Table 5.3.2.4-2 FOTS Cost Estimate for Uvurkhangai Aimag

[1,000 US$]

Item	Cost Estimate	Foreign Portion	Local Portion	Main Work
Multiplexer	165	149	17	2 Multiplexers
Optical Fiber Cable	29	14	14	4 km
Total	194	163	31	

Table 5.3.2.4-3 FOTS Cost Estimate for Selenge/ Dalkhan-Uul Aimags

[1,000 US$]

Item	Cost Estimate	Foreign Portion	Local Portion	Main Work
Multiplexer	376	338	38	6 Multiplexers
Optical Fiber Cable	39	19	19	5.4 km
Total	415	358	57	

5.4 Access Network Facilities

5.4.1 Wired Access Network

(1) Basic Policy for Planning and Design

a) Provision period

Provision period for wired access network in the plan is 15 years after ready for service.

Ready for service: 2006
Provision period: until 2020

b) Scope of work

Scope of the work of the project should be limited to rehabilitation and extension of the outside plant from MDF to the distribution point.

(2) Facility Plan and Bill of Quantity

a) Facility plan and bill of quantity of sample site

Facility plan of 6 Sum centres which the site survey were carried out is attached in Annex 4. The plan was made based on micro demand forecast result.

The bill of quantity of facility plan for sampled Sum centres is shown in Table 5.4.1-1.

Table 5.4.1-1 Bill of Quantity

Aimag	Sum Centre	Proposed cable sheath length			Proposed cable pair.km			Proposed	
		Aerial cable	Buried cable	Total	Aerial cable	Buried cable	Total	DP	Pole
		km	km	km	Pr.km	Pr.km	Pr.km	ea	ea
Uvurkhangai	Burd	2.9	0.0	2.9	68.5	0.0	68.5	11	66
	ZB Ulaan	4.0	0.0	4.0	183.8	0.0	183.8	20	83
	Khujirt	10.9	0.8	11.7	710.8	240.0	950.8	37	28
	Sub total	17.8	0.8	18.6	963.1	240.0	1203.1	68	177
Selenge/ Darkhan-Uul	Zuunburen	9.2	0.0	9.2	222.3	0.0	222.3	12	233
	Sant	5.7	0.0	5.7	242.9	0.0	242.9	22	136
	Shaamar	6.3	0.0	6.3	260.3	0.0	260.3	30	152
	Sub total	21.2	0.0	21.2	725.5	0.0	725.5	64	521
Total		39.0	0.8	39.8	1688.6	240.0	1928.6	132	698

b) Estimation of the project cost

i) Project cost in sampled Sum centre

The project cost in sampled Sum centres are calculated based on the BoQ (Table 5.4.1-1) the relation between number of lines of wired access network in Sum centre and cost/line is shown in Figure 5.4.1-1.

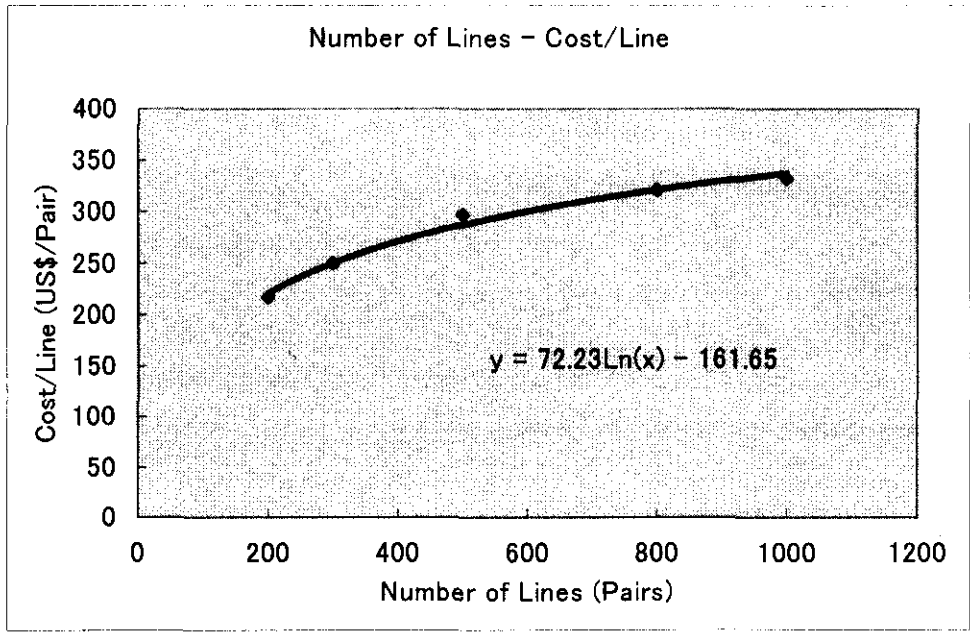


Figure 5.4.1-1 Relation between Number of Lines and Cost/Line

ii) Number of lines in F/S project Sum centres

The necessary network capacity (Number of lines terminated on MDF is shown in Table 5.4.1-2, based on the micro demand estimate result.

Table 5.4.1-2 Number of Lines in F/S Project Sum Centres

Aimag	Sum centre	Priority Rank	Number of Lines (Pairs)
Uvurkhangai	Burd	P-1	254
	Bat-Ulzii	P-1	249
	Bayangol	P-1	151
	Esunzuil	P-1	186
	ZB Ulaan	P-1	265
	Naliinteel	P-1	399
	Sant	P-1	229
	Uyanga	P-1	425
	Khujirt	P-1	628
	Sub total		2,786
Selenge	Altanbulag	P-1	251
	Eruu	P-1	574
	Zuunburen	P-1	152
	Sant	P-1	271
	Shaamar	P-1	434
	Tsagaannuur	P-1	499
	Orkhontuul	P-1	492
	Bayangol	P-1	581
	Tunkhel	P-2	460
	Sub total		3,714
Total			6,500

iii) Project cost in F/S project Sum centres

Project cost in each Sum centre can be get above number of lines (Table 5.4.1-2) multiplies unit cost came from Figure 5.4.1-1. Calculation result of project cost for target Sum centres is described in Chapter 9.

(3) Block Map and Existing Cables of Target Sum Centres

Block map of the town and existing wired network drawings of the target Sum centres are shown in Vol.V.

5.4.2 Wireless Access Network Facilities

5.4.2.1 General

With this project it is planned the existing metallic cables in Sum centres of Uvurkhangai, Darkhan-uul and Selenge Aimags mainly is replaced by new wired access network facilities with outside plant.

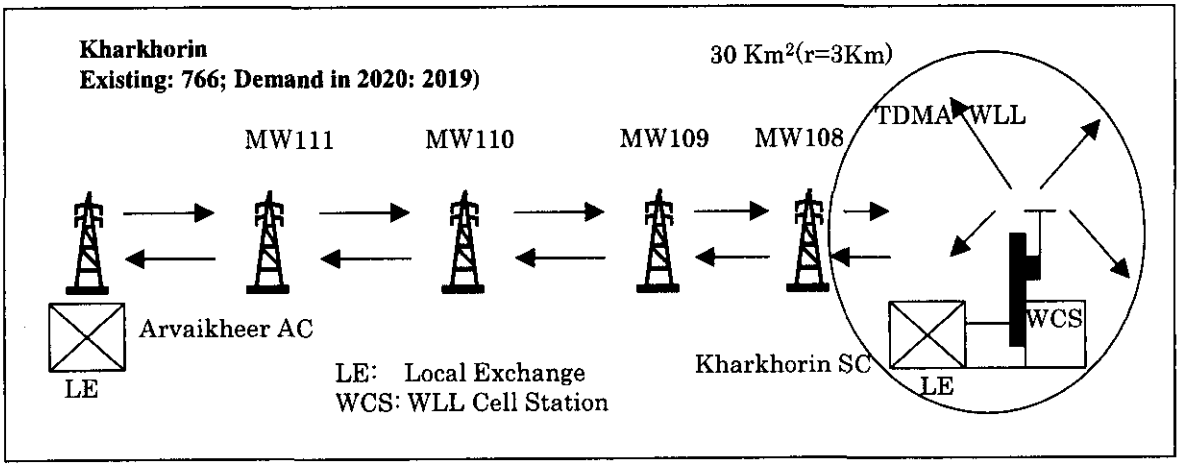
If the demand up to the year of 2020 in the priority Sum centres exceeds 800 subscribers it is proposed to install PMP/TDMA-based WLL access network facilities and the WLL network facilities are put it overlay on the existing metallic cable network to cover the additional traffic capacity in those sum centres.

Due to the topographical conditions as well as widely spread settlements in Mongolia, a Point to Multipoint (PMP) Wireless Local Loop (WLL) in combination with TDMA air interface will be an appropriate and cost effective solution for those rural areas.

5.4.2.2 WLL Systems in Uvurkhangai

(i) Network configuration

In order to provide end-to-end wireless solution and to put it overlay on the copper-line wired local loop it is required to install the TDMA-based WLL equipment at Kharkhorin Sum centre in Uvurkhangai. Kharkhorin Point to Multipoint (PMP)/TDMA-WLL network configuration is shown as follows:



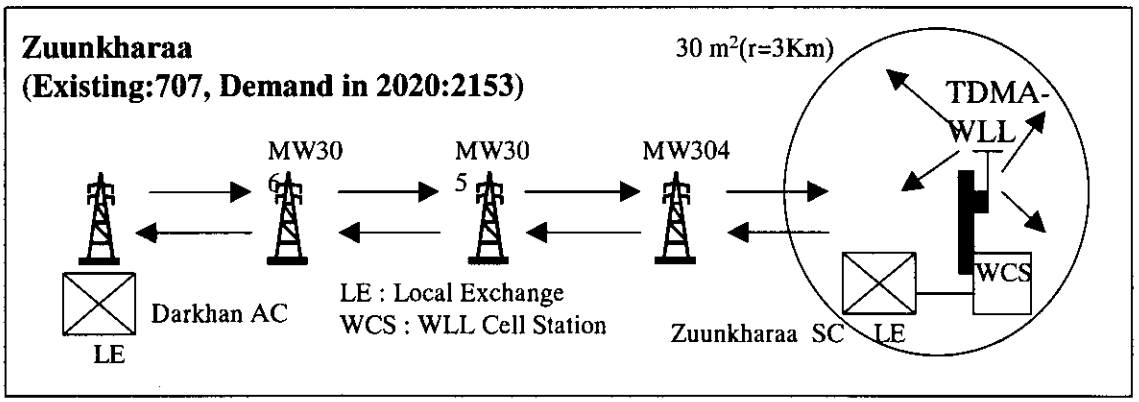
(ii) Main equipment list of TDMA-WLL system

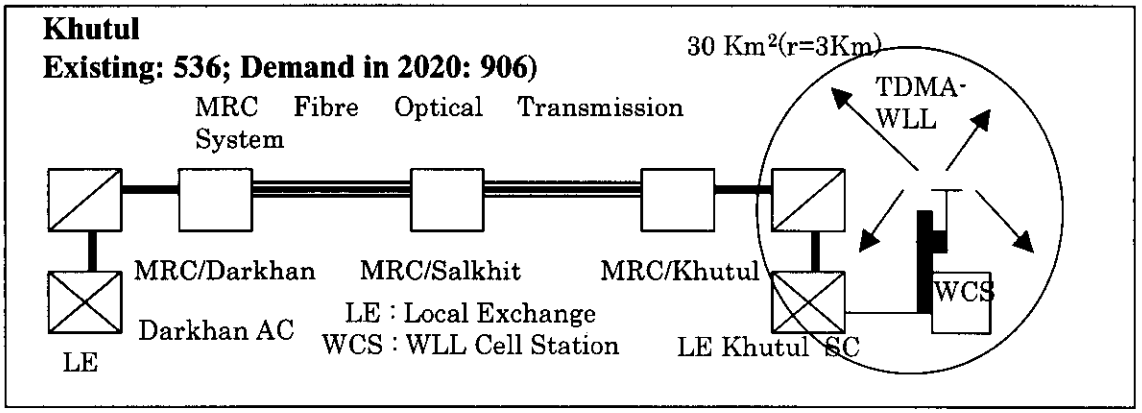
Kharkhorin		
Description	Quantity	Comment
WAC(Wireless Access Controller)	1 set	
NMS(Network Management System)	1 set	
WCS(Wireless Cell Station)	6 sets	
WSU (Wireless Subscriber Unit)	600 sets	
Test equipment and Spare equipment etc.	1 lot	Test equipment: 1set Spare equipment: 1 %

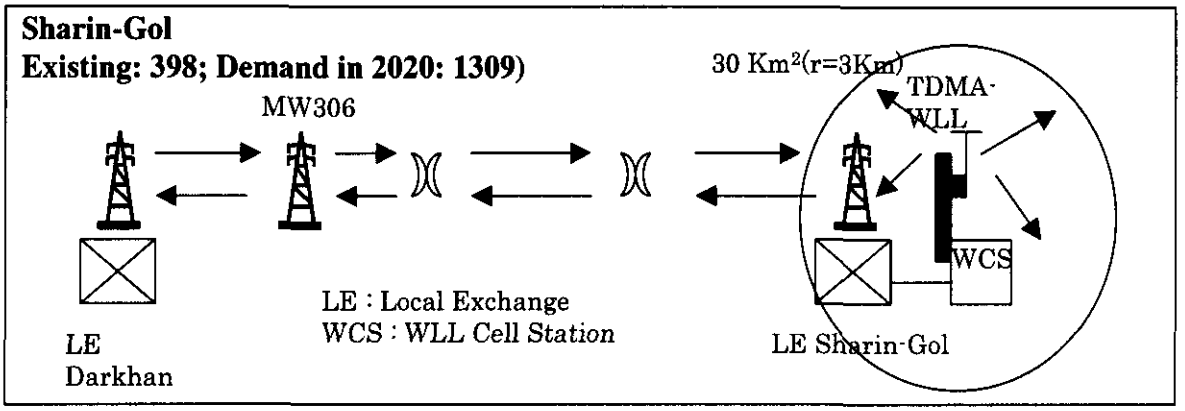
5.2.4.2.3 WLL Ssystem in Selenge and Darkhan-Uul

(i) Network configuration

In order to provide end-to-end wireless solution and to put it overlay on the copper-line wired local loop it is required to install the WLL equipment at Zuunkharaa and Khutul Sum centres in Selenge, at Sharin-Gol Sum centre in Darkhan-Uul. Zuunkharaa, Khutul and Sharin Gol Sum centres WLL network configuration are shown as follows:







(ii) Main Equipment List of TDMA-WLL system

Zuunkharaa		
Description	Quantity	Comment
WAC(Wireless Access Controller)	1 set	
NMS(Network Management System)	1 set	
WCS(Wireless Cell Station)	6 sets	
WSU (Wireless Subscriber Unit)	600 sets	
Test equipment and Spare equipment etc.	1 lot	Test equipment: 1set Spare equipment: 1 %
Khutul		
Description	Quantity	Comment
WAC(Wireless Access Controller)	1 set	
NMS(Network Management System)	1 set	
WCS(Wireless Cell Station)	3 sets	
WSU (Wireless Subscriber Unit)	300 sets	
Test equipment and Spare equipment etc.	1 lot	Test equipment: 1set Spare equipment: 1 %
Sharin-gol		
Description	Quantity	Comment
WAC(Wireless Access Controller)	1 set	
NMS(Network Management System)	1 set	
WCS(Wireless Cell Station)	5 sets	
WSU (Wireless Subscriber Unit)	500 sets	
Test equipment and Spare equipment etc.	1 lot	Test equipment: 1set Spare equipment: 1 %

5.4.2.4 Bill of Quantity of TDMA-WLL Access System

(1) General

All prices shall be quoted in US dollars for "Goods" and "Services" as per Bill of Quantity. For transparency of the project costs following price break down of the Project Price (Grand Total) is requested network wise.

The itemised price break down shall provide detailed information on goods and services in a list version for each site and at least for following items:

(2) Break down of the equipment costs

(2-1) Wireless Access Controller (WAC)
(2-2) Network management system (soft and personal computer) (NMS)
(2-3) Cell Station (CS)
(2-4) Wireless Subscriber Unit (WSU)
(2-5) Antenna support poles (30m height and 8m height)
(2-6) Test equipment
(2-7) Tools
(2-8) Spare parts

(3) Break down of the service costs

(3-1) Installation
(3-2) Training

(4) Explanation on Civil Work and Antenna Supports

The Mongolian side will provide the cite of cell stations, civil work and antenna supports for cell station and wireless subscriber units. Only the technical specifications for the construction of antenna supports and foundations are requested from the Contractor.

5.4.2.5 Project Cost for PMP/TDMA -WLL Access Network System for Uvurkhangai

As a result of the feasibility it is estimated for project cost for Uvurkhangai as shown in the following table:

5.4.2.6 Project Cost for PMP/TDMA-WLL System for Selenge and Darkhan-Uul

Detailed bill of quantity and cost estimation of PMP/TDMA -WLL is shown in Annex 3 Table 5.4.2.6-1. As a result of the feasibility study it is estimated for the project cost for Selenge and Darkhan-Uul as shown in the Table 5.4.2.6-2:

Table 5.4.2-6-1 PMP/TDMA-WLL Project Cost (Uvurkhangai)

Foreign Currency

No	Description		Total Price (US$1,000)
1	WAC		41
2	WCS		49
3	NMS		14
4	WSU		178
5	DC Power Supply		6
6	Installation Materials		9
7	Steel Pole for CS/SU		324
	Sub-total		620
8	Tools and Test Equipment	0.05	20
9	Spare Parts	0.002	1
10	CIF	0.1	40
11	Installation	0.1	40
12	Training		14
	Sub-total		114
Total			734

Local Currency

No	Description	Total Price (x USD 1000)
1	Civil Work and Installation and Commissioni	20
2	Access Road	0
3	Local Transportation	5
Total		**24**

Table 5.4.2-6-2 PMP/TDMA-WLL Project Cost (Selenge and Darkhan-Uul)

Foreign Currency

No	Description		Total Price (x USD 1000)
1	WAC		122
2	WCS		113
3	NMS		41
4	WSU		416
5	DC Power Supply		139
6	Installation Materials		27
7	Steel Pole for CS/SU		756
	Sub Total		1613
8	Tools and Test Equipment	5%	50
9	Spare Parts	0.2%	4
10	CIF	10%	120
11	Installation	10%	120
12	Training		14
	Sub Total		306
	Total		1919

Local Currency

No	Description		Total Price (x USD 1000)
1	Civil Work and Installation and Commissioning		59
2	Access Road		0
3	Local Transportation		7
	Total		67

5.4.2.7 Scope of Work for Uvurkhangai Network

Point to Multipoint/TDMA-WLL is installed at Kharkhorin Sum centre. The WLL system shall be used as redundant systems for existing wired line networks taking account of future traffic increase and it is overlaid on the existing wired line networks.

The Wireless Access Control (WAC) of TDMA-WLL system is interfaced with Sum centre Telecom Office local switch (LS) at 2 x E1 bearer base (V 5.2).

5.4.2.8 Scope of Work for Selenge and Darkhan-Uul Network

Point to Multipoint/TDMA-WLL is installed at Zuunkharaa, Khutul and Sharin Gol Sum centres. The WLL system shall be used as redundant systems for existing wired line networks taking account of future traffic increase and they are overlaid on the existing wired line networks.

The Wireless Access Control (WAC) of TDMA-WLL system is interfaced with Sum centre Telecom Office local switch (LS) at 2 x E1 bearer base (V 5.2).

5.4.2.9 Recommendation for Rural Development by WLL System

(1) Network System Selection

The substitution of wireless system for copper cables in the local loop helps reduce the maintenance costs associated with physical plan in rural areas. Integrated point-to-multipoint/wireless local loop using TDMA technology is selected to put overly on the existing subscriber access network. In order to meet the future demand of Internet broadband services it is recommended to install the LAN-WLL system partly.

(2) Tariffs

The Point-to-Multipoint/TDMA-WLL subscribers are connected as remote subscribers to the mother exchange. Subscribers shall get charged as per sum subscriber numbering and the under laying Mongolian tariff structure.

(3) Subscriber Numbering

Subscriber number is out of consideration for the PMP technology. However, due to the needs for subscriber charging, subscriber numbering shall be done in the mother exchange on the basis of the present numbering plan for sums.

(4) Frequency Plan

The 1.9 GHz frequency band for public use (1895MHz to 1918.1MHz) shall be utilized. The frequency channel allocation shall be according to RCR-28 Japanese standard with a RF channel separation of 300 KHz. Spectrum for public use is 12 MHz.Spectrum for private use is 11 MHz, which can be shared with public use. TDMA/TDD is adopted inWLL,

use of pair channels is not required for two-way communication and both lower and upper side of spectrum can be easily expanded.

The frequency channel arrangement in each system shall generally be optimised to the necessary minimum utilisation of channels but paying attention to:

- Co-ordination with the Mongol Frequency Planning Management;
- Avoidance of co-channel interference;
- Avoiding interferences from/with future broadcast satellite systems;
- Economical re-use of frequency channels for future extension of networks
- Cost reduction of spare equipment and units for O&M
- Provisions of simple antennas (low cost types)
-

In particular, the frequency plan shall take into account no occupancy of this band in the adjacent countries and consider future expansions.

The contractor shall make transparent all the details of the frequency planning, interference calculation and selection of channels and include sample co-calculation by listing and using the characteristic values and patters of equipment and antennas.

(5) Training

There will be two versions of know how transfer:

- Installation instructions for digital transmission system (OFC, microwave transmission and TDMA-WLL system)
- Training on the digital transmission system (OFC, microwave transmission and TDMA-WLL system) including NMS (Network Management System) (class room training)

The installation instructions shall be mainly executed as on-the-job training. Nevertheless three days classroom instructions in Mongolia training centre shall be executed in advance to familiarise the installation teams with the installation principles for digital transmission system.

The training for the digital transmission system requires personnel with knowledge on digital techniques and good competence to communicate in the English language.

This training will be directed to the key personnel in the digitisation of rural telecommunication network like the managers of the Aimag centre communication office

with their acting representatives and the engineers in charge for digitisation of rural telecommunication system from PTA and MT.

Those trained engineers shall train their subordinates in Mongolian language and with concern to the local conditions.

For this project with Uvurkhangai, Selenge and Darkhan-Uul Aimags in total 6 trainees are required. The training shall be executed in the contractors premises with all required equipment and facilities. A training of six weeks is required as minimum duration.

(6) Spare Parts

- The contractor is asked to submit a complete list of all spare parts that are considered necessary for an efficient maintenance of the whole system for a period of five years.
- The Contractor shall recommend the distribution of consumables and spares, for each level of maintenance, including those items, if any, to be held at each individual station.
- The spares may be categorized as consumable items, spare components, etc, and the unit price shall be quoted for each item.
- The Contractor is requested to state the quantity of each spare unit that should be purchased, compared with the number of units in service. The Contractor shall provide details of how the offered quantities have been calculated.
- At the issue of the acceptance certificate, the contractor must have the complete set of spares available.

5.5 Power Supply Facilities

(1) Power Receiving Plan

Figure 5.5-1 shows a typical block diagram for power receiving equipment when power is supplied through near-by power distribution lines from a grid or a diesel generating station to the telecom office at the Sum.

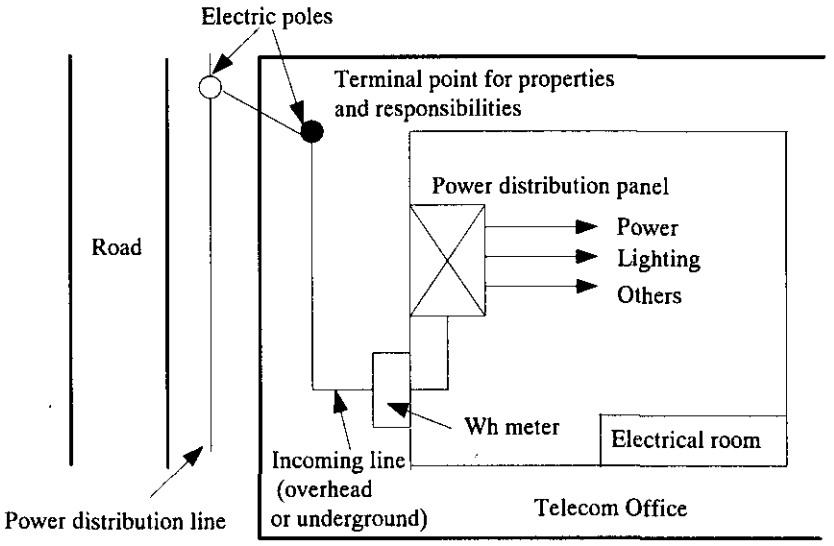


Figure 5.5-1 Typical Power Receiving Plan

(2) Power Supply Facility 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 (generator and battery) in case of power failure at the grid, as shown in Figure 5.5-2. 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.

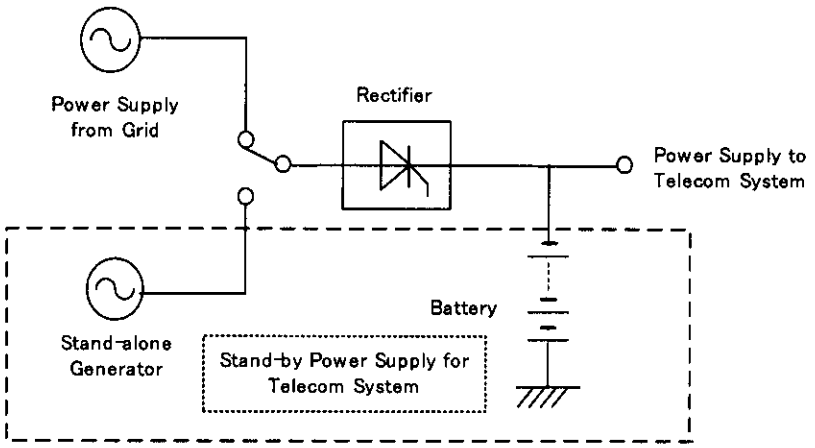


Figure 5.5-2 Stand-by Power Supply Plan

Under the Feasibility Study, batteries and rectifiers shown in Figure 5.5-2 are not included in power supply facilities, but are included in relevant switching and transmission systems.

Figure 5.5-3 shows a typical power supply facility plan that has been configured on the basis of connecting with the existing power supply facilities.

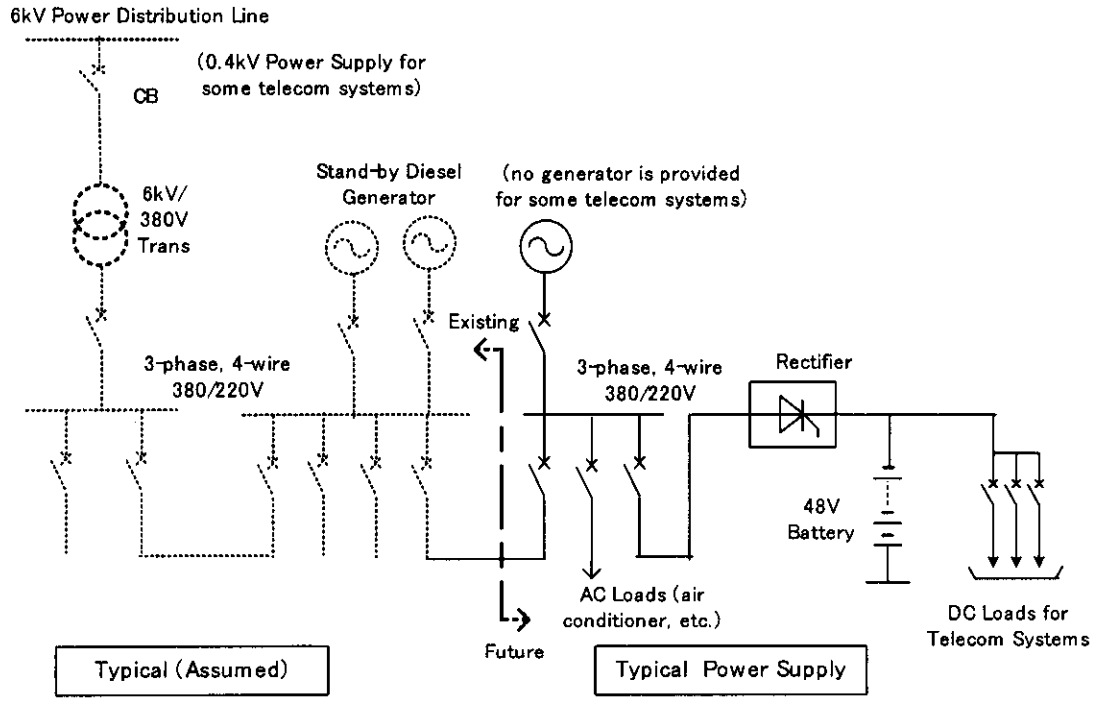


Figure 5.5-3 Typical Power Supply Facility Plan

(3) Capacity of Generators

Stand-by diesel generators to be provided at each Sum are indicated in Annex 5-4 for switching and transmission facilities. Calculated total capacity of the generators by the Aimag is as exhibited in Table 5.5-1. Standard manufacturing capacity will be selected when generators are actually procured.

Table 5.5-1 Summary of Generators

Aimag		Uvurkhangai	Selenge	Darkhan-Uul	Total
Use	Switching	5.1	9.6	2.0	16.7
	Transmission	4.8	7.4	2.6	14.8
Total		9.9	17.0	4.6	31.5

(4) Description of Generators

An example of use of diesel generators at the existing repeater station MW108 is as indicated in Annex 5-3. In this example, two sets of stand-by 16kVA generators are connected with three-phase, three-wire 380/220V bus, to which power is fed from 6kV distribution line through 40kVA (6kV/380V) step-down transformer. Another example indicated in Annex 5-3 is that one set of 6kVA generator is connected with 380/220V bus, to which power is directly fed from 380V distribution line.

As capacity of the generators intended for the Feasibility Study is comparatively small, small-size standard generators with voltage of 220V will be selected. The generators shall be suitable for indoor installation. Small separate rooms for installation of the generator(s) shall be provided by the Mongolian side at the existing telecom offices or repeater stations.

(5) Notes on Use of Generators

Power supply situations at the Sums have considerably improved by installation of diesel generators under grant aid of Japan, even though operating hours of the generators must be suppressed to a minimum level, because of a shortage of fuel resulting from financial problems.

None of the Sums in the Selenge and Darkhan-Uul Aimags have been provided with diesel generators. However, some of the Sums selected for the Feasibility Study in the Uvurkhangai Aimag receive power supply not only from the grid but also from diesel

generators installed at the Sums. For these Sums, stable fuel supply to diesel generators shall be assured to secure a high level of power supply reliability and stability.

As for switching systems with subscriber lines less than 400, diesel generators will be provided for the reasons that existing telecom offices are not provided with back-up generators, fuel cost for generators would be a heavy burden for small-scale Sums, and a high level of power supply reliability is not always needed for such Sums.

5.6 IT Facilities

IT development in rural or distant area is under discussion in the domestic functions and international organizations. One of the discussion items is the introduction of telecommunication centre, so called Tele-centre, Multipurpose Community Tele-centre (MCT), etc., to the rural area for the peoples who cannot hold their own communication facilities.

However 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.

From the above ready-prepared situations in this country, integrated centre is not needed even in Sum area. Just upgrading telephone booth function with automatic dialling system and furnishing access means to Internet, are required. Schools and hospitals are requiring only the telephone lines that are reliable and possible to access to Internet.

Figure 5.6-1 shows an idea of rural area network in Mongolia in Phase-1 and 2 stages of the development. Of course the number of apparatus (telephone set, facsimile machine, video phone, PC, etc.) and connecting lines are depend on the office, school or hospital size. And in this report, the up-graded telephone booth is to be called as "IT-spot".

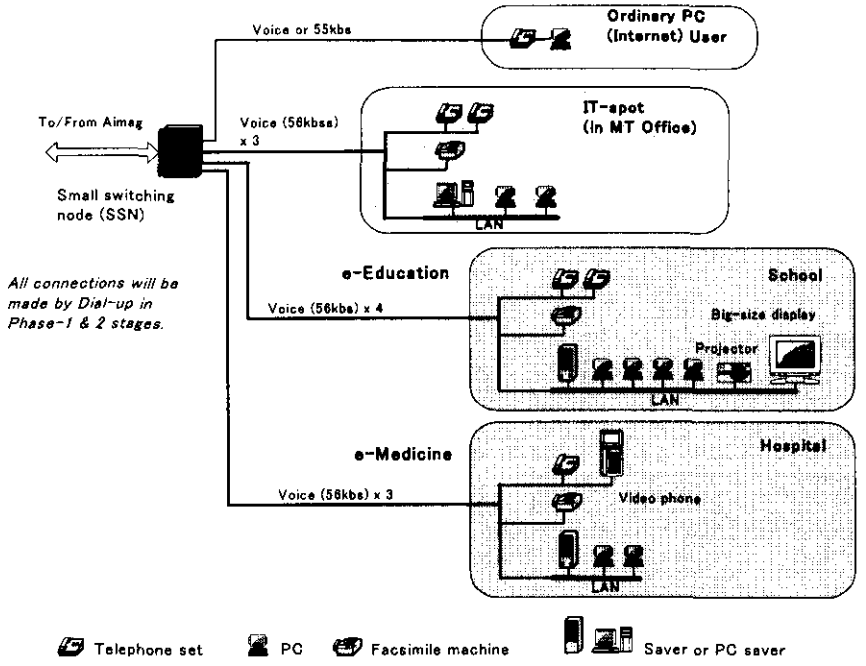


Figure 5.6-1 An Idea of IT Network Configuration in Sum Centre

IT-spot should have a feature so low income or no PC holding persons can visit frankly. Thus tariffs in IT-spot are strongly recommended to apply especially low rate one or free of charge.

The image of IT-spot is the "MT version's Internet café + Business centre". Table 5.6-1 shows recommended kinds and number of apparatus to be furnished in IT-spot at the initial implementation. The cost for the implementation including an initial training fee is estimated in Table5.6.2.

Table 5.6-1 Kinds and Number of Apparatus at IT-spot in Sum Area

	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

The drawing shows a small IT-spot where population is less than 10,000.

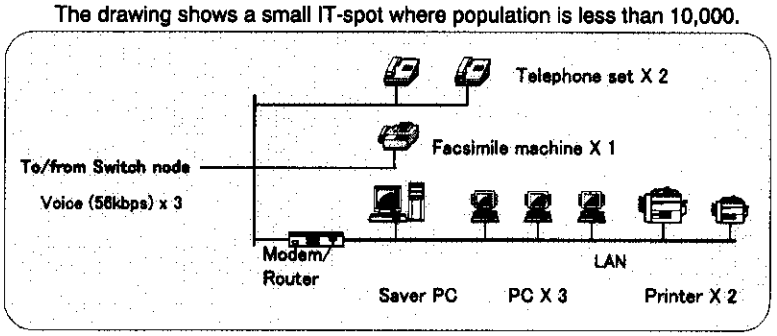


Table 5.6-2 Initial Cost of IT-spot in Sum Area

Unit: 1000US$

		IT-spot Cost
	UVURKHANGAI	
1	Burd	10
2	Bat-Ulzii	10
3	Bayangol	10
4	Esunzuil	10
5	ZB Ulaan	10
6	Nariinteel	10
7	Sant	10
8	Uyanga	10
9	Khujirt	10
10	Kharkhorin	15
	Sub-total	105

Installation Cost	235
Training	13
IT Cost Total	248

		IT-spot Cost
	DARKHAN-UUL	
1	Shariin gol	15
	Sub-total	15
	SELENGE	
1	Altanbulag	10
2	Eruu	10
3	Zuunburen	10
4	Sant	10
5	Tsagaannuur	10
6	Orkhontuul	10
7	Shaamar	10
8	Khutul	10
9	Zuunkharaa	15
10	Bayangol (Baruunkharaa)	10
11	Tunkhel	10
	Sub-total	115

5.7 Land and Building

5.7.1 Switching Facilities

It was confirmed that the space could be available at all target Sum centres. It would be managed, in some cases, by installing the new switch at a room and the furniture in the relevant room could be moved to the space where the existing equipment has been removed.

The typical digital switching system SDX-RB of 600-lines capacity now under installation at MT exchange occupies 3,700 mm x 2,500 mm. The space includes that for MDF, battery banks, rectifier, air conditioning equipment, in addition to the switching unit. HICOM is smaller than SDX-RB switching unit.

5.7.2 Outdoor Installation of Microwave Repeater Stations

With this project it is planned to construct newly the microwave repeater stations as follows:

Uvurkhangai Aimag (Total 7 sites)

(1) MW109-Esunziil link :one repeater station
(2) Esuunziil- Burd link: :one repeater station
(3) MW109-Bat-Ulzii link :one repeater station
(4) MW110-Uyanga link: one repeater station
(5) MW111-Sant: two repeater stations
(6) Sant-Bayangol: one repeater station

Selenge and Darkhan-Uul (Total 8 sites)

(7) MRC Orkhontuul-MT Orkhontuul: one repeater station
(8) MW 305-Sant: one repeater station
(9) MW 306-Sharing-Gol: two repeater stations
(10) MW 307-Tsagaanuur: one repeater station
(11) MW 307-Eruu: two repeater stations
(12) MW 308-Zuunburen: one repeater station

For the installation of antenna supports and shelter and solar equipment (if necessary) at the proposed repeater stations, an average space of 100 m2 is required. These locations shall be fenced as well.

It is required ensure the size of a shelter (2.3 m x 3.2m x 2.7 m) to accommodate the microwave transmission IDU at the repeater site.

The concerning permissions for the use of the land at construction site will be arranged by Mongolia side.

5.7.3 Antenna Supports

Existing antenna support structures at most of the Telecommunication Offices and the existing microwave repeater stations can be used for Point-to-Point microwave transmission system construction purpose. An alternative solution will be the utilisation of steel pole at the height of 20 m as a antenna support for small antenna with 1.8 m diameters.

5.7.4 Main Power Supply

Because of existing 220 V AC mains and 2 generators at the MW sites in case of a power brake, all equipment of microwave transmission newly installed at MW shall be in AC version with the smallest back up battery solution.

At all Telecommunications Offices 220 V AC mains is available. At some repeater sites between 600 m and 2000 m power line have to be installed. (Mongolian side provision)

For the repeater sites in case of the non-availability of power distribution line from the grid the "Photovoltaic Division" solar and wind hybrid power supply facility will be installed at the sites.

At some remote sites, main power supply from the Central Grid Energy system instead of solar power will be more efficient solution. The installation of power distribution cable and connection of 220 V to the site will be arranged by Mongolia side.

5.7.5 Access Roads to the Sites

In general only 4 by 4 vehicles are recommended to access to the sites and some approach roads construction will be arranged by Mongolia side.

5.7.6 Fencing and Safety Measures

For remote microwave relay station facilities against misuse or vandalism sufficient fencing is required.

Antenna supports shall be equipped with air warning facilities and mechanical protection for the personnel.

CHAPTER 6

PROJECT IMPLEMENTATION PLAN

CHAPTER 6

PROJECT IMPLEMENTATION PLAN

6.1 Implementation Schedule

6.1.1 General

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 overseas' donors and the grant aid project of the Japanese Government.

6.1.2 Basic Policy

The implementation plan for the rehabilitation and expansion project for the rural telecommunications system in Mongolia shall be formulated in consideration of:

(1) To execute the project under the "Turn-key" basis,
(2) To hire a consultant to undertake the following work,
    (a) Preparing the basic design, detailed design, specifications and tender documents;
    (b) Assistance in tender evaluation and contract negotiation;
    (c) Factory inspection witnessing;
    (d) Assistance in examination and approval of the detailed construction and installation drawings prepared by the contractor;
    (e) Supervision of the installation and construction works;
    (f) Assistance in acceptance test;
    (g) Assistance in liaison with the authority of the donor country;
(3) To complete the project within the period agreed with the donor,
(4) To count the months for the field installation and construction work as about six (6) months (from May to October), due to the harsh weather condition in Mongolia,
(5) 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,

(6) 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

(7) Keeping with the rules and procedures of Mongolian Government and such of the overseas donors providing the finance.

6.1.3 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:

(1) Application to the Japanese Government
(2) Selection of a consultant to implement the basic design work by JICA
(3) Basic design by the consultant (basic design and budget cost estimate)
(4) Exchange Note
(5) Consulting services agreement with PTA
(6) 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)
(7) Construction and installation (detailed design by the contractor, manufacturing, factory test, delivery, construction and installation, acceptance test)

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.

The date of the exchange note, which cannot be foreseen now, is tentatively stated in the beginning of 2004 as shown in Table 6.1-1. In addition there is some possibility that the selection of a consultant for the basic design by JICA may be delayed about one year due to reasons of the Government of Japan. Such case is shown in Table 6.1-2.

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. Two (2) cases in the beginning and the middle of year are prepared for reference. The detailed implementation schedules for such cases are shown in Tables 6.1-3 and 6.1-4 respectively.

Table 6.1-1 Overall Implementation Schedule for Rehabilitation and Expansion Project for Rural Telecommunication System in Mongolia (Quick Case)

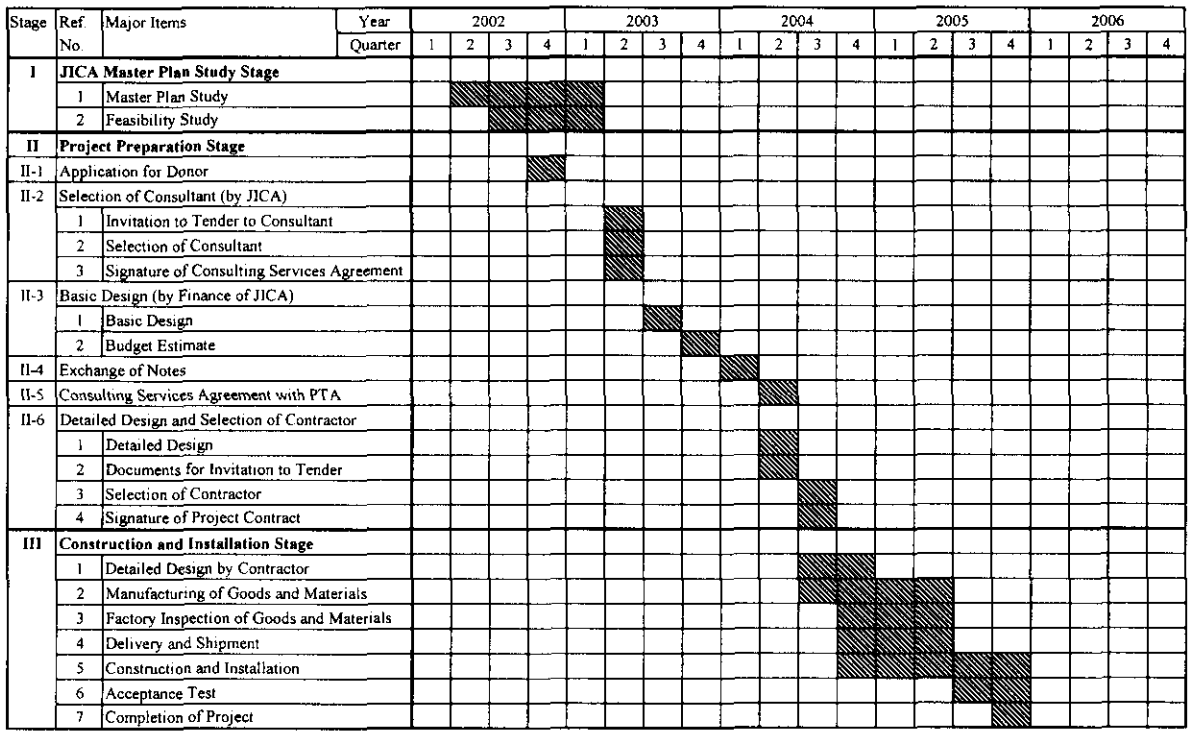


Table 6.1-2 Overall Implementation Schedule for Rehabilitation and Expansion Project for Rural Telecommunication System in Mongolia (Normal Case)

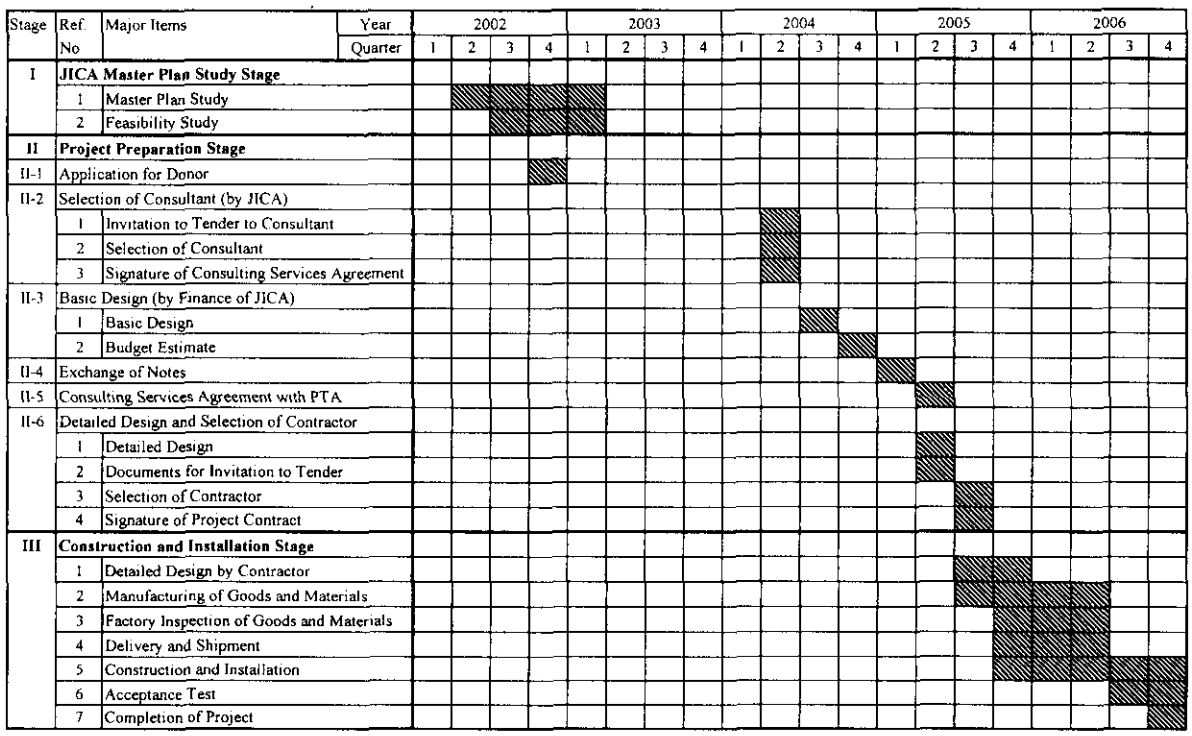


Table 6.1-3 Detailed Implementation Schedule for Rehabilitation and Expansion Project for Rural Telecommunication System in Mongolia (E/N is in the Beginning of Year)

Stage	Ref. No.	Major Items	Year	1st Year												2nd Year											
			Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
			Months from E/N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
I	**Project Preparation Stage**																										
I-1	Exchange of Notes																										
I-2	Consulting Services Agreement with PTA																										
I-3	Deatiled Design and Selection of Contractor																										
	1	Detailed Design																									
	2	Documents for Invitation to Tender																									
	3	Tender Floating																									
	4	Tender Evaluation																									
	5	Signature of Project Contract																									
I-4	Local Tender (for PTA's Portion)																										
	1	*Documents for Invitation to Tender*																									
	2	Tender Floating																									
	3	Tender Evaluation																									
	4	Signature of Project Contract																									
			Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
			Months from Contract								1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
II	**Construction and Installation Stage**																										
	Local Construction Portion (for PTA's Portion)																										
	1	Effective of Contract																									
	2	Access Road Construction																									
	3	Building Construction																									
	Foreign Construction Portion																										
	1	Effective of Contract																									
	2	*Detailed Design by Contractor*																									
	3	Manufacturing of Goods and Materials																									
	4	Factory Inspection of Goods and Materials																									
	5	Delivery and Shipment																									
	6	Construction and Installation																									
	6-1	Anntena Tower Construction																									
	6-2	Switching System																									
	6-3	Radio Transmission System																									
	6-4	Optical Fibre Cable Transmission System																									
	6-5	Wired Access System																									
	7	Acceptance Test																									
	8	Completion of Project																									

Table 6.1-4 Detailed Implementation Schedule for Rehabilitation and Expansion Project for Rural Telecommunication System in Mongolia (E/N is in the Middle of Year)

Stage	Ref. No.	Major Items	Year	1st Year				2nd Year												3rd Year							
			Month	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
			Months from E/N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
I	**Project Preparation Stage**																										
I-1	Exchange of Notes																										
I-2	Consulting Services Agreement with PTA																										
I-3	Deatiled Design and Selection of Contractor																										
	1	Detailed Design																									
	2	Documents for Invitation to Tender																									
	3	Tender Floating																									
	4	Tender Evaluation																									
	5	Signature of Project Contract																									
I-4	Local Tender (for PTA's Portion)																										
	1	Documents for Invitation to Tender																									
	2	Tender Floating																									
	3	Tender Evaluation																									
	4	Signature of Project Contract																									
			Month	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
			Months from Contract								1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
II	**Construction and Installation Stage**																										
	Local Construction Portion (for PTA's Portion)																										
	1	Effective of Contract																									
	2	Access Road Construction																									
	3	Building Construction																									
	Foreign Construction Portion																										
	1	Effective of Contract																									
	2	Detailed Design by Contractor																									
	3	Manufacturing of Goods and Materials																									
	4	Factory Inspection of Goods and Materials																									
	5	Delivery and Shipment																									
	6	Construction and Installation																									
	6-1	Anntena Tower Construction																									
	6-2	Switching System																									
	6-3	Radio Transmission System																									
	6-4	Optical Fibre Cable Transmission System																									
	6-5	Wired Access System																									
	7	Acceptance Test																									
	8	Completion of Project																									

6.1.4 Implementation Schedule of Ordinary Project

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

(1) Application to the donor;
(2) Exchange Note;
(3) Selection of consultant;
(4) Preparation of tender documents (Basic design, preparation of tender documents);
(5) Selection of supply and installation contractor (Tender, tender evaluation, contract negotiation, contract signing); and
(6) Construction and installation (detailed design by the contractor, manufacturing, factory test, delivery, construction and installation, acceptance test).

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.

The date of the exchange note, which cannot be foreseen now, is tentatively stated in the beginning of 2003. We consider that the actual date of the exchange note will be delayed further, depending on the reasons of the donors. The overall implementation schedules and the detailed schedule are shown in Tables 6.1-4 and 6.1-5 respectively.

Table 6.1-5 Overall Implementation Schedule for Rehabilitation and Expansion Project for Rural Telecommunication System in Mongolia

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	Exchange of Notes																						
II-3	Consulting Services Agreement with PTA																						
II-4	Baic Design and Selection of Contractor																						
	1	Basic Design																					
	2	Documents for Invitation to Tender																					
	3	Selection of Contractor																					
	4	Signature of Project Contract																					
III	**Construction and Installation Stage**																						
	1	Effective of Contract																					
	2	Detailed Design by Contractor																					
	3	Manufacturing of Goods and Materials																					
	4	Factory Inspection of Goods and Materials																					
	5	Delivery and Shipment																					
	6	Construction and Installation																					
	7	Acceptance Test																					

Table 6.1-6 Detailed Implementation Schedule for Rehabilitation and Expansion Project for Rural Telecommunication System in Mongolia

Stage	Ref. No.	Major Items	Year / Month / Months from E/N	1st Year												2nd Year												3rd Year											
			Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
			Months from E/N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	34	36
I	**Project Preparation Stage**																																						
I-1	Exchange of Notes																																						
I-2	Consulting Services Agreement with PTA																																						
I-3	Basic Design and Selection of Contractor																																						
	1	Basic Design																																					
	2	Documents for Invitation to Tender																																					
	3	Tender Floating																																					
	4	Tender Evaluation																																					
	5	Signature of Project Contract																																					
I-4	Local Tender (for PTA's Portion)																																						
	1	Documents for Invitation to Tender																																					
	2	Tender Floating																																					
	3	Tender Evaluation																																					
	4	Signature of Project Contract																																					
			Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
			Months from Contract													1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
II	**Construction and Installation Stage**																																						
	Effective of Contract																																						
	Local Construction Portion (for PTA's Portion)																																						
	1	Access Road Construction																																					
	2	Building Construction																																					
	Foreign Construction Portion																																						
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	5-2	Switching System																																					
	5-3	Radio Transmission System																																					
	5-4	Optical Fibre Cable Transmission System																																					
	5-5	Wired Access System																																					
	6	Acceptance Test																																					
	7	Completion of Project																																					

6.2 Management on Project Implementation

6.2.1 Quick Start and Smooth Advance of the Project

This feasibility study was 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 the foreign contractor.

PTA is required to find a good finance. If the finance is provided by a foreign donor, it is very important to pay attention to the related rules and regulations having a close liaison with the authorities concerned. Project may be delayed sometime because of procedures. PTA is required to set up an over-all time table and forward the project referring to the time table. The over-all time table should be studied carefully and its breakdown should be given.

An effective use of a consultant is essential. Experts for the project implementation will ease the management work not only the technical matters but also in the administration matters.

6.2.2 Organisation

(1) Task Force

PTA has an organization of task force for implementing telecommunications projects and has had good experiences through past projects and has accumulated sufficient experiences through past projects and has accumulated sufficient know-how to carry out projects. PTA should keep that organization also for the projects proposed under this feasibility study.

(2) Project Manager

It is preferable to assign some personnel of technical field to manage the project implementation. For a smooth management of the projects, technical staff selection should cover the fields of network and traffic engineering, switching system, transmission system, subscriber access system, power system and supply, IT system and civil works.

(3) Close Co-operation

A close co-operation is essential for the officials in charge of the liaison service with government authorities, including CRC, MOI, etc. PTA will be required to keep a closer contact with MT and MRC than before. CRC also intends to provide the interconnection points between different networks. PTA has to implement its projects in harmony with other network providers.

6.2.3 Attentions on Technical Matters

(1) Synchronisation of Sub-projects

The problems often found in the case of in-door equipment projects, such as switching system and transmission equipment, are mismatching of preparation timing of floor space for the equipment. The buildings should be prepared in a good timing so that the equipment to be installed can be carried out in at a due time. Completion timing of switching system, transmission system, subscriber access system, power system and supply and IT system should also be well organised.

(2) Switching System

The switching system is integrated to the existing network one by one usually. The integration of new unit of switching system involves the change of exchange data base, which should be done very carefully. PTA is required to station temporarily an adequate number of personnel at every site where software change an/or hardware connection are needed. Such work should be prepared very much carefully, otherwise a confusion may come up in the telecommunications network.

(3) Testing

Testing facilities is essential. PTA is required to carry out various tests to verify the function of the telecommunications network when the equipment under this project is integrated in the existing network. Each equipment should be tested individually and as a component of the complicated network. Terminal to terminal connection test which involves other exchange(s) will be efficient to check the compatibility in the network. CCS signalling messages should also be monitored and analysed.

(4) Project Meetings

Periodical project meetings (weekly or monthly) will be held among the project manager, contractor, consultant, and others to check the project progress and to find out any problems and to study the solutions.

(5) Project Progress Control

A manager should be assigned to watch and control all the progress of the sub-projects in order not to delay the works of other sub-projects.

CHAPTER 7

OPERATION AND MAINTENANCE PLAN

CHAPTER 7

OPERATION AND MAINTENANCE PLAN

Through this Project, automatic connection in Sums, effective operation and maintenance by digitalisation, introduction of IT (information technology) and improvement of service quality will be expected.

This Chapter describes Operation and Maintenance Plan by this Project.

7.1 Basic Policy

(1) Centralized Operation and Maintenance

O/M works in Sums are centralized at Aimag centre and Sum O/M personnel are minimized in accordance with work volume

a. Sum O/M works are limited in easy daily works at Sums

b. Aimag centre O/M works are centralized supervision, instructions to Sum O/M works and heavy works such as installation, periodical preventive maintenance, etc.

(2) Training and Skill Level

O/M personnel at Sums and Aimag centre are trained for each required O/M level.

(3) Spare Parts

Spare parts for O/M are initially purchased and stocked for 3 to 5 years in the project.

(4) Tools and Measurement Equipment

Necessary tools and measurement equipment are secured for the work site. Especially, special tools and measurement equipment for the new system planed in the project should be procured in the project.

(5) Vehicles for O/M

Additional one maintenance vehicle as minimum is deployed in each Aimag Centre OMC for the centralized maintenance for Sum Centre's facilities.

7.2 O/M Plan of Each System

7.2.1 Switching System

The new switching system is the full digital system and has the function of billing system and Network management system at Aimag centre. Operation and maintenance Centre should be established at each Aimag Centre that has the functions to monitor the running conditions of Sum centre switching system, to collect traffic data of the switching system and to control the switching system through the Network Management system.

7.2.2 Transmission System (Radio, Optical Fibre, WLL)

PC-based network management system (NMS) will be introduced for remote and centralized monitoring of transmission facilities and the NMS will be installed at Aimag Centre.

Digital microwave repeater station is designed as an unmanned station and the solar, wind and battery hybrid power supply system will be installed at the repeater station.

7.2.3 Outside Plant

Outside plant for access network is composed by aerial cable network and the maintenance technology for the outside plant is very common. Therefore, it is important to strengthen the daily maintenance activities for decreasing the fault occurrence and also quick repairing of the faults.

7.2.4 Power System

All items of the equipment that constitute power supply facilities are commodities and do not require any special kind of operation and maintenance. Standard procedures and periodical checks for operation and maintenance of the equipment as recommended by manufacturers shall be observed in order to achieve expected performance of the equipment during its standard lifetime.

In preparation for unexpected failure of the equipment, an optimum number and type of spare parts shall be kept in stock for operation of three years at minimum.

7.2.5 IT System

For the installed equipment and software, log (Name of equipment/Software, Version number, Purchased and Re-installed data, Repairing status, etc.) should be kept. The log is very important to receive the supporting/repairing information from vender/manufacture and to confirm the compatibility among them.

General knowledge concerning PC and office machines should be up-date always through technical books and/or magazines.

7.3 Main O/M Works

7.3.1 Sum Centre

(1) Switching System

Service order, fault clearance by instructions from Aimag centre (alarm release, package change, etc.)

(2) Transmission System (Radio, Optical Fibre, WLL)

Fault clearance by instructions from Aimag centre (alarm release, package change, etc.)

(3) Outside Plant

Service order, fault clearance of subscriber lines under DP.

(4) Power System

Fault clearance by instructions from Aimag centre (alarm release, package change, etc.)

(5) IT System

Fault clearance by instructions from Aimag centre (alarm release, package change, etc.)

(6) Business Office

Sales office work, Operation of Public telephone, Collection of Telephone charge and miscellaneous job

7.3.2 Aimag Centre

(1) Switching System

Supervision of alarms, fault clearance instructions to Sums, circuit expansion, maintenance and repair of main facility

(2) Transmission System (Radio, Optical Fibre, WLL)

Supervision of alarms, fault clearance instructions to Sums, circuit expansion, maintenance and repair of main facility

(3) Outside Plant

Service order, fault clearance of junction cables and main Access cable, maintenance and repair of main facility

It is recommendable to provide the Task Force in Aimag centre to implement the mass connection work of Sum centre in the service inauguration stage of the rural network. Otherwise, mass connection work will be included in the rural network expansion project together with the cutover work of existing subscriber lines.

(4) Power System

Supervision of alarms, fault clearance instructions to Sums, maintenance and repair of main facility

(5) IT System

Maintenance and repair of main facility

(6) Customer Service Centre

Customer service office covers Service Order work with Customer Database, while the staff of Sum centre will handle the reception of application in Sum centre.

(7) Fault complaint reception and circuits test

Complaint desk handles the Complaint reception, Circuit test, management of Fault repair work and also preparation of Fault statistical data.

(8) Billing

Aimag Centre should compute Billing up to Sum Subscriber based on the Customer database and manage the Billing and Collection process of Sum Centres.

7.4 Maintenance Equipment and Material

(1) Maintenance Material

The following Maintenance Materials are necessary to procure in the project in addition to the existing equipment and materials.

Maintenance material cost per year is estimated as 0.2% of foreign currency portion of the Project Cost in accordance with the results of the other countries.

The volume of the materials that will be procured in the project cover 5 years of maintenance period considering the following points:

- Low flexibility due to the small quantity and wide distribution of the materials
- Difficulty of the operation funds preparation to procure the Maintenance material at the beginning.

The volume of Maintenance material for Optical Fibre System is estimated as minimum but the rate for the project cost becomes high because of small scale of Optical Fibre system.

Maintenance material for the power facility covers the lifetime of the power facility

due to the nature of the materials.

Table 7.4-1 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		Spare parts	0.2% of Foreign	2,057	5	20.57
Transmission	Radio	Spare parts	0.2% of Foreign	4,285	5	42.85
	Optical Fibre	Spare parts and Optical Fibre cable	0.5% of Foreign Portion	521	5	13.03
	WLL	Spare parts	0.2% of Foreign Portion	2,652	5	26.52
Access Outside Plant		Cable, Closure, Jointing connector, 10 pair Pole DP	0.2% of Foreign Portion	1,273	3	7.64
Power Plant	Diesel Generators	Spare parts	0.2% of Foreign Portion	216	15	6.49
IT spot	PC	N/A	N/A			

(2) Maintenance equipment

The following Maintenance equipments are necessary to procure in the project according to the introduction of new systems.

Table 7.4-2 Maintenance Equipment List

Technical Field	Main facility	Equipment and Tools	Quantity	Cost (KUS$)
Switch		N/A	N/A	
Transmission	Radio	Test Equipment		191
	Optical Fibre	OTDR	One for Uvurkhangai	45
		Others Splicer	two	
	WLL	Test Equipment		77
Access Outside Plant		N/A	N/A	
Power Plant		N/A	N/A	
IT spot	PC	N/A	N/A	

7.5 Recommendations

(1) QoS performance Indicator

The following indicators are recommendable to evaluate the subscriber's satisfaction and to improve quality of O&M services from the subscriber's standpoint

Table 7.5-1 QoS performance Indicator

PRINCIPAL TASK	EVALUATION MEASURE
Service Commencement	Service order (rate of service commencement)
Telephone service supply	Rate of Completed call Operator response time
Billing	Number of fault
Customer satisfaction	Number of complaints calls
Fault repair	Number of fault occurrences Repeat faults Fault clearance time

(2) Target Fault Rate and Clearance Rates

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

Table 7.5-2 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%

Note: Including the faults in Subscriber owned facility

(3) Target Call completion Rates

The following target figures are recommended:

Table 7.5-3 Target Figure of Call completion rate

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

CHAPTER 8

HUMAN RESOURCE DEVELOPMENT AND TRAINING PLAN

CHAPTER 8

HUMAN RESOURCE DEVELOPMENT AND TRAINING PLAN

Through this Project, automatic connection in Sums, effective operation and maintenance by digitalisation, introduction of IT (Information Technology) and improvement of service quality will be expected.

This Chapter describes Human Resource Development Plan and Training Plan by this Project.

8.1 Human Resource Development Plan

8.1.1 Present Staff

Present staff of Aimag Centres and Sums in Uvurkhangai, Drakhan-Uul and Selenge are shown in Table 8.1-1 to Table 8.1-3. The features of human resources in Sums are as follows:

a. All facilities such as analogue switch, open wire transmission system, power system and cables in a Sum telecommunication office are operated and maintained by about one to five repair men with Aimag centre's support.

b. One to six operators in a Sum office connect manually telephone calls to outside due to non-automatic connection function in Sums.

c. There are many small Sum telephone offices in a Aimag area, and it is a big obstacle for effective operation and maintenance.

d. In small Sum telephone offices, only one or two staff manage manual telephone calls and maintenance works.

Table 8.1-1 Number of Staff in Uvurkhangai

	Centre/Sum Name	No. of Staff(Sep. 2002)										Past staff		
		Manager	Engineer	Technician(Switch/transmission)	Cable-man	Operator	Accountant/billing	Driver	Economist	Cleaning & miscellaneous	Total	1999(end)	2000(end)	2001(end)
1	Almag Center	1	10	11	27	7	3	4	3	18	84	85	87	88
2	Bayan-Undur	1				1					2	2	2	2
3	Burd	1				1					2	2	2	2
4	Bat-Ulzii	1				1					2	2	2	2
5	BB-Ulaan	1				1					2	2	2	2
6	Bayangol	1				1					2	2	2	2
7	Guchin-Us	1				1					2	2	2	2
8	Esunzuil	1				1					2	3	3	2
9	Ulzit	1				1					2	2	2	2
10	ZB Ulaan	1				1					2	2	2	2
11	Bogd	1				1					2	2	2	2
12	Narlinteel	1				1					2	2	2	2
13	Sant	1				1					2	2	2	2
14	Taragt	1				1					2	2	2	2
15	Tugrug	1				1					2	2	2	2
16	Uyanga	1			1	1					3	3	3	3
17	Khairkhandulaan	1				1					2	2	2	2
18	Khujirt	1			3	4	1		1		10	17	17	17
19	Kharkhorin	1		5	4	6	1	1	1	5	24	26	26	26
20	Bayanteeg	1				1					2	2	2	2
	Total	20	10	16	35	34	5	5	5	23	153	164	166	166

Note: *Objective Sums by this project*

Table 8.1-2 Number of Staff in Darkhan-Uul

	Centre/Sum Name	No. of Staff(Sep. 2002)											Past staff		
		Manager	Engineer	Technician(Switch/transmission)	Repair man(Cable, etc.)	Operator	Accountant/billing	Revenue inspector	Driver	Cleaning	Bolier man	Carpenter	Total	1999(end)	2000(end)	2001(end)
1	Almag center	1	11	14	18	32	4	5	8	3	2	1	99	142	139	141
2	Orkhon<Darkhan>	1			1								2	4	4	3
3	Khongor<Darkhan>	1			1	1							3	4	4	4
4	Sharlin gol<Darkhan>	1		3	2	5		1		1			13	14	13	13
5	Sumber<Tuv>	1			1								2	2	2	2
6	Saikhan<Selenge>	1				1							2	3	3	3
7	Khutul<Selenge>	1		3	2	5	1	1		1			14	13	13	13
8	Zuunkharaa<Selenge>	1	1	2	3	6	1	1	1	1			17	19	19	18
9	Bayangol(Baruunharaa)<Selenge>	1		2	1	4			1				9	11	11	11
10	Tunkhel<Selenge>												0			
	Total	9	12	24	29	54	6	8	10	6	2	1	161	212	208	208

Note: *Objective Sums by this project*

Table 8.1-3 Number of Staff in Selenge

	Centre/Sum Name	No. of Staff(Sep. 2002)										Past staff		
		Manager	Engineer	Technician(Switch/transmission)	Repair man(Cable, etc.)	Operator	Accountant/billing	Driver	Stove man	Cleaning & miscellaneous	Total	1999(end)	2000(end)	2001(end)
1	Aimag center	1	7	11	17	7	3	4		25	75	85	80	78
2	Altanbulag	1			1	2					4	3	3	3
3	Eruu	1			1	1					3	3	3	3
4	Zuunburen	1			1						2	3	3	3
5	Khushaat	1									1	2	2	2
6	Orkhon	1				1					2	3	3	3
7	Sant	1			1	1					3	4	3	3
8	Khuder	1			1						2	2	2	2
9	Tsagaannuur	1			1	1					3	3	3	3
10	Bugant	1			1						2	2	2	2
11	Orkhontuul	1			1						2	3	3	2
12	Baruunburen	1				1					2	3	3	2
13	Dulaankhaan					1					1	2	2	2
14	Javkhlant	1				1			1		3	2	2	3
15	Shaamar	1			1	1			1		4	4	4	4
16	Tushig	1			1				1		3	3	3	3
	Total	15	7	11	27	17	3	4	3	25	112	127	121	118

Note: *Objective Sums by this project*

8.1.2 Staff Plan of the Project

Taking into account of effective management and the Operation and Maintenance Plan in Chapter 10, the staff plan will be as follows:

(1) Staff in Sum

a. Facility Operation and Maintenance

Operation and maintenance works in Sums are basically centralized to Aimag Centre, except for subscriber lines.
Therefore the present repair men carries out daily operation and maintenance of newly introduced facilities such as digital switch, optical fibre transmission system, digital micro-wave system, WLL system and subscriber lines under instructions and support of Aimag Centre staff. The number of staff in a Sum will be the same as the present.

b. Operator

The present operators for manual connection needs to connect calls at the public telephone booth, even subscribers become 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.

c. Total staff

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 are costumed to use internet and e-Mail, the number of operators will be decreased.

(2) Staff in Aimag Centre

By this Project, the major Sums in a Aimag area are digitalized and O/M of these Sums is centralized to Aimag Centre, however the volume of works regarding Sums is not big and absorbed in the current work volume, and the number of staff at Aimag Centre will not be increased.

8.2 Training Plan

Based on the operation and maintenance plan in Chapter 10, the training required for skill level of staff is planned as follows:

The current facilities are mainly analogue exchanges, open wire transmission system, obsolete subscriber cables and repair men in Sums do not have enough skill level for newly introduced digital exchange, transmission system, power system, etc. Meanwhile O/M in Sums is basically centralized to Aimag Centre in consideration of effective O/M, therefore the required skill level for repair men in Sums is daily O/M under instructions and support by Aimag Centre staff. They will be trained for daily maintenance skill.

The staff of Aimag Centre, who carry out centralized O/M, shall give proper instructions and supports to repair men of Sums and are required the skill level of centralized O/M. They will be trained for specialized digital exchange, digital transmission and micro-wave systems, WLL system, optical fibre cable and power system.

Operators in Sums are required for operation and instructions of internet and e-Mail for the public, and will be trained for basic IT such as PC and internet/e-Mail knowledge.
And also IT engineers at Aimag Centre are required for the advanced IT skill level in order to support Sum operators. They will be trained for advanced IT.

For the purpose of economic and effective training for this Project, centralized O/M training will be carried out in manufacturer's country, and daily O/M training will be carried out in Nongolia by instructors of the MT Training Centre, utilizing newly introduced facilities at project sites.

8.2.1 Trainees and Required Skill Level

(1) O/M staff in Sum(1 to 3/Sum)

Daily O/M skill and training for digital switch, digital transmission system, digital micro-wave system, power system). Subscriber lines are maintained by the existing skill, so the training is not required.

(2) Aimag O/M staff(1 to 2/Speciality/Aimag Centre)

Advanced/specialized O/M level and training for centralized O/M and giving instructions to Sum staff. (5 dedicated courses: Digital exchange, digital transmission/micro-wave/WLL, Power system, Optical fibre cable, Advanced IT)

(3) IT operator in Sum(1 to 2/Sum)

Basic operation and instruction level and training for Internet and e-Mail by PC and telephone/Fax operation for the public

(4) Instructor of the Training Centre(2/dedicated course)

Instructor level to train O/M staff in Sums and training for the above dedicated (2) courses

8.2.2 Training Place, Facility and Instructor

(1) Training for Aimag Centre O/M staff and instructors of the Training Centre(except for IT)

Training by manufacturer's facilities and instructors in manufacturer's countries

(2) Training for Sum O/M staff

Training by introduced facilities and instructors of the Training Centre in Mongolia

(3) Training for IT operator in Sum and IT specialist at Aimag Centre

Training by PCs and instructors at the Training Centre

8.2.3 Duration of Training

(1) Training for Aimag Centre O/M staff and instructors of the Training Centre(except for IT)

1 to 6 weeks for each dedicated course

(2) Training for Sum O/M staff

About 2 weeks for basic O/M course

(3) Training for IT operator in Sum and IT specialist at Aimag Centre

About 2 weeks for IT operation and 4 weeks for advanced IT

8.2.4 Summary of Training Plan

The summary of the plan and the required number of trainees by course are shown in Table 8.2-1 and 8.2-2

Table 8.2-1 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

Table 8.2-2 Training Course and Number of Trainees

Aimag	No.	Name of Sum	Training Course							Total
			Basic O/M	Ddigital switch	Digital transmission	Power	Optical fiber cable	Advanced IT	IT Operation	
Uvrkhangai	1	Aimag Center		2	2	2	2	2		10
	2	Bayan-Undur								0
	3	Burd	1						1	2
	4	Bat-Ulzii	1						1	2
	5	BB-Ulaan								0
	6	Bayangol	1						1	2
	7	Guchin-Us								0
	8	Esunzuil	1						1	2
	9	Ulziit								0
	10	ZB Ulaan	1						1	2
	11	Bogd								0
	12	Nariinteel	1						1	2
	13	Sant	1						1	2
	14	Taragt								0
	15	Tugrug								0
	16	Uyanga	1						1	2
	17	Khairkhandulaan								0
	18	Khujirt	1						1	2
	19	Kharkhorin	1						1	2
	20	Bayanteeg								0
		Sub-Total	10	2	2	2	2	2	10	30
Darkhan-Uul	1	Aimag center		2	2	2	2	2		10
	2	Orkhon<Darkhan>								0
	3	Khongor<Darkhan>								0
	4	Shariin gol<Darkhan>	1						1	2
	5	Sumber<Tuv>								0
	6	Saikhan<Selenge>								0
	7	Khutul<Selenge>	1						1	2
	8	Zuunkharaa<Selenge>	1						1	2
	9	Bayangol(Baruunharaa)<Selenge>	1						1	2
	10	Tunkhel<Selenge>	1						1	2
		Sub-Total	5	2	2	2	2	2	5	20
Selenge	1	Aimag center		2	2	2	2	2		10
	2	Altanbulag	1						1	2
	3	Eruu	1						1	2
	4	Zuunburen	1						1	2
	5	Khushaat								0
	6	Orkhon								0
	7	Sant	1						1	2
	8	Khuder								0
	9	Tsagaannuur	1						1	2
	10	Bugant								0
	11	Orkhontuul	1						1	2
	12	Baruunburen								0
	13	Dulaankhaan								0
	14	Javkhlant								0
	15	Shaamar	1						1	2
	16	Tushig								0
		Sub-Total	7	2	2	2	2	2	7	24
Training Center				2	2	2	2			8
Grand-Total			22	8	8	8	8	6	22	82

8.3 Organisation and Management

At this time, the organisation of Aimag and Sums targeted by this Project will be not changed, however, in near future the organization of Selenge will be centralized to Darkhan-Uul Aimag in order to promote more effective utilization of human resources.

8.4 Recommendations

(1) 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 as customer service is needed in order to increase new connections and traffic.

(2) Marketing activity

At present exchange and cable capacities are short and new connections and services are not available, however after the project it is possible to expand the capacities depending on the demand, therefore revenue increase through marketing activities including Internet and e-mail are important.

CHAPTER 9

PROJECT COST ESTIMATE

CHAPTER 9

PROJECT COST ESTIMATE

9.1 General

The cost estimates of the respective technical field described in Chapters 5, as the result of the basic facilities design, are summarized in this Chapter. A set of the rural telecommunications systems are planned for Sum centres in Uvurkhangai Aimag and in Selenge/ Dalkhan-Uul Aimgas, including the access network, switching system and transmission system from Aimag centre to Sum centre. IT-spots are also planned for the spread of the Internet Technology.

9.2 Objective Sum Centres

The cost estimates for the facilities plans are made in two areas of Uvurkhangai Aimag and Selenge/Dalkhan-Uul Aimags. The following Sum centres were undertaken as the objective areas for the expansion and rehabilitation work under this feasibility study:

(1) Uvurkhangai Aimag (10 Sum Centres):
- (a) Burd
- (b) Bat-Ulzii
- (c) Bayangol
- (d) Esunzuil
- (e) ZB Ulaan
- (f) Nariinteel
- (g) Sant
- (h) Uyanga
- (i) Khujirt
- (j) Kharkhorin,

(2) Selenge Aimag/Dalkhan-Uul Aimags (12 Sum Centres):
- (a) Altanbulag
- (b) Eruu
- (c) Zuunburen
- (d) Tsagaannuur
- (e) Shaamar
- (f) Sant

(g) Orkhontuul
(h) Khutul
(i) Zuukharaa
(j) Bayangol
(k) Tunkhel
(l) Shariin gol

9.3 Scope of Work and Precondition for Cost Estimate

(1) Scope of Work

This cost estimate includes the scope of work such as the equipment and material cost, the installation cost, measuring equipment cost, spare parts cost, training cost, access road construction cost, building construction and modification cost, etc.

(2) Local Currency Portion

The project cost consists of the foreign currency portion and the local currency portion. The local currency portion in this cost estimate includes the local currency cost for the work to be undertaken by PTA, such as the access road construction, building construction and modification, etc.

(3) VAT, Duties and Taxes

VAT, duties and taxes are not included in the cost estimate, in consideration of the donors' aid.

(4) Exchange Rate

The exchange rate of US$ 1 = Tg 1,100 is applied in this cost estimate.

9.4 Total Project Cost Estimate

The total project cost estimate is shown in Table 9.4-1. The total project cost estimate is further broken down into those for two areas such as Uvurkhangai Aimag and Selenge/Dalkhan-Uul Aimags as shown in Table 9.4-2 and Table 9.4-3.

Table 9.4-1 Project Cost Estimate

[US$ 1,000]

Item		Total Cost	Foreign Portion	Local Portion	Main Scope of Work
Switch		2,063	2,057	5	22 Switching Systems (6,580 line units)
Transmission	FOTS	609	521	88	9.4 km, 8 Multiplexers
	MW	4,927	4,285	642	Number of Link : 44
	Sub Total	5,536	4,806	730	
Access	Wired	1,764	1,273	491	18 Exchanges, 6,500 pairs
	WLL	2,743	2,652	91	CS: 20, SU: 2000
	Sub Total	4,507	3,925	582	
Power		243	216	27	
IT	IT spots	248	-	248	IT spot: 22
Contingency		630	550	80	
Consultant Fee		1,008	1,008	-	
Total		14,235	12,563	1,672	

Table 9.4-2 Project Cost Estimate for Uvukhangai

[US$ 1,000]

Item		Total Cost	Foreign Portion	Local Portion	Main Scope of Work
Switch		916	914	2	10 Switching Systems (2,520 line units)
Transmission	FOTS	194	163	31	4km, 2 Multiplexers
	MW	2,410	2,106	304	Number of Link :22
	Sub Total	2,604	2,269	335	
Access	Wired	720	519	201	9 Exchanges, 2,786 pairs
	WLL	758	734	24	CS: 6, SU: 600
	Sub Total	1,478	1,253	225	
Power		92	82	10	
IT	IT spots	111	-	111	IT spot: 10
Contingency		260	226	34	
Consultant Fee		416	416	-	
Total		5,878	5,160	718	

Table 9.4-3 Project Cost Estimate for Selenge/ Dalkhan-Uul Aimags

[US$ 1,000]

Item		Total Cost	Foreign Portion	Local Portion	Main Scope of Work
Switch		1,146	1,143	3	12 Switching Systems (4,060line units)
Transmission	FOTS	415	358	57	5.4 km, 6 Multiplexers
	MW	2,516	2,179	338	Number of Link : 22
	Sub Total	2,931	2,537	395	
Access	Wired	1,044	753	291	9 Exchanges, 3,714 pairs
	WLL	1,985	1,919	67	CS: 14, SU: 1400
	Sub Total	3,029	2,672	357	
Power		151	135	17	
IT	IT spots	137	-	137	IT spot: 12
Contingency		370	324	45	
Consultant Fee		592	592	-	
Total		8,357	7,403	954	

CHAPTER 10

FINANCIAL EVALUATION

CHAPTER 10

FINANCIAL EVALUATION

10.1 General

For the financial evaluation of the feasibility study, the main evaluation context of the M/P is firmly kept. An operating entity for the telecommunications services towards the selected 10 Sums of Uvurkhangai and 12 Sums of Selenge/Darkan-Uul areas is assumed. For the purposes of financial calculation, the entity is to own and use newly acquired telecom facilities. The procurement and installation of the equipment and facilities would be made in 2005 and the entity would start business operations in 2006 and the ending year of the evaluation is set in 2020. 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.

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 proportional ratio. The entity extends services for both of the existing and the new subscribers.

The financial evaluation of the feasibility study is focused on the calculation and analysis of Financial Internal Rate of Return on Investment (FIRROI) with a particular weight on whether the project can achieve its financial self-sufficiency and how soon it can.

10.2 Annual Records (1999-2001) of Revenues and Expenditures of the Selected Sums for F/S

Revenues and expenditures of MT's operations of the selected Sums for F/S for the periods from 1999 to 2001 have been reviewed and analysed to support the financial evaluation of F/S. For Uvurkhangai data of the 5 Sums of Kharkhorin, Bayangol, Uyanga, Esunzuil and Sant were secured, which could cover 1,015 subscribers out of 1,274 subscribers from the 10 F/S site Sums, while for Selenge/Darkhan-Uul the collected data covered 1,760 subscribers out of 1,968 subscribers residing in the 12 Sums.

The main points of the data are shown in Table 10.1-1 and 2.

Table 10.1-1 Revenues and Expenditures of Selected 5 Sums of Uvurkhangai

In Tg. mln

	1999	2000	2001
Revenues:			
International Call	3.875	1.375	2.482
Long-Distance Call	32.185	43.297	50.803
National Telegraph	0.422	0.502	0.733
Line Rental	13.374	14.543	13.698
Installation Fee	0.529	1.497	1.137
Others	1.981	1.563	1.060
Total	52.366	62.777	69.913
Expenditures:			
Salary	28.226	29.412	34.892
Social Ins.etc.	7.184	7.299	6.855
Total Staff Cost	35.410	36.711	41.747
Elec Fuel Heat	4.125	4.712	6.066
Other	3.695	3.572	5.771
Total	43.230	44.995	53.584

Source: MT

Table 10.1-2 Revenues and Expenditures of Selected Sums of Selenge/ Darkhan-Uul

In Tg. mln

	1999	2000	2001
Revenues:			
International Call	1.658	5.548	3.964
Long-Distance Call	56.771	73.912	53.796
Domestic Operator Call	6.055	15.010	9.835
Local Call	26.627	21.791	35.757
National Telegraph	1.537	1.506	1.776
Installation	1.788		5.389
Interconnection:			
To Mobicom		4.643	34.660
To Skytel			4.016
Other	1.518	1.018	0.458
Total	95.954	123.428	149.651
Expenditures:	46.059	54.140	73.089
Salary	10.234	11.158	16.465
Social Ins.etc.	56.293	65.298	89.554
Total Staff Cost	18.910	16.245	16.031
Elec Fuel Heat	2.878	7.505	14.046
Other	78.081	89.048	119.631
Total			

Source: MT

Now the readers of this report will notice how small the revenues are. And the recording of those data at Sum level needs standardisation under uniformed rules of definitions. Though new services can eventually developed upon the implementation of the capital investment, thereby increasing the revenues, however, this issue may cast very serious question to the feasibility of the project. Revenues of 2001 are only 64 U.S. Dollars per line in the 5 Sums of Uvurkhangai and 77 U.S. Dollars in the selected Sums of Selenge/Darkhan-Uul, if the exchange rate of Tg. 1,102 to one U.S. Dollar is applied. Accordingly we also reviewed another data secured from the headquarter of MT, covering 23 Aimag level profit centres and subtract numbers of Uvurkhangai, Selenge and Darkahn Aimag Cnetres to get an alternative numbers for project evaluation. Thus, U.S.$ 98 for Uvurkhangai and U.S$ 104 for Selenge/Darkhan-Uul, and the distributed amount of net international settlement and net interconnection charge are taken up for the financial evaluation of the project.

10.3 Preconditions for Financial Evaluation

(1) Key Assumptions

The following assumptions are made as the preconditions for financial evaluation. Most of them are identical to those used in the M/P.

1) Project Evaluation Period
   2005 to 2020 (16 years), consisting of one year of "construction" and 15 years of operations.

2) Fixed Price Base
   All revenues and costs are expressed in the fixed prices at the end of 2001.

3) Exchange Rate
   Exchange Rate is fixed at Tugrug 1,102 for one U.S. Dollar (at the end of 2001).

(2) Subscriber Development Plan

Subscriber Development Plan is set as in Table 10.2.

Table 10.2 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

Source: JICA Study Team

(3) Revenue Plan

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

(4) Operations/Maintenance Cost

In annual average	(US$ '000)
OM Cost (excluding Depreciation Expense)	307
Depreciation Expense	949
Total OM Cost	1,256

10.4 Financial Evaluation of Project

(1) Summary of Income and Cash Flow Projection

Table 10.3 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)

(Note) CF: Cash Flow
Source: JICA Study Team

(2) Base Case Analysis

Financial Internal Rate of Return on Investment (FIRROI) is 2.197%. A dramatic improvement both in cash flow and profitability is brought about in contrast with the Master Plan. Profit would become positive in the 7th year of operations (2012). Accumulated Cash Flow would become positive in the 14th year (2019). The case needs to be supported by the subsidies in an average annual amount of 100 thousand U.S. Dollars for 6 years achieving financial self-sufficiency in the 10th year of operations (2015). However, the total amount of operating losses is small and a discounted front-end lump sum payment can be adopted to minimise the amount of the subsidies, in the case USOF is the source fund of the subsidies.

The tariffs adjustment is dealt with in the 10% increase in the revenues of the sensitivity analysis in Paragraph 10.4-(3).

(3) Sensitivity Analysis

Sensitivity analysis is made in the following five cases:

- Revenue (plus/minus 10%) Case FSR-1 and FSR-2
- Operation-Maintenance Cost (plus/minus 10%) Case FSO-1 and FSO-2
- Capital Investment (minus 15%) Case FSI-1

1) Sensitivity as to change in Revenue

① Case FSR-1: 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 becomes 3.249%, achieving self-sufficiency in the 4th year of operations (2009). Required subsidy is decreased to US$ 100,000 for the 1st year of operations only.

② Case FSR-2: On the other hand, in the case the revenues decrease by 10%, FIRROI would shrink to 1.281%, required annual subsidies are US$ 200,000 for 7 years and self-sufficiency is achieved in the 15th year of operations.

Table 10.4-1 Sensitivity-Revenue

	FSR-1 Revenue +10%	FSR-2 Revenue - 10%
FIRROI	**3.249%**	**1.281%**
Positive Profit in	3rd year	9th year
Positive Cash Flow in	Any year	Any year
Positive Accumulated CF in	13th year	15th year
Required Subsidies Total $'000 Average/year $'000	 100 100(1 year)	 1,400 200 (7 years)

Source: JICA Study Team

2) Sensitivity as to change in O/M Costs: FSO-1 & FSO-2

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

Table 10.4-2 Sensitivity-O/M Cost

	FSO-2 OM Cost -10%	FSO-1 OM Cost +10%
FIRROI	**2.294 %**	**2.017%**
Positive Profit in	6th year	7th year
Positive Cash Flow in	Any year	Any year
Positive Accumulated CF in	14th year	14th year
Required Subsidies Total $'000 Average/year $'000	 300 100(3years)	 800 133(6 years)

Source: JICA Study Team

3) Sensitivity as to decrease in Capital Investment: FSI- 1

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 the capital investment is substantial.

Table 10.4-3 Sensitivity-Investment Cost

	FSI-1 Capital Investment -15%
FIRROI	**3.665%**
Positive Profit in	1st year
Positive Cash Flow in	Any year
Positive Accumulated CF in	13th year of operations
Required Subsidies Total $'000 Average/year $'000	 0 0

Source: JICA Study Team

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.

10.5 Conclusion of Financial Evaluation

The conclusion of this Chapter is enumerated as follows:

1) 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 except for some outstanding cases would need an incubation period of the first 5-6 years of operations.

2) 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.

3) 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.

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

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

CHAPTER 11

RECOMMENDATIONS

CHAPTER 11

RECOMMENDATIONS

11.1 Switching System

(1) Signalling System

ITU-T Common Channel Signalling System No. 7 should be adopted to the protocol of the inter-exchange circuits between Aimag centre and the Sum centre switching systems to be installed hereinafter.

(2) Synchronisation Plan

All switches and digital equipment installed in this FS Project should be synchronized with the Master clock in Ulaanbaatar.

(3) Replacement of Existing PBX Systems with Digital Switch

The existing Sum centre PBXs are mostly not capable for distant direct dialling (DDD) service. They should be replaced with new switching system equipped with DDD function and other functions usually given to urban switching system.

(4) Reuse of Removed Switching Equipment in Other Sums

The digital switching equipment removed in early stage under the Master Plan Project should be re-used at Sum centres that are running with aged analogue switching equipment.

(5) Expansion of Aimag Centre Switch

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 of Development of Rural Telecommunication System.

11.2 Transmission System

(1) Use of existing optical fibre cables sites and digital microwave relay station sites

In order to minimize the investment cost for construction of digital transmission network the existing Optical Fibre Cables sites and the existing Microwave relay stations sites shall be used jointly for establishment of digital links and installation of digital transmission equipments.

(2) Expansion of Backbone Transmission Facilities

In order to carry the additional local or rural areas traffic through the existing backbone transmission facilities it is recommended to make additional route establishment on the backbone microwave transmission systems or to make capacity expansion of the existing optical fibre cable system.

(3) Removal of unused transmission equipment

At all existing microwave repeater stations sites as well the Telecommunications Offices unused equipment or furniture has to be removed.

The existing microwave repeater stations space and the Telecommunications Offices space will be used for installation of digital transmission and switching facility..

(4) Frequency Plan

The 7 GHz frequency band (7125 MHz to 7725 MHz) shall be utilized for all point to point digital microwave transmission networks. The frequency channel allocation shall be according to ITU-R Recommendation 385-6 with a RF channel separation of 28 MHz

11.3 Access Network

(1) Wired Access Network

Since the existing facilities were installed with poor construction manner and the present facility quality of the cable network have been lower, most of the existing facilities should be renewed and the existing facility should be replaced with new one in the project in principle.

(2) Wireless Local Loop (WLL)

In order to provide end-to-end wireless solution in cost efficiency the PMP/TDMA-WLL system is introduced to target sum centres to put it overlay on the existing copper wired local loop for the additional establishment of subscribers lines not for the replacement purpose of the metallic cable lines.

The 1.9 GHz frequency band for public use (1895 MHz to 1918 MHz) shall be utilized. for PMP/TDMA -WLL system. The frequency channel allocation shall be according to RCR-28 standard with a RF channel separation of 300 KHz.

In order to meet future demand for Internet broadband services it is recommended to install the LAN-WLL partly.

11.4 Power Supply Facilities

(1) Main Power Supply

At some remote sites, main power supply from the Central Grid Energy system instead of solar power will be more efficient solution. The installation of power distribution cable and connection of 220 V to the site will be arranged by Mongolia side.

(2) Generator Room

The generators should be installed indoor. Small separate rooms for installation of the generator(s) should be provided at the existing telecom offices or repeater stations by the Mongolian side.

11.5 IT Facility

Internet tariff should be low or free of charge to make IT-spot be easy of access for low-income people or persons who can not own their PCs

11.6 Land and Building

(1) Access Roads to the Sites

In general only 4 by 4 vehicles are recommended to access to the sites and some approach roads construction will be arranged by Mongolia side.

11.7 Project Implementation

The followings are recommended for Quick Start and Smooth Advance of the Project

(1) Early Start of Project

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.

(2) Co-operation of PTA and MT

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 the foreign contractor.

(3) Financing Procedure

PTA is required to find a good finance. If the finance is provided by a foreign donor, it is very important to pay attention to the related rules and regulations having a close liaison with the authorities concerned. Project may be delayed sometime because of procedures. PTA is required to set up an over-all time table and forward the project referring to the time table. The over-all time table should be studied carefully and its breakdown should be given.

(4) Use of Consultant

An effective use of a consultant is essential. Experts for the project implementation will ease the management work not only the technical matters but also in the administration matters.

11.8 Operation and Maintenance Plan

(1) Centralized Operation and Maintenance

O/M works in Sums are centralized at Aimag centre and Sum O/M personnel are minimized in accordance with work volume. An Operation and Maintenance Centre should be established at Aimag centre when the digital switching system is installed at Sum centres. The Operation and Maintenance Centre should be equipped with such functions as to monitor the running status, to collect traffic data, to control subscriber data base of the switching system.

(2) Spare Parts, Tools and Measurement Equipment

Spare parts for O/M are initially purchased and stocked for 3 to 5 years in the project. 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 in the project. Additional one maintenance vehicle as minimum is deployed in each Aimag Centre OMC for the centralized maintenance for Sum Centre's facilities.

11.9 Human Resource Development and Training Plan

(1) 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 as customer service is needed in order to increase new connections and traffic.

(2) Marketing Activity

At present exchange and cable capacities are short and new connections and services are not available, however after the project it is possible to expand the capacities depending on the demand, therefore revenue increase through marketing activities including Internet and e-mail are important.

11.10 Financial Aspect

The followings are recommended:

(1) Financial Self-sufficiency

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 7-8 years of operations.

(2) Importance of Revenue Increase and Capital Investment Reduction

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.

(3) Comprehensive Development

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

(4) Subsidies

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

(5) Backbone Network Rental

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

CHAPTER 12

COMPREHENSIVE ASSESSMENT OF FEASIBILITY STUDY PROJECTS

CHAPTER 12

COMPREHENSIVE ASSESSMENT OF FEASIBILITY STUDY PROJECTS

12.1 General

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.

12.2 Present Status of Project Areas

(1) 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 correspond 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. 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. The mergence of Selenge Aimag and Darkhan Uul Aimag and the provision of free trade zone in Altanbulag Sum adjacent to the Russian border will be approved by the parliament in near future. Those areas are of biggest granary area in Mongolia, consisting of many large scale Sums.

(2) Telecommunications Operators

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.

(3) Telecommunications Facilities 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. Aimag centre of Uvurkhangai is connected with the western route digital microwave trunk transmission network. A private mobile operator is now under construction of the digital microwave radio links on the existing MT microwave trunk transmission link in order to expand digital cellular mobile telephone service. Total length of the open wire transmission system in Uvurkhangai is about 1,700 Km. There is no backbone optical fibre cable transmission 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 has been remarkably deteriorated with the quality. Shortage of the cable capacity is also causing at present.

(4) Telecommunications Facilities 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 Salkhit are not provided with MT exchanges, but with MRC exchanges. The existing Sum switching systems are analogue and digital, that is, 17 analogue units and 5 digital units.

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 digital microwave transmission system. The optical fibre cables establish those approach transmission lines. The 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 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. Aerial cable system has been adopting in almost all Sum centres. Most of the outside plant in Sum centres were built in the 1980s has been remarkably deteriorated on the quality. Shortage of the cable capacity is also causing at present.

(5) Power Supply

The majority telecom offices of Sum centres in Uvurkhangai Aimag 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 to feed power to small power consuming equipment.

(6) Internet Services

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. Internet connection from some Aimag centres is possible basically through dial-up connection. However very limited organisations or persons only can use Internet in Sum areas. That low penetration rate at Sum area is mainly due to poor circuit quality and high charge of long distance communication, low speed connection caused by the old telecommunication facilities, lack of inhabitants' affordability and less opportunity to buy and use PC.

12.3 Proposed Facilities Plan

(1) Microscopic Demand Forecast

The macroscopic demand forecast under the Master Plan Study was reviewed, 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 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. Demand in Sum centre is estimated from the demand density per sample and number of household, public organisation and business company in Sum centre. 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 quite similar to those studied in the macroscopic demand forecast.

(2) Network Design Policy

The telecommunications facilities 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 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 or traffic concentration and distribution node, will be provided with mainly metallic cables and partly with WLL system. Deteriorated or aged metallic cables will be replaced with new one.

(3) Switching Facilities

The new switching system is planned to be (i) full digital, (ii) compatible with existing network, (iii) durable in the Mongolian weather conditions, (iv) detailed billing function at Aimag centre, and (v) 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, and decided so that the new switching system have enough capacity to cater for the demand at least five (5) years after its commissioning.

(4) Transmission Facilities

The local transmission line 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. The existing

backbone microwave transmission facilities, such as tower, building and power supply, will be utilized to save the initial investment cost. 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. The optical fibre cable transmission system of MRC is utilized for Selenge/Dalkhan-Uul Aimagas.

(5) 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 WLL are three Sum centres and the number of newly installed Wireless Cell Stations (WCS) is 20.

(6) Power Supply Facilities

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. 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. 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.

(7) IT System

MT office in Sum centre provides public telephone service using telephone booths and facsimile message transfer service. 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". Telecommunications system in schools and hospitals will be improved by establishing high quality telephone lines that enables access to Internet.

12.4 Analysis and Assessment of Feasibility Study Project

12.4.1 Social Appropriateness

(1) Elimination of Telephone Density Gap between Ulaanbaatar and Project Area

The forecasted fixed telephone density is 11.15 lines per 100 inhabitants in Ulaanbaatar and 7.8 lines in project area in the year 2008, 12.46 and 8.2 in the year 2013 and 15.34 and 9.8 in the year 2020 respectively. The above imbalance in the level of telephone density would be inevitable due to the conditions in the rural areas as featured by the vast land and the dispersed many small Sums, high investment cost and low profitability.

(2) Elimination of Digital Divide

The introduction of IT-spots at the same time with the network infrastructure implementation is planned as elimination measures of digital divide in the project area. IT development is by and large in line with the Government's policy.

12.4.2 Technical Appropriateness

(1) Introduction of New Technologies and Services

New technologies which are state of the art, such as digital microwave system, optical fibre cable transmission system, digital switch and WLL system, are planned in Sums as initial stage of transition from conventional telecommunications network to IP network, taking into account of effective utilisation of the existing system. The introduced plan is to promote modernisation of the existing local network with the new technologies to make them possible to introduce the IP services in Sums.

(2) Modernization and Digitisation of Network

100% digitisation in the targeted Sums by the end of the Project and the operation and maintenance improvement for the network are planned with the network management system, computer supporting system, etc. The replacement of the obsolete facilities with digitalised facilities contributes to the improvement of service quality. Network is modernized and digitised for 100% in the Project for improvement of service quality and for efficiency of operation and maintenance.

12.4.3 Economic Appropriateness

(1) Economic Internal Rate of Return

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.

12.4.4 Financial Appropriateness

(1) Financial Internal Rate of Return on Investment

Financial Internal Rate of Return on Investment (FIRROI) is 2.197%, positive profit would be realised in the 7th year of operations, positive cash flow in every year of operations and financial self-sufficiency in the 10th year of operations. The results in the above explicitly prove the viability and financial soundness of the Project. Though the value of FIRROI doesn't change much from that of the Master Plan, there would be a dramatic improvement in cash flow and profitability of the Project formed by the Feasibility Study.

(2) Subsidies for Operation

Subsidies (annual average of US$100,000) are required for 6 years of operations. However, total amount of operating losses is small and a discounted front-end lump sum payment can be adopted to minimise the amount of subsidies, in the case the Universal Service Obligations Fund (USOF) is the source fund of the subsidies.

(3) Financing

With the above FIRROI, the financing sources for capital investment would be limited to the grants under the ODA, and USOF and the funds from the Mongolian Government including the privatisation proceeds.

12.4.5 Organisational and Management Appropriateness

(1) Efficiency of Operation and Maintenance

It is presumed that the number of telephones per one personnel in the year 2020 becomes about 50% of similar countries. Although maintenance staff will basically be centralised in Aimag centres, improvement of the telephone sets per employees has limitation due to geographic condition and size of the network of Sum centres. The estimated achievement is evaluated as appropriate enough.

(2) Effective Organisation and Staff Allocation

Considering shortcomings in Mongolia such as a vast land and dispersed many small Sums, re-organisation and effective staff allocation are planned by centralisation and integration of offices, etc., in line with the framework of facilities plan. The re-organisation and staff allocation plan are based on the framework of facilities plan, but the details are to be developed.

12.4.6 Appropriateness for Environment Protection

The implementation of the Plan is based on designs for prevention and protection of environment, especially for designing of transmission system. Designing and installation for prevention/protection of environment can be achieved.

12.5 Issues and Attentions for Implementation of Feasibility Study Project

As analysed and evaluated in the above, in order to implement practically and in time the feasibility study project for telecommunications development in the objective areas, attentions should be carefully paid to the following:

(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 overseas' 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 change to need further review of 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.

(2) Implementation Schedule of Grant Aid Project from Japanese Government

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 is concerned 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.

(3) 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 becomes 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 smooth advance of the proposed project 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.

12.6 Conclusion

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 should 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 alleviation, prevention from natural disasters and other administrative services.