CHAPTER 8 PROJECT IMPLEMENTATION PLAN AND PROJECT COSTS

8.1 Introduction

The study road comprises the road stretch between Erdene - Undurkhaan, totaling 258.8 km in length. Within the study road, the 37 km long road section between Erdene - Baganuur is being constructed by the Department of Roads using the Government's own fund. The budget for this section is 4.1 billion Togrog, and the construction period is scheduled to be 4 years from 2001 to 2004.

The project implementation plan covers the road stretch between Baganuur - Undurkhaan (hereinafter referred to as "the project road" for this Study) and totals 221.8 km excluding the above-mentioned 37 km long road section. However, since traffic demand forecast has been carried out to cover the entire road stretch between Erdene - Undurkhaan, the project implementation plan is made in recognition of the work to be done on the road stretch between Erdene - Undurkhaan. This is done particularly for the economic analysis based on the estimated benefit to be accrued from the forecasted traffic demand.

8.2 Construction Planning

8.2.1 Construction Section

There are existing villages such as Tsenkhermandal sum, Jargaltkhaan sum and Murun sum along the route, and there are also connecting roads at Kherlen River East, Jargaltkhaan and Murun West. The study road between Erdene and Undurkhaan, is divided into the following six (6) construction sections based on consideration of the villages and connecting roads.

Section-I: Erdene - Baganuur L=37 km (constructed by DOR and excluded in this construction planning)
Section-II: Baganuur - Kherlen River East L=30.6 km
Section-III: Kherlen River East - Tsenkhermandal L=49.7 km
Section-IV: Tsenkhermandal - Jargaltkhaan L=44.7 km
Section-V: Jargaltkhaan - Murun West L=50.0 km
Section-VI: Murun West - Undurkhaan L=46.8 km

The location of each construction section is shown in Figure 8-2-1.

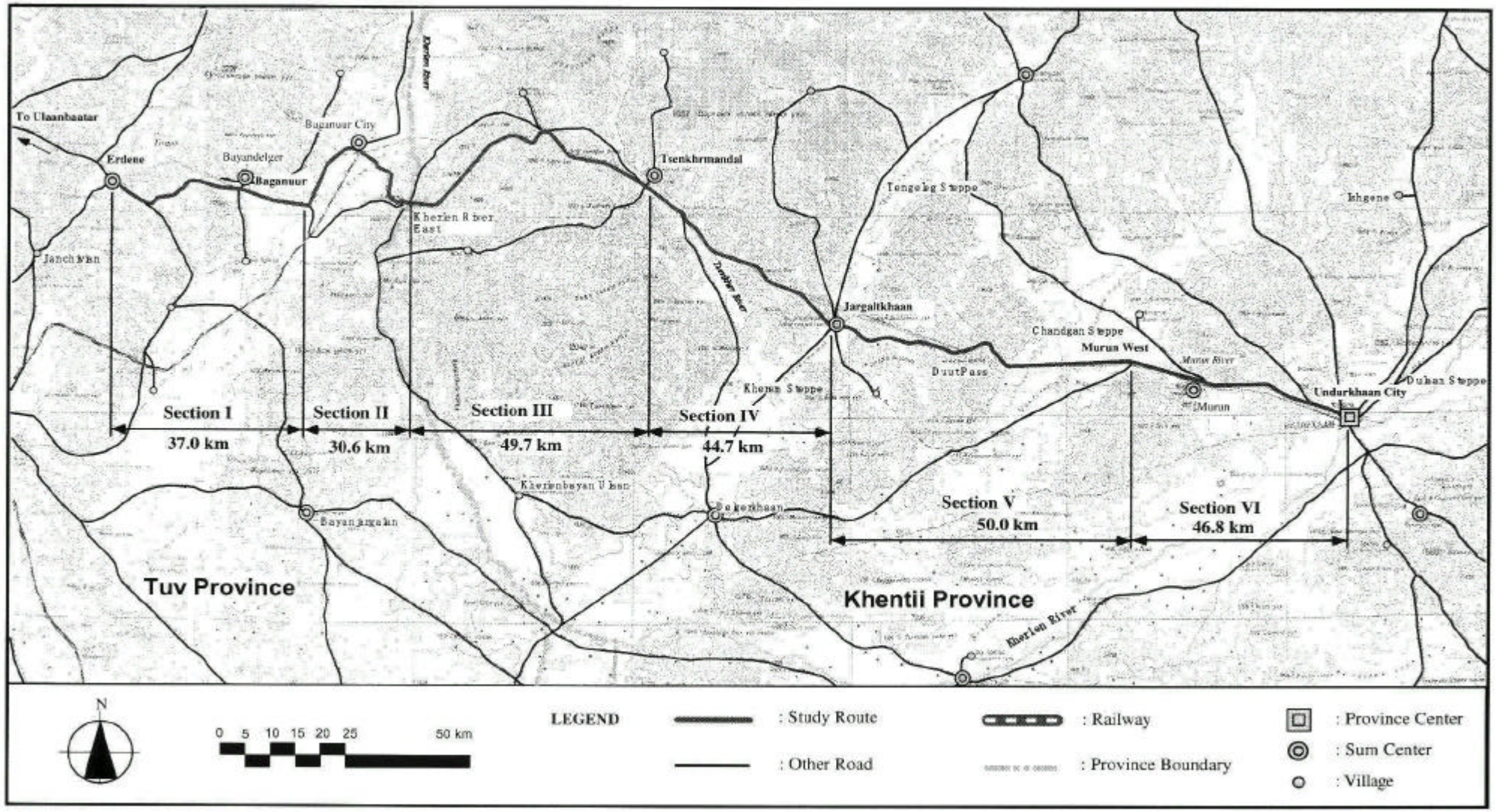

Figure 8-2-1 Location of Each Construction Section

8.2.2 Construction Time Schedule

The construction time schedule to cover Sections II to VI has been prepared based on quantity of works, considering the following salient features in the project area.

1) Asphalt pavement work is limited to the period of 5 months (May to September) and earthwork is limited to the period of 7 months (April to October).
2) Stockpiling of aggregates, pre-cast concrete structures and other preparatory works are carried out through the year.

The period of 4-year construction to cover 221.8 km long road improvement may be justified considering the achievements of the following previous projects:

- ADB first road development (312 km achieved in 5 years)
- Kuwait funded road project (180 km scheduled in 4 years).
- Construction schedule of ADB second road development (200 km scheduled in 4 years)

8.3 Project Implementation Plan

8.3.1 Implementation Plan for Sections II to VI

Although the project will be able to be implemented by various options as long as required fund is available, the type of project implementation has different features upon the completion. For example, the Chinese contractor procured through ICB to undertake the ADB second road development will construct the road using their own imported equipment and procuring necessary materials, equipment and labor from local markets. Only the constructed facilities will remain in Mongolia upon the completion although some technology transfer should be achieved. On other hand, the State-owned Construction Company "Erdene Zam" is constructing the road section of Erdene - Baganuur on a contract basis, using construction equipment procured under Japan's grant aid. Upon completion, the construction technique will be improved through the implementation, the skills of local engineer's, operators and mechanics will be developed and some revenue accrued from equipment rental will transfer to the State Property Committee. The former option is adopted because the use of ICB is compulsory under the terms and conditions of the ADB loan, whereas in the latter option the Government allocates the fund.

Considering the government's difficult fiscal and budgetary position, two schemes are considered within the project implementation plan,:

Scheme-I: Construction by contractor selected through tendering.

The highest priority should be given to Section -II (Baganuur - Kherlen River East L=30.6 km) and Section -VI (Murun West - Undurkhaan L=46.8 km) because they are located in the surroundings of urban area and relatively high economic return is anticipated due to the higher traffic volumes. Accordingly, these sections should be implemented by international contractors in a competitive environment utilizing funds and aids of donors.

Scheme-II: Construction by DOR as a pilot model

The remaining sections of Section -III (Kherlen River East - Tsenkhermandal L=49.7 km), Section -IV (Tsenkhermandal - Jargaltkhaan L=44.7 km) and Section -V (Jargaltkhaan - Murun West L=50.0 km) should be implemented by DOR using the proposed road rehabilitation/ maintenance center. The Equipment required for the road rehabilitation/maintenance center which will construct Sections III, IV and V in the estimated construction period of four (4) years is as shown in Table 8-3-1.

Scheme-I has advantages in the aspects of using effective, efficient and accountable procedures to realize the project by fast track method and with less financial burden on the government. However, no resource except facilities will be developed and road maintenance on the constructed section may face both technical and financial difficulties .

Scheme-II has the possibility to cope with institutional requirements that are issued in the administration of road. It envisages the growth of the construction industry through actual practices to cope with incremental demand brought about by the government policy of road improvement, especially development of the “Millennium Road”.

Figure 8-3-1 shows the construction time schedule for both Scheme-I and Scheme-II.

Table 8-3-1 Required Equipment List for Road Rehabilitation and Maintenance Center

Item	Description	Specification	Q'ty	Remark
1	Bulldozer	28 ton	3 units	Construction
2	Bulldozer	7 ton	2 units	ditto
3	Hydraulic Excavator	0.7 m3	4 units	ditto
4	Wheel Loader	2.1 m3	5 units	ditto
5	Wheel Loader	1.3 m3	2 units	Construction/Maintenance
6	Dump Truck	11 ton	33 units	Construction
7	Motor Grader	3.7 m	9 units	Construction/Maintenance
8	Vibration Roller	10 ton	5 units	ditto
9	Tire Roller	10 ton	1 units	ditto
10	Asphalt Finisher	4 m	1 unit	ditto
11	Asphalt Plant	60 ton	1 unit	ditto
12	Water Tanker	8000 liter	1 units	Construction
13	Asphalt Sprayer	1500 liter	1 units	Construction/Maintenance
14	Chip Spreader	Vessel mount type	2 units	Construction/Maintenance
15	Tractor Head with Trailer	35 ton	1 unit	Construction
16	Crusher Plant	Jaw 60t & Cone 49t	2 units	Construction
17	Asphalt Cutter		2 units	Maintenace
18	Air Compressor	180 PSI	2 units	Construction/Maintenance
19	Plate Compactor	60 kg	8 units	ditto
20	Pnuematic Breaker	30 kg	8 units	ditto
21	Dump Truck	4 ton, 4 x 4	4 units	ditto
22	Truck with 3 ton Crane	5 ton	1 unit	ditto
23	Road Patrol Car	4 x 4	1 unit	Maintenace
24	Double Cab Pick-up	4 x 4	2 units	Construction/Maintenance
25	Line Marker Truck		1 unit	Construction/Maintenance
26	Mobile Workshop	GVW 13 ton, 4 x 4	2 units	Maintenace
27	Rotary Snow Remover	Unimog type	2 units	Maintenace
28	Asphalt Testing Equipment		1 lot	Construction/Maintenance
29	Radio Communication	Base / Mobile	1 lot	Construction/Maintenance
30	Road Measure (wheel type)	5 digits	1 set	Maintenace

Section –II: Baganuur - Kherlen River East

		Quantity	Progress Rate		Year One												Year Two												Year Three												Year Four											
					J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
	Road Length （km）	30.6																																																		
	Construction Schedule																																																		
1	Preparatory Works																																																		
2	Earthwork Volume （cu.m）	268,677	19,191	m3/month																																																
3	Pavement																																																		
	Surface Course （sq.m）	218,988	18,249	m2/month																																															
	Base Course （cu.m）	13,586	849	m3/month																																															
	Sub-base Course （cu.m）	33,317	2,082	m3/month																																															
4	Bridge Work																																																		
	N0. of Location	3																																																	
	Total Length （m）	301.3	27	m/month																																															
5	Culverts																																																		
	No. of Location	10																																																
	Total Length （m）	140.0	13	m/month																																															
6	Incidental Works																																																		

Section –III, IV, V: Kherlen River East - Murun West

		Quantity	Progress Rate		Year One												Year Two												Year Three												Year Four											
					J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
	Road Length （km）	144.4																																																		
	Construction Schedule																																																		
1	Preparatory Works																																																		
2	Earthwork Volume （cu.m）	3,153,328	150,158	m3/month																																																
3	Pavement																																																		
	Surface Course （sq.m）	1,096,923	64,525	m2/month																																															
	Base Course （cu.m）	164,041	7,132	m3/month																																															
	Sub-base Course （cu.m）	357,050	15,524	m3/month																																															
4	Bridge Work																																																		
	N0. of Location	2																																																	
	Total Length （m）	67.5	5	m/month																																															
5	Culverts																																																		
	No. of Location	174																																																
	Total Length （m）	2,436.0	174	m/month																																														
6	Incidental Works																																																		

Section –VI: Murun West - Undurkhaan

		Quantity	Progress Rate		Year One												Year Two												Year Three												Year Four											
					J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
	Road Length （km）	46.8																																																		
	Construction Schedule																																																		
1	Preparatory Works																																																		
2	Earthwork Volume （cu.m）	563,891	40,278	m3/month																																																
3	Pavement																																																		
	Surface Course （sq.m）	355,650	29,637	m2/month																																															
	Base Course （cu.m）	35,565	2,223	m3/month																																															
	Sub-base Course （cu.m）	110,641	6,915	m3/month																																															
4	Bridge Work																																																		
	N0. of Location	1																																																	
	Total Length （m）	52.5	5	m/month																																															
5	Culverts																																																		
	No. of Location	42																																																
	Total Length （m）	588.0	53	m/month																																															
6	Incidental Works																																																		

Figure 8-3-1 Construction Planning for Sections II to VI

8.3.2 Implementation Plan for Economic Analysis

The implementation plan for the economic analysis is made to cover the entire road stretch between Erdene - Undurkhaan because it should coincide with the sections set by traffic demand forecast. This will allow comparison of the estimated costs and benefit that will accrue from the forecast traffic demand. Table 8-3-2 shows the relationship between traffic section and construction section, and the IP section is newly set for the proposed project implementation plan for the economic analysis.

Table 8-3-2 Relationship between Traffic Section and Construction Section

Traffic	Erdene - Baganuur		Baganuur - Jargaltkhaan		Jargaltkhaan - Murun	Murun - Undurkhaan
Construction	Section-I	Section -II	Section -III	Section -IV	Section -V	Section -VI
	Erdene - Baganuur	Baganuur - Kherlen River East	Kherlen River East - Tsenkhermandal	Tsenkhermandal - Jargaltkhaan	Jargaltkhaan - Murun West	Murun West - Undurkhaan
IP Section	IP Section-1		IP Section-2		IP Section-3	IP Section-4

Figure 8-3-2 shows the proposed project implementation time schedule for the purpose of economic analysis, including the road section between Erdene - Undurkhaan.

8.4 Project Costs

Project cost as a financial cost is estimated based on the results of preliminary design, quantity take-off of each work item, and the studies on construction planning and method.

The basic premises of project cost estimates are as follows:

1) The cost is estimated on US Dollar basis, considering the fluctuation of exchange rates against foreign currencies.
2) The unit cost of each cost component is determined based on the economic conditions prevailing in January 2002 (US$ 1.0 = ¥ 133 = 1,100 Togrog).
3) Detailed design and supervisory service costs is assumed to be 7 % of construction cost.
4) Unit prices of fill materials and fine/ coarse aggregates are estimated by every 10 km, considering hauling distance of materials from borrow pits and quarry sites individually. Unit prices of pavement are estimated based on the pavement structure designed by each pavement design section.
5) Equipment cost is based on the local market price as far as they are available. The cost analysis is made in case of special equipment that is not available in Mongolia. Additional equipment will be procured in the proposed road rehabilitation and maintenance center so as to keep supply and demand in balance.

The financial project costs for the purposes of the economic analysis include the cost of road section between Erdene and Baganuur are shown in Table 8-4-1 respectively for each alternative plan.

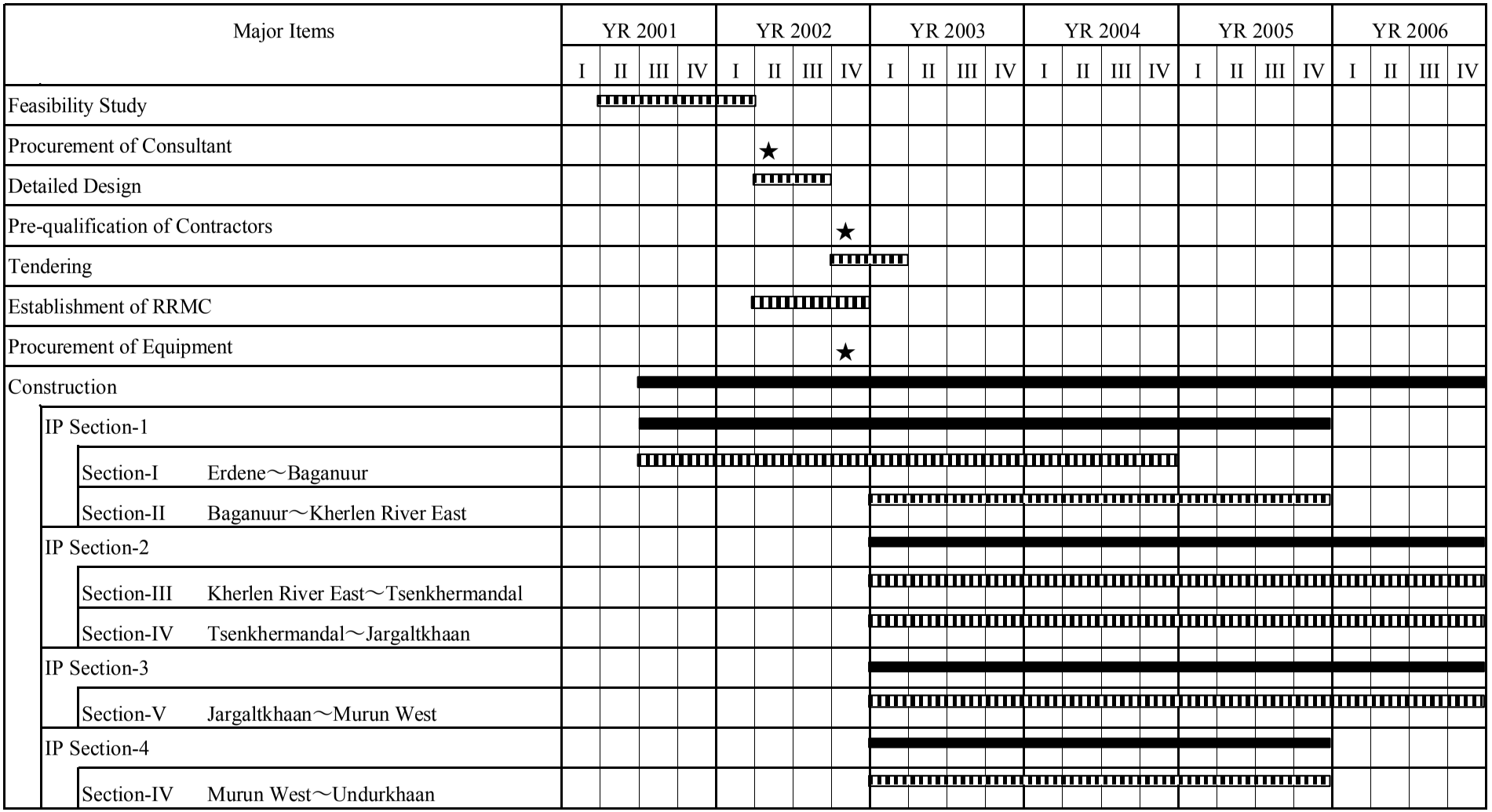

Figure 8-3-2 Project Implementation Time Schedule

Table 8-4-1 Financial Project Cost

Financial Capital Cost

Section: Eredene - Undurkhaan L=258.8 km

Recommended Plan (All Asphalt Concrete Pavement)

AT JAN. 2002 PRICES

Description	Total Financial Cost ($)	Financial Cost of IP Section 1 ($)	Financial Cost of IP Section 2 ($)	Financial Cost of IP Section 3 ($)	Financial Cost of IP Section 4 ($)
1. Direct Construction Cost	42,870,627	8,531,508	18,736,866	8,691,405	6,910,848
2. Physical Contingency (10% of 1)	4,287,063	853,151	1,873,687	869,141	691,085
3. Construction Cost (total of 1&2)	47,157,690	9,384,658	20,610,553	9,560,546	7,601,933
4. Land Acquisition and Compensation	0	0	0	0	0
5. Engineering Services	1,302,913	169,722	618,317	286,816	228,058
6. Supervisory Services	1,737,217	226,295	824,422	382,422	304,077
Total	50,197,819	9,780,675	22,053,292	10,229,784	8,134,068

Capital Cost $

	Total Financial Cost ($)	Financial Cost of IP Section 1 ($)	Financial Cost of IP Section 2 ($)	Financial Cost of IP Section 3 ($)	Financial Cost of IP Section 4 ($)
2001	931,818	931,818	0	0	0
2002	931,818	931,818	0	0	0
2003	10,732,988	2,747,839	2,987,483	2,557,446	2,440,220
2004	15,182,743	3,353,179	6,018,491	2,557,446	3,253,627
2005	13,842,514	1,816,021	7,028,827	2,557,446	2,440,220
2006	8,575,937	0	6,018,491	2,557,446	0
Total	50,197,819	9,780,675	22,053,292	10,229,784	8,134,068

O/M ($)

	Total Financial Cost ($)	Financial Cost of IP Section 1 ($)	Financial Cost of IP Section 2 ($)	Financial Cost of IP Section 3 ($)	Financial Cost of IP Section 4 ($)
Routine (annual)	444,620	124,085	158,448	82,815	79,272
Periodic (year 2012)	4,972,152	997,169	2,112,803	986,842	875,337
Periodic (year 2019)	5,337,001	992,113	2,317,043	1,033,050	994,795
Road Length (km)	258.8	67.6	94.4	50.0	46.8

CHAPTER 9 ECONOMIC AND FINANCIAL ANALYSIS

9.1 Economic Analysis

The economic analysis was conducted based on a comparison of the with- and without-project scenarios. Under the without-project scenario the existing earth road would continue to result in high vehicle operating costs (VOCs). Under the with-project scenario the asphalt concrete pavement would result in reduced VOCs.

The total length of the Project road is 258.8 km, divided into four sections. The construction periods, section by section, are shown below.

Table 9-1-1 Construction Period by Each Section

Section		Road Length	Construction Period
IP Section 1	Erdene-Kherlen River East	67.6 km	2001-2005
IP Section 2	Kherlen River East -Jargaltkhaan	94.4 km	2003-2006
IP Section 3	Jargaltkhaan-Murun West	50.0 km	2003-2006
IP Section 4	Murun West -Undurkhaan	46.8 km	2003-2005

The economic costs include the capital and maintenance costs of the project valued in economic prices. To determine the appropriate economic costs, goods and services to be used in project implementation were divided into tradable and non-tradable groups. Under the without-project scenario, it was assumed that there would not be any maintenance as very little maintenance is presently being carried out. Under the with-project scenario, maintenance was defined to include routine maintenance and periodic maintenance. The source of quantified benefits from the project is savings in VOCs. To be conservative, benefits attributable to savings in travel time were not considered. The VOC estimates are based on the Roads Economic Decision VOC model developed by the World Bank. In the without-project scenario, it has been assessed that the international roughness index (IRI) for the earth road would be 14. In the with-project scenario, the IRI is considered to be 3. Based on these assumptions, VOC costs and savings by vehicle type (in $ per vehicle km) are shown below.

Table 9-1-2 Vehicle Operating Costs in $ per vehicle km

Vehicle Type	IRI 14 WITHOUT	IRI 3 WITH	VOC SAVING
Car	0.234	0.100	0.134
Bus	0.654	0.504	0.150
Small Truck	0.222	0.095	0.127
Medium Truck	0.723	0.445	0.278
Large Truck	0.770	0.498	0.272

The results of the economic analysis are summarized below - firstly for the base case and secondly for a range of sensitivity tests.

Table 9-1-3 EIRR Base Case

Section		Road Length	ALT-1	ALT-2
IP Section 1	Erdene-Kherlen River East	67.6 km	17.3%	17.3%
IP Section 2	Kherlen River East -Jargaltkhaan	94.4 km	9.4%	10.6%
IP Section 3	Jargaltkhaan-Murun West	50.0 km	17.6%	19.0%
IP Section 4	Murun West -Undurkhaan	46.8 km	23.2%	25.6%
Total Section	Erdene-Kherlen River East	258.8 km	15.7%	16.8%

Notes: ALT-1: The whole of the project road will be paved by asphalt concrete.
ALT-2: The road stretch up to Tsenkhermandal will be paved by asphalt concrete and the remaining road stretch will be paved by bituminous surface treatment.

Table 9-1-4 EIRR Sensitivity Tests: Total Section of ALT-1

Test	Result - EIRR %
1. Costs plus 10 %	14.4 %
2. Benefits minus 10 %	14.3%
3. Combination of tests 1 & 2	13.0 %

9.2 Financial Analysis

The total project cost amounts to US$ 50 million (equivalent to Tg. 55 billion) and it is obvious that it will be heavy financial burden to the Government, compared with the total investment to the road sector of Tg. 53.1 billion during five years of 1996 to 2000. Upon the completion of the project in case of ALT-1, the routine maintenance will require Tg. 489 million every year and the periodic maintenance will require approximately Tg. 5 billion every 7 years.

Therefore, in order to secure the annual fund required for road maintenance, it is necessary to increase the Road Fund by strengthening road user cost recovery practices and to draw up a long-term strategy for cost recovery from road users.

For example, if the tolls are car: Tg.500/trip, bus/small truck: Tg.1,000/trip and medium/large trucks: Tg.2,000/trip, the estimated revenue from the proposed toll levied on Kherlen River Bridge is Tg. 248.4 million in 2005 and Tg. 355.3 million in 2010. This will considerably contribute to increasing the available Road Fund. In addition, equipment leasing at the proposed road rehabilitation/ maintenance center after the completion of construction work is also studied, and it is estimated to earn Tg. 424 million annually at most.

It will be possible to envisage that these two schemes will be able to cover the annual required fund of Tg. 489 million for road maintenance based on the DOR normative unit costs.

CHAPTER 10 CONCLUSION AND RECOMMENDATIONS

10.1 Conclusion

The project will directly improve an arterial road located in the eastern part of the country. The area influenced by the project includes the city of Ulaanbaatar and has an existing population of 1,086,000. This is more than 45% of the national population.

High potential of vehicular generation is anticipated once the study road is improved and it stimulates the development potential within the influence area of the study road.

The study road is identified as the priority section by the "Millennium Road Plan" of the Government, and its expected roles and functions are to secure traffic safety and conserve environment. The provision of a paved road to an all-weather international standard will stimulate economic and social development by providing better market accessibility for more competition and lower prices; will increase job opportunities for the poor; will strengthen linkages among growth centers; and will encourage the development of the market economy.

The project has high technical feasibility. There are minimum technical risks as the technical design is based on various engineering site surveys, full-scale natural condition surveys and social/ environmental surveys. The project also has social and environmental justification in that the EIA concluded there are no substantial or irreversible adverse environmental and social impacts arising from the project, and moreover it is concluded that the project is economically viable based on the economic analysis.

Therefore, high priority should be given to the implementation of the project because the project will promote economic and social development and shows expectation of a high economic return. The project will also contribute to reduce poverty in the eastern region through increased employment opportunities both during and after construction, accelerated agricultural and pastoral development induced by lower transport costs and improved accessibility of goods and people to markets.

The project will realize the strategic transport axis in the eastern part of the country as a part of "Millennium Road Plan" by construction of arterial road to an all-weather international standard.

10.2 Recommendations

(1) Implementation of the Project

1) It is recommended that Section -VI (Murun West - Undurkhaan L=46.8 km) be given the highest priority in the implementation plan due to its necessity and urgency together with high feasibility. This section is located in the surroundings of urban area and relatively high economic return is anticipated due to the higher traffic volumes.

2) Section -II (Baganuur - Kherlen River East L=30.6 km) involves the construction of Kherlen River Bridge for which the superstructure type is designed as PC girder totaling

268.8m (span 8@ 33.6m) in length. It is recommended that this section should also be given the highest priority in the implementation plan due to its necessity and urgency together with high feasibility.

3) It is recommended that Section -III (Kherlen River East - Tsenkhermandal L=49.7 km), Section -IV (Tsenkhermandal - Jargaltkhaan L=44.7 km) and Section -V (Jargaltkhaan - Murun West L=50.0 km) be implemented by MOI/ DOR using the proposed scheme of the road rehabilitation/ maintenance center. This scheme is able to cope with incremental demand brought about by the government policy of road improvement, especially development of the "Millennium Road" and possible growth of the construction industry through actual practices.

(2) Recommended Type of Pavement

It is proposed that the project road should be implemented by the recommended alternative of ALT-1: the whole of the project road paved by asphalt concrete. Asphalt concrete pavement has many advantages compared to bituminous surface treatment in the following aspects:

1) It is concluded that both alternatives are economically viable based on the economic analysis, and the 1% difference of IRR is deemed negligibly small in terms of project feasibility.

2) Asphalt concrete (AC) pavement has the advantage of strength and durability to give the longer design life of 10 years. Bituminous surface treated (BST) pavement is less strong and durable and it requires the application of a shorter design life of 3 years in most cases. BST pavement has vulnerable points of progressive loss of cover aggregate and deepening and expanding potholes. The financial constraint will cause delay of timely repairs and this will lead to aggravating the situation. BST pavement is qualitatively inferior because of the high need for road maintenance.

3) Both AC and BST pavements would suffer financial constraint in general. However, BST pavement requires labor-based technology in particular and lack of skilled and unskilled labors will become crucial in Mongolia due to the salient features of low population and vast distance between population centers. Therefore, BST pavement is not suitable in this Study.

(3) Countermeasure against Fund Requirement for Road Maintenance

It is crucial for MOI/ DOR to levy a toll on Kherlen River Bridges and charge the private sectors for the privilege of utilizing the roadside spaces to cope with the increased fund requirement and alleviate the financial burden of the Government. Furthermore, MOI/ DOR should seize the initiative to withhold the revenues from equipment leasing at the proposed road rehabilitation/ maintenance center and earmark them for road maintenance.

(4) Control of Development along the Route

It is important that the development within and along the proposed route should be effectively controlled to prevent indiscriminate development and to facilitate the realization of road and road related facilities such as road station and observation platform.

(5) Appropriation for Road Development Fund

It is recommended that the Government request a donor country to assist in the realization of the project including procurement of equipment at the proposed road rehabilitation/ maintenance center, using bilateral ODA or loan from a multi-lateral lending agency so as to alleviate the financial burden of the Government.

(6) Strengthening of Road Rehabilitation/ Maintenance Center

A scheme for a road rehabilitation/ maintenance center aims to establish personnel training with construction equipment and machinery required for the road development within AZZAN and to restructure the existing organization. It is recommended that the Government request a donor country to assist in the strengthening of a road rehabilitation/ maintenance center by utilizing the system of technical cooperation in the fields of road maintenance.

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10) Mr. L. Gombo : Member, Head of the Planning and Research Division, DOR
11) Mr. B. Manduul : Secretariat, Officer of the Roads, Transport, Info-communication and Tourism Policy Coordination Department, MOI

Counterpart Team Members

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2) Mr. Ch. Bayasgalan : Bridge and Structure Engineer, Engineer of DOR
3) Mr. D. Ulziidelgel : Highway Engineer, Engineer of DOR
4) Ms. B. Oyunchimeg : Transport Economist, Engineer of DOR
5) Mr. D. Zagdradnaa : Pavement Specialist, Engineer of DOR
6) Ms. G. Narantuya : Regional Development Specialist, Engineer of DOR
7) Mr. B. Bayasgalan : Environmental Specialist, Staff of MNE