

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
MINISTRY OF INFRASTRUCTURE DEVELOPMENT (MOID)  
MONGOLIAN COMMUNICATIONS ASSET COMPANY (MCAC)

THE STUDY  
ON  
TELECOMMUNICATIONS NETWORK  
IN  
ULAANBAATAR CITY  
FINAL REPORT  
VOLUME - I  
EXECUTIVE SUMMARY

JULY 1996

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JAPAN TELECOMMUNICATIONS ENGINEERING  
AND CONSULTING SERVICE (JTEC)

NIPPON TELECOMMUNICATIONS CONSULTING CO., LTD (NTC)

TOKYO, JAPAN

SSS

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The study on telecommunications network in Ulaanbaatar City is final product of JICA.



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All prices and costs used in this report are those prevailing in April 1996, excepting the case otherwise stated. They are also assumed to be constant during the whole project period.

Exchange Rate : US\$1=Mongolian Tugrig (Tg) 490 (April 1996)

## PREFACE

In response to a request from the Government of Mongolia, the Government of Japan decided to conduct a study on Telecommunications Network in Ulaanbaatar City and entrusted the study to the Japan International Cooperation Agency (JICA).

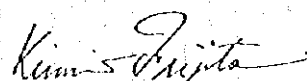
JICA sent to Mongolia a study team headed by Mr. Yasushi TAKAHASHI, Project Manager, Japan Telecommunications Engineering and Consulting Service, three times between September 1995 and July 1996.

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

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

I wish to express my sincere appreciation to the officials concerned of the Government of Mongolia for their close cooperation extended to the team.

July 1996



Kimio Fujita

President

Japan International Cooperation Agency

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## **EXECUTIVE SUMMARY**

### **1. General**

This Study Report describes a basic plan up to the year 2010 and a feasibility study for priority projects. The Basic Plan will be implemented for the Study on Telecommunications Network in Ulaanbaatar city in Mongolia.

The report consists of :

- Volume - I      **Executive Summary**
- Volume - II     **Basic Plan**
- Volume - III    **Feasibility Study for the Priority Projects**
- Volume - IV    **Supporting Documents**
- Volume - V     **Data Book**

The study was carried out in accordance with the work plan and schedule discussed and agreed upon between Ministry of Infrastructure Development (hereinafter referred to as MOID), Mongolia Communications Asset Company (hereinafter referred to as MCAC) and Japan International Cooperation Agency (hereinafter referred to as JICA). The study work was carried out both in Ulaanbaatar and in Japan.

## **2. Background of the Study**

Ulaanbaatar city is the political and economic center of Mongolia. The function of the telecommunications network is considerably deteriorated because of the shortage of the capacities, the obsolescence of telecommunications facilities, and the disorder by the illegal use of telephone lines, etc. This results in a great obstacle for the inhabitants' lives and economic activities.

Telecommunications play an important role as the national economic infrastructure of Mongolia which is shifting toward a market economy. The government of Mongolia has taken up the development of telecommunications as one of the most important policies. It has formulated, by now, a telecommunications master plan for whole Mongolia with the support of the Asian Development Bank (ADB). However, the improvement of the local telecommunications network is considerably delayed. At present, the penetration ratio of telephone lines is 7 per 100 inhabitants, and the number of waiters reached 20,000 in Ulaanbaatar city.

Considering the above conditions, the Government of Mongolia requested a technical assistance to the Government of Japan in September 1994, for the formation of a basic plan of the local telecommunications network in Ulaanbaatar city up to the year 2010, and for a feasibility study of priority project(s). In response to the request, the Government of Japan dispatched JICA preparatory study team and the Scope of Work was agreed on 22nd June, 1995.



### **3. Objective of the Study**

The objectives of the Study are as follows:

- (1) To formulate a basic plan for the development of the telecommunications network in Ulaanbaatar city up to the year 2010 (PHASE I Study);
- (2) To conduct a feasibility study for the identified priority project(s) based on the PHASE I Study (PHASE II Study); and
- (3) To transfer technology to the Mongolian counterparts.

#### **4. Scope of the Study**

The scope of the study is categorized as shown below:

- (1) Forecast of telecommunications demands up to the year 2010;
- (2) Formation of a basic plan in consideration of the existing facilities, on-going and planned projects, and trend of new telecommunications technology;
- (3) Formation of projects composed of objective area, applicable system and project scale;
- (4) Selection of priority project(s) from a view of demand fulfillment and political, economic and social importance.
- (5) Feasibility Study on the Priority Project(s) determining target year(s), planning area(s), and service level(s), with cost estimation, and project evaluation (financial analysis and socio-economic analysis).
- (6) Technology transfer to the counterparts through the Study.

### 5. Work Schedule

The Study was conducted from the end of September 1995 to the end of July 1996. The time schedule of the basic plan study and feasibility study by study stage is shown in table 5-1.

Table 5-1 Work Schedule of the Study

UB: Ulaanbaatar

Study Stages	1995	1996				
First Study in UB	10W					
First Study in Japan		7W				
Second Study in UB			4W			
Second Study in Japan				6W		
Discussion of DF/R					2W	
Preparation of Final Report						4W
Submission of Reports	IC/R	P/R		IT/R	DF/R	F/R
IC/R: Inception Report	W: Weeks					
P/R: Progress Report						
IT/R: Interim Report						
DF/R: Draft Final Report						
F/R: Final Report						

## 6. Activities in each stage

### 6.1 First Study in Ulaanbaatar (PHASE I Study)

During the first study in Ulaanbaatar from 27 September to 2 December 1995, the Study Team carried out the following works.

- (1) Discussion on Inception Report submitted from the Team;
- (2) Collection of data/information related to socio-economy, national development policy, and telecommunications;
- (3) Analysis of data/information collected;
- (4) Field survey for socio-economy, demand and facilities;
  - Field survey by two technical teams
  - Field survey by one socio-economy team
  - Macroscopic demand forecast;
  - Study of long-term development targets;
- (5) Preparation of Progress Report;
- (6) Technology transfer through field survey, data collection, review of development framework, etc.

### 6.2 First Study in Japan (PHASE I Study)

During the first study in Japan from 4 December 1995 to 24 February 1996, the Study Team prepared the Interim Report consisting of draft basic plan based on the results of the first study in Mongolia. The Interim Report plan mainly consists of the following:

- (1) Socio-economic study;
- (2) Demand Forecasts;
- (3) Telecommunications network plan;
- (4) Telecommunications network facilities plan;
- (5) Operation and maintenance study
- (6) Human resource development plan;
- (7) Institution, organization and management plan;
- (8) Study on finance and investment;
- (9) Project formation;
- (10) Evaluation of basic plan;

### **6.3 Second Study in Ulaanbaatar (PHASE II)**

During the second study in Ulaanbaatar from 26 February to 24 March, 1996, the Study Team conducted the feasibility study based on the results of PHASE I Study. The Study items are as follows:

- (1) Explanation and discussion on the Interim Report;
- (2) Discussion on the feasibility study;
- (3) Collection and analysis of available materials;
- (4) Field survey; and
- (5) Confirmation of details of each project.

### **6.4 Second Study in Japan (PHASE II)**

During the second study in Japan from 15 April to 31 May, 1996, the Study team prepared a draft final report consisting of the basic plan and feasibility study of two projects based on the results of the second study in Ulaanbaatar. The draft final mainly consists of the following:

- (1) Socio-economic study;
- (2) Demand forecast;
- (3) Development frame work and strategy;
- (4) Telecommunications network plan;
- (5) Project implementation plan;
- (6) Analyses of financial, economic and social aspects;
- (7) Operation and maintenance plan;
- (8) Institution, organization and management plan;
- (9) Human resource development plan;
- (10) Recommendations;
- (11) Conclusion.

### **6.5 Third Study in Ulaanbaatar**

During the third study in Ulaanbaatar from 3 June to 15 June, 1996, the Study Team explained about the Draft Final Report and discussed with MOID/MCAC.

**6.6 Third Study in Japan**

During the third study in Japan from 17 June to 26 July, 1996, the Study Team prepared the Final Report.

## 7. Concept of the Basic Plan

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.)

### The Telecommunications Policy

- (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 and 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.

This Basic Plan was framed in line with the above mentioned Telecommunications Policy and designed assuming the following conditions:

- 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 installation but also in operation;
- c) The network is made up by applying the latest technologies. Targets of the telecommunications quality are established;
- d) The network is capable of fulfilling every new application for basic telephone services within one year in the year 2010 and afterwards;
- e) Effective operation and maintenance are achieved to satisfy customers.

This basic plan covers the long-term development of telecommunications network up to 2010 in Ulaanbaatar city. The planning period up to 2010 is divided into three 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.



## **8. Key Development Targets up to 2010**

Key development targets consisting of indexes for various service provisions, service quality, operational efficiency and network facility provisions for the respective three stages up to 2010 are summarized in Table 8-1.

Table 8-1 Key Indexes of the Basic Plan

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	Subscriber Numbers	100	44	20	9
Leased 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	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

## **9. Demand Forecast**

### **9.1 Introduction**

A demand forecast has been made for telephone, telex, cellular mobile telephone, radio paging and, leased circuit services and data communication services, which provides a basis for the economic and technical study of the basic plan and the feasibility study for the study on telecommunications network in Ulaanbaatar city in Mongolia up to the year 2010. The forecasting base year is set at 1995, and successive forecasts are made at 2000, 2005 and 2010.

Demand for telephone service was estimated by the three forecast methods. That is, the macroscopic forecast method for the whole country based on the former socialist countries data and the ITU model, the semi-macroscopic forecast method for Ulaanbaatar city based on GDP growth rate to estimate the residential and administrative/business demand, and the microscopic forecast method for 9 districts of administrative unit in Ulaanbaatar city were made and analyzed by the Study Team in this study. Finally, the result of the semi-macroscopic forecast method was used for the basic plan up to 2010.

Also demand for telex service was estimated in consideration of the recent demand decreasing trend in Ulaanbaatar city the same as the international trend. Cellular mobile telephone and radio paging services were estimated mainly based on other countries' data. Leased circuit and data communication service demands were estimated based on the number of companies projected with the GDP growth rate in Ulaanbaatar city up to 2010.

## 9.2 Telephone Demand Forecast

The results of the analysis of three models proved that the demand forecast by ADB Master Plan conducted in 1993 is not realistic at present because this forecast was made when Mongolia was still struggling with significant budget reduction due to less aid from USSR.

It is concluded that the forecast obtained by the semi-macroscopic model (Model II) is considered to be the most reliable, because this model is calculated using the data of the income level per household provided by the Mayor's office in Ulaanbaatar city. The telephone demand per 100 inhabitants is expected to exceed 21 in the year 2010. Table 9-1 shows the results of the demand forecast up to 2010.

**Table 9-1 Results of Telephone Demand Forecast**

Items	1995	2000	2005	2010
Population (x1000)	619.3	668.4	721.5	778.7
Residential Demand	54,259	73,359	98,424	130,615
Admi/Business Demand	13,997	18,359	24,620	32,947
Total Demand	68,256	94,065	123,044	163,562
Demand Density	11.02	13.73	17.05	21.00

## 9.3 Cellular Mobile Telephone and Radio Paging Demand Forecast

Demand for cellular mobile telephone and radio paging services were estimated mainly based on mainly other countries data because of these services are at its initial stage in Ulaanbaatar city and there are no available data. The results of the demand forecast for these services demand are shown in Table 9-2.

**Table 9-2 Results of Cellular Mobile Telephone and Radio Paging Demand Forecast**

Items	1995	2000	2005	2010
Mobile Telephones	0	1,280	3,372	7,179
Radio Paging	1,500	2,554	4,733	9,171

#### 9.4 Leased Circuit and Data Communication Service Demand Forecast

At present, main users of leased circuits and data communication services are those working in administrative offices, with small number of users in private offices. In line with the transition to the market economy private users will become main users of these services in the future. The results of demand forecast for these services are shown in Table 9-3.

**Table 9-3 Results of Leased Circuit and Data Communication Services Demand Forecast**

Items	1995	2000	2005	2010
Leased Circuit	300	447	681	1,066
Data Communication	400	596	909	1,422

## 10. Telephone Traffic Forecast and Circuit Calculation

### 10.1 Traffic Forecast and Circuit Calculation

Based on the telephone supply volume specified mentioned in Table 8-1 and the latest traffic data of E-10B digital exchange, traffic forecast and circuit were calculated up to 2010.

Outgoing calling rate per subscriber and distribution ratio of outgoing call used in this study are shown in Table 10-1 and Table 10-2.

**Table 10-1 Outgoing Calling Rate per Subscriber and Telephone Supply Volume**

Items	1995	2000	2005	2010
Residential Subscriber	13,797	18,398	24,620	32,947
Admi./Business Subscriber	30,285	47,126	77,592	130,615
Total Subscriber	44,082	65,524	102,212	163,562
Calling Rate (Residential)	0.045erl	0.052erl	0.059erl	0.067erl
Calling Rate (Admi./Business)	0.067erl	0.078erl	0.089erl	0.1erl

**Table 10-2 Distribution Rate of Outgoing Call**

Items	1995	2000	2005	2010
International calls	1.50%	1.65%	1.82%	2.00%
Long distance calls	3.60%	4.49%	5.61%	7.00%
Service calls	1.00%	1.00%	1.00%	1.00%
Local and Intra-office calls	93.90%	92.86%	91.57%	90.00%

## 11. Network Configuration in 2010

### 11.1 Network Formation

Items to be taken into consideration for the network formation are as follows:

- (1) Hierarchical network structure of Mongolia will not be changed under this plan. That is, the Ulaanbaatar network plan is formed in accordance with the present three leveled structure.
- (2) SSC which will consist of two exchanges should be pluralized as soon as possible in order to secure reliability and safety of the network.
- (3) PSC should belong to plural SSCs and LE should belong to plural PSCs.
- (4) In case that the outgoing traffic between two LEs is more than 40 erlang, a direct route should be set up.
- (5) ISC is the equipment to process international calls. It will become more important in the future and it is necessary to duplicate it at an appropriate time.

Figure 11-1 shows the logical network configuration and Figure 11-2, the physical network configuration in Ulaanbaatar city in 2010, under the circumstances mentioned above.

Note 1: Switching Unit Abbreviations in Ulaanbaatar city for the Basic Plan are shown in Volume II, Chapter 7, Table 7-1-1 and Table 7-1-2.

Note 2: SSC : Secondary Switching Center  
PSC : Primary Switching Center  
LE : Local Exchange  
ISC : International Switching Center

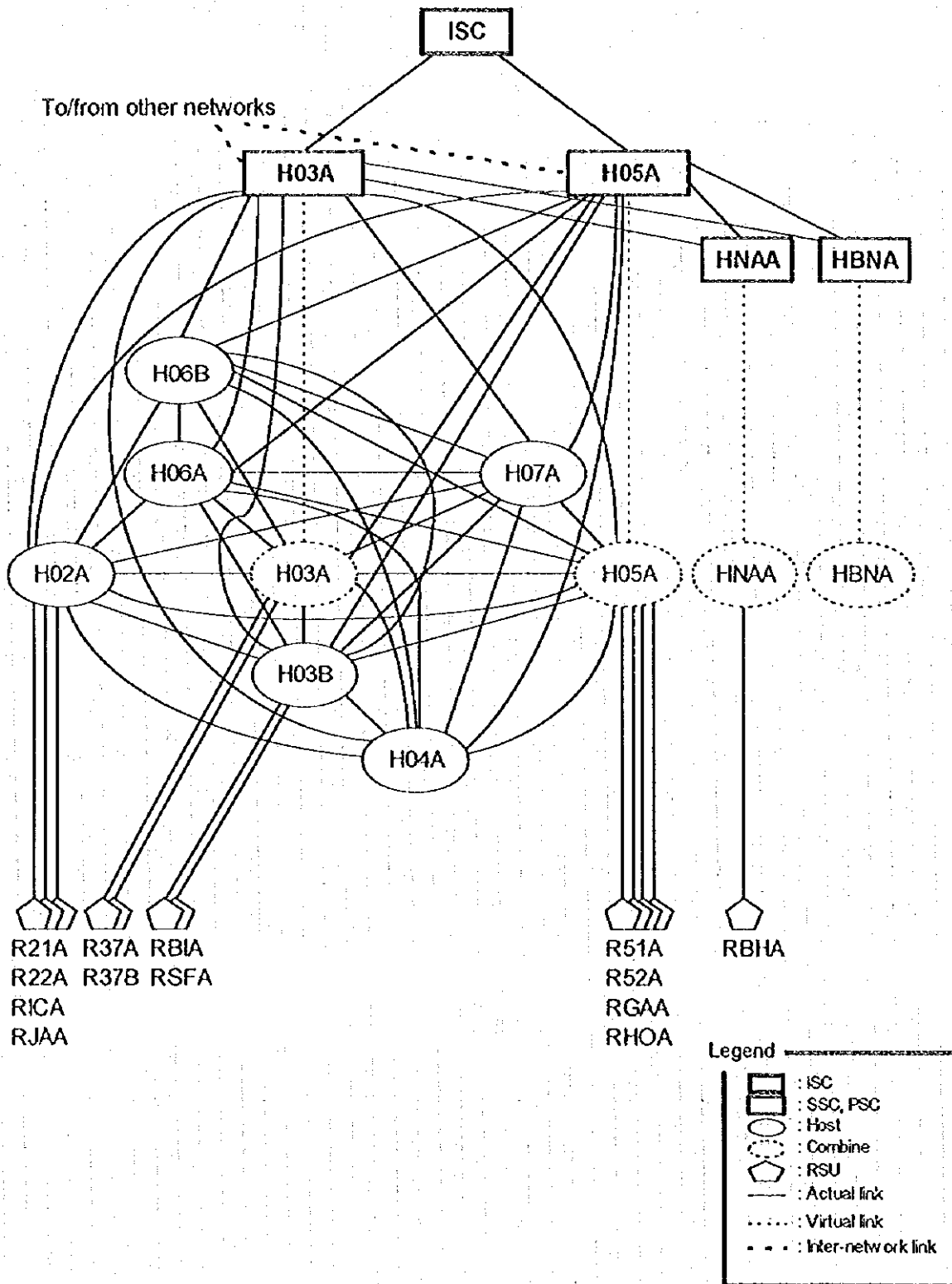


Figure 11-1 Logical Network Configuration of Ulaanbaatar City in 2010



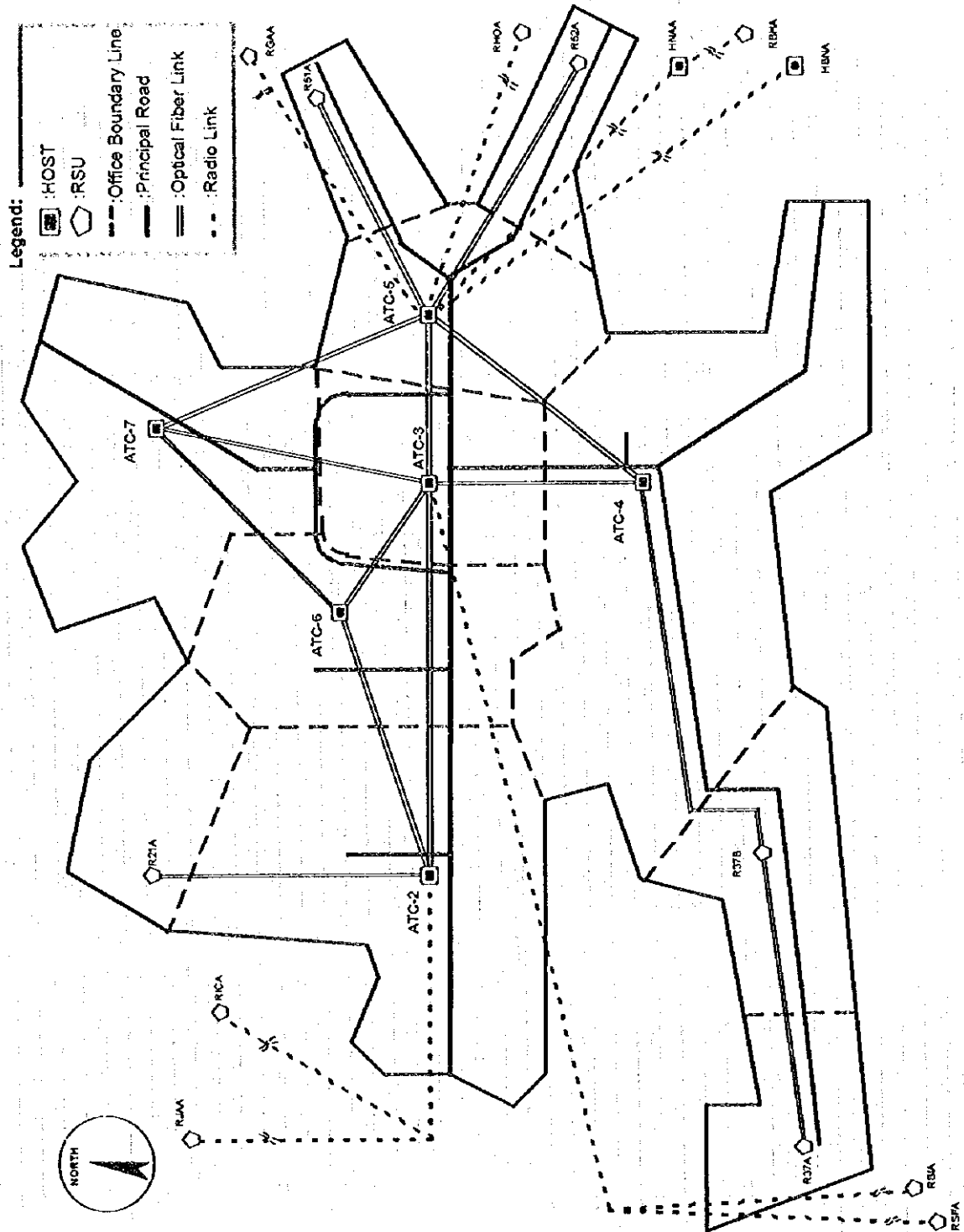


Figure 11-2 Physical Network Configuration in Ulaanbaatar city (2010)

**11.2 Local Exchange Capacity to be Provided in 2010**

The existing local exchange capacity is supposed to increase up to 54,644 in the year 1997, according to the ongoing projects as of November 1995. The local exchange capacity to be provided during this Basic Plan period is calculated based on the telephone switching system introduction policy stated in Chapter 7 of Volume II. It will be increased up to 210,560 in the year 2010. Table 11-1 shows the local exchange capacity of each Exchange.

**11.3 ISC, SSC and PSC Capacity to be provided in 2010**

In accordance with the local subscriber increase, International, Secondary and Primary Switching Centers should be expanded. Necessary numbers of trunks and circuits are shown as in the Table 11-2 and Table 11-3.

Table 11-2 Trunk Capacity of SSC and PSC

	2000	2005	2010
HO3A	5,700	5,700	5,700
HOSA	1,500	3,000	4,500

Table 11-3 ISC Capacity

	2000	2005	2010
Domestic	570	570	990
International	570	570	990
Total	1,140	1,140	1,980

**11.4 Transmission to be provided in 2010**

As shown in Figure 11-1 Ulaanbaatar junction network in 2010, ATCs in the center of Ulaanbaatar city will be connected in ring by optical fiber cables of SDH system (STM-4). ATCs and RSUs in rural areas will be connected by radio systems or optical fiber cables.

**11.5 Outside Plant Capacity to be provided**

The number of MDF pairs in the target area of this Basic Plan is 64,850 as of November, 1995. The number will increase to 86,890 pairs after the completion of the ADB project in 1998. In this Basic Plan, 132,900 pairs will be expanded by 2010. Therefore, the total number of MDF pairs will be 219,790 pairs.

Existing 48,000 pairs (approximately) will be replaced in the rehabilitation projects.

Table 11-1 Local Exchange Capacity Plan

Year	Exchange		Install			Total
	Host	RSU	New	Expansion	Transfer	
1998	H06A		16,000			16,000
1999	H05A			3,000		22,700
	H07A		6,000			
		R34A			4,000	
		R37A			2,000	
		R37B			1,000	
		R38A			4,000	
	HNAA		2,000			
		RBHA		700		
2000	H03B		13,000			13,800
		RBIA	500			
		RSFA	300			
2001	H02A		20,000			21,700
		R21A	1,500			
		RJAA	100			
		RICA	100			
2002	H05A			4,000		11,200
		R51A	1,000			
		R52A	1,000			
		RGAA	100			
		RHOA	100			
	HBNA	5,000				
2003	H06A			11,000		13,000
	HNAA			2,000		
2004	H03B			10,000		10,100
		RSFA		100		
2005	H04A			11,000		15,000
	H07A			4,000		
2006	H02A			11,000		11,500
		R21A		500		
2007	H05A			11,000		13,100
		RHOA		100		
	HBNA			2,000		
2008	H06A			8,000		16,000
	H06B		5,000			
	HNAA			2,500		
		RBHA		500		
2009	H03B			12,000		12,300
		RBIA		200		
		RSFA		100		
2010	H04A			4,000		8,000
	H07A			4,000		
Total						184,400

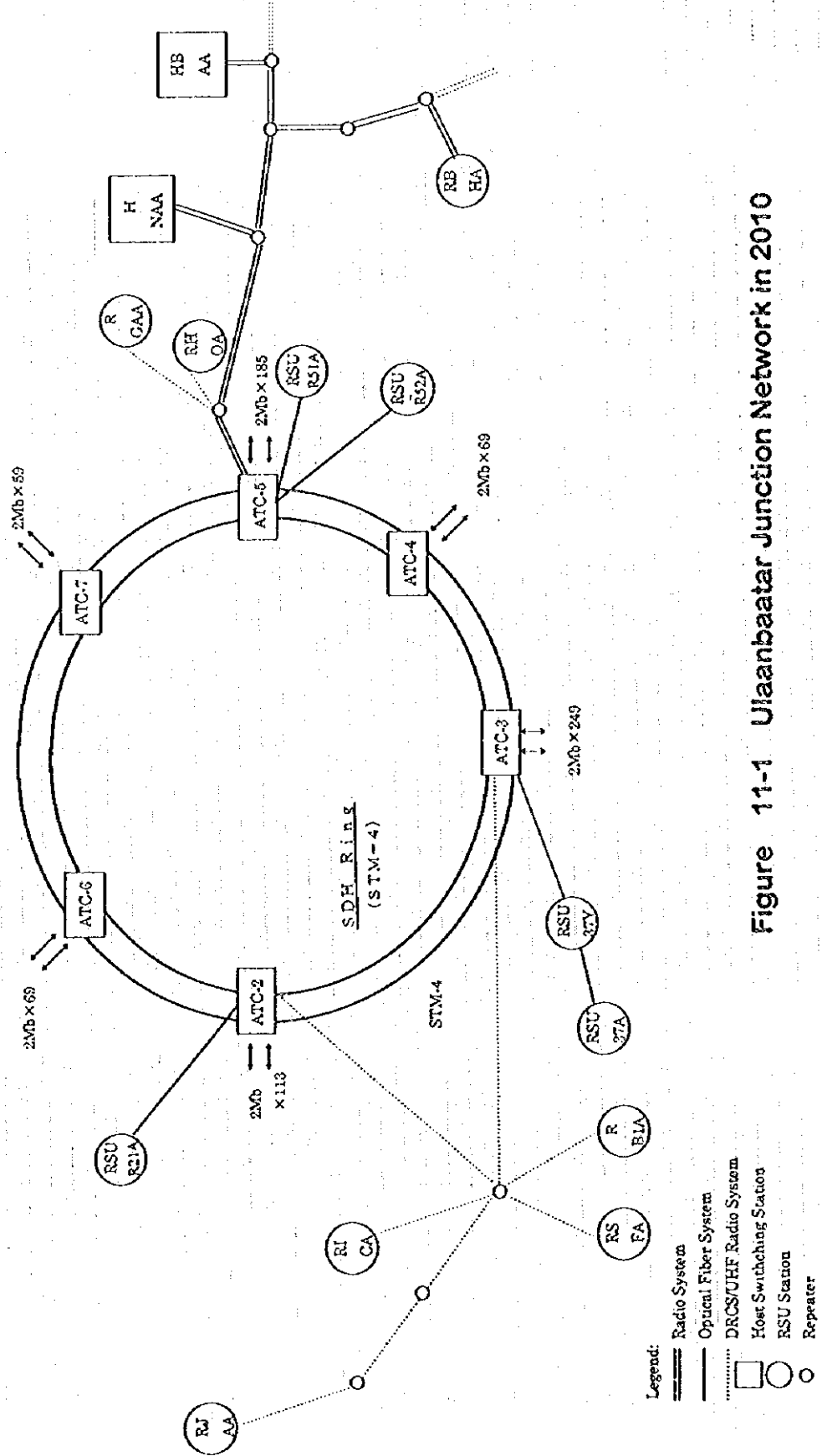


Figure 11-1 Ulaanbaatar Junction Network in 2010

## 12. Project Implementation Plan

The projects of this Basic Plan are formed following the under mentioned policy;

- a) Adoption of the time local charge system is assumed;
- b) The basic telephone service is provided by the network which is economical not only in installation but also in operation;
- c) The network is made up by applying the latest technologies. Targets of the telecommunications quality are established;
- d) The network is capable of fulfilling every new application for basic telephone services within one year after its registration in the year 2010 and afterwards;
- e) Effective operation and maintenance are achieved to satisfy customers.

The Project Implementation is planned as follows:

- (1) The telephone demand of Ulaanbaatar city in the year 2010 is 163,000 in direct exchange lines.
- (2) The demand will be fulfilled in the year 2010.
- (3) The existing service areas of exchanges will be maintained allowing a partial modification. The modification is summarized to the following four points.
  - (a) The area ATC-73 where the telephone service is provided by extending subscriber lines from ATC-3 exchange will have a host exchange, as the ATC-3 exchange service area is very big.
  - (b) RSU-38, which is placed under ATC-3 host exchange will be transferred to ATC-2 host exchange when the latter is introduced.
  - (c) The Bayan Hoshuu area will be merged to the ATC-2 area.
  - (d) In addition, the nomenclatures of some exchanges will be changed as shown in the table below.

Table 12-1 Exchange Service Areas

Existing	New name proposed in Basic Plan
ATC-31, 32; RSU-37A, Y	ATC-3
RSU-33, RSU-38	ATC-2
RSU-34	ATC-4
ATC-73	ATC-7
RSU-36	ATC-6
RSU-35	ATC-5
Nalaikh	ATC-Nalaikh
Baganuur	ATC-Baganuur

- (4) The ATCs listed in Table 12-1 will have host exchanges. As to the exchange types, a host exchange is proposed in the cases where the ATC area needs a switching capacity of 10,000 subscriber lines in the year 2010. However, introducing host exchanges is proposed for Nalaikh and Bagamuur, in consideration of maintainability as they are far from the central part, though their capacity is less than 10,000 subscriber lines in the year 2010. Areas far from the host exchange will be served by a remote switch unit (RSU) to achieve economy.
- (5) Priority of project implementation is given in consideration of the following points.
- (a) Number of waiters in the year 1995;
  - (b) Political, economic, and social importance;
  - (c) Balance in work volume
- (6) Implementation plan was made as follows. In order to fulfil telephone demand of each ATC in the year 2010, installation of new and additional exchanges, and trunk circuits, and rehabilitation and installation of additional outside plants are planned, taking into account the existing equipment of the work commencing year and the demand in the year 2010 in each area. In principle, installation quantity of the facilities is planned to cover the supply schedule of the following five years for switchings, primary cables, and secondary cables, and fifteen years for civil facilities. In addition, the time of new RSU installation or its expansion is planned as close as possible to the time of its host exchange installation or expansion.

Table 12-2 shows the price quotation and Table 12-3, percentage to be added to T1.

Table 12-2 Price Quotation

	Item	T 1
Switch	Host Exchange	US\$ 245
	RSU	US\$ 195
Outside Plant	New & Expansion	US\$ 360

T1 : Equipment + Training + Installation + Transportation

Table 12-3 Percentage to be added to T1

	Switch	Outside Plant	Transmission
Consultancy	10	10	8
Tax	18.25	18.25	18.25
Contingency	5	10	10

Table 12-4 shows Project Implementation Plan.





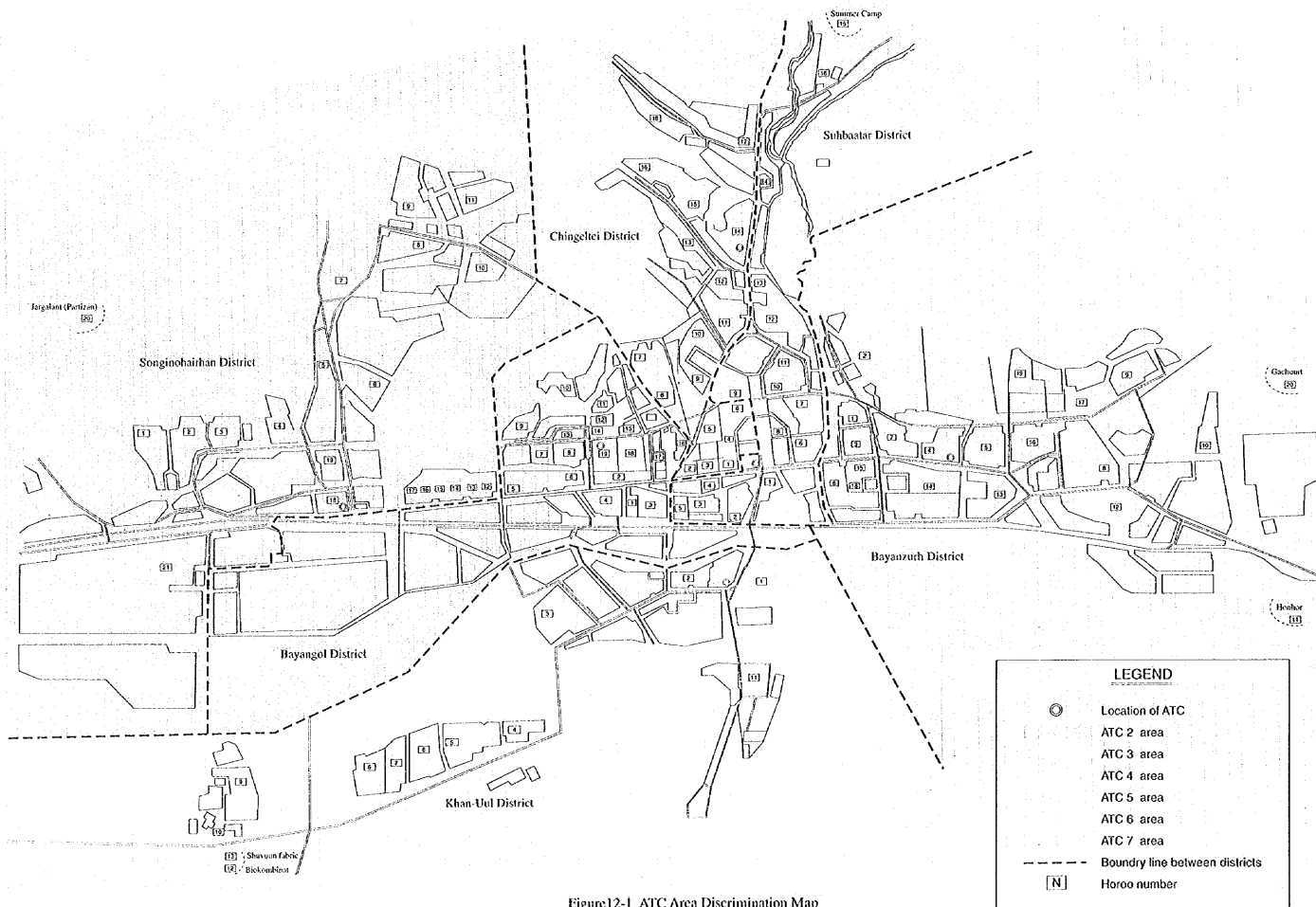


Figure 12-1 ATC Area Discrimination Map

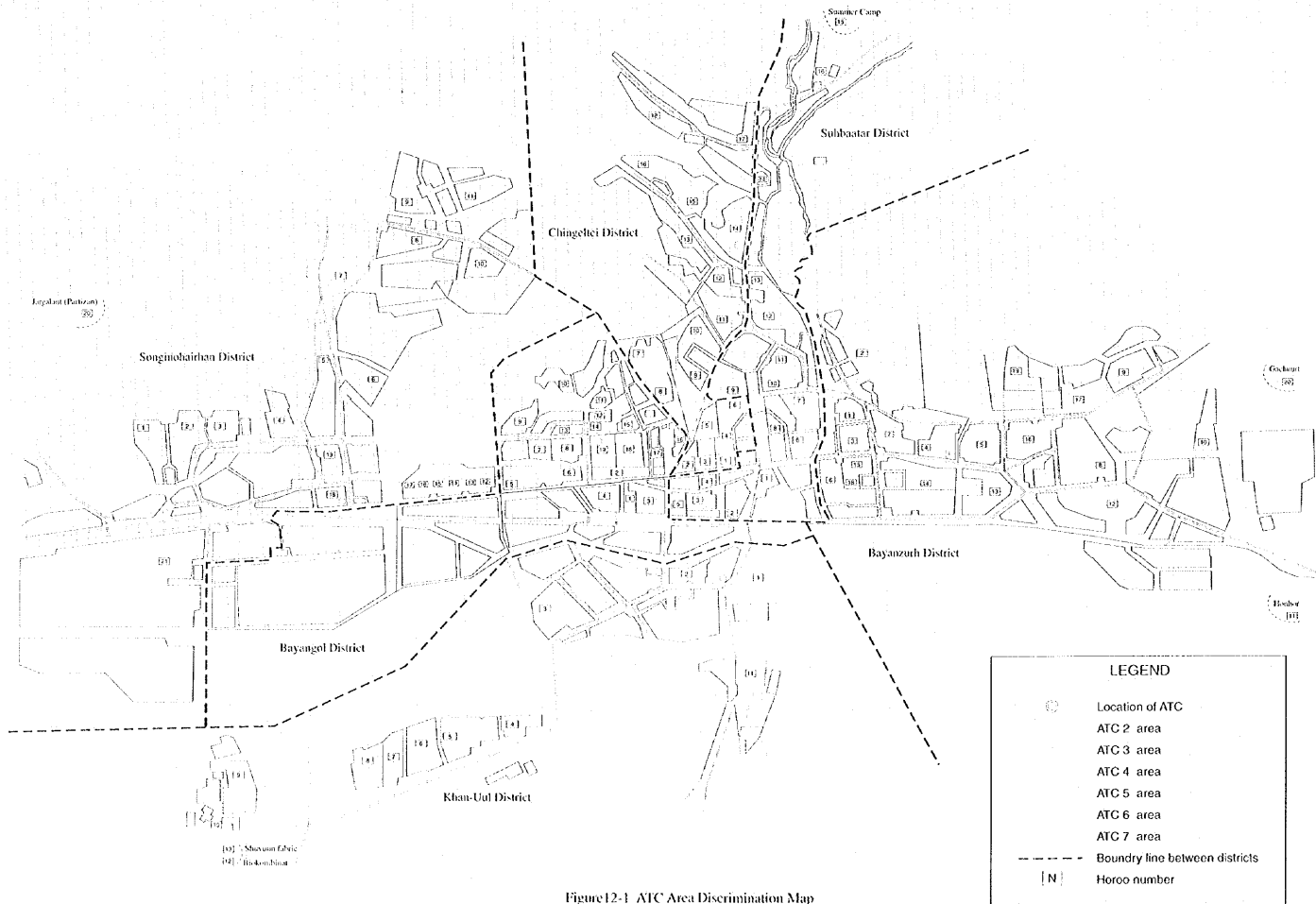


Figure12-1 ATC Area Discrimination Map



Table 12-4 Project Implementation Plan

Number	Year	Project Name	Cost (Mill. US\$)
1	1998	New exchange unit and its related facilities installation in ATC-6 (Bayangol district project Phase 1)	15,808
2	1998	Governmental network rehabilitation in Ulaanbaatar city	7,437
3	1998	Radio subscriber system installation for Ger area and remote areas (DRCS for ger area and remote areas project)	3,586
4	1999	New exchange unit and its related facilities installation in ATC-7 (Chingeltey/Sukhbaatar district phase 1 project)	7,170
5	1999	Reuse of the suspended RSU-36 exchange components to RSU-34, 37A, 37Y	6,086
6	1999	New exchange unit and its related facilities installation in ATC-Nalaih and Bagahangai (Nalaih and Bagahangai district project)	5,40
7	1999	Expansion work of the existing exchange LU and its related facilities in ATC-5 (Bayanzurch ger area phase 1 project)	8,353
8	1999	Trunk unit expansion work-1 in international switching center (Expansion of ITC phase 1 project)	0,212
9	2000	Change to high precision master clock at the secondary switching center of ATC-3 and installation of a standby clock at ATC-5	1,914
10	2000	New exchange units and its related facilities installation in ATC-3, Biokombinat and Shuvuun Fabric (Toy Shoodan, Biokombinat, Shuvuun Fabric pro.)	20,509
11	2000	Outside plant maintenance center establishment	2,140
12	2001	New exchange units and its related facilities installation in ATC-2, Bayan Hoshuu, Int. Children and Jargalant (Songinohaimau dist. pro.)	18,841
13	2002	New exchange units and its related facilities installation in Shamad, Amgalan, Honhor and Gachuurt, and expansion works in ATC-5 (Bayanzurch dist. pro.)	4,195
14	2002	New exchange unit and its related facilities installation in ATC-Baganuur (Baganur district project)	5,967
15	2003	Expansion works of the existing exchange LU and its related facilities in ATC-6 (Bayangol district project)	8,747
16	2003	Expansion works of the existing exchange LU and its related facilities in ATC-Nalaih (Nalaih district project)	1,829
17	2004	Expansion works of the existing exchange LU and its related facilities in ATC-3 and Shuvuun Fabric	9,909
18	2005	Expansion works-1 of the existing exchange LU in ATC-7 (Chingeltey/Sukhbaatar district ph.2 project)	1,257
19	2005	Trunk unit expansion work-2 in international switching center	0,357
20	2005	New ISDN exchange unit and its related facilities installation in ATC-3 (Toy Shoodan, ISDN project)	0,866
21	2005	New exchange unit and its related facilities installation in ATC-4 (Bagd Khan area phase 1 project)	5,612
22	2005	Expansion works of the existing exchange LU and its related facilities in ATC-2 and Bayan Hoshuu (Songinohaimau dist. ph.2 pro.)	7,436
23	2007	Expansion works of the existing exchange LU and its related facilities in ATC-5 and Honhor (Bayanzurch district ph.2 project)	7,093
24	2007	Expansion works of the existing exchange LU and its related facilities in ATC-Baganuur (Baganuur dist. ph.2 project)	1,249
25	2008	Expansion works of the existing exchange LU and installation of a new exchange unit in ATC-5 (Bayangol dist. ph.3 pro.)	4,667
26	2008	Expansion works of the existing exchange LU in ATC-Nalaih and Bagahangai (Nalaih ph.3 and Bagahangai ph.2 project)	0,915
27	2009	Expansion works of the existing exchange LU in ATC-3, Shuvuun Fabric and Biokombinat (Toy Shoodan, Biokombinat, Shuvuun Fabric pro.)	3,349
28	2010	Expansion works-2 of the existing exchange LU in ATC-7 (Chingeltey/Sukhbaatar dist. phase 2 project)	1,257
29	2010	Expansion works of the existing exchange LU in ATC-4 (Bagd Khan area phase 2 project)	1,257
Total Cost			163,439

### 13. Institution, Organization and Management Plan

The basic telecommunications service in Mongolia is at present urged to rehabilitate and expand critically obsolete network and to realize quick transition toward market economy simultaneously.

In consideration of this difficulty, institutional, organizational and management aspects are reviewed in the current situation, in analysis and in enumeration of problems. As the result, followings are proposed in each aspects.

#### 13.1 Institution

- (1) MOID is requested to stipulate and clarify further the functions of MCAC so that MCAC could consistently undertake planning, fund-raising, tender, procurement, implementation and depreciation of the basic telecommunications asset and take accountability for it.
- (2) MCAC's completion of the development plan is awaited. Acquisition of the sufficient planning staff should be considered by the sector as a whole.
- (3) It is recommended that distribution of the functions among MOID, MCAC and MTC be reviewed.
- (4) Several social needs of telecommunications services which are dropped off the objectives of commercialism due to its cost inefficiency must be addressed separately. Institutional arrangement to cater for such needs is necessary.  
MCAC as the asset holding corporation closely acting with the government under the governmental policy is considered to be standing at the proper position to cater for those social needs through its planning activity.

### 13.2 Organization

- (1) It is recommended to make over all review to the organizational structure and deployment of the staff of MOID Department of Communications / MCAC / MTC in relation with sorting out basic functions of each organization. The following common procedure for effective formation of modern organizations should be recommended to be taken strictly in this order.

- ① Target setting
- ② Division of functions
- ③ Position making
- ④ Description of jobs
- ⑤ Staffing

It is recommended a telecommunication agency should be establish in this context.

- (2) As an example, the organizational structure of MCAC which enables to corporate different kind of divisions could be suggested for efficient and integrated activities after expansion of the organization.
- (3) In consideration of positive role of MCAC in the future, it is recommended to establish Computing System Department, Radio Department, Rural Affair Department. Reinforcement of research function, accounting staff, financial staff and international relationship staff are necessary.
- (4) MCAC had better be prepared for management of outside activities of construction as well as of inside cooperation construction work.
- It is recommended to install a center organization to supervise and promote smooth progress of outside construction work conducted either by the direct contractors or by contracted outsiders. Ability of related inspection jobs must be enhanced.
- Not only construction work, out-sourcing procedure will be more effective to MOID and MCAC than handling everything inside the organizations.

### 13.3 Management

- (1) In the well motivated organization like MCAC, the best effort to enhance income standard for personnel should also be made.

Some modification of the income structure is worth studying. For instance, introduction of seniority system to the certain extent so that personnel could have long term expectation or introduction of some remuneration for acquired status or skills.

- (2) As a non-monetary motivation, the government had better promote advertisement of significance of telecommunications in future society so that the telecommunications personnel could have their pride for jobs.

In response to that, the corporation like MCAC should publish the corporate target and make it possessed in common among the personnel.

- (3) It is proposed to organize the job site as the place where self-actualization through jobs are possible. For that purpose, distribution of authority is necessary.

On the other hand, personnel in such organization are obliged to make reports and communications properly. All those should be stipulated in the job description. In this meaning, the job description should be completed as soon as possible.

- (4) When the organization is expanded and the vertical integration of the lines are strengthened and self autonomy of personnel provides basics for the organization, the problem of corporate integration comes up alternatively.

Installation of the coordination center and understanding of horizontal staff-functions become necessary. Corporate Planning Division is a typical and common solution.

- (5) The Plan-Do-See cycle which functions as a integration method of organization and at the same time as an effective mobilization system of organization will be useful in the organization like MCAC.

Following steps make a cycle between planning and its implementation.

- ① Establishment of the corporate policy. (By drafting corporate plan etc.)
- ② Setting of the target. (By the annual planning etc.)
- ③ Execution of the plan.
- ④ Checking of the progress. (By monthly meeting etc.)
- ⑤ Measure for discrepancy between the plan and the result.

Feed back actual development to the original plan.



## 14. Human Resource Development Plan

Business essentially requires three elements: human resources, capital and equipment. Especially ready made human resources are often unavailable and it takes time to develop human resources. In the telecommunications industry where it is necessary to introduce very rapidly advancing technology and improve services by its own manpower, it is essential to make full effort to develop human resources.

Although the Scope of Work of this report is confined in Ulaanbaatar city, this chapter is applicable to whole Mongolia.

Three categories of personnel, that is, corporate planners, technical staff, and field workers / service fronts are discussed.

Human resource development is reviewed in current situation, in analysis and in enumeration of problems. As the result, followings are proposed for Human Resource Development Plan.

- (1) Currently undergoing preparation of Human Resource Development Plans should be completed as soon as possible and further necessity of cooperation should be reviewed and listed up.

As the training plan of telecommunications sector, following area should primarily be covered.

### Technical training;

Network planning, Optical fiber technology, SDH, switching(hardware and software), data transmission technologies, ISDN technologies, and Radio transmission

### Commercial training;

Basic knowledge about industrial organizations, Basic knowledge of finance and accounting, Personnel management, Marketing skills, and Customer service

- (2) It is recommendable to consider following kind of training for which other countries including Japan have possibility to offer assistance.  
Those skills should preferably be acquired from neutral institutes under the funds like ODA instead of support from equipment suppliers.

- (3) It should be recommended to be given priority to carry out innovation and reinforcement of educational tools for Mongolian Technical University (MTU) so that the students could acquire technical training for advanced technology.

MCAC as the asset holding organization developing the telecommunications infrastructure united with the government body (MOID) needs the facility to research and test telecommunications systems.

- (4) It is proposed to institutionalize study abroad system for the purpose of training the high class managers and engineers.

- (5) It is also suggested to search and develop the training opportunities in the facilities of world wide equipment manufacturers as their facilities are more and more sophisticated and increases capacity as their duty to train personnel of the buyers of their equipment constitutes an important part of the business activity in recent years.

- (6) It is important to try to get in touch with the market through, for example, market research activities by organization such as MCAC in order to understand market oriented operation.

- (7) As the very fundamentals to consider human resource development in the sector, the report must point out necessity to study the level and structure of salary for the telecommunications personnel and make it more stimulus to acquire further training and work long.

- (8) It is recommended to construct data base and its index in the computer regarding available engineers technicians and other staff within the telecommunications sector.

It facilitates the staff to find out other jobs and at the same time facilitates the new industries advancing into Mongolian market to find out personnel in their urgent needs.

## 15. Project Evaluation of Basic Plan

### 15.1 Financial Analysis

A financial evaluation of the Basic Plan is conducted for confirming the financial viability of the Basic Plan from the implementing agency's point of view. A notional unit of MCAC and MTC combined is assumed as the implementing agency. Governmental Network is therefore excluded from the evaluation. The financial analysis is carried out by deriving a financial internal rate return (FIRR) and preparing an income statement and a cash flow statement of the Basic Plan. The following are the findings.

- An FIRR is calculated to be 8.5%, which is considered moderate for a public investment program.
- An income statement reveals that the Basic Plan generates deficits in the initial 3 years. Effort is needed on the part of MCAC and MTC to increase operational efficiency.
- A cash-flow statement shows that the Basic Plan will generate sufficient revenue to repay a loan provided that the loan conditions of the ongoing ADB project be applied. The Basic Plan, however, will generate deficits in the initial 10 years assuming the present relending conditions of the ADB loan between the government and MCAC. An appropriate set of relending conditions should be worked out between the government and MCAC for implementing the Basic Plan, including the following items.
  - possibility of tax exemption
  - provision of a grace period
  - adjustment of interest rate level

### 15.2 Economic Analysis

An economic analysis is conducted for confirming the economic viability of the Basic Plan. An economic internal rate return (EIRR) is calculated as a criterion. In deriving the costs, investment and operation and maintenance costs used for the financial analysis are so modified that costs represent resource utilization. For this purpose, transfer payments, tax and duty, are deducted from the investment cost. Economic benefit is estimated as the sum of financial revenue portion and consumer surplus portion as representing the total willingness-to-pay of subscribers. Consumer surplus for calls and installation charge is estimated based on the data collected by the Socio-Economic Survey. A base case EIRR is calculated to be 14.9%, indicating the sound economic viability of the Basic Plan.

### **15.3 Social Analysis**

Social impacts of the Basic Plan implementation are analyzed based on the information collected by the Socio-Economic Survey. The two major positive impacts to be realized by improved telecommunications services are : improvement of life through reduced burden on communications and an increased sense of security for emergency cases. Both in apartment and ger areas, the most serious problem cited by people is the lack of telephone for emergency cases especially for calling an ambulance. The implementation of the Basic Plan will enable most of the people in Ulaanbaatar, a population of 779 thousand in 2010, to reach a phone without difficulty, resulting in more enriched and secured life.

## 16. Feasibility Studies

### 16.1 Feasibility Study on "New Exchange Unit and Its Related Facilities Installation in ATC-6" Project (ACT-6 Project)

#### 16.1.1 Outline

There are about 7,000 telephone waiting applicants in the ATC-6 area, the highest in Ulaanabaatr. Telecommunications system development in the ATC-6 area is urgently needed from demand fulfillment and financial and economic points of view. New exchange (capacity:16,000 line units) will be installed and the junction circuit between ATC-6 and ATC-3 will be expanded by optical fiber system in the year 1998. At the same time, new cables (11,000 lines) and rehabilitation cables (10,800 lines) will be installed by 2000.

#### 16.1.2 Cost Estimate

Table 16-1 shows the project investment cost.

Table 16-1 Project Investment Cost

(Unit: Million US\$)

Items	Switch		Outside Plant		Total
	Local	Foreign	Local	Foreign	
Man power	0.000	0.950	0.000	0.810	1.760
Equipment	0.000	3.061	0.000	7.550	10.611
Construction	0.002	0.457	0.650	0.670	1.779
Tax	0.559	0.000	1.100	0.000	1.659
Total	0.561	4.468	1.750	9.030	15.809
	5.029		10.780		15.809

### **16.1.3 Project Evaluation**

#### **(1) Financial Analysis**

A financial internal rate of return (FIRR) is estimated to be 13.1 %, considered fairly high for a public investment project. In terms of cash flow, the relending condition of the ongoing ADB project can be applied to the ATC-6 project except that a grace period of 1 year would be needed.

#### **(2) Economic Analysis**

An economic internal rate of return (EIRR) is derived in the same manner as for the Basic Plan. Costs are modified and economic benefits derived as the sum of revenue and consumer surplus. An EIRR is estimated to be 26.5 %, indicating the sound economic viability of the ATC-6 project.

#### **(3) Social Analysis**

Socially, the ACT-6 project will improve the life of the population in terms of realizing comfortable life with more time and energy spent on other activities than communication and an increased sense of security through easier access to telecommunications services in emergency cases.

### **16.2 The Project "Radio Subscriber System Installation for Ger Areas and Remote Areas" (Digital Radio Concentration System Project : DRCS Project)**

#### **16.2.1 Outline**

The DRCS Project aims at providing telecommunications services to the ger area and public organizations in four enclaves and in Ulaanbaatar, especially those urgently needing better access to telecommunication services. Prompt development will be possible by adopting the DRCS.

Poor access to telephone is cited as the second serious problem felt by ger residents (refer to Volume II Chapter 3 p 3-4). Better access to telecommunication services in the ger area would fit one of the national development targets, the need to protect vulnerable population from adverse impacts of transition to the market economy.

Base station will be installed at ATC-3, and all subscribers are to be connected by the system and are accommodated in E10B.

### 16.2.2 Cost Estimate

Table 16-2 shows the project investment cost.

**Table 16-2 Project Investment Cost**

(Unit: Million US\$)

Items	Local	Foreign	Total
Man power	0.000	0.725	0.725
Equipment	0.000	1.930	1.930
Construction	0.060	0.519	0.579
Tax	0.352	0.000	0.352
Total	0.412	3.174	3.586

### 16.2.3 Project Evaluation

#### (1) Financial Analysis

A financial internal rate of return (FIRR) of the DRCS project is estimated to be negative based on the assumed tariff level at Tg 3/minute. The FIRR turns positive at Tg 13.1 per minute. An arrangement is needed to subsidize the implementation of the DRCS project. An FIRR of the DRCS project combined with ACT-6 project is estimated to be 12.7%.

#### (2) Economic Analysis

An economic internal rate of return (EIRR) is derived for the DRCS project. Costs applied to the financial analysis are modified so that they represent resource utilization. Economic benefit is derived as the sum of revenue and consumer surplus for public phones. The data collected from the people coming to privately-run payphones at present are processed to derive the willingness-to-pay of the people using public phones. Including the economic benefit from public phones in the ger area and government organization telephones in enclaves and Ulaanbaatar for important communications, an EIRR is estimated to be 5.4%. A higher EIRR would be derived once various socio-economic benefits that could be realized, but not quantified are successfully taken into EIRR calculation.

**(3) Social Analysis**

The importance of the DRCS project can be found in the national development context. The national development policy sets forth the necessity of minimizing the adverse effect of transferring into a market economy for the vulnerable population. Telecommunications development targeted mainly at the ger area population, who are generally poorer and living in a low standard environment, would contribute to improving the living condition of the vulnerable group. The project would achieve a significant improvement in access to telephone in the ger areas through providing public phones. The project would benefit a population of about 142 thousand in the ger areas enabling them to reach a phone within 300 meters. A more enriched and secure life will be guaranteed for the target ger population by the implementation of the DRCS project.



## 17. Recommendations

This section describes recommendations concerning the Study.

### Recommendation 1

It is recommended that host exchanges should be connected in ring, and toll exchanges should belong to plural upper level exchanges in Ulaanbaatar city from the viewpoint of network reliability.

### Recommendation 2

It is recommended to introduce a new numbering plan over the whole Mongolia, in consideration of the large-scale introduction of ISDN and new services. On that occasion, it is recommended to review interactive connection numbering with other networks, toll numbers, special numbers (special numbers for subscribers, special numbers for technical operators, various kinds of special numbers, international direct dial service special numbers).

### Recommendation 3

It is recommended that the signaling system should be unified to Number 7 signaling system as soon as possible.

### Recommendation 4

It is recommended that ISDN is to be introduced when the demand is increased.

### Recommendation 5

It is recommended to duplicate ISCs in order to improve reliability of the international switching equipment which will become more and more important in the future.

### Recommendation 6

It is recommended to adopt SDH for transmission system, considering the easy shifting to ISDN and recent tendency in technical innovation.

### Recommendation 7

The present master clock has low precision characteristics. It is recommended to install a high precision clock for SDH system.

**Recommendation 8**

It is recommended that a sector which deals with effective use of radio frequency, interference, etc. should be organized in MOID/MCAC, since the radio system will be very effective in the vast territory of Mongolia.

**Recommendation 9**

It is recommended to introduce OSP Facility Management System in order to plan, construct and maintain OSP efficiently, since the OSP facilities will surely be expanded and modernized in the future.

**Recommendation 10**

It is recommended to build an Outside Plant Maintenance Center (OPMC) in order that the maintenance of OSP be centralized permitting effective operation, that the working environment of OSP staff be improved, and that the staff be trained efficiently.

**Recommendation 11**

It is recommended that the cable rehabilitation works should be the same as those of new cable installation considering maintainability and reliability, taking into account the poor condition of existing ducts that cannot be reused.

**Recommendation 12**

It is recommended to renovate the Governmental Network by adopting data communication technology, to achieve high reliability, as well as high confidentiality. The network carries important messages including those of the President, governmental high ranking officials and VIPs from foreign countries. The present network is too old and obsolete to be operated satisfactorily.

**Recommendation 13**

It is recommended that an appropriate set of relending conditions be worked out between the government and MCAC, including such items as tax exemption, provision of a grace period, and the level of interest rate.

**Recommendation 14**

It is recommended to establish a Research and Development Center in MCAC. The technical function of the Research and Development Center includes introduction of advanced technologies to Mongolia. The managerial function of the Research and Development Center includes development and adoption of world's advanced managerial, financial and accounting methods.

**Recommendation 15**

It is recommended to request international organizations such as ITU, ADB, etc. and advanced countries to dispatch specialists or to receive trainees in order that Mongolian personnel can acquire advanced technologies as well as skills of managerial, financial and accounting methods.

## **18. Conclusion**

This Report of the Study on telecommunications network in Ulaanbaatar city is formed to fulfill the telephone demand in the city by the year 2010 using new technologies such as digitalization, fiber optical cables, SDH, and so forth.

The Study revealed that the Basic Plan up to the year 2010 is feasible from technical, financial, and economic perspectives. In social aspect the implementation of the Basic Plan will upgrade the people's living standard in Ulaanbaatar city, and in particular expand economic opportunities for low income layer represented by the ger area population. It is, therefore, recommended that the telecommunications network in Ulaanbaatar city be developed in accordance with the Basic Plan until the year 2010.

Lastly, this Study covering the period from 1998 to 2010 has been prepared mainly based on the past data, present conditions and future trends in socio-economy and telecommunications of Mongolia as of 1994 - 1995. It is hoped that this Report would be useful and beneficial for Ulaanbaatar city in future. However, it is recommended that this Basic Plan is, periodically and, when remarkable changes on preconditions on preparation of the Report were found in the future, to be reviewed and revised based on the latest condition.



