7.2 Macroscopic Demand Forecast of Mobile Telephone

The macroscopic demand forecast for the mobile telephone in Mongolia is made by adopting the features of development tendency of 43 Asian countries for the mobile telephone as follows:

(a) Fixed telephone demand forecast formula is simulated to the exponential curve in relation to GDP per Capita and telephone density as described in the above;
(b) In contrast to the fixed telephone case, a growth rate curve for the mobile telephone in Asian countries can be simulated to an approximate Logarithm curve; and
(c) In this case, the growth rate of the mobile telephone is very sharp at the time of the introduction of mobile telephone services.

Three (3) scenarios of the demand forecast of the mobile telephone are adopted as in a similar way as those in the fixed telephone, as shown in Table 7-3.

Table 7-3 Three Scenarios for Macroscopic Demand Forecast of Mobile Telephone

Scenarios	Formula for Demand Forecast	Results of Forecasted Demand at 2020 Number of Mobile Telephone/Telephone Density
Low rate	$y = 7.55\ ln(x) - 39.54$	2020; Mobile Telephone: 480,650 Density: 15.11
Medium rate	$y = 14.63\ ln(x) - 84.74$	2020; Mobile Telephone: 672,950 Density: 21.15
High rate	$y = 21.71\ ln(x) - 129.90$	2020; Mobile Telephone: 866,530 Density: 27.23

y = Density; x = GDP per capita.

Out of three (3) scenarios of the national demand forecast, the medium growth scenario is selected to be more appropriate one for the demand forecast of the mobile telephone in Mongolia.

The summary of the national demand forecast of the mobile telephone is shown in Table 7-4.

Table 7-4 Summary of Demand Forecast of Mobile Telephone

	Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Demand	Total of Sum Centres	35,525	37,987	40,448	42,910	45,372	47,834	50,295	52,757	56,064	59,371
	Total of Aimag/Districts	110,367	118,323	126,278	134,234	142,189	150,145	158,100	166,056	176,452	186,848
	Ulaanbaatar	97,716	105,735	113,755	121,774	129,794	137,813	145,833	153,852	163,485	173,119
	National Total	208,083	224,058	240,033	256,008	271,983	287,958	303,933	319,908	339,937	359,966

	Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Demand	Total of Sum Centres	62,678	65,985	69,292	73,348	77,405	81,461	85,518	89,574	93,631	97,687
	Total of Aimag/Districts	197,243	207,639	218,035	230,796	243,558	256,319	269,080	281,841	294,603	307,364
	Ulaanbaatar	182,752	192,386	202,019	213,843	225,667	237,491	249,315	261,139	272,963	284,787
	National Total	379,996	400,025	420,054	444,639	469,225	493,810	518,395	542,980	567,566	592,151

7.3 Fulfilment Plan of Forecasted Sum Demand

The fulfilment plan for the demand forecast in Sum centres is prepared using the priority rank of Sum centres. According to the priority of Sums and implementation years, the fulfilment plan of the demand of the fixed telephone in Sum centres is shown in Table 7-5.

Table 7-5 Fulfilment Plan of Fixed Telephone in Sum Centres

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Demand	28,795	29,797	30,798	31,800	32,801	33,803	34,804	35,806	37,508	39,211
Existing	10,521									
New connection	0	0	0	6,682	3,443	2,198	3,460	2,998	3,045	2,060
Working Sub.	10,521	10,521	10,521	17,203	20,646	22,844	26,304	29,302	32,347	34,407
Fulfilment Ratio	36.5%	35.3%	34.2%	54.1%	62.9%	67.6%	75.6%	81.8%	86.2%	87.7%

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Demand	40,913	42,616	44,318	46,670	49,021	51,373	53,725	56,077	58,428	60,780
Existing										
New connection	3,004	2,424	2,557	2,664	2,686	2,663	2,670	2,624	2,597	2,486
Working Sub.	37,411	39,834	42,391	45,055	47,741	50,404	53,074	55,698	58,294	60,780
Fulfilment Ratio	91.4%	93.5%	95.7%	96.5%	97.4%	98.1%	98.8%	99.3%	99.8%	100.0%

7.4 Demand Forecast of Internet

All fixed and mobile telephones will be connected by IP (Internet Protocol) by the year 2020. This means the telephones and Internet are operated on the same IP network, and then all telephone subscribers become the Internet subscribers in a wide sense. However in

this report, as a matter of convenience, Internet subscribers (and their number) are to be specified as who access to the Internet contents, i.e., users who use e-mail, www and/or home-page only pointed out as, a narrow sensed, Internet users. Subscriber whose telephone terminal is capable to connect to IP network but he does not access to Internet contents, should not be regarded as Internet subscriber.

Three forecasting methods are tried to obtain an appropriate demand figures under this study as follows:

(a) Forecasting by Asian and Mongolian Internet trends;
(b) Forecasting by density of fixed telephone subscribers; and
(c) Forecasting by features of households and their GDP/Capita.

Figure 7-1 shows the resulted figures obtained from the above three methods.

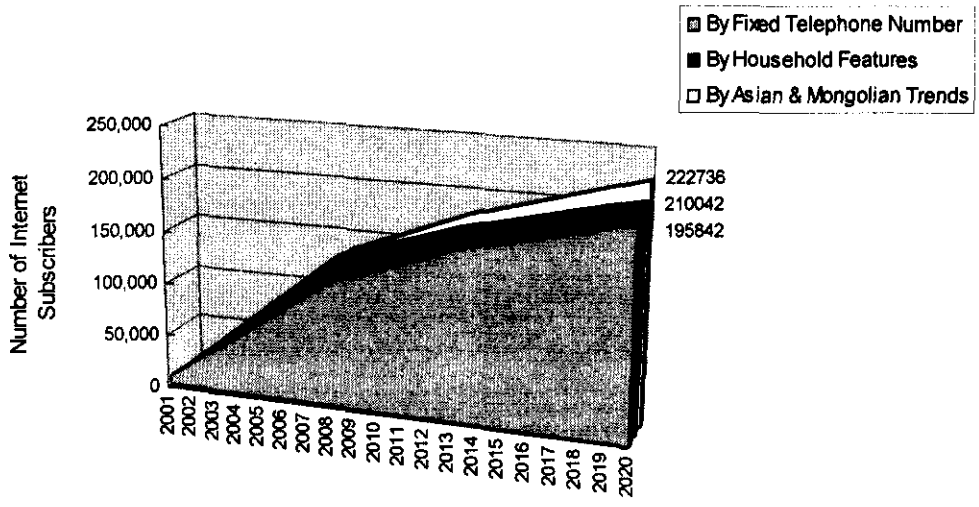

Figure 7-1 Number of Internet Demand Forecasted by Three Methods

Among these three methods, the forecast by "households features" is preferable to adopted in this report since it involves more actual situations of Mongolian societies than the others. Assumptions and calculation ways are as follows for the forecast by "households features" method:

(a) Number of family members (for households' estimation)

Ulaanbaatar:	4.6 persons in a family
Aimag centre:	4.53 persons in a family
Sum & Others:	4.2 persons in a family

(b) Number of subscribers in 2020

Ulaanbaatar: 0.4 subscribers per total households

Aimag centre: 0.33 subscribers per total households

Sum Centre: 0.1 subscribers per total households

Other rural: 0.05 subscribers per total households

The summary of the macroscopic demand forecast of Internet is shown in Table 7-6.

Table 7-6 Macroscopic Demand Forecast of Internet

No	Name of Aimag	Population (2020) (Except Rural)	Population (2020) (Rural)	Number of HH (2020) (Except Rural)	Number of HH (2020) (Rural)	Number of Sub. (2008) (Aimag)	Number of Sub. (2008) (Sum & Other)	Number of Sub. (2013) (Aimag)	Number of Sub. (2013) (Sum & Other)	Number of Sub. (2020) (Aimag)	Number of Sub. (2020) (Sum & Other)
1	Arkhangai	41,014	67,661	9,422	16,110	689	543	919	950	1,149	1,357
2	Bayan-Ulgii	66,126	72,675	15,098	17,304	740	382	986	669	1,233	956
3	Bayankhongor	36,735	63,819	8,383	15,195	929	599	1,239	1,049	1,549	1,498
4	Bulgan	33,071	37,937	7,718	9,033	383	491	511	860	639	1,228
5	Govi-Altai	28,416	36,939	6,522	8,795	568	410	757	718	947	1,025
6	Dornogovi	44,776	21,679	10,320	5,162	730	395	973	691	1,217	987
7	Dornod	63,177	22,170	14,347	5,279	814	244	1,086	426	1,357	609
8	Dundgovi	20,797	38,063	4,753	9,063	301	246	402	430	502	615
9	Zavkhan	39,122	49,229	9,026	11,721	476	440	635	771	793	1,101
10	Uvurkhangai	54,997	83,171	12,696	19,803	562	549	749	961	936	1,372
11	Umnugovi	27,279	33,235	6,229	7,913	559	330	746	578	932	826
12	Sukhbaatar	27,110	36,904	6,218	8,787	534	351	712	614	890	877
13	Selenge	108,794	21,694	25,454	5,165	723	792	964	1,385	1,205	1,979
14	Tuv	59,721	55,658	13,920	13,252	508	635	678	1,111	847	1,587
15	Uvs	40,150	44,436	9,181	10,580	532	351	710	615	887	878
16	Khovd	55,968	56,332	12,750	13,412	812	389	1,082	681	1,353	973
17	Khuvsgul	63,184	78,875	14,482	18,780	1,172	723	1,563	1,266	1,954	1,808
18	Khentii	49,759	32,672	11,581	7,779	575	546	766	955	958	1,364
19	Darkhan-Uul	116,445	7,478	26,021	1,780	2,045	150	2,727	263	3,409	376
20	Orkhon	115,594	7,045	25,583	1,677	13,628	201	18,170	352	22,713	503
21	Govisumber	13,297	3,440	2,997	819	273	41	365	71	456	101
	Aimag Total (1)		1,976,644		460,104	27,555	8,809	36,740	15,415	45,924	22,022
22	Nalaikh	36,457	0	8,140	0	1,864	82	2,485	143	3,106	205
23	Baganuur	32,206	0	7,109	0	1,925	0	2,567	0	3,209	0
	District Total (2)		68,663		15,249	3,789	82	5,052	143	6,315	205
	Aimag & Dist Total (1)+(2)		2,045,307		475,353	31,344	8,891	41,792	15,559	52,240	22,227
		2,045,307		475,353		40,234		57,350		74,466	
24	Ulaanbaatar	1,136,637	0	247,095	0	94,903	0	115,239	0	135,575	0
	UB Total (3)	1,136,637		247,095		94,903		115,239		135,575	
	Mongolia Total (1)+(2)+(3)		3,181,944		722,448	126,247	8,891	157,031	15,559	187,815	22,227
		3,181,944		722,448		135,137		172,590		210,042	

8. TRAFFIC FORECAST

8.1 Traffic Forecast for PSTN

The traffic forecast was focused for calculating the number of circuits of the telecommunications network between Aimag centre and Sum centres in the relevant Aimag Area. However, national network traffic was also forecast for reference in order to relieve the relationship of Aimag centres in the national telecommunications network. The number of circuits of individual sections presented here shall be reviewed based on the practical conditions or existing circuit plans before deciding the network for equipment purchase. The telephony service traffic was forecast on the supposition that the traffic density by line (calling rate) would not decline even after the VoIP has taken over the existing voice communication on PSTN.

The cross bar switch did not have the function to measure intra-exchange traffic data and, thus, a) calling rate; b) density by call category were estimated based on the data analysis of given fragment data, consultant experience, in addition to ITU-T GAS manual reference data. It should be noted that measuring the total traffic of exchange by operator command started a few years ago since the Aimag centre switches were replaced with digital exchanges.

The telephone traffic is increasing steadily every year according to the MT traffic data. The trunk call traffic growth recorded around 117.1% in 1998, 136.7% in 1999, 177.9% in 2000, 219.8% in 2001, when compared with that of 17,656,794 minutes in 1998. Paid minutes data of Sum centres of selected Aimags were found available during field survey at some Aimag centre telecommunication offices.

The forecast was done based on the demand fulfilment plan, using traffic density by line and the number of lines to be provided, at 2008, 2013 and 2020. Traffic between Aimag centres is calculated applying the call distribution ratio presented for traffic distribution by call category in line with the procedures presented in ITU-T GAS Manual. Number of circuits required between exchanges of Aimag centre and Sum centres is calculated applying the loss probability of 0.01 per link to the forecast traffic. Circuit matrix between Aimag centres is calculated applying the loss probability of 0.01 per link to the forecast traffic.

8.2 Traffic Forecast for IT

All the Internet traffics for Aimag and Sum subscribers will flow to/from Ulaanbaatar where Mongolia Internet Exchange (MIX) exists. This star connection style will be continued for the time being, and no direct circuit among Aimags will be required.

Current MT's leased circuit business is less than 3.5% of the total revenue. Future's leased line, if the demand arises, will be provided in a form of VPN. And the required volume of the transmission system will be within the affordability of the IT circuit, and then it can be negligible for the long-term design.

9. TELECOMMUNICATIONS NETWORK FACILITIES PLAN

9.1 Basic Policy

The telecommunications facilities plan is focused to design the Sum centre network and links to connect them with Aimag centre and is worked out in line with the Key Development Target. The plan is established under the conditions that the proposed expansion and improvement be realised solely as part of MT network which is possessed by PTA, and that the facilities to be introduced be compatible with existing operators' networks.

The facilities quality will be upgraded to an international level and the technology to realise the capacity expansion of the facilities will be decided carefully paying attention to:

(a) Appropriateness to the site;
(b) Compatibility with the existing network;
(c) Flexibility in merging into IP-based network;
(d) Maintainability after service commencement; and
(e) Purchase and installation cost, etc.

9.2 Switching System Facilities

Analogue automatic and manual switches in Sum centres will be replaced with digital ones under this Master Plan period up to 2020. Switching system by small digital PBX will be reused, if removed at early stage of the period, at the sites where the digitisation is planned in Phase-III. The switching system to be introduced shall be compatible with the IP-based network. The switching system discussed herein is that to be introduced in Sum centres. It could be a small switching node that could be made up with small PSTN switch, private automatic branch exchange (PABX) or digital loop carrier (DLC) system, etc. The node type should be decided concretely at the time to purchase. The switching system in Sum centres should be introduced in line with the following basis:

(a) Digital type compatible with existing telecommunications network;
(b) System flexible to be merged into IP-based network or compatible with IP-based network; and
(c) Designed to have a capacity enough to cater for the demand for five (5) years at least after its installation.

The exchange may accommodate other equipment of transmission and subscriber access network. The switching system to be introduced should be digital and in conformity with ITU-T Recommendations, and be flexible to be merged into the IP-based network. The switching system capacity in 21 Aimags and 2 Districts, which counted 68,000 line units in 2001, will increase up to 203,000 lines in Phase 3, if the capacity is expanded duly to cater for the demand in that Phase. The total capacity of Sum centre switching system is planned to be 63,000 line units. Table 9-1 shows the total of switch capacity by Aimag.

Table 9-1 Switch Capacity of Sum Centres by Aimag

No.	AIMAG	Switch Capacity			
		2001	Phase-1	Phase-2	Phase-3
1	Arkhangai	550	3,018	3,400	3,400
2	Bayan-Ulgii	422	962	1,668	1,790
3	Bayankhongor	384	2,556	3,550	3,550
4	Bulgan	974	3,920	3,970	3,970
5	Govi-Altai	916	1,924	2,694	2,810
6	Dornogovi	894	1,938	2,760	2,920
7	Dornod	240	614	806	1,020
8	Dundgovi	912	1,266	1,456	1,550
9	Zavkhan	660	2,166	2,740	3,070
10	Uvurkhangai	2,308	3,684	4,518	4,530
11	Umnugovi	144	778	1,330	1,410
12	Sukhbaatar	424	1,828	2,010	2,130
13	Selenge	3,140	4,264	4,700	5,640
14	Tuv	1,488	4,130	4,418	4,560
15	Uvs	526	1,046	1,148	1,320
16	Khovd	734	1,592	1,950	2,060
17	Khuvsugul	900	3,546	4,650	4,690
18	Khenti	712	3,340	4,410	4,500
19	Darkhan-Uul	800	1,250	1,770	1,770
20	Orkhon	2,300	2,950	3,680	4,790
21	Govisumber	248	318	320	320
22	Nalaikh	48	48	280	480
23	Baganuur	0	0	0	0
	Total	19,724	47,142	58,228	62,100

The exchange capacity is supposed to be expanded to meet the demand fulfilment plan of each target year, that is, 2008, 2013, and 2020 in whole the country. The capacity expansion of switching system in Sum centres is designed on the conditions that the national network will be expanded duly to meet national demand.

Figure 9-1 shows the concept of switching facilities expansion as national network, which the conventional exchanges will be gradually replaced to IP based exchanges as IP networks develop. The size of the switching system to be introduced in Sum centres is decided basically under that concept.

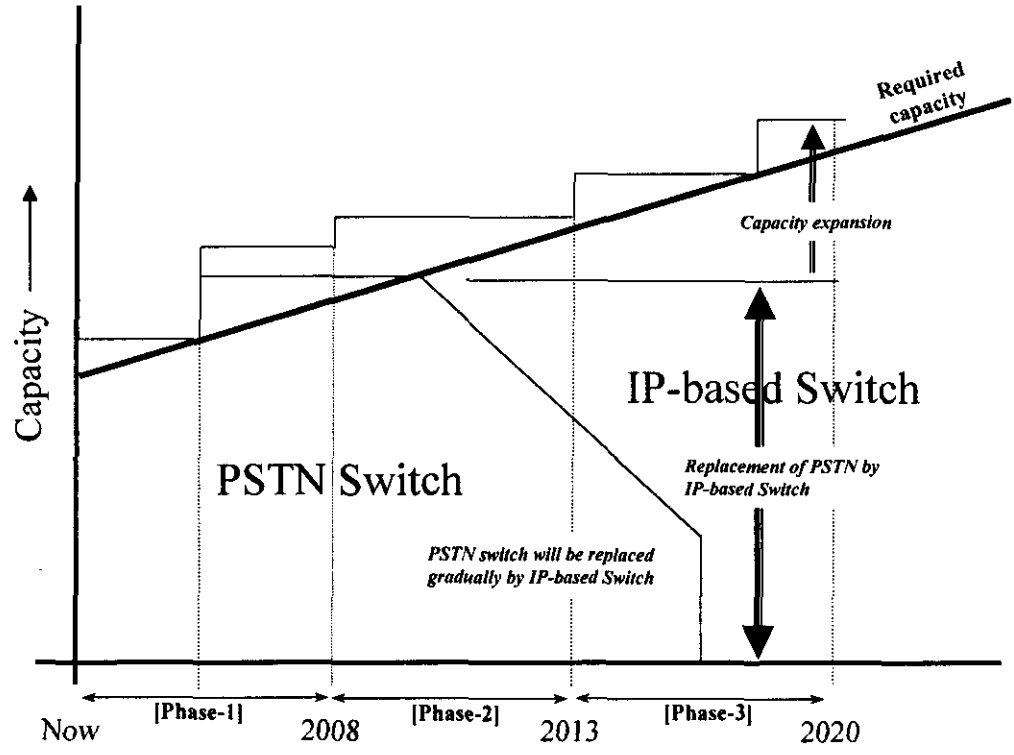

Figure 9-1 Concept of Switching Facilities Expansion

9.3 Transmission System Facilities

The analogue Aimag-Sum links, which are composed mainly with open wire transmission system, will be replaced with digital transmission links. The capacity of transmission systems will also be increased to meet the traffic of the increased telephone subscribers and IP-users. The target area transmission systems will be fully digitised to carry the IP-based signals by the end of Phase-III or the year 2020. Optical fibre cable transmission system, digital microwave transmission system, or VSAT system will be adopted to provide digital links which could be compatible with the IP-based network.

Transmission facilities between Aimag centres and Sum centres will be digitised for fixed telephone, mobile telephone and IT traffics. Backbone networks, not included in the scope of the work, should be digitised before the digitisation of transmission facilities from Aimag centres to Sum centres. Some of the digital transmission links from Ulaanbaatar to Aimag centres are required to expand the traffic capacity to carry the rural telecommunications. Transmission capacity delivered to each Sum centre is estimated as 4 x 2Mbps in the year 2020 for the fixed telephone, mobile telephone and IT services.

System selection is based on the capacity in the year 2020. Optical fibre cable transmission system is not competitive in comparison with the microwave system for such small capacity from viewpoint of initial cost. Optical fibre cable transmission system is selected only for short distance section less than 10 km from Aimag centre to Sum centre, from Sum centre to Sum centre, or from backbone optical fibre location to Sum centre. Optical fibre cable transmission system is competitive for short distance section even if small capacity is required there.

VSAT satellite transmission system is selected for Sum centres far from Aimag centres where many microwave hops are required.

9.4 Access Network Facilities

Access network is provided with mainly metallic cables and partly with a Wireless Local Loop (WLL) system. The design policy for the wired access network in Sum centres is to provide the facilities for the period of 15 years, applying the aerial cable system. The wired access network under the Master Plan Study is estimated as about 70,000 pairs for 332 Sum centres. From the service provider's prospective, the key benefits of WLL are low capital costs, fast network deployment and lower maintenance costs, clearly attractive considerations. WLL is overlaid to the metallic cable network in 7 (seven) Sum centres where the demand forecast at the year 2020 is 800 telephone subscribers or more.

9.5 IT Facilities

IT development in rural or remote area is one of policies of the Government of Mongolia. The introduction of "IT-spot" in which PC, printer, telephone set, facsimile set are provided, is planned.

9.6 Power Facilities

Many target Sum centres are not provided with stable power source and some of them are even out of community power supply. A power source will be provided for the telecommunications system, where the target Sum centre is not connected, or not planned to be connected, with the national power grid. Application of photovoltaic (PV) systems is planned as a key power supply source for telecommunications systems that are installed in the areas with a favourable level of isolation. Power supply situations at Aimag centres or Sums that are connected with grids are comparatively reliable and stable.

10. PROJECT IMPLEMENTATION PLAN AND COST ESTIMATE

10.1 Project Implementation Plan

Project implementation plan consists of the Phase-I (by the year 2008), the Phase-II (by the year 2013) and the Phase-III (by the year 2020). Phase-I is further divided into two phases: Phase I-1 (by the year 2005) and Phase I-2 (by the year 2008). Phase-I is of facilities plans for Sums which are given in high priority. Priority projects should be mainly formed out of Sums in Phase-I-1. Phase-II and III are of facilities plans for Sums, not so highly evaluated in Master Plan.

10.2 Priority of Sums

All plans made in this Master Plan cannot be implemented in consideration with the finance required. All Sums has been evaluated to give it a priority rank. Priority ranks are "P-1" (first priority), "P-2" (second priority), "P-3" (third priority), and "P-4" (fourth priority), considering of the total work volume of each priority category.

10.3 Project Formation

The following items should be considered in actual project formations:

(a) A number of Sums in same phase and Aimag should be grouped to make one integrated project;
(b) In order to get revenue soon after completion of facilities installation, all the facilities concerned should be installed simultaneously as much as possible;
(c) Back-bone transmission network, which is not included in the scope of this Mater Plan, shall be provided before the implementation of the priority project;
(d) Situations of on-going and planned projects should be carefully studied in project formation;
(e) Project effects should be studied and the pre-conditions for project effects should be explained; and
(f) Project plan should be made, based on the feasibility study for technical and economical feasibilities.

10.4 Project Cost Estimate

The project costs are estimated, based on the facilities plans to implement the Master Plan. The total cost estimates is summarized in the Table 10-1. Main progress work corresponding to the costs is shown in Table 10-2. However, taxes (Import Tax, VAT), consultant fee, cost of overseas training and contingency are not included. The total cost estimates is about US$ 140 million as shown in Table 10-1. The cost for Phase-I is about US$ 77 million and it is about half of the total cost. The cost for Phase-II is about US$ 42 million and it is about one third of the total cost. The cost for Phase-II is about US$ 20 million and it is about one sixth of the total cost.

Table 10-1 Cost Estimate

(US$1,00)

Item		Short-Term		Medium-Term	Long-Term	Total
		(2003-2005)	(2006-2008)	(2009-2013)	(2014-2020)	
Switchin System		6,535	7,457	7,135	3,245	24,372
Transmission System	Optical Fibre Cable	1,421	787	1,547	1,492	5,247
	Microwave and VSAT	18,479	8,888	17,742	8,783	53,892
	Sub-total	19,900	9,675	19,289	10,275	59,139
Access System	Wired	9,035	5,169	3,434	913	18,551
	Wireless	3,519	567	567	567	5,220
	Sub-total	12,554	5,736	4,001	1,480	23,771
Power Plant		7,272	6,094	10,690	4,802	28,858
IT Services	IT Spots	1,245	615	1,035	540	3,435
Total		47,506	29,577	42,150	20,342	139,575

Table 10-2 Main Scopes

Items		Facilities	Short-Term		Medium-Term	Long-Term	Total
			(2003-2005)	(2006-2008)	(2009-2013)	(2014-2020)	
Switchin System		Line Unit	27,460	15,020	14,580	5,040	62,100
Transmission System	Optical Fibre Cable	Length (Km)	37	26	69	74	206
		SDH Section	9	4	7	9	29
	Microwave	Terminal Sation	84	46	76	42	248
	VSAT	Earth Sation	19	12	22	2	55
Access System	Wired	Cable Pair	33,440	19,133	12,712	3,377	68,662
	Wireless	Cell Sation	30	3	4	5	42
Power Plant			-	-	-	-	-
IT Services	IT Spots	Sites	122	60	103	54	339

11. ANALYSIS OF FINANCIAL, ECONOMIC AND SOCIAL ASPECT

11.1 Preconditions for Financial Evaluation

The special features of this Master Plan Study in terms of the long-term operations projection in extending quality telecommunications services of an advanced technology to the population of the rural areas as part of the country's rural development programme are taken into consideration in the following points:

(a) An operating entity for the rural telecommunications services, covering 339 Sum Centres and equivalent settlements, possessing the newly acquired facilities is assumed.

(b) The entity would start business operations in 2004 and the ending year of the evaluation is set in 2025, reflecting the phased capital investments for the above rural telecom services to be continuously executed from 2004 up to 2020 under this Master Plan Study.

(c) The average useful life of the new facilities is assumed for 15 years and straight-line depreciation method is applied, regardless of the financing sources including grant aid and donation.

(d) The entity would use the backbone network and a proportionate cost to the outstanding numbers of rural subscribers would be charged to the entity, while the revenues derived from the use of the backbone network would be distributed to the entity in accordance with the same proportional ratio.

(e) The cost of satellite use for VSAT would be borne by the entity (US$ 83,100 for 55 stations annually).

(f) The entity extends services for both of the existing and the new subscribers (10,521 subscribers as at the end of 2001 and an aggregate of 50,259 new subscribers from 2002 to 2020, and no increase in subscriber after 2020).

(g) Revenues and expenditures of MT and PTA for the periods from 1997 to 2001 have been reviewed and analysed to support the relevant factors of the operating revenues and costs plan of this Master Plan Study.

11.2 Cost and Revenue Estimation of Financial Evaluation

(1) Summary of Capital Investment Plan

Table 11-1 Summary of Capital Investment Plan

in US$ '000

Year	Case A	Case B	Year	Case A	Case B
2004	33,801	27,737	2016	4,377	3,592
2005	24,089	19,767	2017	3,333	2,735
2006	12,144	9,966	2018	3,081	2,528
2007	11,347	9,311	2019	3,831	3,144
2008	12,552	10,300	2020	2,792	2,291
2009	13,598	11,158			
2010	9,891	8,116			
2011	9,839	8,074			
2012	8,570	7,032			
2013	9,468	7,770			
2014	4,174	3,425			
2015	3,202	2,627			
			Total	**170,088**	**139,574**

(Note) Case A: US$ 2,798 /line including Duty and VAT

Case B: US$ 2,296/line excluding Duty and VAT

(2) Subscriber Expansion Plan

Table 11-2 Subscriber Expansion Plan for Fixed Telephone

(Lines)

	National Base		Sum Base			National Base		Sum Base	
Year	New	Aggregate	New	Aggregate	Year	New	Aggregate	New	Aggregate
End '01		130,000		10,521	2013	10,355	270,175	2,556	42,392
2004	11,050	174,200	6,682	17,203	2014	14,330	284,505	2,664	45,056
2005	11,050	185,250	3,443	20,646	2015	14,330	298,835	2,686	47,742
2006	11,050	196,300	2,198	22,844	2016	14,330	313,165	2,663	50,405
2007	11,050	207,350	3,460	26,304	2017	14,330	327,495	2,670	53,075
2008	11,050	218,400	2,998	29,302	2018	14,330	341,825	2,624	55,699
2009	10,355	228,755	3,045	32,347	2019	14,330	356,155	2,596	58,295
2010	10,355	239,110	2,060	34,407	2020	14,334	370,489	2,486	60,780
2011	10,355	249,465	3,004	37,411					
2012	10,355	259,820	2,424	39,835					
					Total	207,339	Total	50,259	

(Note) 2002-2003 National Base Subscribers Increase: 33,150

(3) Revenue Plan

In annual average	(US$ '000)
Revenues	8,017
Revenues/line	0.181

(4) Operations and Maintenance Cost

In annual average	(US$ '000)
OM Cost (excluding Depreciation Expense)	1,557
Depreciation Expense	5,916
Total OM Cost	7,473

11.3 Financial Analysis of Master Plan

(1) Summary of Income and Cash Flow Projection

Table 11-3 Summary of Income and Cash Flow Projection

	Case A	Case B
Period of Evaluation	22 years (2004-2025)	22 years (2004-2025)
Capital Investment $ '000	**170,088** (2004-2020)	**139,574** (2004-2020)
Average Revenue/Yr $'000	8,017	8,017
Annual Revenue/ Subscriber $	181	181
Positive Profit in	16th year	16th year
Positive Cash Flow in	9th year	9th year
Positive Accumulated CF in	21st year	20th year
FIRROI	**0.948%**	**1.871%**
Required Subsidies		
Total $'000	41,300	19,800
Average/year $'000	2,753 (for 15 years)	1,414 (for 14 years)

(Note) Case A: including Duty and VAT

Case B: excluding Duty and VAT

CF: Cash Flow

(2) Base Case Analysis

As the impact of the import duties and VAT totalling US$ 30.5 million is quite substantial to the investment evaluation, the financial analysis is made towards Case B and its sensitivity, leaving the issues in the hands of the Mongolian government how to eliminate the burden of those taxes.

● Financial Analysis of Base Case B

Financial Internal Rate of Return on Investment (FIRROI) is 1.871 %. The fundamental cause is the fact that the capital investment of US$ 2,296 per telephone line is required for the development of rural telecommunications system due to geographic and socio-economic features of Mongolia, while average annual revenues would be limited to US$ 181 per telephone line. (For reference: The annual average telecom revenue per line of the countries of less than US$ 411 GNP per Capita was US$ 199 in 2000 according to the World Bank statistics.) Accordingly, the case needs to be supported by the subsidies in an average annual amount of US$1,414,000 for 14 years. Financial self-sufficiency (after full recovery of the subsidies) would be accomplished in the beginning of the 21st year (2024).

The disbursements of subsidies from the state budget appear to be very difficult and the current legislation of Universal Service Obligations Fund (USOF) cannot take care of the operating losses of rural service providers. Nonetheless, in our opinion, those subsidies can be actualised in Mongolia, provided that the workable system of the USOF is created as being studied by MOI. The current provisions of USOF should be revised under the consensus of telecom sector stakeholders, so that the operating losses can be covered in addition to the capital investment, following the customary practices of USOF in many countries of the world. Proper action of the Mongolian government for the revision of laws and regulations of USOF is of vital importance.

Simultaneously, the fair adjustment of telecom tariffs is required. The tariffs have been kept unchanged to date since 1997, except for an aggregate of 60 % reduction in the international call charge rates denominated in U.S. Dollars. The timing for the revision of tariffs appears to be matured in consideration of the effect of inflation, unless there are the need and reality in the rural areas that at least the existing tariffs should be kept and that a limited period incentives such as the further discount of call charge rates within a monthly calls volume capping should be given to the rural people to help them enable to increasingly access the telecom system of the country as the public wealth. CRC's report aiming at rebalancing of the respective tariffs (e.g. a set of upward adjustment of local call charges and of interconnection charges) is upcoming taking in the recommendations of the studies by the World Bank and foreign specialists.

In view of the obtaining situation, in this Master Plan the effect of tariffs adjustment is dealt with in the 10% increase in revenues of the sensitivity analysis.

(3) Financial and Economic Internal Rate of Return of Other Studies in Mongolian Telecom Sector

Reference is made to the latest results of financial and economic analyses of other project studies in Mongolian telecom sector as follows (The results varied with the scope, particulars and preconditions of the respective studies.):

	Year completed	FIRR	EIRR
Mater Plan Study on Telecommunications Network in Ulaanbaatar City (JICA)	1996	8.5%	14.9%
Feasibility Study on Development of Telecommunication services in Mongolia (ADB)	1997	4.2-5.8% (several scenarios)	

In our trial calculation applied to the feasibility study of the selected 22 Sum centres of Uvurkhangai, Selenge and Darkhan-Uul Aimags (explained herein below), FIRROI would become some 5 %, if the three Aimag centres were added.

(4) Sensitivity Analysis

(a) Sensitivity as to change in Revenue

- In the case the revenues increase by 10% as a result of tariffs adjustments (such as upward adjustment of local call charges and reduction in international call charges as well as interconnection charges) or other causes, FIRROI would become 2.452%, achieving financial self-sufficiency in the 18th year (2021). Required annual subsidies would be decreased by 34% to US$ 927,000 for 11 years. Impact of increase in the revenues is substantial.
- On the other hand, in case the revenues decrease by 10%, viability of the project would be lost.

(b) Sensitivity as to change in Operations/Maintenance Cost

- As the weight of O/M costs is not significant, change in O/M costs does not cause much impact to FIRROI.

(c) Sensitivity as to decrease in Capital Investment

- Provided that the capital investment is reduced by 15% as a result of competitive bidding or other causes, FIRROI would become 2.839%, achieving financial self-sufficiency in the 17th year (2020). Required annual subsidies are decreased by 50% to US$ 710,000 for 10 years. Impact of decrease in the capital investment is substantial.

(d) Case of combined effect (Increased Revenue +5%, Reduced O/M Cost –10%, Reduced Capital Investment –10%)

- In this case, FIRROI would become 2.926 %, achieving financial self-sufficiency in the 16th year (2019). The aggregate amount of required subsidies would be decreased to US$ 4,800,000 and no subsidy is required in the 12th year (2015) and onward.

11.4 Economic Evaluation

(1) Approach and Calculation Methodology

For the purposes of securing relevant information for economic evaluation of the Master Plan, purchasing power or affordability of people in the rural areas in terms of telecommunications is considered as the key factor. The Study Team conducted the socio-economic household survey of the rural areas using questionnaires that contained necessary queries. Among those queries, there were items regarding "Willingness to Pay" and "Travel to Ulaanbaatar" as well as "Travel to Aimag Centre". The answered monetary amounts of "Willingness to Pay" were even lower than the amounts that the people were paying as telephone charges. Consequently, the "Travel Cost" method is applied for the economic evaluation instead of the "Willingness to Pay".

According to the household survey most of the rural people go to Ulaanbaatar about 5 times a year on average and to Aimag Centres 9 times. The cost of travel and an opportunity cost such as forgone wages during the travel have become a heavy burden to their household income (being equivalent to 3.5 times (or Tg. 252,000) of average monthly income of Tg. 72,000), though all of such cost could not be saved by the use of telephone, even if the telephone would be readily in use.

Another attention should be paid to the facts that the number of times of travel that the rural people can afford to make is limited, even though the net economic benefits for one time of travel are enormous. (Travelling would cost 25 times of telephone charges.) As such, the "Saved Travel Cost" cannot fully substitute the benefits being covered by telecom revenues. Therefore, the economic evaluation of the Master Plan still has to mainly rely on the telecom revenues with a supplement of the assumed "Saved Travel Cost". (Note: The telecom revenues that are comprised in the total economic benefits are the net telecom revenues excluding such amounts as used to compute "Saved Travel Cost".)

(2) Summary of Economic Evaluation

Table 11-4 Summary of Economic Evaluation

Period of Evaluation		22 years (2004-2025)		
Costs			**Benefits**	
Capital Investment	$ '000	139,574	Net Tel. Revenue $ '000	171,959
O/M Cost	$ '000	34, 242	Saved Travel Cost $ '000	107,517
Working Capital	$ '000	1,496		
Total Costs	$ '000	175,312	Total Benefits $ '000	279,476
			Positive Accumulated Cash Flow at end 2025 $ '000	104,164
			EIRR	**7.66%**
			Cash Flow: Positive Cash Flow in	8th year
			Positive Accumulated CF in	16th year

Economic Internal Rate of Return (EIRR) that is to clarify the magnitude of economic contribution of the Master Plan is 7.66%. The rate amply exceeds the forecast frame of Mongolia's GDP growth rate of 4.97% of the medium growth case. This result suggests that the implementation of the Master Plan facing the serious financial issues can be accomplished by a comprehensive development approach jointly and harmoniously made by the government, people and the relevant firms as the matter of total development of Mongolia.

11.5 Conclusion

The major points of the conclusion of this Chapter are enumerated as follows:

(a) The amount of the rental for the use of backbone network should not be higher than the proper annual depreciation expense of backbone network.

(b) Subsidies such as the Universal Service Obligations Fund, etc. should be indispensable to give a fair competition opportunity to telecom operators for the rural areas.

(c) Establishment of financial self-sufficiency could be realised towards the final stages of the evaluation period. This means that the implementation of the Master Plan as a business project would still need measures to cover operating losses for a long period of time. To make this Master Plan feasible, we would urge prioritisation of project components (such as development speed, scope and investment scale in each development phase, etc.) through timely and proper review of the Master Plan.

(d) Sensitivity analysis suggests the importance of increased revenues in addition to the reduced capital investment. Above all, formulation and implementation of the tariffs adjustment that are acceptable to all stakeholders of telecom sector should be urgently required.

(e) To aim at the increased telecommunications revenues in the long run, there should be realised a comprehensive development in the rural areas of agriculture and livestock farming industry, small and medium scale enterprises of manufacturing, mining, tourism and services sectors.

(f) Economic evaluation of the Master Plan suggests that this Master Plan can be fulfilled by a comprehensive development approach jointly and harmoniously made by the government, people and the relevant firms as the matter of total development of Mongolia.

12. OPERATION AND MAINTENANCE PLAN

12.1 General

The purpose of maintenance is to retain and perform a required function of the telecommunications network. Operational activities are related to all daily works, to run the telecommunications facilities effectively and efficiently, for provision of the customer services that include the circuit establishment works and small-scale installation works.

It is necessary to consider the following features and conditions of Mongolian rural areas for the improvement of the operation and maintenance:

(a) Small scale of facilities that is scattering in the vast country;
(b) Aged and old type facilities and the lifetime is over; and
(c) Difficult transportation due to poor road and railway condition.

The operation and maintenance for the rural telecommunications network in Mongolia has many difficulties. However, good quality of service will be required with the advance of ICT technology and competitive market environment in Mongolia even for the rural telecommunications services. The telecommunications company requires high efficiency to maintain sound finance. Therefore, the following points are especially important for the operation and maintenance in Mongolia:

(a) Effective and reliable management;
(b) Proper staff arrangement and staff education;
(c) Procurement and arrangement of maintenance material and tools;
(d) Preparation of standard practice; and
(e) Effective organization structure.

12.2 Present Status

MT is taking their best efforts to improve the operation and maintenance activities and work procedures. Majority of the existing facilities in Sum centres were installed in 1980s under the control of former Soviet Union and run out of equipment life, and equipment is maintained by minimum number of staff. In the corrective maintenance, it takes longer repair time because of shortage of spare units or parts.

12.3 Recommendation

As a result of the investigation and analysis of the present operation and maintenance work in MT, the following operation and maintenance improvement plan is recomended:

(1) Quality of Services (QoS) and Network Performance Control

The present quality control taken by MT is evaluated and the future target levels for the fault ratio, fault clearance rate and call completion rate are recommended as follows:

Table 12-1 Target Fault Ratio and Fault Clearance Rate

	2001	Phase I (2008)	Phase II (2013)	Phase III (2020)
Faults /100 sub./Year				
Aimag Total	44	35	30	23
Ulaanbaatar	31	26	22	17
National Total	42	34	28	22
Faults clearance rate (24 hours)	50%	70%	80%	95%

Table 12-2 Target Figure of Call Completion Rate

	(2002)	Phase I (2008)	Phase II (2013)	Phase III (2020)
Call Completion Rate (Successful connection)	55%	60%	64%	70%

The desirable indicators of QoS, network performance and facilities control are recommended for monitoring of the total activity of operation and maintenance. The corrective maintenance method shall be introduced to all telecommunications facilities that equipment checking or repair works is made after fault occurrence.

(2) Operation and Maintenance System for New Rural Network

The periodical review of the operation and maintenance activities shall be made to provide good service quality in the telecommunications services:

(a) Operation and Maintenance Organization for New Rural Network

The organization for the rural telecommunications network should be reconstructed. Operation and maintenance works in Sum centres should be centralized in Aimag centres. Aimag centres should handle the operation and maintenance of the equipment in Sum centres with the remote alarm monitoring system of the rural network. Sum centre should handle the operation and maintenance of the outside plant facilities and access network in Sum centre.

(b) Improvement of Outside Plant Fault Repairing System

For repair work on site facilities it is essential to maintain the facilities according to work procedure, repair method and repair report

(c) Solution for Effective Subscriber Connection Works

It is recommendable to provide the task force in Aimag centre to implement a lot of new customer connection work in Sum centre. Otherwise, large quantity of connection work shall be included in the rural network rehabilitation and expansion project together with the service cutover work of the subscriber lines. The work procedure of service order in Sum centre and Aimag centre is also recommended.

(d) Network Management in Aimag Centre

Aimag centres should manage totally the new rural transmission and switching network from Aimag centre to Sum centre with the NMS (Network Management System), which is required monitor the alarm and traffic data transmitted from Sum centre facilities.

(e) Tools, Test Equipment, Maintenance Material and Vehicles

The review of the provisions of suitable tools and test equipment for the operation and maintenance of the new digital rural telecommunications network is required. These should be basically stored in Aimag centre. Proper quantities of the maintenance material should be secured in Aimag centre for the maintenance. It is recommendable to procure the materials needed to

maintain the equipment for three years in the rural network rehabilitation project. It is recommend that 2-3 vehicles as minimum requirement should be arranged for the maintenance group of the rural network in each Aimag centre to shorten the repair time of the fault in outside facilities.

(f) Information Management System in Sum Centre

It is desirable to introduce the computer network with e-mail system between Aimag centre and Sum centres for the smooth operation and maintenance.

(g) Improvement of Skills Level for Digital Rural Network

The staff training is required to cultivate the digitalisation skills of rural network, especially for the technical staff, of multi-skill staff, high skill expert, etc. The in-house training and the supplier training should be considered.

(h) Billing and Collection System

Billing system should be expanded to Sum centre subscriber. Aimag centre should compute the billing up to Sum subscriber and billing data corrected at Sum centre shall be transmitted to Aimag centre through the data transmission system.

13. HUMAN RESOURCE DEVELOPMENT PLAN

13.1 Present Status

The total number of the existing staff of MT is 4,508 at the end of 2001 and the structure features of the staff are as follows:

(a) Aimag/Sum level employees are 66.3% of the total;
(b) Average number of employees per one Aimag is about 100 and about 50-60% out of it is operators; and
(c) 356 employees are decreased from 1999 to June of 2002.

Past and present productivity data of MT is shown in Table 13-1.

Table 13-1 Trend of Productivity of MT

Year	1996	1997	1998	1999	2000	2001
No. of Main Telephone	82,100	86,800	93,800	104,100	112,486	119,357
Population (in Thousand)	2,245	2,270	2,291	2,313	2,380	2,413
Telephone Density (%)	3.66	3.82	4.09	4.50	4.73	4.95
No of Employees	4,925	4,794	4,794	4,568	4,556	4,508
Productivity (Telphone/Enployee)	16.7	18.1	19.6	22.8	24.7	26.5
Productivity (Employees/1,000 Telephones)	60.0	55.2	51.2	43.9	40.5	37.8

For the training, 865 staff were trained in MT training centre in 2001 according to both requested and planned training programs (40 courses).

13.2 Forecast of Number of Employee and Productivity of MT

According to the ITU data, the number of staff for telecommunications sectors has a close correlation between the number of fixed telephone lines per 100 inhabitants (telephone density) and the number of telephone lines per employee, which normally represents the productivity of employee (staff). The adjusted number of employees and staff distribution plan to each division are shown in Table 13-2. MT should implement the staff plan based on this table, considering the factors of productivity improvement.

Table 13-2 Adjusted Number of Employees and Productivity in MT

Year	Required No. of employees by Scenario-2				Adjusted No. of employees			Distribution Plan			
	No. of lines (thousand)	Teledensity	Productivity (No. of TELs/staff)	No. of employees	Productivity (No. of TELs/staff)	No. of employees (calculation)	**No. of employees (round)**	HQs	Aimag Center	Sums	Total
2001	119,360	4.950000	26.48	4,508	26.48	4,508	4,510	1,517	2,004	987	4,508
2002	174,849	7.120697	77.89	2,245	32.11	4,369	4,370	1,420	1,912	942	4,274
2003	182,112	7.295697	79.26	2,298	37.74	4,230	4,230	1,692	1,777	761	4,230
2004	189,374	7.470698	80.62	2,349	43.37	4,092	4,090	1,636	1,718	736	4,090
2005	196,637	7.645699	81.97	2,399	49.01	3,953	3,950	1,580	1,659	711	3,950
2006	203,899	7.820700	83.31	2,447	54.64	3,815	3,810	1,524	1,600	686	3,810
2007	211,162	7.995700	84.65	2,495	60.27	3,676	3,680	1,472	1,546	662	3,680
2008	218,424	8.170701	85.98	2,541	65.90	3,538	3,540	1,416	1,487	637	3,540
2009	228,782	8.413441	87.80	2,606	71.53	3,399	3,400	1,360	1,428	612	3,400
2010	239,139	8.656181	89.61	2,669	77.16	3,261	3,260	1,304	1,369	587	3,260
2011	249,497	8.898921	91.41	2,729	82.79	3,122	3,120	1,248	1,310	562	3,120
2012	259,854	9.141661	93.19	2,788	88.43	2,984	2,980	1,192	1,252	536	2,980
2013	270,212	9.384401	94.96	2,845	94.96	2,845	2,850	1,140	1,197	513	2,850
2014	284,537	9.707126	97.30	2,924	96.23	2,916	2,920	1,168	1,226	526	2,920
2015	298,863	10.02985	99.61	3,000	98.40	2,987	2,990	1,196	1,256	538	2,990
2016	313,188	10.35258	101.90	3,074	100.58	3,058	3,060	1,224	1,285	551	3,060
2017	327,513	10.67530	104.17	3,144	102.75	3,129	3,130	1,252	1,315	563	3,130
2018	341,838	10.99803	106.42	3,212	104.92	3,200	3,200	1,280	1,344	576	3,200
2019	356,164	11.32075	108.65	3,278	107.09	3,271	3,270	1,308	1,373	589	3,270
2020	370,489	11.64348	110.87	3,342	110.87	3,342	3,340	1,336	1,403	601	3,340

13.3 Staff Estimation by Microscopic Method

In order to review the result of macroscopic estimation and staff estimation by division/section microscopic method by calculation of the necessary number of staff in each organizational unit or work group, i.e., by using quantitative indexes such as the number of subscriber lines and the number of subscription requests, should be applicable. The long term staffing plan (macroscopic estimation) should be appropriately allocated to headquarters and Aimgs/Sums by each phase, based on the following policies and strategies. The long term staff allocation plan roughly will be Table 13-3 and should be reviewed every year as to be practically implemented.

Table 13-3 Staff Allocation Plan to Aimag/Headquarters

	Skill	2001		PH-1(2002-2008)		PH-2(2009-2013)		PH-3(2014-2020)	
Aimag/District	Eng./Technician	1,270	28.2%		25.0%		25.0%		25.0%
	Financial/Accounting	117	2.6%		3.0%		3.0%		3.0%
	Customer Services	1,136	25.2%		20.0%		15.0%		10.0%
	Market	21	0.5%		0.5%		4.0%		5.0%
	Human Resources	22	0.5%		0.5%		0.5%		0.5%
	IT	35	0.8%		3.0%		5.0%		10.0%
	Administration/procurement	390	8.7%		8.0%		7.0%		6.0%
	Sub-Total	2,991	66.3%		60.0%		60.0%		60.0%
HQs/UB	Eng./Technician	709	15.7%		15.0%		15.0%		13.0%
	Financial/Accounting	79	1.8%		2.0%		2.0%		2.0%
	Customer Services	556	12.3%		12.0%		8.0%		7.0%
	Market	11	0.2%		3.0%		4.0%		5.0%
	Human Resources	24	0.5%		0.5%		0.5%		0.5%
	IT	20	0.4%		5.0%		8.0%		10.0%
	Administration/procurement	118	2.6%		2.0%		2.0%		2.0%
	Sub-Total	1,517	33.7%		40.0%		40.0%		40.0%
Total	Eng./Technician	1,979	43.9%		40.0%		40.0%		38.0%
	Financial/Accounting	196	4.3%		5.0%		5.0%		5.0%
	Customer Services	1,692	37.5%		32.0%		23.0%		17.0%
	Market	32	0.7%		3.5%		8.0%		10.0%
	Human Resources	46	1.0%		1.0%		1.0%		1.0%
	IT	55	1.2%		8.0%		13.0%		20.0%
	Administration/procurement	508	11.3%		10.0%		9.0%		8.0%
	G-total	4,508	100.0%		100.0%		100.0%		100.0%

13.4 Training Plan

As a result of analysis of the current training and overview of future management and technology trend, the framework of training should roughly be as shown in Figure 13-1. MT should implement this framework based on the following policies and strategies.

Skill Level \ Period		Phase-1 (Start of systematic training)	Phase-2 (Review of training)	Phase-3 (Improvement of training)
Senior manager	Management skill	•Management training(High level)	⇒	
Manager		•Management training(Normal level)	⇒	
Engineer Administrator		•Technical training(IT, Outside plant, Transmission, SW) •Marketing training	•Marketing management training •IT, O/M management training ⇒	
Technician Clerk	Technical skill	•Fundamental skill training	•Skill-up training	
Training system		Enhancement of human recourse Division	Introduction of CDP and review of training system	Improvement of training system
Master plan(Business plan)		Expansion of provincial telecommunication facilities, Introduction of IT	Development of IT, Enhancement of quality of service(O/M service) and Marketing service	Provision of needs oriented services and best quality of service under competition

Figure 13-1 Framework of Training

14. INSTITUTION, ORGANISATION AND MANAGEMENT PLAN

14.1 Institution Plan

(1) MTSPS 2001

The MTSPS 2001 is targeted to implement the liberalisation of communications sector as well as the principle of non-discrimination in the telecommunications sector by creating an efficient regulatory system. It stipulates the sector's management/governance and structural organisation, general strategy for the telecommunications sector development, competition and regulation in the telecommunications market, privatisation and investment support of the telecommunications sector, universal service obligation, financial resource, and human resource. The objective of the general strategy for developing the telecommunications sector with the target year in 2010 is to introduce more fruitful investment along with the latest high-tech and technology in Mongolia.

(2) Government and Regulatory Body

The current roles and obligations of MOI, CRC and PTA are as follows:

(a) MOI is to make policies and strategies for development of telecommunications and IT, and also to lead and arrange the implementation;
(b) CRC is to assist and recommend MOI on the state policy towards communications and in charge of execution of laws, issuance of operation licenses, type approval, complaints, services, tariff, etc., regarding telecommunications operation, services and manufacturing; and
(c) PTA is to implement telecommunications strategies, network plan, and projects, based on telecommunications development policies decided by MOI.

PTA owns all telecommunication facilities on behalf of the State and leases it to MT for provision of basic telephone services, and does not have any stakes of MT.

(3) Recommendations

In order to develop and implement the basic policy and strategy of the sector development and privatisation, the followings are recommended:

(a) Rural telecommunications;

(b) Technical aspects for investment;
(c) Profit and loss of the rural telecommunications network;
(d) Policy and regulation of the universal service obligation;
(e) Universal service obligation fund;
(f) Nationalisation (State -own) of the backbone transmission system and its lease to operators;
(g) Privatisation;
(h) Giving incentive to investors;
(i) Discount or subsidy of telephone and internet charges/fees to users in rural area;
(j) Financial resource; and
(k) Privatisation and effectiveness of investment.

14.2 Organisation Plan

(1) MT's Present Organisation

The features of MT organisation are summarized as follows:

(a) At present no planning, design, construction functions for big investment projects, because the State (PTA) owns most of telecommunications assets of MT, and PTA plans and manages the projects;
(b) MT has only operation and maintenance functions except recently introduced WLL in Ulaanbaatar and small expansion by MT (the State owned assets except back-bone networks will be transferred to MT by selling, currently it is not realized);
(c) Management in Ulaanbaatar are more important than that in Aimag/Sum level due to development level and size of profit;
(d) Each Aimag and District manages about 10-20 Sums as control tower of rural areas; and
(e) Sum office is composed of manager, engineers/technicians, operators, accountants, drivers, etc., with 3-10 employees.

(2) Improvement of Organisation

From improvement viewpoints of the organisation, main required organisational functions will be summarised as follows:

(a) Enhancement of Aimag/Sum level management by training/seminar;
(b) Decrease of Aimag/Sum level human resource by introduction of digital systems and automatic connection, and integration of offices;
(c) Skill-up of Aimag/Sum level staff by introduction of digital systems and new technologies such as IT & IP;
(d) Enhancement of customer oriented services such as marketing and improvement of quality of service;
(e) Delegation of Headquarters authorities to Aimag/Sum by staff's own initiative; and
(f) Introduction of integrated organisations of Aimag centres (current organisation by each Aimag unit will be too small for management unit).

Re-organisation framework for realisation of the above organisational functions will be divided into 3 phases considering re-organisation timing, and re-organisation, structure and authority in each phase should be in accordance with business objectives and human resource development plan. Based on the framework, MT shall make a detailed re-organisation plan and implement it, taking in account of organisation configuration, and also future development of telecommunications sector such as State-owned back-bone systems, spread of mobile telephones to rural areas and separation of Aimag/Sum level operation, etc.

14.3 Management Plan

(1) Present Status

At Present, MT is managing with the following indicators:

(a) Income and expenditure (Annual budget);
(b) New connection (new connection and demand, waiting list);
(c) O/M (fault and call completion);
(d) Billing and collection (collection only);
(e) Human resource (comprehensive performance); and
(f) Training (courses and trainees).

(2) Recommendations

In order to implement the above framework, the followings are recommended:

(a) Management strategy and Corporate culture should be established.

(b) Referring to the example of indicators and considering the priority, indicators should be decided and implemented.

(c) New connection, billing and collection, account, budget control, fault control, call completion control, etc. should have standard work flows with duration, responsibility, forms, etc. of segment works and all related staff should keep the work flow.

(d) Management data such as budget, new connection, demand, fault, etc. should be stored in a database and should be utilized commonly for management staff. It is a precondition of MIS introduction.

(e) In order to manage the database at each office, communication system among offices such as internet, WAN is absolutely necessary, so MT should introduce a dedicated communication system between Headquarters and Aimags/Sums. It is also a precondition of MIS introduction.

(f) The above integrated (c) & (d) system with application software is MIS and it is useful for top people to get information and make decisions and control for management. It should be introduced step by step, and

(g) MIS should be introduced step by step.

15. SPECTRUM MANAGEMENT PLAN

15.1 General

In proportional to the growth and expansion of economic and social activities, the radio frequency utilization is dramatically increasing in Mongolia. Many wireless services (mobile phone, paging, broadcasting, and transceiver) have been licensed and the illegal radio stations also increased. The improvement and expansion of spectrum management functions and organization are indispensable matter in Mongolia in consideration of increase of such illegal radio stations. In order to use effectively radio waves of limited resource, the following actions will be taken:

(a) Speed up of digitalisation of radio frequency equipment and communications system;
(b) Introduction of frequency re-use technology and transition to new frequency band;
(c) Development of unused radio frequency band;
(d) Introduction of centralized and computerized radio spectrum monitoring system; and
(e) Rehabilitation and improvement of frequency monitoring station.

15.2 Frequency Allocation

The international frequency allocation has been defined in the table of the frequency allocation of the Radio Regulations (RR) in ITU. This frequency allocation table is reviewed and revised as required by the World Radio communication Conference (WRC) of ITU. The Communications Regulatory Commission (CRC) has built and completed the strategy on dividing and using of radio frequencies, planning of channels of the national resource within the framework of the international frequency allocation decided by ITU.

The radio frequencies have been allocated to the various services based on the Radio Regulations in Mongolia, which belongs to Region 1. The assignment to radio stations is carried out application by application from users. The guidelines for frequency allotment shall be established in Mongolia, because allotment, especially for HF/VHF to areas, is done without any guidelines.

The specific radio frequency bands have been stipulated in detail by MOI. The radio frequency allocations for the IMT-2000 mobile system are defined in Mongolia now.

However, the radio frequency bands in Mongolia will be assigned in preparation for the future service expansion of the existing mobile communication services.

15.3 Spectrum Control

The spectrum control is being carried out by CRC, following the Telecommunication Act and Asia Pacific Telecomm unity (APT). CRC is to assist and recommend MOI on the state policy towards communications and in charge of execution of laws, issuance of operation licenses, type approval, complaints, services and tariff etc., regarding telecommunications operation, services and manufacturing. CRC is trying to build a complete legal document system regarding the management of frequency spectrum. The CRC's present situation of legal system is as follow:

(a) Radio Law;
(b) Radio Standard;
(c) Radio Registration System; and
(d) Decisions concerned with Spectrum Control.

15.4 Frequency Monitoring System

Spectrum management can be defined as a complex of administrative and technical measures necessary to ensure the operation of radio stations of different radio communication services at any given time without causing or receiving harmful interference at national and international levels. The following difficulties have been revealed in the operation of frequency management, spectrum monitoring and regulation in Mongolia:

(a) Lack of the monitoring, testing and measuring equipment;
(b) Urgent need of the human resources development in the spectrum management;
(c) Urgent need of the establishment administrative structure, tools for spectrum management, engineering and software package; and
(d) Management, engineering and software package.

MOI has a plan to improve the frequency monitoring system for inspecting and controlling of radio frequencies. Frequency monitoring is carried out by CRC and the objectives of the improvement project are as follows:

(a) To allow the country to control the use of radio spectrum in order to ensure availability of radio frequencies for orderly use and development of radio services in the country;

(b) To define and adopt the necessary regulations, create an appropriate national spectrum regulatory structure; and

(c) To provide the necessary technical standards, monitoring, computer and information support enabling the spectrum regulatory structure.

In order to reinforce radio monitoring at frequency monitoring centre in Ulaanbaatar, it is recommended to introduce DEURAS (DEtect UNlicensed Radio Stations) system, which has four functions, such as sensor station, central station and mobile sensor station.

15.5 Recommendations for Spectrum Management Plan

The improvement of the spectrum management should be implemented not only in hardware aspect, but also software aspect such as organization and legal system. These issues to be solved are pointed out and some improvements are recommended herein.

(a) Frequency Allocation and Reuse

The frequency allotment to areas shall be strengthened to avoid interference between radio frequencies allotted in different areas. Acceleration of the digitalisation in various radio communications system that enables to increase the efficiency of the frequency use is recommendable.

To promote effective reuse of the radio frequencies, two frequency transmission system designs in microwave path design and frequency reuse pattern method to cover large areas by limited radio frequencies in cellular system shall be considered carefully.

(b) Spectrum Control Activities

The following technical data and information shall be correctly kept by CRC:

(i) Number of systems;
(ii) Location of transmitter using coordinates;
(iii) Radio frequency; and
(iv) Transmit power (antenna power).

The technical computation such as interference calculation, computerization of administrative work should be carried out in order to perform effectively and smoothly the spectrum control activities.

(c) International Frequency Coordination

The following activities regarding international frequency coordination shall be carried out:

(i) Orbit position for Geostationary Satellite;
(ii) Frequency Register and Coordination; and
(iii) Border Coordination with Neighbouring Countries.

(d) Frequency Licensing

The frequency licensing is carried out according to the stipulated procedure and fee. Illegal users besides the new licensee shall be ordered to terminate as soon as possible. The license fee and spectrum utilization fee shall be utilized to improve the spectrum control in Mongolia. The frequency licensing procedure shall be modified according to the method of licensing application such as an introduction of online application and FD based application.

(e) Frequency Monitoring System

By improving of frequency monitoring systems and establishment of powerful organization, the illegal users/stations shall be supervised and controlled and radio frequency due to illegal radio waves shall be reduced. To reduce illegal users, available frequency monitoring area shall be expanded nation-wide, especially in bordering and rural areas, because interference in cellular mobile services is now occurring in the border of Russia Federation and China. To cover the target areas for frequency monitoring, facilities and equipment should be improved in quantity and quality.

16. PRIORITY PROJECT AND FEASIBILITY STUDY PROJECT

16.1 Selection Policy

For the selection of the priority projects, the following basic policy is envisaged in this Master Plan Study:

(a) Priority area for the rural social economic build-up to make contribution to the development in the rural areas;
(b) Elimination of the ICT gap between the urban and rural areas for the establishment of the national information infrastructure;
(c) Necessity for the emergency rehabilitation and expansion of the telecommunications facilities in the rural areas;
(d) Un-funded priority projects; and
(e) Consistency with the national and rural development plans and telecommunication development policy in the rural areas.

16.2 Selection Criteria and Procedures

For the selection of the priority project, Aimag and region, the following criteria and procedures are applied:

(a) Development Needs and Potentials for Rural Development;
(b) Economic Indicators of Rural Areas;
(c) Technical Factors in Sums;
(d) Comprehensive Evaluation for Selection of Important Sums; and
(e) Selection of priority Aimag in each region.

The selection of the Sums and Aimags, and the preparation of the lists of the priority projects and the feasibility projects is done in the following procedures:

(a) Selection and ranking of priority Aimags in each region;
(b) Selection of important Sums;
(c) Formation of priority project; and
(d) Selection and listing of priority projects.

In order to prioritise the regions and Aimags for selection of the priority projects as the rural development priority, the quantitative analysis of the rural development and socio-economic criteria with respect to (i) social services needs, (ii) development potentials, (iii) preparedness factors and (iv) economic indicators including the government's (state and local) social services disbursements is made and, on top of that, relative evaluation score points are given to the regions and Aimags in each region as shown in Table 16-1. The results are utilized for the selection of important Sums as key factors as explained below.

Table 16-1 Rural Development Priority

Region	Region Rank	Aimag	Aimag Ranking
Western Region	3	1.Bayan-Ulgii	3
		2.Uvs	2
		3.Khovd	2
		4.Zavkhan	1
		5.Govi-Altai	2
Khangai Region	1	6.Khuvsugul	2
		7.Arkhangai	1
		8.Bayankhongor	2
		9.Bulgan	2
		10.Orkhon	3
		11.Uvurkhangai	1
Central Region	2	12.Selenge	2
		13.Darkhan-Uul	3
		14.Tuv	2
		15.Dundgovi	2
		16.Umnugovi	1
		17.Govisumber	3
		18.Dornogovi	2
Eastern Region	3	19.Khentii	1
		20.Sukhbaatar	2
		21.Dornod	3

Analysis and evaluation of all Sums are made by the available data, ranging from the rural development projects, economic indicators, demand forecast, and technical factors of cost effective investment and power supply. Selection criteria are composed of five (5) categories below:

(a) Aimag evaluation as total Sums scores by the rural development needs and potentials factors;
(b) Aimag evaluation as total Sums scores by the key economic indicators;
(c) Sums where the demand forecast and working lines of the fixed telephone are considerably bigger, and Sums where the populations and GRDPs are bigger;

(d) Sums where the investment costs are smaller and the investments are very effective, and Sums where the digitalisation of networks is cost-effective; and

(e) Sums where the power supply is available, and Sums where the power supply is available and stable.

16.3 Formation of Priority Project and Listing of Priority Project

The formation of the priority project is carried out as follows:

(a) To select the important Sums from the selection result of the important Sums;

(b) To take account of proper size in financing, and simultaneous upgrading, rehabilitation and/or expansion of the telecommunications facilities; and

(c) To include IT factor such as IT spot.

The candidate priority projects formed through the above-mentioned process are shown in Table 16-2.

Table 16-2-1 Priority Project List (1)

Ref. No.	Project Name	Region Name	Cost (Million US$)
1	Rehabilitation and Expansion Project of Telecommunications Network in Uvurkhangai Aimag	Khangai	5.8
2	Rehabilitation and Expansion Project of Telecommunications Network in Selenge/Darkhan-Uul Aimag	Central	8.3
3	Rehabilitation and Expansion Project of Telecommunications Network in Zavkhan Aimag	Western	10.0
4	Rehabilitation and Expansion Project of Telecommunications Network in Khentii Aimag	Eastern	7.9
5	Rehabilitation and Expansion Project of Telecommunications Network in Umnugovi Aimag	Central	7.0

Table 16-2-2 Priority Project List (2)

Ref. No.	Project Name	Region Name	Cost (Million US$)
6	Rural HF Radio-to-Phone Automatic Patch Solution Project	All Region	1.5
7	Renewal Project of Frequency Monitoring System	Ulaanbaatar	1.5

16.4 Method of Selection of Feasibility Study Projects

Out of the above priority project list, feasibility study project(s) is selected in consideration of the following matters and the field survey is carried out for the Feasibility Study:

(a) Most urgent project(s) on the rural development, etc., in conformity with the policy of the Government of Mongolia;
(b) Project(s)that brings substantial socio-economic benefits;
(c) Project(s) that brings the maximum utilisation of the new network linking to the existing and new digital transmission trunk link;
(d) Proper size of the project(s) from the point of the financial source;
(e) Project(s) for which financing is not decided; and
(f) Project(s) that does not exceed the work volume limit of the Study Team assigned under this Study.

Finally, the Feasibility Study project covering 22 Sums from Uvurkhangai Aimag and Selenge/Darkhan-Uul Aimags areas was selected as shown in Table 16-3. Darkhan-Uul Aimag areas have been made an integral part of Selenge/Darkhan-Uul Aimags area, based on the information brought by the Mongolian side that the merger of the two Aimags is upcoming.

Table 16-3 Result of Selection of Feasibility Study Project

Project Name	Region
Rehabilitation and Expansion Project of Rural Telecommunications Network in Uvurkhangai ・Selenge/Darkhan-Uul Aimags areas	Khangai and Central

17. RECOMMENDATIONS

Recommendations are made for a smooth and effective implementation of the Master Plan towards the year 2020 on institution, organization, management, human resource development, technical affairs, financing, etc. Especially, the following recommendations are made in this Master Plan:

(a) Institution and Rural Telecommunications Development Policy
  (i) Rural Telecommunications Development;
  (ii) Technical Aspects for Investment;
  (iii) Profit and Loss of Rural Telecom Networks;
  (iv) Policy and Regulations of USO (Universal Service Obligations)
  (v) Universal Service Obligations Fund (USO Fund);
  (vi) Nationalisation of Backbone Transmission System and its Lease to Operators;
  (vii) Privatisation;
  (viii) Giving Incentives to Investors;
  (ix) Discount or Subsidy of Telephone and Internet Charges/fees to Users in Rural Areas; and
  (x) Establishment of Comprehensive Rural Development Plan.
(b) Operation and Maintenance
(c) Human Resource Development
(d) Organization and Management of MT
(e) Technical Fields
  (i) Telephone Numbering Plan and Switching Network;
  (ii) Optical Fibre Transmission Network;
  (iii) Radio Transmission System and Spectrum Management;
  (iv) Cable Network (Junction and Access network);
  (v) Power Facilities; and
  (vi) Internet Services.
(f) Financial Aspect
(g) Socio-Economic Aspect
(h) Implementation of Master Plan

Especially, the following on the institution and rural telecommunications development policy are emphasized:

(1) Universal Services Obligation Fund

The rural telecommunications network, part of the national telecommunications network, has special features such as small sized facilities deployed at many little Sum centres or settlements scattered in the vast territory requiring a massive capital investment and less revenues compared to those in the urban areas. The Universal Services Obligation Fund (USOF), which is collected from the revenues of telecom operators from the urban subscribers, aims to subsidise the initial investment costs, and operation and maintenance costs for the rural telecommunications services. MT has subsidised the rural operation and maintenance cost internally. The Government promulgated a regulation on USOF in September 2002 in order to involve the other mobile telephone operators, in addition to the amendment of the Telecommunications Act in 2001. It is an urgent task for the Government to modify the shortcomings of the present laws and regulations.

(2) Digitalisation of Trunk Transmission System

Among the trunk transmission systems that connect the telecommunications facilities in the capital city and the rural major cities, 40 % are digitalized, though the remaining 60% are still of an analogue type. For the effective and smooth implementation of the rural telecommunications system construction, the digitalisation of such analogue type trunk transmission systems is essential for the development of the rural telecommunication system, including the common use of the trunk transmission systems, though such trunk transmission systems are not the objectives of this Master Plan. Therefore it is recommended that the digitalisation of such analogue transmission systems should be performed before the completion of the rural telecommunications facilities in order to utilise such completed facilities most.

(3) Joint-Company of Owning and Leasing Trunk Transmission Systems

The existing trunk transmission network systems that cover the country are owned by PTA, and the other telecommunications operators, such as MRC and Mobicom. In the case of the telecommunications operators intending to expand their services in the rural areas, they have two options; i.e., use of a part of such exiting trunk transmission systems by lease, or construction of a new trunk transmission system by themselves.

It is highly recommended that the unused transmission capacity of the newly installed trunk transmission system with huge investment costs and advanced technology should be leased to other operators with a fair rate of lease rental, in order to recover the investment

cost earlier. The establishment of a joint venture company that leases trunk transmission systems is also recommended in order to utilise the trunk transmission systems most, as a national policy.

18. COMPREHENSIVE ASSESSMENT OF THE MASTER PLAN

This Master Plan has been studied and elaborated as a long term rural telecommunication development plan, taking into consideration of all viewpoints of social, technical, economic, financial, organizational and management and environmental protection in Mongolia. In order to assure and realize this Master Plan, the results of the Plan have been analysed and assessed comprehensively as its appropriateness in the following items:

(a) Social Appropriateness

(i) National Telephone Density;
(ii) Improvement of Telephone Density Imbalance between Urban and Rural Areas;
(iii) Subscriber Direct Dialling;
(iv) Regulation Change and Privatisation in the future;
(v) Elimination of Digital Divide;
(vi) Improvement of Productivity and Efficiency of Industry in Rural Area;
(vii) Contribution to Need of Rural Economy; and
(viii) Contribution to Needs of Social and Human Development in Rural Area.

(b) Technical Appropriateness

(i) Introduction of new Technologies and Services; and
(ii) Modernisation and Digitalisation of Network.

(c) Economic Appropriateness

(i) Economic Internal Rate of Return (EIRR); and
(ii) Consumer's surplus.

(d) Financial Appropriateness

(i) Financial Internal Rate of Return on Investment (FIRR);
(ii) Required Subsidies; and
(iii) Financing.

(e) Organizational and Management Appropriateness

(i) Efficiency of operation and maintenance;
(ii) Effective organization and staff allocation; and
(iii) Standardisation and computerisation of works.

(f) Appropriateness for Environment Protection

Applying the above method to the total achievement of this Master Plan, it has been proved that some high degree fulfilment of the respective targets can be realised as to the national base telephone density, introduction of new technologies and services; and the pending development issues in the rural telecommunications in eliminating telephone density gap and digital divide between urban and rural areas; and in the management and organisational improvements.

However, every effort of rural telecommunications development will have to face the country's geographic and demographic features that small Sums or settlements are scattered in its vast territory. In the implementation of the Master Plan, the formulation of long-range business plan in particular, low profitability in the rural areas would hinder the accomplishment of self-sufficiency of rural telecommunications operators, while their services would require a massive amount of capital investment. This problem would result in limiting the sources to finance such investment as well as the necessary working capital. The above operational and financial issues that are most critical for the rural telecommunications development in Mongolia will have to be overcome.

In addition to the above, there should be noted that substantial benefits that cannot be quantified could be realised in terms of contribution to the economy and social and human development needs, such as medical and health care services, education, poverty reduction, prevention from natural disasters and other administrative services.

PART II

SUMMARY OF FEASIBILITY STUDY

PART II SUMMARY OF FEASIBILITY STUDY

1. INTRODUCTION

1.1 Background of the Priority Projects

In consideration of the gap found between the urban and rural areas, the Government of Mongolia intends to establish a telecommunications network which could contribute to life level improvement in the rural areas and the local economic development. The rural telecommunications network development is an important theme for the country which should be listed as a project to be realised under international assistance.

This is a feasibility study for the priority projects selected from the urgent development program discussed in the Master Plan for development of rural telecommunications system up to the year 2020. The priority projects aim to be completed by the year 2006.

1.2 Selection of Priority Projects for Feasibility Study

In the Master Plan, a project implementation plan up to the year 2020 was prepared. The project implementation plan consists of short-, medium- and long-term plans. The short-term plan is an development programme of urgent projects in 21 Aimags. The priority projects for the feasibility study were selected from the short-term plan through prioritisation procedure in the Master Plan study. The priority projects aim to meet the rapidly growing telephone demand and to catch up 100% fulfilment to the waiting demand in selected Sum centres of top priority by the year 2006.

Uvurkhangai, Selenge and Darkhan-Uul Aimags were selected for the Feasibility Study. Uvurkhangai Aimag got the highest score in the Master Plan. Selenge and Darkhan-Uul Aimags scored the highest point because of the urgent rural development needs such as a) the mergence of the relevant two Aimags, b) the establishment of free trade zone along the border to Russia, c) the biggest granary area in the country, and d) the utilisation of the existing digital microwave and optical fibre cable transmission system.

2. PRESENT STATUS OF TELECOMMUNICATIONS

2.1 General

Telecommunications network in target area is exploited by MT, MRC, MobiCom and Skytel. MT provides fixed telephone service in Aimag centres, Sum centres, and some Bags. MRC provides fixed telephone service in the settlements along the railway. MobiCom and Skytel provide mobile phone service in Aimag centres and a few Sum centres. Internet service is available through dial-up connection in Aimag centres and in some Sum exchanges connected through digital inter-exchange link.

All of the Sum centres are provided with telephony service; some are through the PBX switching system and others through the distant subscriber line from Aimag centre. The physical transmission network is made up with digital microwave transmission system, optical fibre cable transmission system, open-wire transmission system, and metallic cables of subscriber access network. The MT switching systems in Aimag centres are digital, and those in Sum centres are mostly analogue and others are digital PBXs.

2.2 Socio-economic

The project area, consisting of 10 selected Sums in Uvurkhangai Aimag and 12 selected Sums in Selenge/Darkhan-Uul Aimags area, currently has a total of 3,242 rural telephone subscribers that corresponds to 2.5% of the national base fixed telephone subscribers. This composition ratio, according to the feasibility study plan, would once reach some 3.3% in 2006, taking in those transferred from mobile telephone and would become stabilised at 2.8% in the long-range.

Upon reviewing the main issues and development directions of regional and rural development activities being elaborated, formulated or implemented in the country under the policy as approved by the parliament in June 2001, a comparative evaluation was made under the master plan study among the five economic regions and the comprising Aimags in each region on the grounds of rural development potential and key economic factors to support its selection of the candidate sites of the feasibility study having high telecommunications development priority.

As a result, Khangai region, followed by Central region, was selected as the top priority region and Uvurkhangai was ranked at the top priority Aimag concurrently with

Arkhangai Aimag, and Selenge Aimag was among the four second ranking Aimags in the Central region.

Socio-economic profiles of the project area is shown in Table 2-1

Table 2-1 Socio-Economic Profiles of Project Area

	Population 2001			GRDP 2001 Current Price	Household 2001 Sum Centre
	Total Sum	Sum Centre	Other Than S.C.		
	(persons)	(persons)	(persons)	(Tg.mln)	(households)
Uvurkhangai					
Burd	3,896	607	3,289	0	0
Bat-Ulzii	5,750	1,837	3,913	0	649
Bayangol	4,747	896	3,853	98.3	173
Esunzuil	3,820	1,003	2,817	898.4	244
ZB Ulaan	5,106	669	4,437	0	253
Nariinteel	4,279	1,386	2,893	6.1	339
Sant	3,878	730	3,148	8.9	170
Uyanga	7,824	1,343	6,481	679.2	394
Khuzirt	0	0	0	151.7	2,193
Kharkhorin	13,444	8,523	4,921	69.9	3,453
Total	55,645	15,757	39,888		8,025
	100%	28.3%	71.7%		
Selenge/Darkhan-Uul					
khutul	8,755	6,596	2,159	0	2,068
Zuunkharaa	22,304	15,461	6,843	14,036	3,597
Bayangol	5,261	3,580	1,681	2,440	1,182
Tunkhel	3,526	3,526	0	0	710
Shariin gol	8,619	7,722	897	9,778	2,131
Altanbulag	3,812	3,206	606	327.8	710
Eruu	3,130	2,745	655	1,200	681
Zuunburen	2,245	1,998	247	161.3	396
Sant	2,053	1,601	452	62.5	532
Tsuganuur	4,326	3,073	1,253	110.6	976
Orkhontuul	4,002	3,500	502	385.6	878
Shaamar	4,409	3,426	983	144.2	1,030
Total	72,442	56,164	16,278		33,595
	100%	77.5%	22.5%		

2.3 Existing Facilities and Services

2.3.1 Switching System

In Uvurkhangai, Sum centres are all furnished with telephony service. There are 11 analogue switch units and 7 digital switch units in Uvurkhangai Aimag for the telephony

service. Out of 19 Sum centres, Bayan-Undur is not furnished with switching unit but the telephone service is provided through a distant subscriber line from the Aimag centre.

In Selenge and Darkhan-Uul, the administrative limit does not coincide completely with the service area of MT Telecom centres. Most Sum centres and Bags in Selenge Aimag fall under Sukhbaatar, the provincial capital of Selenge, but some Sum centres and Bags fall under Darkhan-Uul Telecom centre. Total number of Sum centres and Bags in Selenge and Darkhan-Uul Aimags where the exchange is installed is 22 in total. Telephony service of Tunkhel and Sal hit are not provided with MT exchanges, but with MARC exchanges. The existing Sum switching systems are analogue and digital, that is, 17 analogue units and 5 digital units.

2.3.2 Transmission System

Aimag centre of Uvurkhangai is connected with microwave radio relay station, which is a terminal station on the western route in the SDH STM-1 digital microwave trunk transmission network. Total six microwave repeater stations and one terminal station in Uvurkhangai consist of the national trunk transmission network in the western route. In order to expand digital cellular mobile telephone service to the western and southern rural areas, MobiCom is now under construction of the 34 Mbps digital microwave radio links on the existing MT microwave trunk transmission routes. Analogue microwave radio transmission system was built in 1980s but was outdated and now not used. All of the toll transmission line of MT between Aimag centre and Sum centre has been established by analogue open wire carrier transmission system in Uvurkhangai Aimag. Total length of the open wire carrier transmission system is about 1,700 Km. There is no backbone optical fibre cable transmission system in Uvurkhangai Aimag.

MT national inter-province toll transmission lines in the northern direction from Ulaanbaatar is terminated at Darkhan-Uul Aimag Telecom office and Selenge Aimag Telecom office through the PDH 34 Mbps digital microwave transmission system.

The optical fibre cables establish those approach transmission lines. In the northern toll transmission route passing through Selenge and Darkhan-Uul Aimags, it is consisted of two terminal stations and five repeater stations. The SDH STM-1 optical fibre cable transmission system owned by MRC is laid along the railway road passing through Selenge Aimag and Darkhan-Uul Aimag. All of the toll transmission line of MT between Aimag centre and Sum centre has been established by analogue open wire carrier transmission

system in Selenge and Darkhan-Uul Aimag. The total length of the open wire carrier transmission lines reaches about 1,380 km.

2.3.3 Access Network System

Aerial cable system has been adopted in almost all Sum centres. Most of the outside plant in Sum centres were built in the 1980s, and has been remarkably deteriorated. The cable capacity is in shortage at present.

2.3.4 Power System

The majority telecom offices of Sum centres in selected three Aimags are supplied by the central energy electricity system. Back-up diesel generators are installed at a few telecom offices that receive electricity from the central energy system. Sum centres that are not connected with the central energy system are supplied with electricity from diesel generating stations located at Sum centres. Almost all of the diesel engine generators were provided under the grant aid of Japan for the last few years. Power supply capabilities by the diesel engine generators is high. Some of such Sum centres are provided with stand-alone photovoltaic (PV) systems of small capacity ranging from 0.4 kW to 0.8 kW to feed power to small power consuming equipment.

2.3.5 IT System

There are eight (8) Internet Service Providers (ISP) in Mongolia at present. 9,000 peoples have their own accounts as of the end of 2001. Around 95 % of the total users are residents of Ulaanbaatar. Internet connection from Aimag centres in three Aimags is possible basically through dial-up connection. However, very limited (or a couple of) organisations or persons only use the Internet in Sum areas. That low penetration rate at Sum areas is mainly due to poor circuit quality and high charge of long distance communication, low speed connection caused by the old telecommunications facilities, lack of affordable money of the people and less opportunity of buying PC. The situation should be cleared one by one but it is desired to improve it for better rural ICT environment as soon as possible.

3. Microscopic Demand Forecast

3.1 Basic Data for Microscopic Demand Forecast

In this study the microscopic demand was forecasted, based on the answer from the inhabitants, such as households, public organisation and business companies in the sampled Sum centres during the site survey. The hearing on the telephone demand was executed for 300 households and 200 public organisations and business companies of 10 sampled Sum centres in Uvurkhangai, Selenge and Darkhan-Uul Aimags. The statistical data on the economic activity, population, number of household and number of public and business organisations etc., were collected from the governmental offices of Sum centres.

3.2 Fixed Telephone Present Demand in Samples

The present demand density per household, public and business organisation has been collected from the site survey. A part of the mobile telephone demand that will be shifted to the fixed telephone demand during un-available mobile telephone service period is also considered as a fixed telephone demand in the initial stage.

3.3 Affordable Payment for Household

The affordable payment for the monthly telephone charge is asked in the questionnaire. The payment available rate for 5,000 Tg. actual monthly charges equivalent is calculated as Table 3-1.

Table 3-1 Payment Available Rates in Each Income Bracket

(in Tugrug)

Income Bracket	Less than 18,999	19,000 - 41,000	41,000 - 101,000	More than 101,000
Payable Households to Tg. 5,000 per month	0 %	19 %	43 %	75 %

Therefore, the affordable demand is calculated by the answered demand with payment available rate as shown in Table 3-2.

3.4 Fixed Telephone Demand Categorized with Size of Organisation

The present telephone demand is calculated as sum of the existing subscriber line and the expressed demand of sampled organisation and it is classified by the size of organisation. Demand density per household, public organisation and business company are shown in Tables 3-3 and 3-4.

Table 3-2 Affordable Demand and Density per Household in Sampled Household

Income(TG)	Sample	Affordable Fix Demand	Affodable Mobile Demand	Affordable Change Demand	Fix Demand Density	Mobile Demand Density	Change Demand Density
18999	14	0.00	0.00	0.00	0.00	0.00	0.00
19000	60	4.37	1.92	0.96	0.07	0.03	0.02
41000	164	38.21	17.78	9.92	0.23	0.11	0.06
101000	63	43.50	21.00	14.25	0.69	0.33	0.23

Table 3-3 Demand Density per Public Organisation

Sector	Large	Medium	Small
Government	614%	529%	86%
Others	571%	112%	76%
School	209%	100%	100%
Hospital	270%	200%	100%

Table 3-4 Demand Density per Business Company

Sector	Large	Medium	Small
Agriculture/Stock	200%	100%	50%
Trade/Sells	200%	150%	100%
Fabric	200%	100%	50%
Others	200%	100%	50%

3.5 Present Telephone Demand in Sum Centre

Demand in Sum centre is estimated from the demand density per sample and number of household, public organisation and business company in Sum centre. Present total demand of the fixed telephone is the sum of household demand, public organisation demand and business company demand and shown in Table 3-5.

Table 3-5 Present Telephone Demand in Sum Centre

Aimag/Sum Name	Existing Fix Sub	Household Demand	Pubblic Demand	Business Demand	Present Fix Demand	Arranged Present Fix Demand	Macro Demand 2001	Micro Density (2002) per Population	Shiting Mobilee Demand	Population 2002
Uvurkhangai	1,274	1,431	677	191	2,299	2,318	2,014	0.09	193	25,624
Selenge	2,397	2,952	312	523	3,787	3,861	3,410	0.06	350	62,835
Darkhan-Uul	736	634	191	132	957	1,014	945	0.08	182	13,371
Total	4,407	5,017	1,179	846	7,042	7,194	6,369	0.07	725	101,830

3.6 Future Demand Estimate

The growth of the future demand basically depends on two factors, one is the increase of telephone necessity due to economical activity etc., and the other is the growth of population. In this study, the growth of the demand density is estimated by the growth of the economical activity. Actually, the future microscopic demand density was calculated by macroscopic demand density growth rate. The estimation result is shown in Table 3-6. The nature of the microscopic demand forecast result is reasonable in comparison with the macroscopic demand, as example, the deviation between the microscopic demand and the macroscopic demand in 2020 is not so much.

Table 3-6 Comparison of Micro Demand and Macro Demand

Aimag	Macro2020	Macro2020 Demand Density	Micro2020	Micro2020 Demand Density	Rate of Micro for Macro
Uvurkhangai Total	4,444	0.18	4,931	0.19	1.11
Selenge Total	5,359	0.06	6,628	0.08	1.24
Darkhan-Uul Total	1,765	0.10	1,862	0.10	1.05
Total	11,568	0.09	13,420	0.10	1.16

3.7 Fulfilment Plan for Microscopic Demand

According to the priority of Sums, the inauguration year and also design period of network, the fulfilments plan of the Sum demand is shown in Table 3-7.

Table 3-7 Fulfilment Plan

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010
Demand	6,086	6,189	6,292	6,395	6,498	6,601	6,704	6,882	7,060
Existing Sub	3,829								
New Connection	0	0	0	0	2,667	102	96	183	183
Working Sub	3,829	3,829	3,829	3,829	6,496	6,598	6,694	6,876	7,059
Fulfillment Ratio	63%	62%	61%	60%	100%	100%	100%	100%	100%

3.8 IT Demand

(1) Method of Demand Forecast

Forecasting method of target Sums of the feasibility study is based on the same as macro study in the master plan. i.e., features of households and their GRDP are applied.

(2) Results of IT Demand Forecasted

Estimated Internet demands in the target Sums are as shown in Table 3-8.

Table 3-8 Internet Demand in the Target Sums of F/S

	Population (2020) (Except Rural)	Population (2020) (Rural)	Number of HH (2020) (Except Rural)	Number of HH (2020) (Rural)	Number of Sub. (2008) (Sum & Other)	Number of Sub. (2013) (Sum & Other)	Number of Sub. (2020) (Sum & Other)	Number of Sub. For (Organization)
UVURKHANGAI							GRDP Adjust:	0.5297
Burd	639	4,085	152.2	972.5	22	38	34	20
Bat-Ulzii	2,277	4,642	542.1	1,105.2	29	51	58	15
Bayangol	828	4,954	197.2	1,179.5	25	44	42	21
Esonzuil	1,146	3,380	272.8	804.7	23	40	36	22
ZB Ulaan	1,020	5,557	242.8	1,323.1	26	46	48	18
Nariinteel	1,469	3,781	349.7	900.2	24	42	42	18
Sant	1,040	4,201	247.7	1,000.2	24	42	40	20
Uyanga	1,640	7,502	390.4	1,786.2	48	84	68	52
Khuzirt	4,782	4,680	1,138.6	1,114.4	46	81	90	26
Kharkhorin	10,522	6,206	2,505.3	1,477.7	96	167	172	67
Total	25,363	48,987	6,039	11,664	363	635	629	279
		74,350		**17,702**				**908**
SELENGE (DARKHAN-UUL)							GRDP Adjust:	0.4622
Shariin gol	11,449	1,218	2,726.0	290.1	91	159	133	95
Total	11,449	1,218	2,726	290	91	159	133	95
		12,668		**3,016**				**228**
SELENGE							GRDP Adjust:	0.5853
Altanbulag	3,667	820	873.1	195.3	33	57	57	25
Eruu	3,022	4,346	719.5	1,034.7	39	68	72	25
Zuunburen	2,492	733	593.3	174.6	31	54	40	37
Sant	2,032	588	483.7	139.9	22	39	32	23
Tsagaannuur	3,970	1,349	945.3	321.3	41	71	65	37
Orkhontuul	3,505	1,501	834.5	357.5	40	70	59	41
Shaamar	4,842	854	1,152.7	203.2	35	62	73	15
Khutul	3,775	0	898.7	0.0	41	73	53	51
Zuunkharaa	28,166	460	6,706.2	109.5	236	414	396	195
Bayangol (Baruunkharaa)	4,798	2,158	1,142.4	513.8	52	91	82	48
Tunkhel	256	1,022	60.8	243.4	15	26	11	26
Total	60,523	13,832	14,410	3,293	585	1,024	940	523
		74,355		**17,704**				**1,463**
FS Aimag's ALL		**161,373**		**38,422**	**1,039**	**1,819**		**2,598**

4. TECHNICAL PLAN

4.1 Switching Network Plan

The switching network is designed as an expansion of the existing MT network. The switching network in target Aimags is structured stick to the existing one in principle. However, the links between Aimag centre and Sum centres in Selenge and Darkhan-Uul is modified in keeping with new transmission links. Switching network plan of Uvurkhangai is a star type connection where all the Sum centres are connected directly to Arbaikheer Aimag centre switch.

The switching network plan of Selenge and Darkhan-Uul is consisted of two (2) centres, that is, SDE switch of Sukhbaatar and EWSD switch of Darkhan-Uul. Five (5) Sum centre switches of Selenge Aimag and one (1) Sum centre switch of Tuv Aimag are assigned, respectively, a directory number of Darkhan-Uul EWSD. The switching systems of 10 Sums in total of Uvurkhangai Aimag and 12 Sums in total of Selenge and Darkhan-Uul Aimags will be replaced with digital switching system. The switching network plan will be designed basically not changing the existing network.

The traffic forecast is done in order to know adequate number of inter-exchange circuits between exchanges to be linked. The number of circuits between Aimag centre and Sum centres was calculated. The numbering plan allocated to each of the exchanges of the target area is designed in conformity with the existing numbering plan. Existing actual numbering is succeeded without change.

The signalling system of new switch should be CCS No. 7. The EWSD/SDE in Arvaiheer, Sukhbaatar and Darkhan-Uul should be equipped with CCS No. 7, for it is an international standard of digital network. The signalling protocol ITU-T Protocol V5.2 will be applied to the section between Sum switching system and WLL system.

All the switching systems in Sum centres will be functioned to have local call meters of subscriber line. Detailed communication records for trunk and international calls will be monitored and collected by the switching system in Aimag centre. The Aimag centre switch shall send the call records to Operation and Maintenance Centre (OMC) in Ulaanbaatar through X.25 protocol transmission link.

4.2 Interconnection Plan and Synchronization Plan

From technical view point, location of demarcation points between two operators is the most important. The network configuration may be changed that depends on location of demarcation. As an example, 4 cases in that MT leases the optical fibre cable or a part of the transmission capacity from MRC are explained, taking account of demarcation points.

All switches and digital equipment installed in this feasibility study project should be synchronized with the master clock in Ulaanbaatar. In this project, there is no synchronization problem in transmitting the master clock timing information to the Sums digital equipment.

4.3 Transmission System Plan

The optical fibre cable to be installed in Selenge/Darkhan-Uul Aimags is of single mode (mono mode) and 1.5 nm wave length, and shall meet ITU-T recommendations. The optical fibre cable transmission equipment to be installed is specified as follows:

(a) Equipment shall comply with the ITU-T recommendations;
(b) Equipment shall be connectable with existing equipment;
(c) Equipment shall be expandable to STM-4; and
(d) Equipment shall be compatible with the existing NMS system, regarding main functions such as setting up paths and monitoring alarms.

As a result of feasibility study it is proposed to install the 7GHz 34 Mbps digital radio transmission system in the rural areas. The system design and radio path engineering shall be conducted based on the following criteria:

(a) As a frequency plan, the ITU-R Recommendation 385-6 will be applied in the radio link frequency allocation;
(b) As a BER performance objective, the ITU-R Recommendation 634-1 will be applied in the radio link design;
(c) The antennae heights on each path will be designed to keep at least First Fresnel Zone clearance above the tree canopy, or any other apparent obstruction, at any point along the path, at an effective earth radius factor K of 1.33;
(d) The antenna type and size and the feeder type will be selected to satisfy the link reliability considering the fading occurring probability; and

(e) The microwave transmission facilities shall be stable and reliable under the harsh climatic conditions in the rural and cold areas.

The transmission quality of the digital radio transmission system is specified by the bit error rate. The design criteria is based on the ITU-R Recommendation 634-1 as follows:

(a) Short term incompleteness
1×10^{-3} for more than (D/2500) x 0.054 % of any month (integration time 1 second)

(b) Long term incompleteness
1×10^{-6} for more than (D/2500) x 0.4 % of any month (integration time 1 minute)

The presumed conditions for the digital radio transmission system, i.e., terrain profiles, surface conditions and obstruction height are as follows:

(a) Height of obstructions: 25 m height trees is presumed on the terrain;
(b) Path parameters: based on system configuration; and
(c) Feeder length: Antenna height + 10 to 20 m. The length of coaxial feeder varies depending on the result of detailed survey.

4.4 Access Network Plan

For the wired access network, the design policy for the outside plant facilities under this project is as follows:

(a) To apply the non-filled polyethylene (PE) insulated and sheathed cable with self-supporting wire for the aerial installation;
(b) To apply the jelly filled PE insulated and sheathed cable for the underground installation;
(c) To adopt the direct distribution system (Rigid distribution system) for the wiring; and
(d) 7dB tolerance attenuation loss and 1,500 ohms D.C. resistance limitation from MDF to the subscribers.

Taking account of the economic solutions and rapid installation, it is recommended to introduce the Wireless Local Loop (WLL) system to supplement the existing wired access network system. WLL shall be put it overlay on the existing metallic cables and it is cost

effective to provide the services in rather high-density Sum centre areas. WLL is the provision of fixed telecommunications services using Point-to-Multipoint (PMP) terrestrial wireless technologies to connect subscribers to local exchange. The components that establish the wireless connection are the Wireless Cell Stations (WCS) and the Wireless Subscriber Units (WSU) and the TDMA assignment technology is used at the air interface in the wireless network.

4.5 Power System Plan

Power supply facilities are designed and constructed to meet the following requirements:

(a) Power in required quality and quantity should be supplied;
(b) Power supply shall be stable and reliable even under harsh climatic conditions;
(c) Initial investment cost and running cost should be within tolerable level; and
(d) Easy and sustainable operation and maintenance can be fulfilled.

Capacity of the power supply facilities is determined on the basis of the power demand when a maximum demand occurs. Power demand or load patterns usually vary according to the traffic density from the telecom equipment installed at each of the project sites. Power supply from the grid is usually stable. However, scheduled or unscheduled power outages cannot be avoided. In preparation for such power outages, alternative power supply system is normally provided to secure reliability and stability of power supply. Batteries are used to meet requirements for short-interruption of power supply, while diesel generators are used for long-interruption of power supply.

4.6 IT Plan

The IP network or node/router of ISP does not exist in Sum centres in the initial stages, such as the Phases I and II. Internet user has to access to the Internet by dial-up connection and through PSTN. The Internet traffics from subscribers in Sum centres will flow to/from Ulaanbaatar via Aimag. 2 Mbps circuit capacity will be prepared for the Internet services in the transmission system between Aimag centre and Sum centre at Phase I stage under this project.

5 FACILITIES PLAN

5.1 General

The telecommunications facilities plan is focused to design the Sum centre network and links to connect them with Uvurkhangai, Selenge, and Darkhan-Uul Aimag centre. The plan is established under the conditions that:

(a) The proposed expansion and improvement be realised solely as part of MT network which is possessed by PTA; and
(b) The facilities to be introduced under this Feasibility Study be compatible with existing operators' networks.

The quality of facilities will be upgraded by introduction of digital transmission and digital telephone switches having a capacity of 6,580 telephone lines. The analogue Aimag-Sum links, which are composed mainly with open wire transmission system, will be replaced with digital transmission links. The capacity of transmission systems will also be increased to meet the traffic of the increased telephone subscribers. Analogue automatic and manual switches in target Sum centres will be replaced with digital ones.

Subscriber access network, which makes up links between user terminals and switching system, will be provided with mainly metallic cables and partly with WLL system. Deteriorated or aged metallic cables will be replaced with new one.

5.2 Switching Facilities

The new switching system is planned to be:

(a) Full digital;
(b) Compatible with existing network;
(c) Durable in the Mongolian weather conditions;
(d) Detailed billing function at Aimag centre; and
(e) Equipped with CCS No. 7 and R2 (D) signalling, V5.2 protocol function.

The switching systems to be introduced in each of the target Sum centres are dimensioned based on the given demand fulfilment plan. The size of the switching system is decided so that the new switching system have a capacity enough to cater for the demand at least five (5) years after its commissioning.

(a)	Sum centres under Uvurkhangai centre switch:	2,520 line units.
(b)	Sum centres under Selenge centre switch:	1,020 line units.
(c)	Sum centres under Darkhan-Uul centre switch:	3,040 line units.
	Total:	6,580 line units

In addition to the switching system to be installed at Sum centres, the capacity of switching system of Aimag centre will also be expanded in relation to the interface devices with the Sum centre switches. Spare parts will be provided to cater for the repair demand for five (5) yeas after commissioning. The scope of work of switching facilities under this Project is summarised as:

(a) Switching systems: 22 units with 6,580 line units; which include
(b) Three (3) units of Operation and Maintenance Centre (OMC).
(c) Trunk interface hardware of three (3) Aimag centre switches.

An OMC will be established at each Aimag Centre, that is, at Arvaikheer, Sukhbaatar, and Darkhan-Uul. The OMC will be equipped with such function to monitor the running condition of Sum centre switching systems, to collect traffic data of the switching systems, and to control the switching systems. The switching systems now in use at the target Aimag's centres shall be expanded in its capacity of inter-exchange interface equipment. Programming of exchange data and up-grading in software will be required, for new digital switches are to be connected. Such work should be born by other projects than this project.

5.3 Transmission Facilities

5.3.1 Digital Microwave Transmission Facilities

With this project the national trunk transmission lines between Aimag centre and Sum centre shall be digitalized not only to improve the transmission quality but also to introduce IP-based new services in rural areas. 7 GHz digital microwave transmission system will be used in Uvurkhangai, Darkhan-Uul and Selenge Aimags. The existing backbone microwave transmission facilities, such as tower, building and power supply, will be utilized to save the initial investment cost. The proposed digital transmission network between Aimag centre and Sum centres in Uvurkhangai, Selenge and Darkhan-Uul Aimags are shown in Table 5-1.

Table 5-1 7GHz/P-P Digital Microwave Transmission Link Configuration

Region	Link	Distance (km) /Sections	Radio Capacity (Initial Capacity)	Repeater Station	Number of Links	Required Antenna Diameter (cm)
Uvurkhangai	MW108 – MW109	52.5	16E1	–	1	300
	MW109 – MW110	34	16E1	–	2	180
	MW110 – MW111	34	16E1	–	3	180
	MW111 – MW112	51	16E1	–	4	300
	MW112 – MW113	43	16E1	–	5	240
	MW108 – Kharkhorin	30	4E1	–	6	120
	MW109 – Esunziil	60/2	4E1(2E1)	#1	7	120
					8	120
	Esunziil – Burd	32/2	4E1(1E1)	#2	9	60
					10	60
	MW109 – Bat-Ulzii	64/2	4E1(2E1)	#3	11	120
					12	120
	MW110 – ZB Ulaan	28	4E1(1E1)	–	13	120
	MW110 – Uyanga	30/2	4E1(2E1)	#4	14	60
					15	60
	MW111 – Arvailheer	13	16E1	–	16	60
	MW111 – Sant	94/3	4E1(2E1)	#5 #6	17	120
					18	120
					19	120
	Sant – Bayangol	46/2	4E1(2E1)	#7	20	120
					21	120
	MW113 – Nariinteel	30	4E1(2E1)	–	22	120
Selenge and Darkhan-Uul	MW304 – MW305	57.8	16E1	–	23	300
	MW305 – MW306	43.1	16E1	–	24	240
	MW306 – MW307	48.3	16E1	–	25	300
	MW307 – MW308	31.6	16E1	–	26	180
	MRC Orkhontuul – Orkhontuul	18/2	4E1(2E1)	#8	27	60
					28	60
	MW305 – Sant	43.8/2	4E1(2E1)	#9	29	120
					30	120
	MW306 – Darkhan	4.5	16E1	–	31	60
	MW306 – Sharin-Gol	40.3/3	4E1	#10 #11	32	60
					33	60
					34	60
	MW307 – Tsagaanuur	44.8/2	4E1(2E1)	#12	35	120
					36	120
	M307 – Shaamar	21.8	4E1(2E1)	–	37	120
	MW307 – Eruu	72.3/3	4E1(2E1)	#13 #14	38	120
					39	120
					40	120
	M308 – Sukhbaatar	25	16E1	–	41	120
	M308 – Zuunburen	26.1/2	4E1(2E1)	#15	42	60
					43	60
	M308 – Artambulag	23	4E1(2E1)	–	44	120

The Mongolian side shall prepare the site of microwave repeater station, the access roads, and the civil work. The technical specifications for the construction of antenna supports and foundations are requested from the Contractor.

As a result of the feasibility study the required number of digital microwave transmission link to be established in the target Aimags is 44 and the number of unmanned microwave repeater station newly constructed is 15.

5.3.2 Optical Fibre Transmission Facilities

In order to implement of digitalisation of the transmission system, the optical fibre cable transmission system of MRC is utilized for Selenge/Darkhan-Uul Aimags. For the project implementation, a part of the exiting STM-1 capacity from MRC is leased.

The network configuration plans of the proposed optical fibre cable transmission system for Selenge/Darkhan-Uul and Uvurkhangai Aimags are shown in Figures 5-1 and 5-2, respectively.

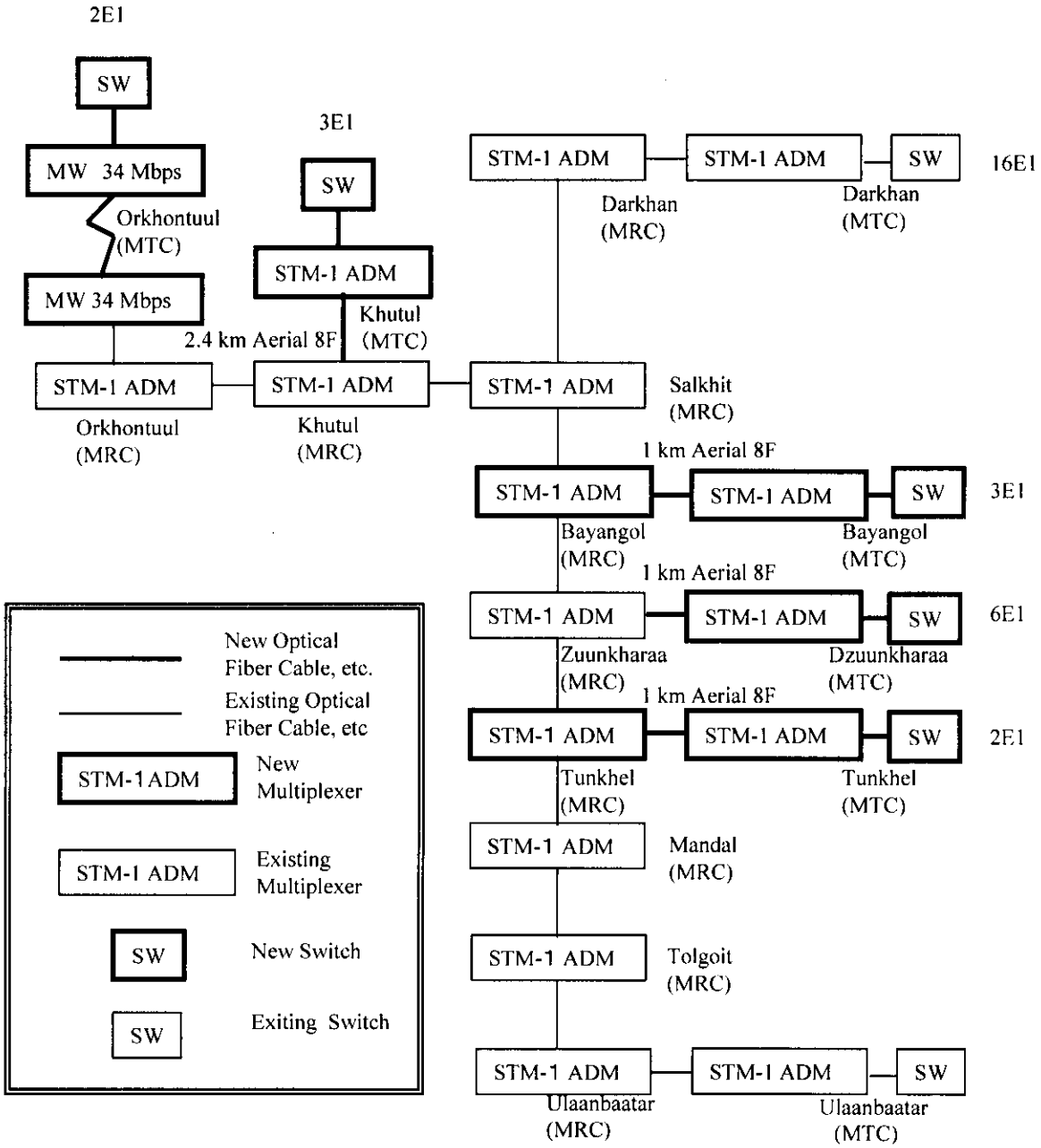

Figure 5-1 FOTS Plan for Selenge/ Darkhan-Uul Aimags

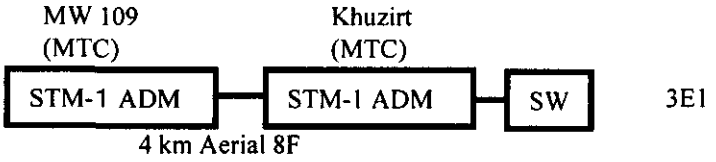

Figure 5-2 FOTS Plan for Uvurkhangai Aimag

Demarcation points of the maintenance and operation in Selenge/Darkhan-Uul Aimags are shown in Figure 5-3.

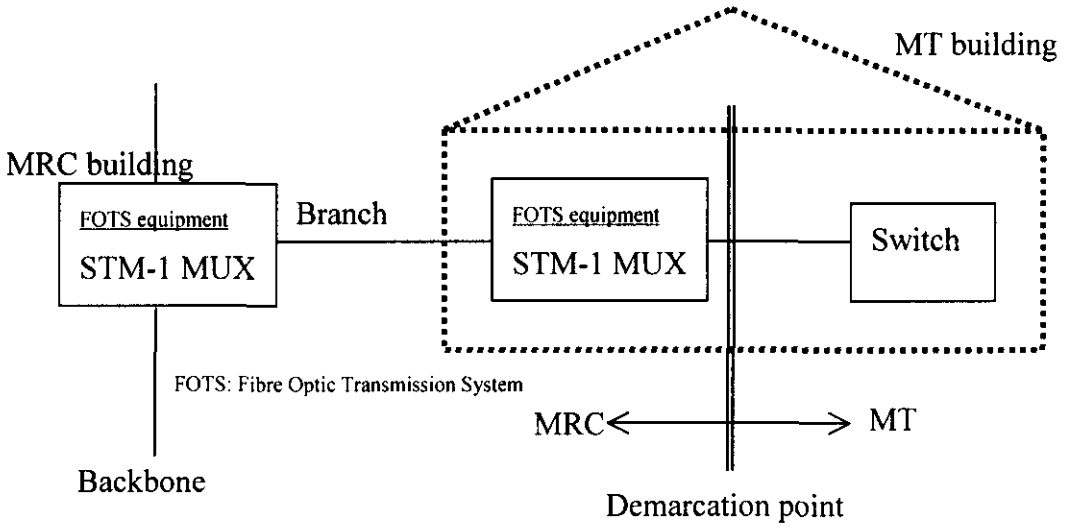

Figure 5-3 Demarcation Point between MRC and MT

5.4 Access Network Facilities

For the wired access network, the provision period is considered for 15 years after ready for service. The wired access network facilities have been planned by the metallic cable system, which total cable capacity is about 6,500 pairs for 18 Sum centres of three (3) target Aimags.

The target sums improved by the Point to Multipoint wireless local loop facilities are Kharkhorin, Zuunkharaa, Khutul and Sharin Gol Sum centres. In those sums the demand up to the year of 2020 will be expected to exceed 800. The provision of the WLL system shall be made to make a fulfilment of the future demand put it overlay in those rural areas and the number of newly installed Wireless Cell Stations (WCS) is 20 and the number of newly

installed Wireless Subscriber Unit (WSU) is 2000. The traffic interface at the Local Switch of the sum centre telecom office is V.5.2 and the capacity is 2 Mbps x 2.

5.5 Power Supply Facilities

Figure 5-4 shows a typical block diagram for the power receiving equipment when power is supplied through near-by power distribution lines from a grid or a diesel engine generating station to the telecom office at the Sum.

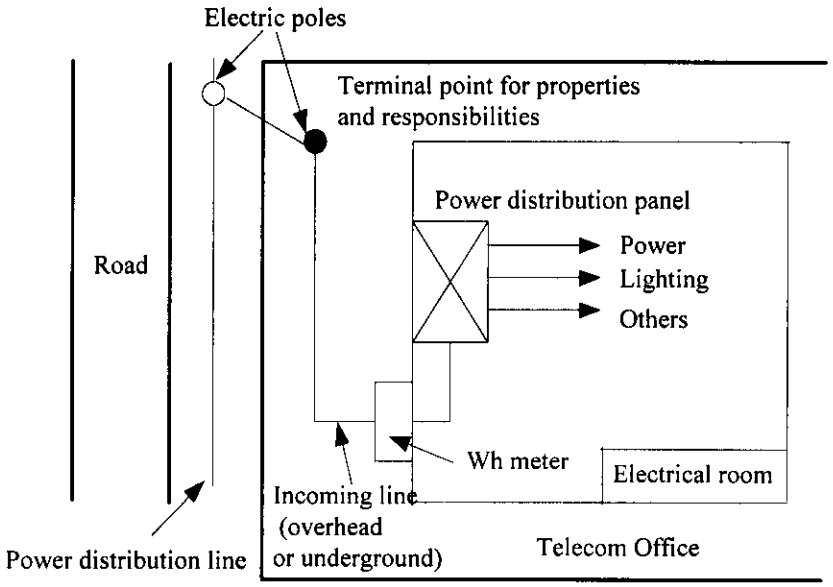

Figure 5-4 Typical Power Receiving Plan

Power supply to the new telecom systems will be made by a combination of grid for normal power supply and stand-by power supply equipment in case of power failure at the grid, as shown in Figure 5-5. Power supply from grid is basically reliable and stable, but provision of the stand-by power supply system is needed for important switching and transmission facilities.

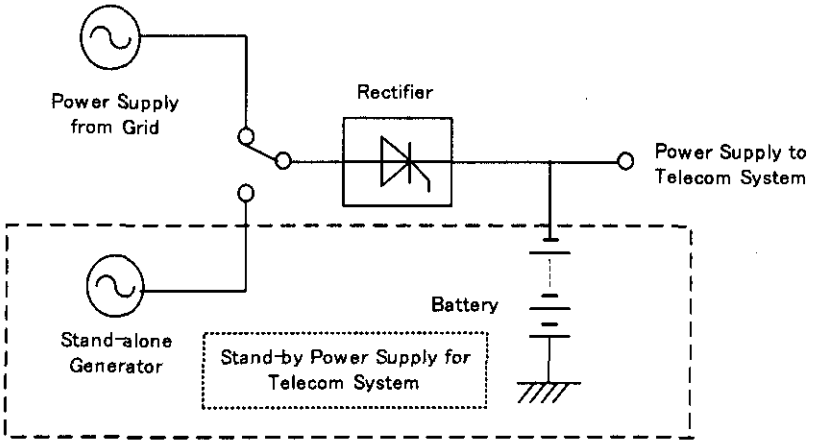

Figure 5-5 Stand-by Power Supply Plan

5.6 IT System

In Mongolia, there are 10-years (or 8-years) school and small size (number of beds: 10-20) hospital at least in all Sum centres. Meanwhile MT office in Sum centre provides public telephone service using telephone booths (2-4 booths per office) and facsimile message transfer service. Therefore the installation of an integrated communications centre so-called Tele-centre or Multipurpose Community Tele-centre (MCT) is not cost effective in case of Sum area. Just upgrading telephone booth function with automatic telephone dialling system and providing access means to Internet, are required. The upgraded telephone booth is called as "IT-spot" in this report. Telecommunications system in schools and hospitals shall be improved by establishing high quality telephone lines that enables access to Internet. The image of IT-spot is the "MT version's Internet café + Business centre". Table 5-2 shows required terminal equipment to be installed at IT-spot in Sum areas.

Table 5-2 Required Terminal Equipment at IT-spot in Sum Area

Terminal Equipment	More than 10000 pop.	Less than 10000 pop.
Server PC with UPS	1	1
PC with UPS	6	3
Modem & LAN with cables	1	1
Printer (Middle size)	1	1
Printer (Small size & as a spare)	1	1
Facsimile machine	1	1
Telephone set	4	2
Software (Windows & games)	1	1

6. PROJECT IMPLEMENTATION PLAN

6.1 Implementation Schedule

The implementation schedule for the rehabilitation and expansion project for the rural telecommunications system in Mongolia are studied in two (2) cases due to the different schemes, as the ordinary project to be financed from the foreign donors and the grant aid project of the Japanese Government. The implementation plan for the rehabilitation and expansion project for the rural telecommunications system in Mongolia shall be formulated in consideration of:

(a) To execute the project under the "Turn-key" basis;
(b) To hire a consultant to undertake the follow-up works;
(c) To complete the project within the period agreed with the donor;
(d) To count the months for the outdoor works as about six (6) months (from May to October), due to the harsh weather condition in Mongolia;
(e) To commence the project earlier as possible to make use of this feasibility study, because the circumstances may be changed to review this feasibility study, if project commencement is delayed;
(f) To advance the preparation work for the local work portion left to PTA, depending on the conditions required by the donor, such as the access road construction, building construction and modification, etc.; and
(g) Keeping with the rules and procedures of Mongolian Government and such of the overseas donors providing the finance.

6.2 Implementation Schedule of Grant Aid Project from Japanese Government

The procedures to implement the grant aid project to be financed from the Japanese Government are as follows:

(a) Application to the Japanese Government;
(b) Selection of a consultant to implement the basic design work by JICA;
(c) Basic design by the consultant (basic design and budget cost estimate);
(d) Exchange Note;
(e) Consulting services agreement with PTA;
(f) Detailed design and selection of the contractor (detailed design, preparation of the tender documents, selection of the contractor, signing of the supply and installation contract); and

(g) Construction and installation.

JICA is the responsible agency to manage and control all the implementation of the grant aid project of the Government of Japan. The project preparation period from the selection of a consultant for the basic design by JICA to the Exchange Note is about one year. The period from the Exchange Note to the completion of the project is about two years. Accordingly the total period of about three years is required. It can be considered that the project could not be completed within the target period due to the harsh weather conditions in Mongolia, depending on the dates of the Exchange Note.

Table 6-1 Overall Implementation Schedule for Rehabilitation and Expansion Project for Rural Telecommunication System in Mongolia (Quick Case)

Stage	Ref. No.	Major Items	Year	2002				2003				2004				2005				2006			
			Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
I	**JICA Master Plan Study Stage**																						
	1	Master Plan Study																					
	2	Feasibility Study																					
II	**Project Preparation Stage**																						
II-1	Application for Donor																						
II-2	Selection of Consultant (by JICA)																						
	1	Invitation to Tender to Consultant																					
	2	Selection of Consultant																					
	3	Signature of Consulting Services Agreement																					
II-3	Basic Design (by Finance of JICA)																						
	1	Basic Design																					
	2	Budget Estimate																					
II-4	Exchange of Notes																						
II-5	Consulting Services Agreement with PTA																						
II-6	Detailed Design and Selection of Contractor																						
	1	Detailed Design																					
	2	Documents for Invitation to Tender																					
	3	Selection of Contractor																					
	4	Signature of Project Contract																					
III	**Construction and Installation Stage**																						
	1	Detailed Design by Contractor																					
	2	Manufacturing of Goods and Materials																					
	3	Factory Inspection of Goods and Materials																					
	4	Delivery and Shipment																					
	5	Construction and Installation																					
	6	Acceptance Test																					
	7	Completion of Project																					

6.3 Implementation Schedule of Ordinary Project

The procedures to implement the ordinary project to be financed from the foreign donors are as follows:

(a) Application to the donor;
(b) Exchange Note;
(c) Selection of consultant;
(d) Preparation of tender documents (Basic design, preparation of tender documents);
(e) Selection of supply and installation contractor (Tender, tender evaluation, contract negotiation, contract signing); and
(f) Construction and installation.

The project preparation period from the Exchange Note to the signing of the supply and installation contract is about one year. The installation and construction period from the effective date of the supply and installation contract to the completion of the project is about two years. Accordingly the total period of about three years is required.

6.4 Management on Project Implementation

This feasibility study is conducted based on the conditions as of 2002. It is desirable that PTA makes effort to start the project in 2003, before the information in this feasibility study become out of date. In addition to that, it is very much desirable to start the project as soon as possible to fulfil the demand in coming years.

Projects can be advanced smoothly by PTA's effort in cooperation with MT. PTA and MT are required to provide the finance, personnel and facilities for a smooth advance of the project proposed based on this feasibility study. Depending on the donor's condition, the local work portion such as the access road construction, building construction and modification, etc., will be started earlier stage to implement smoothly the main work to be carried out by the foreign contractor.

7. OPERATION AND MAINTENANCE PLAN

Through this project, fully automatic direct dialling connection in Sums, effective operation and maintenance by digitalisation, introduction of IT and improvement of service quality will be expected and the following operation and maintenance plan is recommended.

7.1 Basic Policy

The basic policy for the operation and maintenance for the new network planned under this feasibility study is as follows:

(a) Operation and maintenance works in Sums are centralized at Aimag centre and operation and maintenance personnel in Sum centres are minimized in accordance with work volume;
(b) Operation and maintenance personnel at Sums and Aimag centre are trained for each required operation and maintenance level;
(c) Spare parts for operation and maintenance are initially procured and stocked for 3 to 5 years under the project;
(d) Necessary tools and measurement equipment are secured for the work site. Especially, special tools and measurement equipment for the new system planned in the project should be procured under the project; and
(e) Additional one maintenance vehicle as minimum is deployed in OMC of each Aimag centre for the centralized maintenance for Sum centre's facilities.

7.2 Main Operation and Maintenance Works

The operation and maintenance works in Sum centres are limited in easy daily works at Sums as follows:

(a) Service order, fault clearance by instructions from Aimag centre (alarm release, package change, etc.) in switching system, transmission system (radio, optical fibre and WLL), IT system and power system;
(b) Service order, fault clearance of subscriber lines under DP in the outside plant system; and
(c) Sales office work, operation of public telephone, collection of telephone charge and miscellaneous job in business office.

(2) The operation and maintenance works in Aimag centre are centralized supervision, instructions to the operation and maintenance works in Sum centres and heavy works such as installation, periodical preventive maintenance, etc.

(a) Supervision of alarms, fault clearance instructions to Sums, circuit expansion, maintenance and repair of main facility on switching system, transmission system, IT system and power system;
(b) Service order, fault clearance of junction cables and main access cable, maintenance and repair of main facility in outside plant;
(c) Customer service office covers the service order work with customer database, while the staff of Sum centre will handle the reception of application in Sum centre;
(d) Complaint desk handles the complaint reception, circuit test, management of fault repair work and also preparation of fault statistical data; and
(e) Aimag centre should compute the billing up to Sum subscriber based on the customer database and manage the billing and collection process of Sum centres.

7.3 Maintenance Material

The following maintenance materials are necessary to procure in the project in addition to the existing equipment and materials:

Table 7-1 Maintenance Material List

Technical Field	Main facility	Maintenance Material and Spare parts	Quantity	Project Cost (Foreign Portion) (KUS$)	Maintenance Period	Maintenance Material Cost included in Project Cost (KUS$)
Switch	Exchange	Spare parts	0.2% of Foreign	3,096	5	30.96
Transmission	Radio	Spare parts	0.2% of Foreign	5,000	5	50.00
	Optical Fibre	Spare parts and Optical Fibre cable	0.5% of Foreign Portion	690	5	18.00
	WLL	Spare parts	0.2% of Foreign Portion	2,254	5	22.54
Access Outside Plant	Cable	Cable, Closure, Jointing connector, 10 pair Pole DP	0.2% of Foreign Portion	1,405	3	8.43
Power Plant	Diesel Generators	Spare parts	0.2% of Foreign Portion	241	15	7.23

7.4 Maintenance Equipment and Tools

The following maintenance equipment and tools are necessary to procure in the project according to the introduction of new systems.

Table 7-2 Maintenance Equipment List

Technical Field	Main facility	Equipment and Tools	Cost (KUS$)
Transmission	Radio	Test Equipment	191
	Optical Fibre	Optical Fibre Splicing Machine, OTDR	145
	WLL	Test Equipment	77

7.5 Target Fault Rate and Clearance Rates

The following target figures for the faults ratios, clearance rates and call completion rates are recommended.

Table 7-3 Target Fault Ratio and Fault Clearance Rate

	2002	2006	2010
Faults /100 sub./Year	44	44	23
Faults clearance rate (24 hours)	50%	50%	95%

Table 7-4 Target Figure of Call completion rate

	2002	2006	2010
Call Completion Rate (Successful connection)	55%	55%	70%

8. HUMAN RESOURCE DEVELOPMENT AND TRAINING PLAN

8.1 Staff Plan

The operation and maintenance works in Sums are basically centralized to Aimag centre, except for subscriber lines. The present maintenance staff in Sums are required to do daily operation and maintenance of newly introduced facilities such as digital switch, optical fibre cable transmission system, digital microwave transmission system, WLL system and subscriber lines under instruction and support of Aimag centre staff. The number of staff in a Sum will be the same as the present.

The present operators are necessary for manual switching to connect calls at the public telephone booth, even subscribers enable to connect automatically calls without operators, and also they have to operate and instruct newly introduced internet/e-mail facility for the public. Therefore the current operators will remain as it is.

As a result of the above, basically the number of staff in Sums will not be decreased so far, but at the stage when automatic subscribers increase considerably and the public is accustomed to use Internet and e-mail, the number of operators will be decreased.

With this Project, the major Sums in Aimag area are digitalized and operation and maintenance of these Sums is centralized to Aimag centre. However the volume of works regarding Sums is not heavy load and absorbed in the current work volume, and the number of staff at Aimag centre will not need to be increased.

8.2 Training Plan

The current facilities are mainly analogue exchanges, open wire transmission system, obsolete subscriber cables. Repair men in Sums do not have enough skill level for newly introduced digital exchange, transmission system, power system, etc. Meanwhile the operation and maintenance works in Sums are basically centralized to Aimag centre taking an effective operation and maintenance into consideration. Therefore the skill level for repair men in Sums is only required to do daily operation and maintenance under instruction and support by Aimag centre staff.

The staff of Aimag centre, who carry out centralized operation and maintenance, shall give proper instruction and support to repair men of Sums and are required for the skill level of centralized operation and maintenance. They will be trained for maintenance skills in

digital exchange, digital transmission and microwave systems, WLL system, optical fibre cable and power system.

Operators in Sums are required and trained for basic literacy, computer skills for operation of Internet and e-mail services. IT engineers at Aimag centre are also required and trained for the advanced IT skill level in order to support Sum operators.

For the purpose of economic and effective training for this Project, centralized operation and maintenance training will be carried out in manufacturer's country, and daily operation and maintenance training will be carried out in Mongolia by instructors of the MT Training Centre, utilizing newly introduced facilities on sites. The summary of the plan and the required number of trainees by course are shown in Table 8-1.

Table 8-1 Summary of Training Plan

No.	Course name	Required Level	Curriculum	Duration	Place	Training facility	Instructor	Trainees	
1	Basic O/M	Daily O/M	Digital switch, Digital Transmission, Power	2W	Mongolia	Newly introduced switch/transmission/power facilities in a site	Instructor of Training Center(after training)	Sum O/M staff	1-3/Sum
2	Ddigital switch	Centralized O/M	Digital switch	6W	Manufacturer's Country	Manufacturer's facility	Manufacturer's instructor	Aimag O/M staff & instructor of the training center	1-2/Aimag & 2/training center by each course
3	Digital transmission	Centralized O/M	Digital optical fiber/micro wave transmission, WLL system	6W					
4	Power	Centralized O/M	Power(including solar Batt.)	1W					
5	Optical fiber cable	Centralized O/M	Optical fiber cable	3W					
6	Advanced IT	Instruction of IT	Advanced PC & Internet/E-Mail operation	4W	Training Center	Training Center	Instructor of Training Center	Aimag O/M staff	1-2/Aimag
7	IT Operation	IT Operation	PC & Internet/E-Mail operation	2W				Sum operator	1-2/Sum

8.3 Organisation and Management

At the present time, there is no organisation changes in Selenge and Darkhan-Uul. However, two Aimags will be merged in near future, and more effective utilization of human

resources shall be considered. In order to improve organisation and management after the project implementation, the followings are recommended:

(a) Improvement of Service Quality

The current service quality such as voice quality, fault clearance, etc., is very poor and customers are not satisfied. Therefore improvement of the quality oriented in customer service is needed in order to expand the services.

(b) Marketing Activity

At present exchange and cable facilities are short capacity and new connections and services are not available. However after the project it is possible to expand the capacities depending on the demand. Therefore it is very important to strengthen marketing activities for revenue increase.

9. PROJECT COST ESTIMATE

9.1 Objective Project

The feasibility study for the rehabilitation and expansion of the rural telecommunications systems was implemented and it is required to give priority over its project implementation for ten (10) Sum centres in Uvurkhangai Aimag and twelve (12) Sum centres in Selenge/Darkhan-Uul Aimags, which scope of the work consist of access network, switching system and transmission system from Aimag centres to Sum centres, including IT-spots for the spread of the Internet technology.

9.2 Precondition for Cost Estimate

The project cost estimate includes the cost for the equipment and materials, installation, measuring equipment, spare parts, training, civil works, access road construction, building construction and modification, etc.

The project cost consists of the foreign currency portion and the local currency portion. The local currency portion in this cost estimate includes the cost for the work to be undertaken by PTA, such as the access road construction, building construction and modification, etc. VAT, import duties and taxes are not included in the cost estimate, in consideration of the donors' aid.

The major works and the total project cost estimate are shown in Tables 9-1 and 9-2, respectively.

Table 9-1 Main Work Volumes of Feasibility Study Projects

Items		Facilities	Quantities
Switching System		Number of Exchanges	22
		Line Unit	6,580
Transmission System	Optical Fibre System	Cable Length (km)	9.4
		Multiplessor	8
	Mincrowave System	Number of Links	44
Access System	Wired System	Number of Exchanges	18
		Cable Pairs	6,500
	Wireless System	Number of Exchanges	4
		Number of Cell Stations	20
IT Services	IT Spot	Number of Spots	22

Table 9-2 Total Cost Estimate for Feasibility Study Projects

(US$ 1,000)

Items		Total Cost	Foreign Currency Portion	Local Currency Portion
Switchin System		2,062	2,057	5
Transmission System	Optical Fibre System	609	521	88
	Microwave System	4,927	4,285	642
Access System	Wiered System	1,764	1,273	491
	Wireless System	2,743	2,652	91
Power Plant		243	216	27
IT Services		248	0	248
Contingency		630	550	80
Consultancy Fee		1,008	1,008	0
Total		14,234	12,562	1,672

10. FINANCIAL EVALUATION

10.1 Preconditions for Financial Evaluation

For the financial evaluation, an operating entity for the telecommunications services towards the selected Sums of the project area is assumed in a similar manner with the Master Plan. The entity would use the backbone network and a proportionate cost to the outstanding numbers of its rural subscribers would be charged to the entity, while the revenues derived from the use of the backbone network towards its territory would be distributed to the entity in accordance with the same proportionate ratio. More emphasis is put on whether the project can achieve its financial self-sufficiency within a reasonably early time of operations. The key assumptions are as follows:

(a) The project evaluation period is 2005 to 2020 (16 years), consisting of one year of "construction" and 15 years of "operations",

(b) All revenues and costs are expressed in the fixed price level at the end of 2001, and

(c) The exchange rate is fixed at Tugrug 1,102 for one U.S. Dollar (at the end of 2001).

The subscriber development plan is set as shown in Table 10-1.

Table 10-1 Subscriber Development Plan

(Lines)

Year	F/S Area		Composition Ratio	National
	New	Aggregate		
2006	2,667	6,496	3.31%	196,300
2007	102	6,598	3.18%	207,350
2008	96	6,694	3.06%	218,400
2009	182	6,876	3.01%	228,755
2010	184	7,060	2.95%	239,110
2011	178	7,238	2.90%	249,465
2012	177	7,415	2.85%	259,820
2013	178	7,593	2.81%	270,175
2014	402	7,995	2.81%	284,505
2015	403	8,398	2.81%	298,835
2016	402	8,800	2.81%	313,165
2017	402	9,202	2.81%	327,495
2018	403	9,605	2.81%	341,825
2019	402	10,007	2.81%	356,155
2020	403	10,410	2.81%	370,489

(1) The revenue plan is as follows:

In annual average	(US$ '000)
Revenues	1,430
Revenues/line	0.179

(2) The operation and maintenance cost is as follows:

In annual average	(US$ '000)
Operation and maintenance cost (excluding depreciation expense)	307
Depreciation expense	949
Total operation and maintenance cost	1,256

10.2 Financial Evaluation of Project

The summary of income and cash flow projection is shown in Table 10-2.

Table 10-2 Summary of Income and Cash Flow Projection

	Base Case
Period of Evaluation	16years (2005-2020)
Capital Investment $ '000	**14,235** (2005)
Average Revenue/Yr $'000	1,430
Annual Revenue/ Subscriber $	179
Positive Profit in	7th year of operations
Positive Cash Flow in	Any year
Positive Accumulated CF in	14th year of operations
FIRROI	**2.197%**
Required Subsidies Total $'000 Average/year $'000	 600 100(for 6 years)

Financial Internal Rate of Return on Investment (FIRROI) is 2.197%. A dramatic improvement both in cash flow (being positive every year throughout the evaluation period as against in the 9th year of the Master Plan) and profitability (to turn out positive in the 7th year of operations as against in 16th year of the Master Plan) is brought about in contrast with the Master Plan. These results clearly prove the viability and financial soundness of the Feasibility Study project over the Master Plan in substance, although the value of FIRROI doesn't change much from that of the Master Plan.

The case needs to be supported by the subsidies in an average annual amount of US$ 100,000 for 6 years, achieving financial self-sufficiency in the 10th year of operations (as against in the 21st year of the M/P). Since the total amount of operating losses is small, a discounted front-end lump sum payment can be adopted to minimise the amount of the subsidies, in the case the USOF is utilised as the source fund of the subsidies.

As explained on the financial analysis of the Master Plan, the tariffs adjustment is dealt with in the 10% increase in revenues of the sensitivity analysis.

The sensitivity as to change in the revenue is as follow:

(a) In case the revenues increase by 10% as a result of tariffs adjustments (such as upward adjustment of local call charges and reduction in international call charges as well as interconnection charges) or other causes, FIRROI would become 3.249%, achieving financial self-sufficiency in the 4th year (2009). The amount of required subsidy would be decreased to US$ 100,000 to cover the loss in the first year of operations. Impact of increase in revenues is substantial.

(b) On the other hand, in the case the revenues decrease by 10%, FIRROI would shrink to 1.281%, required annual subsidies would become US$ 200,000 for 7 years and financial self-sufficiency is achieved only in the beginning of the 15th year of operations.

The sensitivity as to change in the operation and maintenance cost is as follows:

- As the weight of O/M costs is not significant, change in the operation and maintenance costs does not cause much impact to FIRROI.

The sensitivity as to decrease in capital investment is as follows:

- Provided that the capital investment is decreased by 15% as a result of competitive bidding or other causes, FIRROI would become 3.665%. This case shows positive profit in all years of operations and subsidy is unnecessary. Impact of decrease in capital investment is substantial.

The value of Economic Internal Rate of Return (EIRR) would be higher than 7.66% of the Master Plan. As 12 Sums of Selenge/Darkhan-Uul Aimag area that share bigger weight

in the Project area have highly concentrated population of 77.5% in Sum centres in contrast with the national average of 33% and the industries there are well developed, high economic contribution is estimated.

10.3 Conclusion of Financial Evaluation

The conclusion of the financial evaluation is as follows:

(a) To assure the possibility of financial self-sufficiency of the project, both of the government and non-government workable supporting systems for management and financing should be effectively established. The project needs an incubation period of the first 5-6 years of operations.

(b) Sensitivity analysis suggests the importance of increased revenues and of reduced capital investment. The responsible persons for the formation and implementation of the project should keep these in their minds and accumulate efforts for realisation.

(c) To aim at the increased telecommunications revenues in the long run, there should be realised a comprehensive development of agriculture and livestock farming industry, small and medium scale industries and mining, tourism and services industries in the project area.

(d) Subsidies such as the Universal Service Obligations Fund, etc. are indispensable to give a fair competition opportunity to telecom operators in the project area.

(e) The amount of the rental for the use of backbone network should not be higher than the proper annual depreciation expense of backbone network.

11. RECOMMENDATIONS

The following recommendation as a result of the feasibility study are issued:

(1) Digital Switching System
  (a) Signalling System;
  (b) Synchronisation Plan;
  (c) Replacement of Existing PBX Systems with Digital Switch;
  (d) Reuse of Removed Switching Equipment in Other Sums; and
  (e) Expansion of Aimag Centre Switch.

(2) Digital Transmission System
  (a) Frequency Plan; and
  (b) Joint Use of Existing Backbone Transmission Facilities and Sites.

(3) Access Network System
  (a) Rehabilitation of Existing Wired Access Facilities; and
  (b) Installation of Wireless Local Loop (WLL) Facilities.

(4) Power Supply Facilities
  (a) Reliable Main Power Supply; and
  (b) Generator Room.

(5) IT Facilities
  (a) Introduction of IP-based Services; and
  (b) Installation of IT-spots.

(6) Land and Building
  (a) Access Roads to the Sites

(7) Project Implementation

(8) Operation and Maintenance Plan
  (a) Centralized Operation and Maintenance; and
  (b) Spare Parts, Tools and Measurement Equipment.

(9) Human Resource Development and Training Plan
  (a) Promoting the ICT engineers in Rural Areas; and
  (b) Improvement of Service Quality.

(10) Financial Aspect

12 COMPREHENSIVE ASSESSMENT OF THE PROJECT

This feasibility study for the priority project has been studied and elaborated in consideration of all aspects of social, economic, technical, financial, management and organisational and environmental protection factors. In order to assure and realise the Priority Projects, the respective aspects are analysed and assessed comprehensively in respect of their appropriateness.

(a) Social Appropriateness
  (i) Elimination of the telephone density gap between Ulaanbaatar and the Project area; and
  (ii) Elimination of digital divide.

(b) Technical Appropriateness
  (i) Introduction of new technologies and services; and
  (ii) Modernization and Digitalisation of network.

(c) Economic Appropriateness
  (i) Economic contribution

(d) Financial Appropriateness
  (i) FIRR;
  (ii) Subsidies for operations; and
  (iii) Financing.

(e) Organisational and Management appropriateness
  (i) Efficiency of O/M; and
  (ii) Effective organisation and staff allocation.

(f) Appropriateness for environment protection

Applying the above method in the total achievement of this Project, it has been confirmed that some high degree fulfilment of the respective targets can be realised as to the introduction of new technologies and services; and the pending development issues in the rural telecommunications in eliminating telephone density gap and digital divide between urban and rural areas, etc.

However, every effort of rural telecommunications development in the Project area will have to face the country's geographic and demographic features that small Sums or settlements are scattered in its vast territory. In the implementation of the Project, low profitability would hinder the rural operators' building-up of financial soundness, while their services would require a massive amount of capital investment. This problem would result in limiting the sources to finance such investment as well as the subsidies to cover the deficit arising from the initial stages of operations. The above operational and financial issues that are still critical for the Project are to be overcome.

In addition to the above, there should be noted that substantial benefits that cannot be quantified could be realised in terms of contribution to the economy and social and human development needs, such as medical and health care services, education, poverty reduction, prevention from natural disasters and other administrative services.