and improvement of public relations.

1.4 Concept of Basic Plan

This Basic Plan was framed in line with the above mentioned Telecommunications Policy and designed in consideration of :

a) Adoption of the timed local charge system is assumed;

b) The basic telephone service is provided by the network which is economical not only in the installation but also in the operation;

c) The network is made up applying the latest technologies. Targets of the telecommunications quality are established;

d) The network is capable to fulfill every new application of basic telephone service within one year after its registration in the year 2010 and afterwards;

e) Satisfaction of customers is responded by effective operation and maintenance.

1.5 Planning Period and Target Years of the Basic Plan

This basic plan covers long-term development for the telecommunications network up to the year 2010 in Ulaanbaatar city. The planning period up to the year 2010 is divided into several milestones as target years, i.e. a short-term plan up to 2000, a medium-term plan up to 2005 and a long-term plan up to 2010.

2. Key Development Targets up to 2010

Key development targets consisting of those for various service provisions, service quality, operational efficiency and network facility provisions for the respective short-term, medium term and long-term plans up to 2010 are summarized in Table 6-2-1.

Table 6-2-1 Key Development Targets up to 2010

Indexes	Sub-Indexes	Present Status as of 1995	Development Targets		
			Short-Term Targets by 2000	Medium-Term Targets by 2005	Log-Term Targets by 2010
Socio Economy	Population	619,300	668,400	721,500	778,700
	GRDP (million Tugrig)	86,106	113,071	151,315	202,493
	Growth rate (% / year) of GRDP	6.3	5.6	6.0	6.0
Telephone Service	Expressed demand	68,256	94,065	123,044	163,562
	Supply Volume(SL)	44,082	65,524	102,212	163,562
	Switching Capacity(LU)	53,444	80,664	112,712	165,920
	SL/100 inhabitants	7.1	9.8	14.2	21
	No. of Tele-Post Office(24H)+(6H)	6+21	7+23	7+25	8+27
	No. of Telephone Operators	355	360	360	360
Telex Service		100	44	20	9
Leased Circuit Circuit	Voice Circuits, Data Circuits	300	447	681	1,066
Value Added Service	Cellular Mobile Communications*	Not operated	1,280	3,372	7,179
	Data Communications	400	600	910	1,400
	Radio Paging*	1,500	2,600	4,700	9,200
	Personal Handy-Phone System	Not operated	Not operated	Operated	Operated
	Narrowband ISDN	Not operated	Not operated	Operated	Operated
Service Quality	Call Completion Rate	42%	60%	70%	80%
	No. of Faults(/month/100 SL)	39	30	20	10
	Faults Clear Rate within 24hrs	70%	85%	90%	95%
Operational Efficiency	Number of Staff	1,351	1,428	1,505	1,583
	Staff / 1,000 SL	31	22	15	10
Network Facilities	Switching System	Analogue & digital	Analogue & digital	digital ISDN	digital ISDN
	Transmission System	Microwave & OFTS Analogue &digital	Microwave & OFTS UHF digital radio	Microwave & OFTS UHF digital radio	Microwave & OFTS UHF digital radio
	Subscriber Network System	Metallic cable	Metallic cable DRCS, OPMC	Metallic cable, OFC, DRCS OPMC	Metallic cable, OFC, DRCS OPMC

Note
SL : Subscriber Line
LU : Line Unit
ISDN : Integrated Service Digital Network
DRCS : Digital Radio Concentrate System
GRDP : Gross Regional Domestic Product
OFTS : Optical Fiber Transmission System
OFC : Optical Fiber Cable
OPMC : Outside Plant Maintenance Center

* nationwide

3. Service Provision and Supply Volume

The service provision and supply volume up to the year 2010 are established based on the telecommunications policy which is outlined in the preceding section. In the policy, major objectives for the service provision and supply volume are as follows:

- To attain an acceptable quality of service for voice and data communications
- To eliminate waiting lists for telephone facilities.

3.1 Service Provision

The telecommunications operators in Mongolia are providing various telecommunications services mainly consisting of basic telecommunications services and value added services. MTC has been granted a monopoly to provide basic telephone service, and leased circuit service.

Regarding the value added services, it is opened to private operators. An introduction of the value added services to be expected to popularize from short-term and long-term views are proposed considering a service development strategy of Mongolia and a world-wide trend on the telecommunications service development. In the basic services in Mongolia, it is expected from a view in a world trend that telex and telegram services will be transferred to other value added services.

The value added services both operated already and proposed are provided initially in Ulaanbaatar city and will be gradually expanded to outside Ulaanbaatar city in the country. The details of service introduction and enhancement are shown in the Table 6-2-1 "Key Development Targets up to 2010."

3.2 Supply Volume

The supply volume up to the year 2010 is established based on the telecommunications policy. According to the policy, "To eliminate waiting lists for telecommunications facilities" is the most crucial objective. Establishment of the supply volume described in this Chapter is mainly that for the ordinary telephone service.

3.2.1 Telephone Service

As of the end of 1995, approximately 44,000 SL (Subscriber Line) are provided as a result of development up to the present. It means 7.1 per 100 inhabitants. However, approximately 24,000 waiters are registered, and most of them are waiting for a long time.

According to the telecommunications policy, the MCAC intends to achieve that telephone service is to be made available on demand by the year 2010.
It means that all waiters will be cleared by 2010. However, as a result of analysis of the progress of the on-going projects and demand estimate, it is realistic that the target of fulfilling 100% demand will be attained by the year 2010 with further investment in addition to the on-going investment.

In consequence, all the planning components consisting of supply plan, network plan, facility plan, etc. are prepared based on the above condition.

The Table 6-3-2 shows a summary of the estimated demand and supply established based on the demand and the basic condition. The number of supply by area is referred to in Table 6-3-3.

Table 6-3-2 Demand and Supply

Year	1995	2000	2005	2010
Demand	68,256	91,757	123,044	163,562
Supply Volume (SV)	44,082	65,524	102,212	163,562
SV / 100 inhabitants	7.1	9.8	14.2	21.0

Note: The demand and the supply are the same after 2010 due to 100% fulfillment.

Table 6-3-3 The Number of Subscriber lines (SL) up to the year 2010

Site \ Year	2000	2005	2010
ATC 2	4,864	18,060	29,137
ATC 3	18,297	25,094	38,367
ATC 4	4,509	6,876	10,669
ATC 5	10,531	14,554	23,534
ATC 6	13,839	20,315	32,900
ATC 7	3,730	5,994	9,854
RSU37A	823	1,237	1,889
RSU37Y	472	778	1,294
RSU38	4,608	0	0
RSU51 (Shard)	0	493	825
RSU52 (Amgalan)	0	478	754
RSU21 (Bayan Hoshuu)	0	1,164	1,929
Jargalant	25	42	65
Honhor	50	69	113
Gachuurt	29	41	64
Biokobinat	219	315	462
Shuvvun Fabric	131	193	290
Int. Children	30	50	60
Nalaih	1,266	2,179	4,429
Baganuur	1,927	3,829	6,013
Bagahangai	174	451	914
Total	65,524	102,212	163,562

3.2.2 Telex and Telegram Services

According to the telecommunications policy, MCAC intends to provide not only telephones but also telegram and facsimile access to all people. The telegram service is realized by telephone network. As for the facsimile service expansion, it will be expanded depending on the development of the telephone network.

However, from a view of international trend on telex and telegram services, the number of telex subscribers and telegram messages have been gradually declining. In fact, the same trend is seen also

in Mongolia. Considering the above situation, it is not proposed to expand the existing system. In the future, those services will be replaced by other services and transferred to the value added services.

3.2.3 Leased Circuit Service

In Mongolia, leased circuits mainly consists of data, voice, packet and telex circuits. In the business activities, leased circuit services become important means of business communication in all industrial and service sectors. In addition, the leased circuit service is also indispensable not only for ordinary commercial sectors but also for telecommunications business sector, especially for value added service operators. Based on a result of leased circuit demand estimate and considering the above circumstances, necessary leased circuit capacity is included in the transmission network plan and facility plan. From a view of area expansion, the leased circuit service is to be expanded to nation-wide service. With a progress of popularization of the value added services and computer communication toward the information society, careful market survey is to be carried out.

3.2.4 Value Added Services

Recognition of the crucial role played by telecommunications for the promotion of socio-economic development and business development is very significant not in the developed countries but also in the developing countries. With a progress of innovation toward information society, value added services will be essential for administrative, business and social activities. In addition, the provision of the value added services will be very attractive as a business in the new field.

In accordance with the telecommunications policy MOID encourages investment and parallel operation by the private sector in healthy competition with MTC for the operation of the value added services to be expected to popularize. The status of operation of the value added services at the end of 1995 is referred to the Table 6-2-1.

(1) Cellular Mobile Telephone Service

Since March 1996, the cellular mobile telephone service is operated by a company, Mobicom Corporation, which is a joint venture of three companies. It was established in September 1995. The coverage area of the service is Ulaanbaatar city. The total number of cellular mobile telephone

subscribers is expected to be 300 at the initial stage. It is only 0.7% of the total telephone subscribers in the city. Table 6-3-4 shows expected numbers of subscribers and service areas to be added.

Table 6-3-4 Number of Subscribers

Year	1996	1997	1998	1999	2000
Annual Increase	300	90	160	165	215
Accumulation	300	390	550	715	930
Service Area	Ulaanbaatar	Ulaanbaatar	Darhan Erdenet added	Naraih Zuunmod added	Baganuur Suhbaatar Choir Sainshand Arvaiheer etc. added

The cellular mobile telephone service meets the need to communicate anywhere and with anybody. In consequence, this service is considered to be rapidly popularised in the area described in Table 6-3-4 as in many countries, both industrilized and developing counties. Mobicom Corporation monopolizes the cellular service until 1998.

(2) Other Value Added Services

As already described at the beginning of this sub-section, MOID encourages the private sector to participate in the operation of the value added services in healthy competition. The value added services have many potential needs toward information society and are keeping unforeseeable needs for users and immeasurable large business market for telecommunications service providers in not only the developed counties but also the developing countries including Mongolia.

In Mongolia, most of the value added services except several services are not provided yet. Considering the situation, it is proposed that the value added services which are not provided yet is to be started as a pilot project in Ulaanbaatar city. With an increase of number of the users, the service areas will be gradually expanded to othe major cities and major districts. For the value added services, careful market survey, user servey and example survey should be carried out not only in Mongolia but also in other countries which have experience to such services.

4. Network Expansion and Improvement

Considering the telecommunications policy, one of the most important development objectives is to eliminate waiting lists. In this plan, it is proposed that the above objective will be achieved by the year 2010 considering the progress of on-going projects. In consequence, 100% fulfillment of the demand within one year after the registration of the application will be attained.

Based on the above, the proposed telecommunications network of this basic plan is designed in consideration of the following:

a) The network is economical in not only the installation but also the operation.
b) The network is made up applying latest technologies at present.
c) The network is capable of fulfilling every new application of basic telephone service within one year after its registration in the year 2010 and afterwards.

The development targets for respective network components are shown in Table 6-4-1. For more details, refer to Chapter 7 "Telecommunications Network Plan"

Table 6-4-1 Development Targets for Network Component up to 2010

System	Present Status as of 1995	Development Targets		
		Short-Term by 2000	Medium-Term by 2005	Long-Term by 2010
Switchig	Analogue & digital	digital	digital ISDN	digital ISDN
Transmission	Microwave & OFTS/Analogue & digital	OFTS & microwave, digital radio	OFTS & microwave, digital radio	OFTS & microwave, digital radio
Subscriber Network	Metallic cable	Metalic cable, OPMC	Metalic cable, OFC	Metalic cable, OFC

Note: OFTS: Optical Fiber Transmission System
OFC: Optical Fiber Cable
OPMC: Outside Plant Maintenance Center

5. Service Quality Improvement

The service quality is able to be indicated by major three factors i.e. call completion rate, faults rate and fault clearance rate. They are still at low level compared with those in developed countries. Low call complection rate will result loss of revenue from call charge and high faults rate will bring an increase of operation and maintenance cost. Low clearance rate will affect to various customers' activities. The service quality as of the end of 1995 is as follows:

- Call completion Rate: 42% *
  Mainly caused by called number busy, customer error and forward system.

- Number of Faults : 39 / month / 100 SL **
  Mainly occurs at subscriber cables and overhead lines.

- Fault Clearance Rate within 24 hours: 70% **

* Refer to Volume V. Chapter 3 Page 3-49
** Refer to Volume V. Chapter 3 Page 3-29

The above service quality will be able to be improved by taking appropriate actions with an introduction of adequate quality control system. Improvement targets of the service quality are shown in the following Table 6-5-1.

Table 6-5-1 Improvement Targets of the Service Quality

Item	Target Year				Actions to be taken
	1995	2000	2005	2010	
Call Complection Rate	42%	60%	70%	80%	· Increase SL for high traffic subscribers · Promote pilot number and call waiting service · Campaign to reduce incorrect dialling · Expand telecommunication facilities
Faults Rate	39%	30%	20%	10%	· Replace unreliable cables · Up-grade skill of maintenance staff
Clearance Rate within 24 hours	70%	85%	90%	95%	· Modernization of customer service management · Reinforce maintenance teams

6. Operational Efficiency Improvement

The operational efficiency is able to be indicated by the number of total MTC staff per 1,000SL. The number of staff per 1,000 SL as of the end of 1995 was 51. It means low efficiency compared with 16 of both Thai and Malaysia 1991. This low efficiency will result large operation and maintenance cost.

The present low efficiency will be able to be improved mainly by modernization of network facilities, introducting computerised operation and maintenance system and restructuring operation and management. As this basic plan is limited within Ulaanbaatar city, Table 6-6-1 shows the improvement targets of the operational efficiency in Ulaanbaatar city.

Table 6-6-1 Improvement Targets of the Operatinal Efficiency in Ulaanbaatar city

Item	Target Year			
	1995	2000	2005	2010
No. of subscriber line (SL)	44,082	65,524	102,212	163,562
No. of Staff	1,351	1,428	1,505	1,583
No. of Staff / 1000 SL	31	22	15	10

CHAPTER 7

TELECOMMUNICATIONS NETWORK PLAN

CHAPTER 7

TELECOMMUNICATIONS NETWORK PLAN

1. Basic Concept of Network Plan

1.1 Fundamentals of Network Plan

The proposed network of this basic plan is designed in consideration of:

a) The network is economical not only in the installation but also in the operation;
b) The network is made up applying the latest technologies at present;
c) The network is capable to fulfill every new application of basic telephone service within one year after its registration in the year 2010 and afterwards; and covering whole Ulaanbaatar city.

The discussion on the design of the network is done on the assumption that the nation wide general service is provided by one network provider. However, attention is paid to the fact that several telecommunications service entities already coexist in Mongolia.

1.2 Compatibility of Different Networks

Mongolia has regulated to introduce new telecommunications service entities, some telecommunications service entities are found besides MCAC.

The other telecommunications service entities have their own network, respectively. Some of them are inter-connected by some means with MCAC network. There is a cellular telephone service network, a data communications service network, a governmental communications service network, a railway communications service network, a paging service network, etc. MOID plans to introduce some more networks in future. Only MCAC provides a general network which is consisted of subscriber line networks, transmission links and telephone switching centers, covering the whole country.

Those different networks will coexist in Mongolia. Inter-network connection of those networks are taken into consideration in making up the proposed network. The MCAC should be equipped with the function of inter-network connection linking with their communications networks.

1.3 Evolution of Existing Network to ISDN

Some developed countries have been introducing ISDN to integrate the telephone network, telex network and data communications network. However, the ISDN is still on the way of development. This Basic Plan does not propose to introduce all ISDN systems.

The existing MCAC network should be changed gradually into an ISDN in consideration of economic aspects and technical issues in future. The assets accumulated for the past should be maintained and used to the utmost. It is recommended to introduce an ISDN in the capital, Ulaanbaatar, at the first stage of ISDN era and extend it , in proportion to the growth of demand, from a point to a line and finally from line to area. The ISDN should be able to contain an Intelligent Network (IN) function. For this, the ISDN should be equipped with CCS No. 7 ISDN User Part (ISUP). The IN will enable MCAC to provide the general public with such services as Toll Free Call service, Premium Charge Call service, Universal Personal Communication Number service, etc.

During the transfer phase from conventional networks to an ISDN, such various networks as normal telephone network, data communication networks, cellular telephone networks, telex network, and leased circuits networks will coexist. The telex network now provided by MCAC will be demolished when its subscriber number is considerably reduced. Then the telex service may be substituted by facsimile or data communication service through digital telephone network or ISDN. At the first stage of this basic plan, narrow-band ISDN system will be introduced.

1.4 Measures for Higher Reliability of MCAC Network

MCAC will adopt some measures for higher reliability of its network. MCAC will realize the policy to provide the key telephone node with separate hardware. Separation by function of combined-function switching unit and introduction of loop (or ring) transmission path will be the objects of new stage as the MCAC network is getting larger.

The Ulaanbaatar city area network should be established with a highest reliability taking account of its role as the national Capital. All the host exchanges in the Capital should be linked with a ring transmission path for establishing a reliable network.

1.5 Switching Unit Abbreviation in Ulaanbaatar City for Basic Plan

For this study, the study team made the abbreviation of switching units on the condition as shown in Table 7-1-1.

Table 7-1-1 Condition to Make The Abbreviation of Switching Units

New Abbreviation of Switching Units		
Digit 1	Digit 2 and 3	Digit 4
Type of Exchange	Site Number or Site Name	Unit Number in Age Order
S : SxS X : XB P : PBX H : Host Switching R : Remote Switching	e.g. 03 : ATC-3 BI : Biokombinat	Digital (Alphabet) PBX (Number)

Table 7-1-2 presents the abbreviation of switching units for Basic Plan. Hereinafter, the following abbreviation will be used in the this document.

Each ATC telephone office area is shown by distinguishable color in Figure 7-1-1.

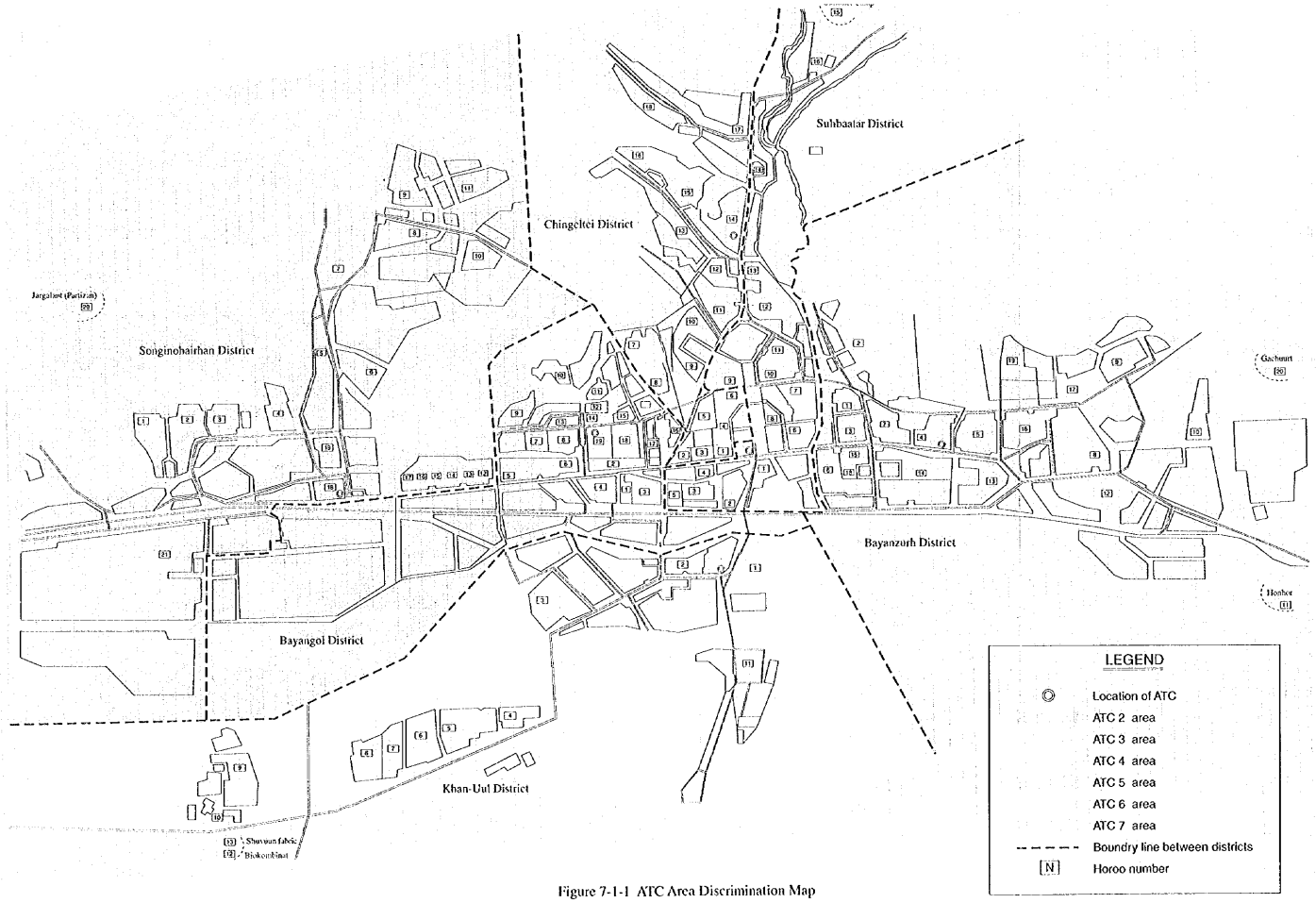

Figure 7-1-1 ATC Area Discrimination Map

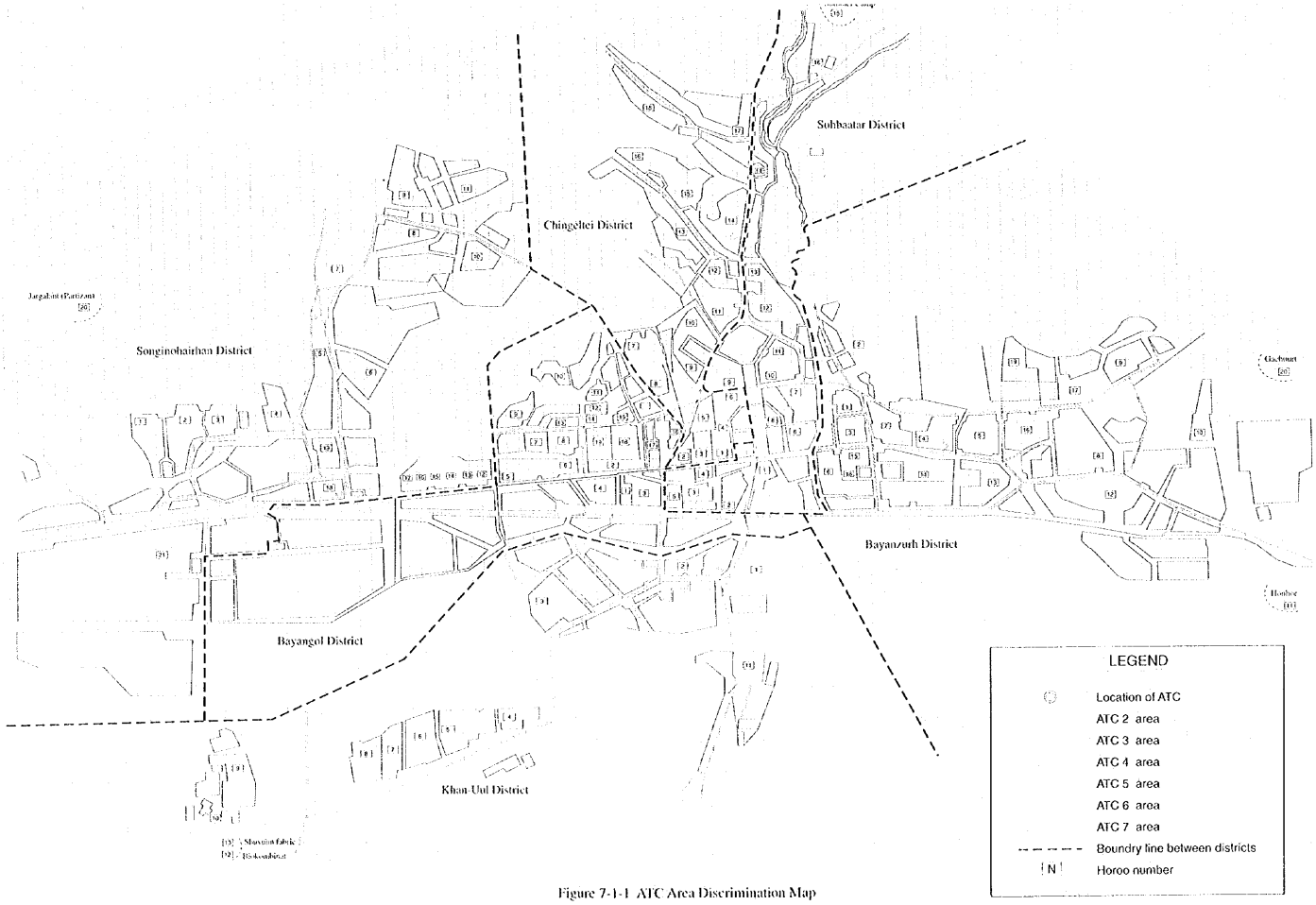

Figure 7-1-1 ATC Area Discrimination Map

Table 7-1-2 New Abbreviation of Switching Units in Ulaanbaatar city

Site Name	Old SW Unit Name	Type of SW Unit	Function of SW	New SW Unit SW
ATC-3	ATC2	SxS	LS	S03
	ATC3	E-10B	TLS (MS)	H03A
	---------	(HOST)	LS	H03B
	---------	(HOST)	LS	H03C
ATC-4 (ATC-	ATC34	RSU (E-10B)	LS	R04A
	---------	(HOST)	LS	H04A
ATC-37A (Airport)	ATC37A	RSU (E-10B)	LS	R37A
ATC-37Y (Yarmag)	ATC37Y	RSU (E-10B)	LS	R37B
ATC-7 (ATC-73)	MDF73	From ATC2	LS	M73
	---------	(HOST)	LS	H07A
ATC-5	ATC5	SxS	LS	S05
	ATC35	RSU (E10B)	LS	R05A
	---------	(EWSD)	TLS (MS)	H05A
ATC-51 (Sharhad)	---------	(RSU)	LS	R51A
ATC-52 (Amgalan)	---------	(RSU)	LS	R52A
ATC-6 (ATC-36)	ATC36	RSU (E-10B)	LS	R06A
	---------	(HOST)	LS	H06A
ATC-2 (ATC-33)	ATC33	RSU (E-10B)	LS	R02A
	---------	(HOST)	LS	H02A
ATC-38	ATC38	RSU (E-10B)	LS	R38A
ATC-22 *	ATC22	(RSU)	LS	R22A
ATC-21 (Bayan hoshuu)	---------	(RSU)	LS	R21A
Jargalant	(JA)	XB	LS	XJA
	---------	(RSU)	LS	RJAA
Honhor	(HO)	XB	LS	XHO
	---------	(RSU)	LS	RHOA
Gachuurt	(GA)	XB	LS	XGA
	---------	(RSU)	LS	RGAA
Biokombinat (ATC-76)	ATC76	XB	LS	XBI
	---------	(RSU)	LS	RBIA
Shuvvun Fabric	(SF)	PBX	LS	PSF
	---------	(RSU)	LS	RSFA
Int. Children Camp	(IC)	PBX	LS	PIC
	---------	(RSU)	LS	RICA
Nalaih	(NA)	SxS	TLS	SNA
	---------	PBX	TLS	PNA
	---------	(HOST)	TLS	HNAA
Baganuur	(BN)	XB	TLS	XBN
	---------	PBX	TLS	PBN1
	---------	PBX	TLS	PBN2
	---------	(HOST)	TLS	HBNA
Bagahanbai	(BH)	XB	TLS	XBH
	---------	(RSU)	TLS	RBHA

Note:

: Trunk Area,
LS : Local Switch,
TLS : Trunk & Local Switch,
(MS) : Tandem Function
*) The name of "RSU-38" will be changed to "RSU-22"

2. Network Configuration in 2010

Recently, digital telecommunications networks introduced in the world have been changed into simple ones (less hierarchical levels compared to conventional ones), reflecting large capacity and lower price of transmission systems, and high processing ability of exchanges. With such background, MCAC network will be able to be constructed simple. However, taking into account the future conditions of Mongolia (territory, population growth, etc.), i.e. co-existence of digital and analogue systems in the transient period, it will be appropriate to maintain four levels of the present status.

In addition, from the viewpoint of network reliability, it is desirable to construct network so that exchanges of each level should doubly belong to two upper level exchanges in order that 50 percent of traffic of busiest hours could be saved in case that one of the upper level exchange breaks down. More over, the new ISC should set up in other than Ulaanbaatar city.

Figure 7-2-1 shows the network configuration in Mongolia in future.

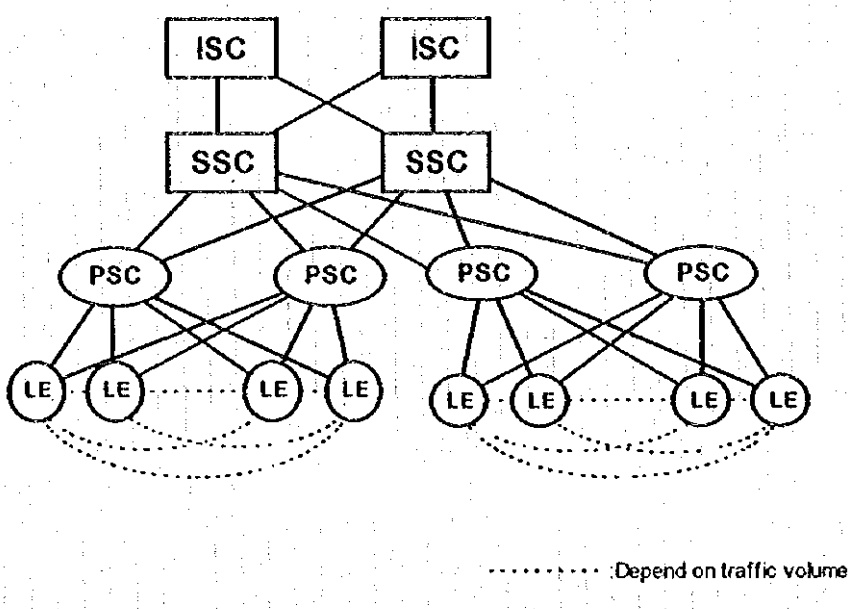

Figure 7-2-1 Concept of the Logical Network Configuration

2.1 How to Decide Network Configuration

(1) ISC is the equipment to process international calls that will become more important in future. It is necessary to duplicate it at an appropriate time.

(2) SSC which will consist of two exchanges in 1997 should be pluralized and be connected in mesh in the future.

(3) PSC should be belonged to plural SSCs and LE should be belonged to plural PSCs.

(4) At least, two PSCs should be installed in each AIMAG.

(5) In the case that the outgoing traffic between two LEs is more than 40 erlangs, direct route should be set up.

Considering the circumstances mentioned above, Figure 7-2-2 shows the logical network configuration of Ulaanbaatar city in 2010 and Figure 7-2-3 shows the physical network configuration of Ulaanbaatar city in 2010.

Volume V, Chapter 5, page 5-1 shows the configuration of Host exchanges and RSUs (2000,2005 and 2010), and the same Volume, same chapter, page 5-2 shows a list of exchanges in operation up to 2010.

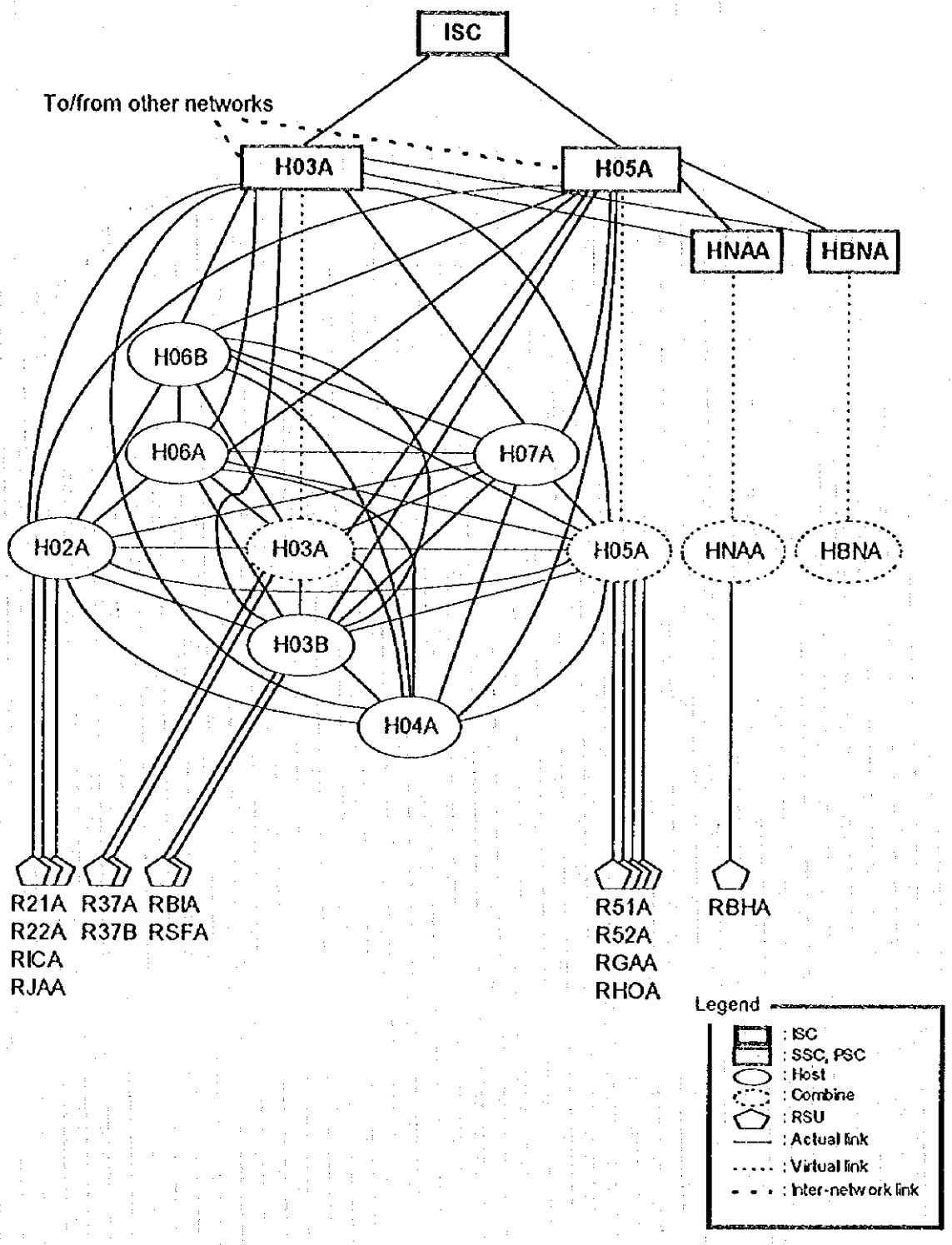

Figure 7-2-2 Logical Network Configuration of Ulaanbaatar city in 2010

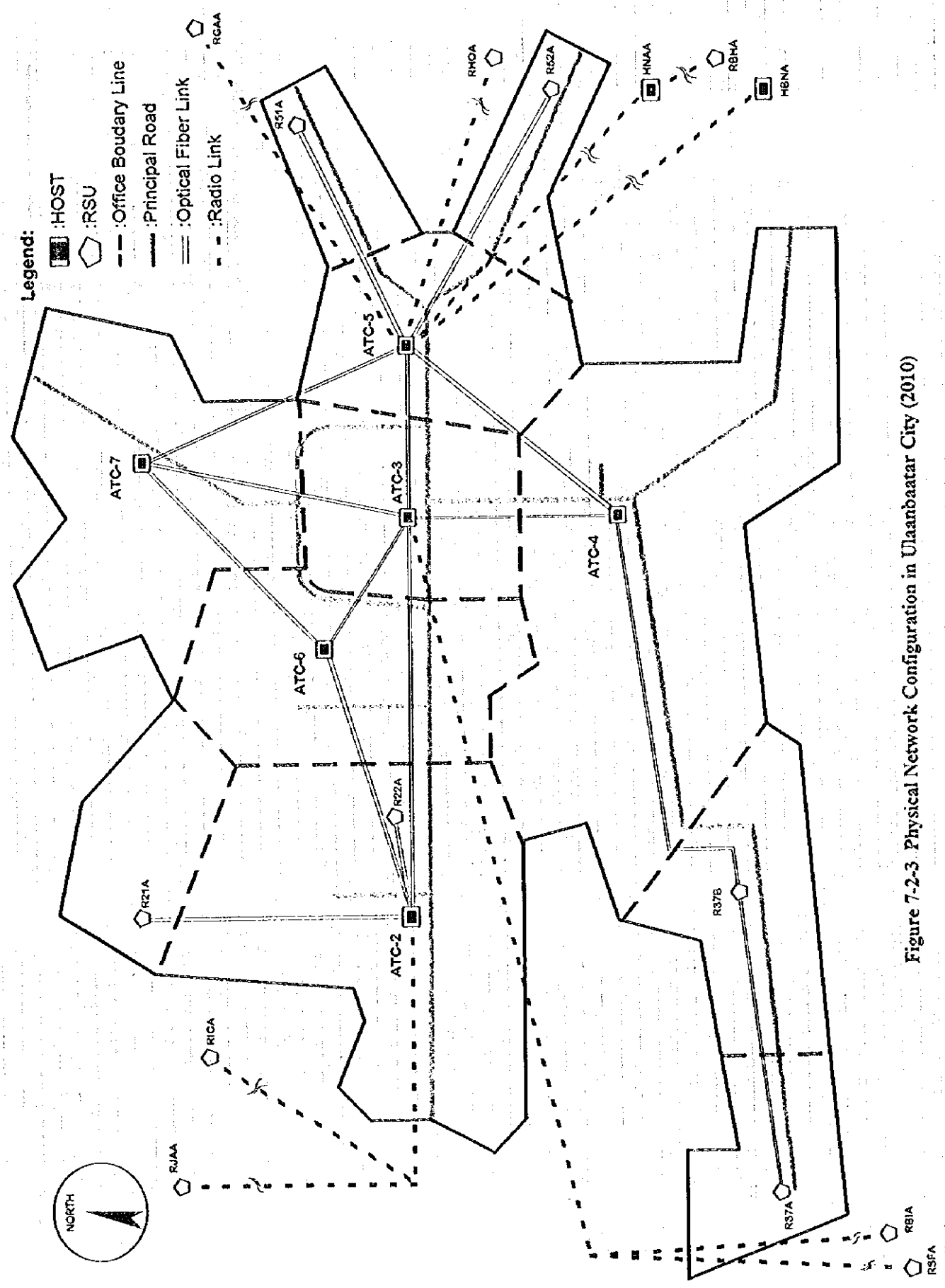

Figure 7-2-3 Physical Network Configuration in Ulaanbaatar City (2010)

3. Fundamental Technical Plan

3.1 Numbering Plan

3.1.1 Number structure

Telephone number of Mongolia consists of Country code (CC), Trunk code (TC), Exchange code (EC) and Subscriber number (SN). The CC is "976" in accordance with CCITT Rec. E. 163. Figure 7-3-1 shows the existing number structure of Mongolia . The maximum number of digits of the telephone number (CC+TC+EC+SN) of Mongolia is 10.

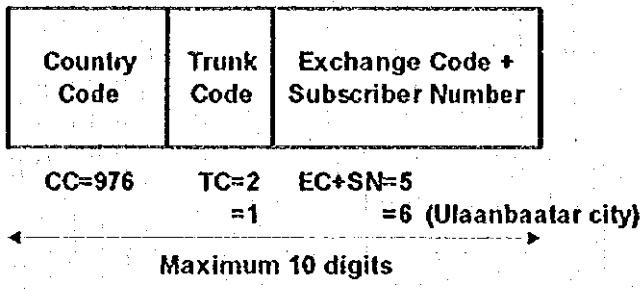

Figure 7-3-1 Existing Number Structure of Mongolia

3.1.2 Trunk Code & Local Number

The numbering plan should be revised in the future introducing escape code to access to other networks operated by entities other than MCAC/MTC.

Provision of new services may require a unique escape code prefixed to the routing digits. In consideration of new services, Mongolia will have to adopt a new numbering plan in near future. The numbering plan as outlined in the ADB Master Plan will be the basis for the proposed numbering plan described hereafter.

In the network, a seven digit numbering scheme is applied. For routing purposes two unique digits of Trunk code are prefixed to the 5 digits local number.

Ulaanbaatar case is the exception with a 6-digit local numbering scheme.

Table 7-3-1 shows the national numbering, or trunk code plus local numbering.

Table 7-3-1 National Numbering

Aimag/ Main City	National Numbering		Aimag/ Main City	National Numbering	
	TC	EC-SN		TC	EC-SN
Choir	75	X-XXXX	Baruunurt	51	X-XXXX
Tsetserleg	73	X-XXXX	Suhbaatar	49	X-XXXX
Ulgie	71	X-XXXX	Zuunmod	47	X-XXXX
Bayanhongor	69	X-XXXX	Ulaangom	45	X-XXXX
Bulgan	67	X-XXXX	Hovd	43	X-XXXX
Altai	65	X-XXXX	Muren	41	X-XXXX
Sainshand	63	X-XXXX	Underhaan	39	X-XXXX
Choibalsan	61	X-XXXX	Darhan	37	X-XXXX
Mandalgovi	59	X-XXXX	Erdenet	35	X-XXXX
Uliastai	57	X-XXXX	Nalaih	33	X-XXXX
Arvaiheer	55	X-XXXX	Baganuur	31	X-XXXX
Dalanzadgad	53	X-XXXX	Ulaanbaatar	1	XX-XXXX

3.1.3 Special Service Numbers

(1) Public Service

MCAC provides some 3-digit special numbers for the services to public. Table 7-3-2 shows the 3-digit numbers with corresponding services.

It is desirable that this special service numbering will be adopted as the local special service numbering through out Mongolia.

Table 7-3-2 3-Digit Special Numbers for Public Services

Number	Service	Number	Service
100	Emergency Ambulance	117	National Enquiry
101	Fire	118	National Enquiry
102	Police	119	Information (Airport)
103	Ambulance	120...129	Police Use
104	Spare	139	Railway Enquiry
105	NEAX61→E-10B Operator	140...159	Subscriber Facilities,
106	International Operator Booking		(Rotary dial telephone sets)
107	National Operator Booking	179	MobiCom
108	Spare	181	Fault Reports
109	Directory Enquiry	182	Fault Reports
110...114	MobiCom	185...188	Fault Reports
115	E-10B→NEAX-61 Operator	193...198	Manual AIMAG Operator
116	International Enquiry	199	Mobile Service Enquiry

(2) Services other than Ordinary Telephone

For various services, the following numbers are allocated;

Railway service : 74 + XXXX
Cellular service : 99 + Area Code + XXXX
⌈ Ulaanbaatar city 991 + XXXX⌉
⌊ Other cities 99 + XX + XXXX ⌋
Telex service : 08 00 + XXXXX + letters
Paging service : 35-8282 Operator

3.1.4 Proposed Local Numbering Plan in Ulaanbaatar city

As Ulaanbaatar city is the capital of Mongolia, the population and number of telephone subscriber will rapidly increase compared to the other provincial areas.

(1) Numbering Capacity

a) Planning Term

A long planning period is normally required for numbering plan because of the fundamental nature of the numbering plan i.e. great difficulty and inconvenience to both administration and subscribers of changing their numbers. ITU suggests 50 years as the planning term.

b) Necessary Digit Number

The necessary digits are decided by the required numbering capacity. On the assumption that after 50 years the population of Ulaanbaatar city is 1.3 million and at that time the penetration ratio becomes 50 per 100 persons, the required number of telephone subscribers in Ulaanbaatar city is considered to be less than 700,000.

In the case of the 6 digit system, the total theoretical possible numbering capacity becomes one million.

However, trunk code "0","1", the first number of exchange code "0" and special service code "1XY" decrease the whole capacity of numbering.

Therefore, total possible numbering capacity is:

$$8 \times 10^5 = 800{,}000$$

Under the above condition, the 6 digit numbering plan will be enough for Ulaanbaatar city for coming 50 years, if the numbering is well assigned.

(2) The Exchange Code Numbering Plan in the Year 2010

Table 7-3-3 shows the proposed local numbering plan for telephone offices in Ulaanbaatar city in the year 2010. At present, the escape code for numbering of railway network is 74 as shown in the table 7-3-4.

In future, this escape code number should be transferred to another number (e.g. 1XY or 9X). Table 7-3-5 shows the exchange code numbering introduction schedule with new exchange installations.

Table 7-3-3 Exchange Code Numbering in Ulaanbaatar City (in the year 2010)

Site Name	Unit Name	Exchange Code	Exchange Capacity
ATC-3	H03A	31;32	14,336
	H03B	30;33;36;39	35,000
ATC-37A	R37A	37	3,012
ATC37Y	R37B	37	2,012
ATC-76 (Biokombinat)	RBIA	37	700
Shuvuun Fabric	RSFA	37	500
ATC-5	H05A	50;51;52	26,500
ATC-51 (Sharhad)	R51A	59	1,000
ATC-52 (Amgalan)	R52A	59	1,000
Honhol	RHOA	59	200
Gachuurt	RGAA	59	100
ATC-6	H06A	60;61;62	35,000
	H06B	63	5,000
ATC-2	H02A	20;21;22	31,000
ATC-21 (Bayan Hoshuu)	R21A	29	2,000
International Children Camp	RICA	29	100
Jargalant	RJAA	29	100
ATC-7	H07A	70;71	14,000
ATC-4	H04A	40;41	15,000
Nalaih	HNAA	2	6,500
Bagahangai	RBHA	3	1,200
Baganuur	HBNA	2	7,000

Table 7-3-4 Exchange Code Numbering for Host Exchange and RSU in Ulaanbaatar City

(in the year 2010)

A / B	0	1	2	3	4	5	6	7	8	9	*	#
0	International	Ulaanbaatar				Trunk			Telex			
1					Special Service							
2	H02A	H02A	H02A							R21A RICA RJAA		
3	H03B	H03A	H03A	H03B			H03B	R37A,R37B RBIA RSFA		H03B		
4	H04A	H04A				H07A	H07A					
5	H05A	H05A	H05A							R51A,R52A RHOA RGAA		
6	H06A	H06A	H06A	H06A H06B								
7	H07A	H07A			Railway							
8												
9										Cellular		
*												
#												

AB-XXXX

A : The first digit number of exchange code

B : The second digit number of exchange code

X : The digit number of subscriber

Table 7-3-5 Exchange Code Numbering Schedule in Ulaanbaatar City

Site Name	Unit	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Ex Cap in 2010
ATC-3	H03A	31,32														14,336
	H03B		30,39						36					33		35,000
ATC-37A	R37A	37														3,012
ATC37Y	R37B	37														2,012
ATC-76 (Bickombinat)	RB1A				37											700
Shuvuun Fabric	RSFA				37											500
ATC-5	H05A	50			51							52				26,500
	R35A	35										Dis				
ATC-51 (Sharhad)	R51A						59									1,000
ATC-52 (Amgalan)	R52A						59									1,000
Honhot	RHOA				59											200
Gachuurt	RGAA							59								100
ATC-6	H06A		60,61,62													35,000
	H06B												63			5,000
	R36A	36	Disuse													
ATC-2	H02A					20,21				22						31,000
	R33A	33				Dis										
ATC-38	R38A	38				Dis										
ATC-21 (Bayan Hoshuu)	R21A					29										2,500
International Children Camp	RICA						29									100
Jargalant	RJAA							29								100
ATC-7	H07A				45										46	14,000
ATC-4	H04A										40,41					15,000
	R34A	34									Dis					
Nalaih	HNAA			#												6,500
Bagahangai	RBHA						#									1,200
Baganuur	HBNA						#									7,000

Dis : Disuse # : used number at present

3.2 Signaling Plan in Ulaanbaatar city

MCAC now uses CCITT signaling system R2 (Digital Version) in Ulaanbaatar city. The CCITT No.7 signaling system will be applied to the links between Ulaanbaatar, Erdenet and Darhan. Figure 7-3-2 shows the existing plan. It is recommended that CCITT No.7 signaling system should be introduced throughout the network at a later stage of this basic plan.

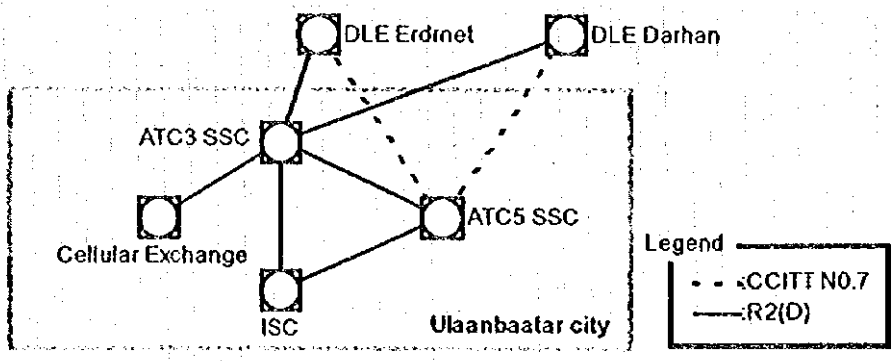

Figure 7-3-2 Existing Signaling Plan

CCITT Recommendations indicate the Signaling System No.7 protocols which provide the signaling functions required to support services in a telephone network, data communication network, as well as basic bearer services and supplementary services for voice and non-voice applications in an integrated services digital network. Leading telephone exchange manufacturers make their products in compliance with the specifications defined by such Recommendations and supply them to users for international and national applications.

CCITT Recommendations deal with fundamentally the international networks. However, most signaling procedures, information elements and message types specified for international use are also required in typical national applications. Coding space has been reserved in order to allow national administrations and recognized private operating agencies to introduce network specific signaling messages and elements of information within the internationally standardized protocol structure.

The signaling messages specified by CCITT cover most services essential to a general telephone network. Accordingly, MCAC can establish its signaling link network making use of the messages already specified by CCITT.

It is recommended to conduct a further study for establishing the guidelines or specifications regarding the detailed parts of Signaling System No.7 for MCAC network use and getting harmony with exchange control software specifications. MCAC should introduce only the signaling systems defined by CCITT in order to avoid inter-working problems or cost increase afterwards.

As the signaling system between host exchanges, CCITT No.7 is essential signaling system to introduce ISDN and new services. Therefore MCAC should introduce CCITT No.7 signaling system as soon as posible.

3.3 Synchronization Plan

3.3.1 Existing Network

In the existing network, there are only two switches which are synchronized:

- E10B (ATC3)
- NEAX61E (ATC3)

In this network, the E-10B switch (ATC3) serves as the master clock supply with the accuracy of 10^{-8}.

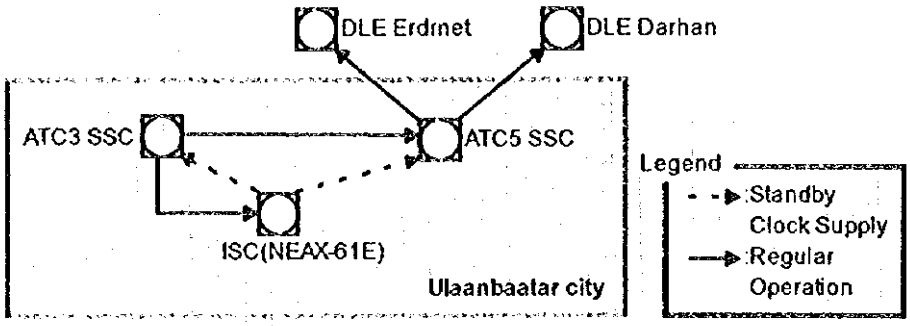

Figure 7-3-3 Synchronization Principle

3.3.2 New Network

The new exchanges shall be synchronized in Ulaanbaatar with the E10B (ATC3) and NEAX61E.

But in future, the master clock should have the accuracy of 10^{-11} to satisfy the requirements on slip rate recommended by CCITT Rec. G811/823/824 for international digital links. It is recommended that the high accuracy master clock should be introduced to the digital international switch at a later stage of this basic plan and all the other digital switches in Mongolia should be synchronized to the master.

Therefore, it is recommended to change to the high accurate master clock system at a later stage of this basic plan. The central clock in Ulaanbaatar will be the master clock for Erdenet and Darhan. Figure 7-3-4 shows the national reference clock network of MCAC in future.

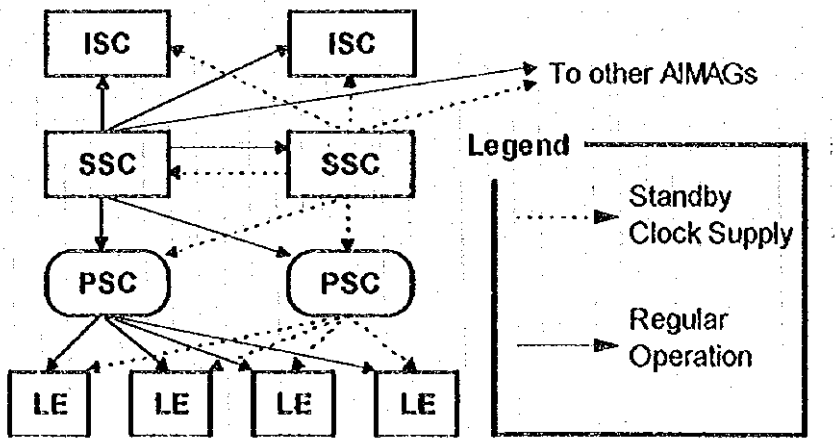

Figure 7-3-4 National Reference Clock Network of MCAC

3.4 Inter-Network Connection

3.4.1 Inter-network Connection of Existing Networks in Mongolia

In Mongolia there are several telecommunications networks besides MCAC telephone network; i.e., cellular telephone network, data communication network, railway communication network, governmental communication network, and paging service network. Data communications network are not inter-connected with MCAC telephone network. Governmental network has not been inter-connected, but is going to be inter-connected with MCAC network in the future. Figure 7-3-5 shows the existing major networks and inter-connection between them.

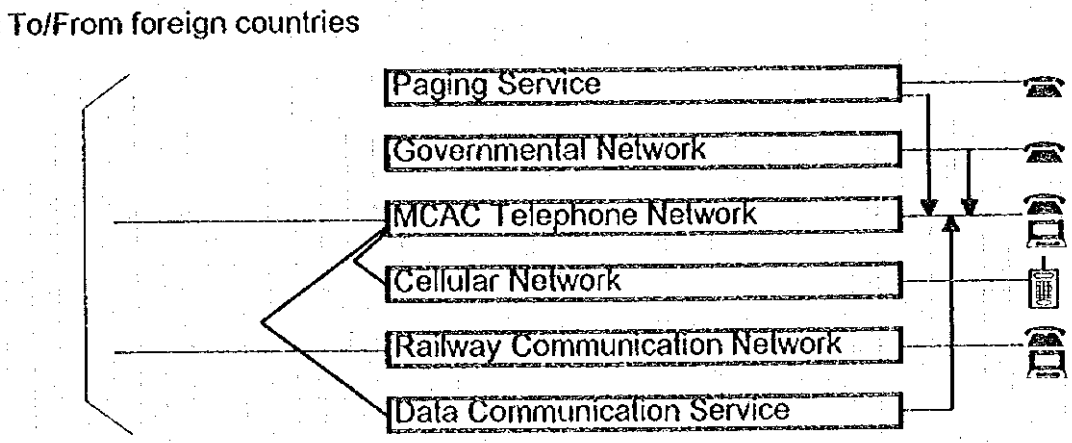

Figure 7-3-5 Existing Major Networks and Inter-Connection between Them

The cellular telephone network and railway communication network are interconnected with MCAC telephone network through trunk circuits. It is inter-connected with E-10B local exchange through trunk circuits. Paging service network is now connected with MCAC telephone network by means of normal telephone subscriber numbers.

3.4.2 Inter-network Connection in Future

MCAC network will be inter-connected with the existing and new networks through a gate switch. The MCAC gate switch should be, primarily, in Ulaanbaatar. The number of gate switches or the connection points should be increased in proportion to the growth of inter-network traffic. The signaling system between the gate switches should be CCITT No.7 signaling system.

3.5 Charging System Plan

3.5.1 Existing Network

National calls are charged by time at rates determined by distance in five charging zones as follows:

0 to 100km
101 to 300km
301 to 500km
501 to 1,000km
Over 1,000km

Local calls will be also charged by timed local call charge. However, nowadays this facility is not available in some of the existing switches.

3.5.2 New Network

Charging of calls shall depend on:

Duration
Time of day
Distance

The local exchange shall be capable of charging calls. As the new switch equipment will comprise of IDD facilities.

Charging at the booking offices/manual switch boards would be possible.

As it is intended to introduce card telephones, transmission of charging pulses must be possible.

3.5.3 Billing System

Charging information will have to be stored on data processing media.

The data processing media shall be a tape, since there already exists an operational procedure for ATC3 and NEAX61E (international accounting) switches. The Specification for the new switching technology has to coincide with the existing data format.