Table 4-4-6 Design Standard for Culverts (Pipe & Box)

Type	Area of Design Discharge	Construction Method
A- PipeΦ1.0m	0.63m^2	Pre-cast
B- PipeΦ1.5m	1.41m^2	Pre-cast
C- PipeΦ1.5m@ 2	2.82m^2	Pre-cast
D- Box H2.5*B2.5- 1 Box	5.00m^2	Pre-cast or Cast in Place
E- Box H2.5*B2.5- 2 Box	10.00m^2	Pre-cast or Cast in Place
F- Box H2.5*B2.5- 3 Box	15.00m^2	Pre-cast or Cast in Place
G- Box H3.0*B3.0- 3 Box	21.60m^2	Pre-cast or Cast in Place

Note: Bridge construction is more than 30m^2 of area of design discharge (Bridge length: min. 15m)

4.5 Preliminary Design

Through the alternative route study based on engineering surveys the total length of the selected route is approximately 259 km in the road section between Erdene and Undurkhaan. However, the Mongolian side has determined that the section from Erdene to Baganuur (T-shape paved intersection) with approximately 37 km in length would be accomplished by the Government own budget. Therefore, the preliminary design is carried out for the road section between Baganuur and Undurkhaan in accordance with the amended Scope of Work.

Figure 4-5-1 shows road length and location of structures based on the results of the preliminary design.

4.5.1 Preliminary Design for Road

(1) Alignment

Horizontal and vertical alignments are located at the center of roadway. Horizontal and vertical alignments along the selected route are set based on the road section and geometric design standard.

(2) Bridges and Structures

Six bridges, twenty-nine box culverts and one hundred ninety-seven pipe culverts are planned to be set along the study route.

(3) Roadside Channels

Roadside channels are set for guiding rainwater to the river or culvert, because of the need for protection of the embankment and roadbed. It is planned to install roadside drainage channels, which are a V-shape open-channel ditches, between top and toe-of-slopes along the road.

Lined ditches will be installed where grades are over 4 % to prevent the erosion which will occur if the velocity of flow exceeds the permissible velocity.

(4) Traffic Safety Facilities

1) Regulatory and Warning Traffic Signs

Principal regulatory and warning signs will be installed at the following locations:

- Horizontally sharp curve (R<600m)
- Vertically steep grade (steeper than ±5 %)
- Domestic animal crossing

2) Guide Traffic Signs

Principal guide signs will be installed at the following locations:

- Direction at diverging/ merging points
- Road station / observation platform / gas station

3) Road Markings

Principal road markings will be painted on the pavement and will consist of the following types:

- Centerline
- Roadside line

4) Guard Posts

Guard posts will be installed at the following locations:

- High embankment sections (H>4.0m)
- Horizontally sharp curve (R<600m)
- Bridge and box culvert approaches

5) Kilometer Posts

Kilometer posts will be installed at 1 km intervals.

(5) Road Related Facilities

1) Road Station

The Road Station is the functional and desirable element of the new road and provides road users with the traffic safety and convenience. They will be located adjacent to the roadside but will be physically separated from the roadway and will include parking facilities, rest facilities, gas station and repair shop. They will provide the motorists with somewhere to stop and rest for short periods. It is recommended that only the minimum requirement of parking facilities and approach road be provided in the project as it is preferable that the other facilities are provided by the private sector. Based on site investigation and considering the existing “ger” type restaurants and gas stations, road station will be planned as the following locations:

- Kherlen River Check point
- Ogzam Valley (Tsenkher West)
- Tsenkher Bridge East

- Jargarantkhaan
- Murun

2) Observation Platform

Observation Platforms will be located away from the road and will provide motorists with somewhere to stay to enjoy tourism spots together with parking lots, observation platform, and restaurant. It is recommended that only the minimum requirements of parking facilities, approach road and observation platform are provided as in the project as it is preferable that the other facilities are provided by the private sector. Considering the existing fine viewpoints, Observation Platforms will be planned at the following locations:

- Kherlen River East
- Duut Pass

(6) Countermeasures against Environmental Impact

The following road landscape measures are planned in order to maintain the desirable road structure and show favorable scenery. This can also help to prevent traffic accidents because they contribute to reduce boredom for the driver.

- Countermeasure for permafrost
- Approach slopes for domestic animal crossing
- Tree planting beside road for environmental protection of inhabitants
- Reinstatement of hauling road
- Recovery measure after excavation at borrow pit and quarry site

4.5.2 Preliminary Design for Bridge and Structure

(1) Location and Type of Bridge

The location, scale and type of six bridges are determined based on field investigation, natural condition, hydrological analysis as shown in Figure 4-5-1. This figure also gives the detailed scale and type with station numbers based on the topographic survey and road alignment.

Damaged parts of the existing Kherlen Bridge will be repaired based on a check of the conditions to allow it's continued use for light vehicles, domestic animals and pedestrians.

Table 4-5-1 Outline of Bridges

No.	Name of Bridge	Station	Bridge Length	Type of Bridge		
				Super-structure	Sub-structure	Foundation
B1	Khujirt	113k+847.50	15.0m	RC T Girder	RC Wall	Spread Footing
B2	Khutsaa, Nariin	134k+044.75	17.5m	RC T Girder	RC Wall	Spread Footing
B3	Kherlen	142k+376.40	268.8m	PC T Girder	RC Wall	Spread Footing
B4	Tsenkher	205k+098.25	52.5m	RC T Girder	RC Wall	Spread Footing
B5	Urt Valley	231k+903.50	15.0m	RC T Girder	RC Wall	RC Pile
B6	Murun	307k+860.25	52.5m	RC T Girder	RC Wall	Spread Footing

(2) Location and Type of Box Culvert

The location, scale and type of RC box culverts are determined in the same way as bridges. and the types with station numbers are shown in Table 4-5-2. The details are shown in chapter 9 in the main report.

Table 4-5-2 Outline of Box Culverts

No.	Type	Station	No.	Type	Station	No.	Type	Station
BC-1	D	150 + 773	BC-11	E	187 + 215	BC-21	D	224 + 577
BC-2	D	151 + 770	BC-12	E	190 + 521	BC-22	E	250 + 377
BC-3	D	154 + 885	BC-13	D	192 + 570	BC-23	D	259 + 077
BC-4	E	157 + 770	BC-14	F	194 + 970	BC-24	F	268 + 777
BC-5	F	158 + 265	BC-15	D	196 + 370	BC-25	E	270 + 730
BC-6	D	171 + 313	BC-16	E	198 + 921	BC-26	E	301 + 177
BC-7	D	171 + 963	BC-17	F	207 + 020	BC-27	D	305 + 377
BC-8	E	176 + 367	BC-18	E	210 + 677	BC-28	D	309 + 877
BC-9	D	181 + 171	BC-19	F	214 + 577	BC-29	E	313 + 427
BC-10	E	184 + 370	BC-20	E	216 + 274			

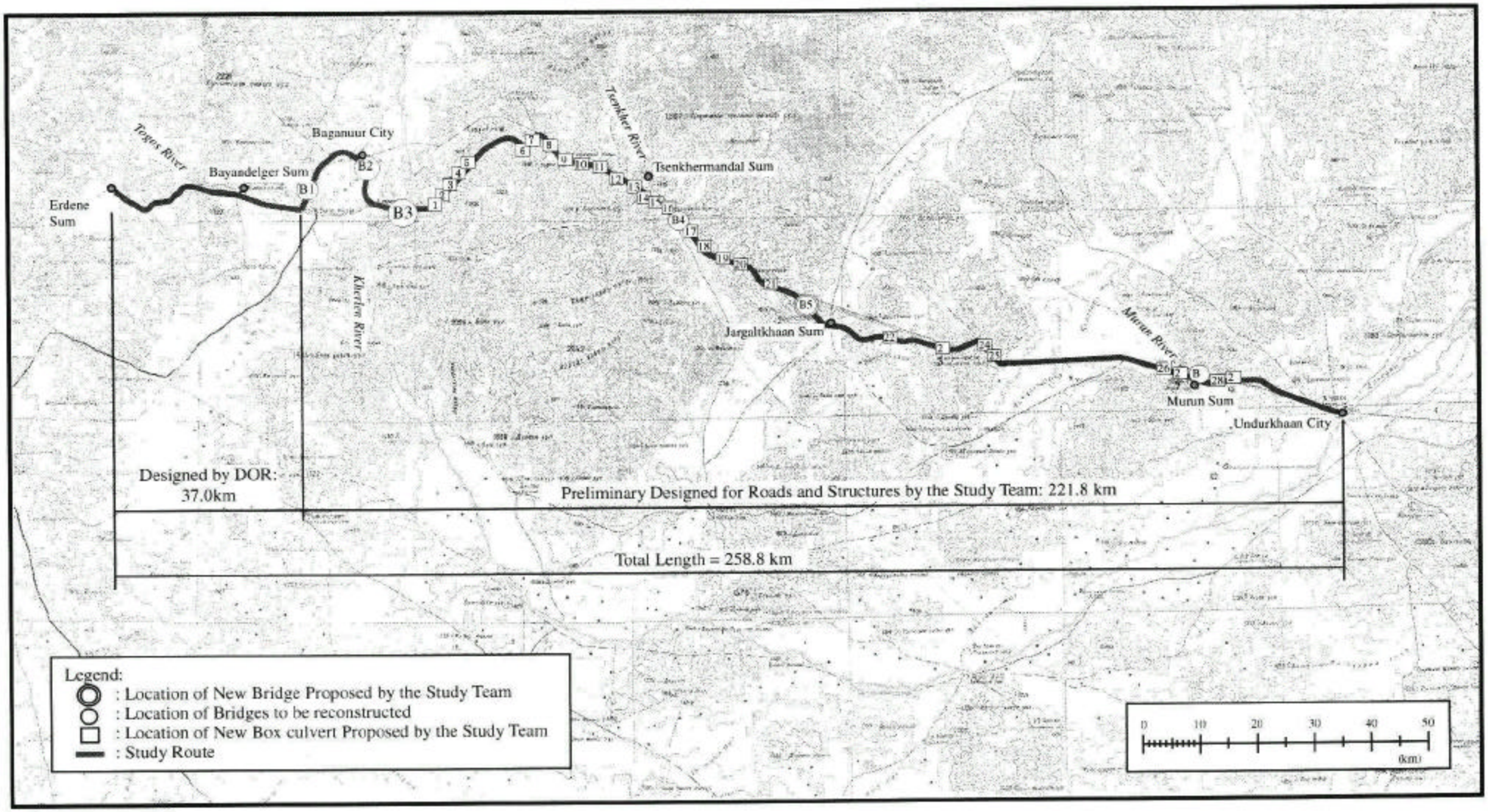

Figure 4-5-1 Road Length and Location of Bridges and Box Culverts

CHAPTER 5 ENVIRONMENTAL ASPECTS

5.1 Objectives of Environmental Impact Assessment

This Chapter gives the results of the Environmental Impact assessment (EIA). It addresses the Feasibility Study on Construction of the Eastern Arterial Road (EAR) in Mongolia and covers approximately 258.8 km of State Road A0501 from Erdene to Undurkhaan. According to the evaluation of the Initial Environmental Examination (IEE),, the Schedule and direction of EIA by Information, Monitoring and Assessment Department of Ministry of Nature and Environment (MNE), the JICA Study Team has set the Scope of work for EIA which covers the direction given by MNE after the IEE study.

The EIA study has finalized by the local consultant and the EIA study report has submitted to the Ministry of Nature and Environment (MNE) for evaluation by the MNE.

5.2 Socioeconomic Environmental Impact Assessment

The following is a summary of environmental impacts of the EAR project as to the socio-economic conditions.

(1) Environmental impact along the improved route

1) Negative impacts

- After opening the improved route there will be some increased safety problems for the local inhabitants and their cattle when crossing the road as a result of accidents due to the unregulated activities of community and their cattle.
- The increase of traffic volume may affect negatively on the health condition of the habitants and the generated noise will also have a negative influence to them.

2) Positive impacts

- After the opening of EAR, the road will become a main trunk corridor and contribute to the development opportunities for rural people to have more income and to move and travel with flexibility.
- Infrastructure networks will also develop new settlements along the route and this will have a positive affect on the life style of cattle breeders.

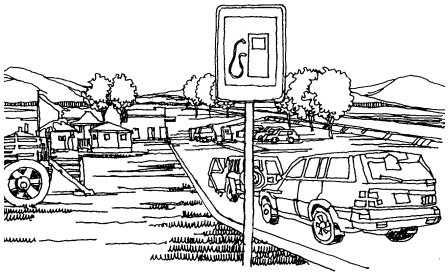

Figure 5-2-1
Service Area with Gas Station and Restaurant

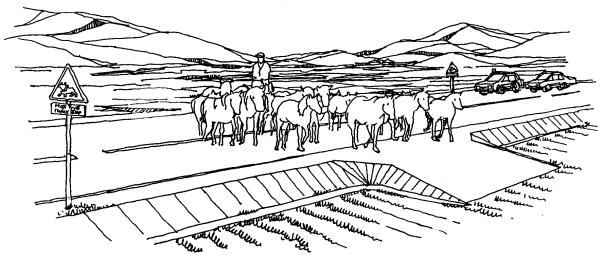

Figure 5-2-2
Slope for Cattle Crossing and Signs

3) Mitigation measures for negative impacts

- Figure 5-2-1 shows a proposal of service area with gas station, restaurant, etc.
- Figure 5-2-2 shows another proposal of slope for cattle to cross safely with caution sign installed on the EAR.
- It is required to install warning or traffic regulating signs and to provide a road crossing system for the critical places.
- Traffic regulation should be established considering the following matters: traffic control is necessary inside the settlement and town areas for the safety of both inhabitants and cattle, cattle breeders should not disturb the traffic outside the urbanized area.
- Trees should be planted to protect inhabitants from the noise and air contamination caused by passing vehicles.

(2) Impact assessment on quarry sites and borrow pits

1) Negative impacts

- The construction will cause noise and dust around the quarry sites during the operation
- It is possible to degrade the natural landscape and affect underground water during the excavation work.
- The construction could also cause negative impacts to the surface soil and vegetation by excavation and conveyance of surface soil.
- It is likely for animals (mammals, insects and rodents etc.) to escape from the area during the construction.
- Quarry site and borrow pits could be a dangerous place for animals (mammals, insects and rodents etc.) or cattle to fall in and even after the construction.

2) Positive impacts

- Construction of the paved road and bridges will protect the vegetation and surface soil from damage caused by the present system where vehicles travel on multiple tracks along the corridor.
- The construction will mitigate the effects of geodynamic activities at hydrological sections and sliding etc. It will also contribute to protect the riverbank from damage at the crossing points.

3) Mitigation measures for negative impacts

- The quarry sites and borrow pits should be planned to be as far as possible from the settlements and towns. In particular they should not be located in the zones of special protected areas, natural resource, historical monuments, zones of forest protection and rare plants, and also near water sources.
- When starting work it is necessary to remove the fertile soil layer of 20 to 30 cm thickness and keep it in a separate storage area during the construction.
- All protective measures and the operations organized to prevent the spreading of dust should be put into practice in the case of using explosives.

- After the construction it is vital to restore the excavated areas using the fertile soil which had been kept safely in the storage area during the construction. The edge of the excavated ground must be smoother out for the safety of animals and cattle.
- The reformed pits could be utilized as a reservoir for surface water run-off.

(3) Environmental assessment on urbanized area

1) Negative impacts

- After the opening of EAR, there are probabilities of the accidents due to the unregulated activities of local inhabitants and cattle.
- Generated noise and air contamination will likely to influence negatively to the health condition of the habitants.

2) Positive impacts of the project

- After the opening of EAR, the infrastructure network development will promote the accessibility advantages of transport and improvement of the related areas.
- New settlements will be generated and employment opportunity will be increased region-wide.
- The positive influence might result in self-generated improvements to the lifestyle of cattle breeders.

3) Mitigation measurements for negative impacts

- It is required to install warnings, traffic regulation signs on the critical places of crossing points.
- Safety measures should be carried out for the daily movement of people and cattle.
- Figure 5-2-3 shows the provision of tree planting on both sides of the EAR in urbanized area.

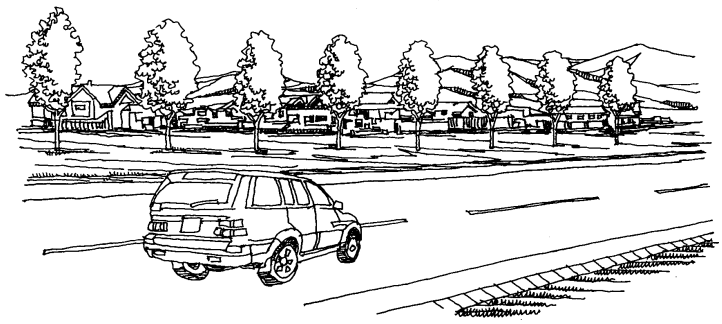

Figure 5-2-3 Tree Planting near by Settlement Area for Environmental Mitigation

(4) Impact assessments on protected areas and historical monuments

1) Negative impact

- After the opening of EAR, the air of the area will be contaminated by the suspended solid matters in exhaust gas due to increase of the traffic volume.
- However the impact to the natural and historical monuments is not harmful as these are located at a far distance from the road.

2) Positive impacts

- It is obvious the EAR has high importance on the state policy on natural environmental protection of special protected areas and their neighboring regions.

3) Mitigation measures for negative impacts

- It is required to clarify the unique features of the various natural and historical monuments and to recognize their importance. The authorities should promote awareness of the inhabitants of the areas.
- Figure 5-2-4 shows the example of observation deck with service facility on the scenic point along the EAR.

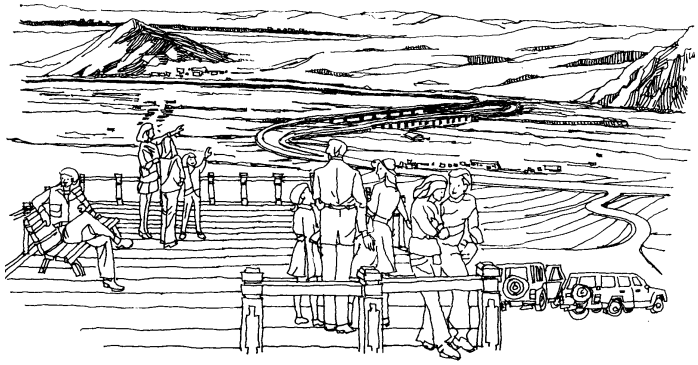

Figure 5-2-4 Observation Deck and Panoramic View for Traveling Passengers

5.3 Natural Environmental Impact Assessment

The following is a summary of environmental impacts of the EAR project as to the natural environment.

(1) Impact assessment on hydrological condition

1) Negative impacts

- During the bridge construction, there will be deformation of the riverbeds, temporary change of river water balance, turbidity of water and escape of fish and aquatic animals.
- If there is leakage of oil products from vehicles and construction machines into the water, it will cause contamination conditions.

2) Positive impacts

- After the river crossing facilities is constructed, there will not be crossing vehicles on the riverbed. This will result in a significant decrease of contamination of the hydrological environment caused by oil spill from vehicles and other machine products.
- Embankment works of implementation plan will protect surface soil and riverbed from natural erosion and aquatic animals from contamination and also prevent heavy turbidity and change of river flow.

3) Mitigation measures for negative impacts

- It is required to undertake the turbidity prevention works and control system to prevent the heavy turbidity during the construction works.
- It is necessary to control the leakage of oil and chemical products from construction machineries during the construction works.

(2) Impact assessment on permafrost

1) Negative impacts

- Permafrost could be affected by construction and operation of the road if the route is placed above it.
- The main impact is to increase the temperature inside the permafrost and this is likely to result in a thaw or disappearance of it in a few years.
- The general construction methods are suitable to be applied where permafrost has less moisture or is frozen. It is because the permafrost will become stable again after the road construction is completed. The upheaval and settlement will occur if the permafrost has an underground water stream near the surface because of the active freezing and thawing of the permafrost.

2) Positive impacts

- There is no positive impact.

3) Mitigation measures for negative impacts

- Certain construction methods is required to be applied in the area with water near the surface such as spreading of geo-textile sheets below the road embankment.
- Potential quarry sites and borrow pits which have permafrost should not be proposed nor selected in the implementation plan. It was evaluated that the permafrost along the study route was of small size and therefore only slight effects are expected.

(3) Impact assessment on geography and landscape

1) Negative impacts

- Exhaust gas may affect natural plants and reduce their harvest capacity to 1/3 to 1/4.
- It could also affect to the propagation and ecology of wild animals and vegetation. However, it was evaluated that the effects along the study route is fairly slight.

2) Positive impacts

- The multi-trails along the EAR have occupied large area of the field, but this will gradually return to vegetated landscape after the completion of the road.

(4) Impact assessment on flora environment

1) Negative impacts

- Flora environment is affected during the construction works due to removal of the soil, transporting materials and constructing the road.

2) Positive impacts

- The flora environment will recover within 2 to 4 years after completion of the road construction. The soil nutrition will increase due to the recovery of the vegetation.
- The area of multi-trails can be regenerated, so that pasture resource would increase after the EAR is constructed.

3) Mitigation measures for the negative impacts.

- It is necessary to keep soil, water and air as clean as possible and free from the fuel product used by the construction machinery during the construction of EAR.
- Approximately 357 ha of surface soil will be removed for the road construction. The surface soil and vegetation should be preserved before and during the construction and utilized to cover the embankment slope and to recover the construction sites after the construction.

(5) Impact assessment on fauna environment

1) Negative impacts

- During the construction of bridges, negative impacts will occur on shorebirds and bird nesting places.
- Animal burrows, dens and nests could be damaged during the construction of roads and bridges.
- Pollution to the river water by organic substances from human activities would increase.
- During the construction of bridges, habitat of rare and endangered species that are registered in the "Red book" would be impacted and could be slightly and temporarily damaged.
- During the construction, the wild animals will escape to the area that is 1 to 2 km wide along the road. However, it will recover after the completion with re-vegetation of the multi-trails.

2) Positive impacts

- There are species that expands their habitat along the EAR. This will contribute to both spread and recovery of animals' habitat.

3) Mitigation measures for negative impacts

- It is not allowed to damage animal burrows, dens and nests and not to kill animals that are registered in the "Red book" while constructing the roads and bridges.
- Installation of speed regulation signs is necessary for car drivers to avoid accidents with big birds on the road.
- Provision of management system on traffic control (traffic regulations, restrictions and manners) is required to protect the natural environment and decrease negative impacts during the operation stage of the road.

(6) Impact assessment on soil environment

1) Negative impacts

- Lead generated by exhaust gas of vehicle would increase 3 to 4 times due to the general increase of traffic volume.
- Agricultural products could be affected in a strip of 10 to 15 m along the route and human health condition could also be affected. However, it is evaluated that negative impacts on the soil environment is not very significant.

2) Positive impacts of project on soil environment

- All the degraded soil of the multi-trails will recover within next 3 years after completion of the project. Multi-trails area currently covers 40,000 ha. and most of this will be converted into agricultural or pasture resources in future.

3) Mitigation measures for negative impacts.

- During the road construction, the nutritional surface soil needs to be preserved and utilized for surface treatment on the embankment slopes.
- The excavated areas in the borrow pits and quarry sites should not be left untreated after the construction and where necessary they must be reinstated with the nutritional surface soil. The unity with the surrounding landscape should be taken into account in this work.
- These areas must be regulated for 5 to 10 years after the completion of mitigation works and the regulations should include restrictions to prevent the inhabitants from utilizing the surface soil as agricultural or pasture resources.
- It is necessary to remove the soil which has been polluted by fuel products of the construction machineries to allow the surface soil to recover and re-vegetate.

5.4 Environmental Impact Assessment on Pollution

The following is a summary of environmental impacts of the EAR project as on pollution.

(1) Impact assessment on air and noise condition

1) Negative impacts

- During the construction period, the noise generated by the construction machinery may disturb the inhabitants and cattle.
- Noise will be caused by running vehicle.
- The negative impacts are evaluated to be very low because of the low density of village, population and cattle along the route.

2) Positive impacts

- The EAR construction will reduce and improve noise level conditions which occur due to vehicle running on the earth road.

3) Mitigation measures for negative impacts.

- Trees should be planted around the villages and at critical areas along the EAR as this will reduce some negative impacts including psychological effects.

(2) Impact assessment on surface water quality

1) Negative impacts

- Turbidity of water could occur and be spread 4 to 6 km downstream during bridge construction. As a result of this, fish and other aquatic animals could move to other areas.
- Spill of oil products could also occur by vehicles and construction machinery if they go into the river flow directly.

2) Positive impacts

- Polluted water will be improved and kept clean after the bridge constructions because the vehicles will no longer cross the riverbed directly.

3) Mitigation measures for negative impacts.

- It is necessary to require the contractors to undertake turbidity prevention works and control system to prevent leakage of oil and chemical products from construction machineries during the construction works.

(3) Impact assessment on solid wastes

1) Negative impacts

- The humus soil layer in the road construction area will be damaged because of the removal of the surface soil in the early stage of the construction.
- Construction debris may cause negative impacts to the area along the EAR if site management and disposal of waste are not controlled properly.
- Wastes generated in the site camps may cause impact to the nature namely to the aesthetic and sanitary conditions.

2) Positive impacts of project on solid disposals

- Removed surface soil from construction works can be utilized for recovery of the degraded and damaged ground of the earth roads in the areas.

3) Mitigation measures for negative impacts

- It is necessary that the nutritional surface soil layer should be restored during the construction and utilized for the following works: surface treatment on the embankment slope, recovery for damaged areas of construction site, site camps and existing multi-trails earth roads.

- Every possible way should be used to keep construction sites and camps clean. It is also necessary to establish the management system for routine environment protection to be implemented by the community and organized by state, province and other authorities.

5.5 Summary of Impact Assessment

(1) Final Conclusion of the EIA on the EAR project

1) Conclusion

The details of the EIA are shown on following Table 5-5-1.

"The project of construction of the Eastern Arterial Road" has moderate negative impact.

During implementation of the project, careful attention should be paid to the negative impacts. It is important to carry out measures to reduce identified intensive and medium negative impacts.

In the implementation of the project, it is necessary to set up an environment management plan to mitigate negative impacts both on the social and natural environment and on the pollution. It is imperative to establish a control and monitoring program and keep eye on the impacts carefully to positively follow its criteria. It is necessary to carry out the supplementary or additional mitigation measures when the derived effects are not sufficient to what are expected or unexpected impact has occurred.

2) Major Recommendation

In the implementation of the project of EAR, it is vital to pay close attention to reduce negative impacts, and consider the following special requirements:

a) To provide adequate traffic and warning signs and information at the crossing points. These will assist children and elderly people to cross the road with safety and to avoid possible risks for drivers and passengers.

b) To organize and constantly inform the public, community leaders and drivers about safe use of the road during the construction and operation period.

(2) Environmental management plan and Monitoring program on the EAR project

It is certainly important to enforce both the environmental management plan and the monitoring program to mitigate effectively the negative impacts of the EAR project during and after the construction. This will help to protect environmental conditions of socioeconomic and natural environment and mitigate the pollution and negative impacts on them. It is necessary to make sure that the construction workers follow the management plan and monitoring program and to promote them to the drivers and inhabitants

Table 5-5-1 Summary of Environmental Impact Assessment of the EAR Project

No	Environs to be suffered with project impact	Number of total impacts	Negative impacts			Positive impacts			Assessment
			Intensive	Moderate intensive	Low intensive	With high effective	With effective	With low effective	
1	Socio-economic/ urbanized environment	12	1	2	1	3	5	0	Special importance, low negative impact
2	Air & Noise	5	0	0	3	2	0	0	Low negative impact
3	Hydrology/ quality of surface water	11	3	2	3	1	2	0	Moderate negative impact
4	Permafrost	3	0	0	3	0	0	0	Low negative impact
5	Geography and landscape	7	1	2	0	0	4	0	Moderate negative impact
6	Soil	9	2	3	1	3	0	0	High importance, moderate negative impact
7	Vegetation / Flora	4	0	0	1	2	1	0	Low negative impact
8	Fauna	20	4	1	10	3	1	1	Low negative impact
9	SPA, natural and historical place	3	0	0	2	1	0	0	Low negative impact
10	Quarry sites	11	4	2	2	0	3	0	Intensive negative impact
11	Solid Waste	6	0	3	1	2	0	0	Low negative impact
Total		91	15	15	27	17	16	1	-
Weight		1	0.16	0.16	0.30	0.19	0.18	0.01	-
Total assessment results		Based on the weight of the impacts assessment of the project, it is assessed that the EAR project has a “moderately negative” impact.							

CHAPTER 6 IMPROVEMENT OF ROAD MAINTENANCE SYSTEM AND ROAD DEVELOPMENT FUND

6.1 Road Maintenance Practices

6.1.1 Road Maintenance Works

Road maintenance works are classified into three types, namely routine, periodic and emergency. In addition to any special reports received from police or other agencies, the basis for all maintenance work is the regular inspection of the condition of facilities to monitor any defects or damage. The results of these regular inspections will be promptly reported to the operation office for follow-up maintenance works that may need to be undertaken as either periodic or emergency maintenance. Periodic maintenance will be carried out either partially each year or according to the plan at certain intervals of year. The term "preventive maintenance" is given to maintenance that is not required to restore the road function at this time but is intended to prevent deterioration that will lead to the need for costly rehabilitation work in future.

Periodic maintenance is based on detailed inspection performed at certain regular intervals. Defects and damages that require periodic maintenance will be reported for repairs or remedies, and the works are then planned at intervals of up to several years.

Emergency maintenance basically comprises works to restore road and road related facilities to their normal operating conditions and which cannot wait to be done under the periodic maintenance cycles. They are often caused by road accidents or natural causes.

6.1.2 Present Situation

The maintenance situation for existing roads has received attention in a number of recent studies under the sponsorship of the World Bank, the Asian Development Bank and Japanese bilateral funding. It is a well-established finding that the maintenance attention given to the existing roads in Mongolia is in general highly inadequate because of low fund availability and institutional weakness.

The funds which have been allocated annually for the maintenance of roads and bridges during the years 1997-2001 range from Togrog(Tg.) 1.0 billion to 2.0 billion.

In the present budgetary system, the operation expenditure is categorized into construction and maintenance even though a majority of the maintenance funds are probably spent on emergencies and this results in very little funds being left for conventional periodic maintenance activities.

On the institutional side, one fundamental problem of road maintenance lies in the existing road sections being scattered in relatively small stretches in 21 provinces. The maintenance work available in most provinces is thus too small to sustain adequate and resourceful road maintenance organizations. The road companies have been nominally privatized in recent

few years, but the major shareholder in most cases remains as the Government. The relationship between DOR and road maintenance corporation/ companies continue to exist in practice, in as much as DOR has to depend on the road corporation/ company in a particular province to get the road maintenance done in that province. Similarly, the road corporation/ company also has to depend on DOR for getting the work required to sustain themselves. On the whole, although the Government has issued a decentralization policy it has not yet been effectively achieved.

6.2 Present Maintenance System and its Organization

In accordance with the recommendations of the Asian Development Bank and in order to implement the Law on Roads, DOR established the Road Repair and Maintenance Management Unit within their organization in 1990. After institutional restructuring of the road sector in 1997, the Government established the state-owned Road Repair and Maintenance Corporation (AZZAN) in order to undertake road repair and maintenance works as well as to provide road users with traffic safety. However, DOR is still responsible for maintenance of national roads and road facilities and this responsibility has been delegated through the establishment of maintenance corporation/ companies including AZZAN and the involvement of the private sector in the remote provinces by regional zoning.

At present, there are a variety of road construction and maintenance companies with different types of legal status. 15 road maintenance units, which previously were under DOR and were responsible for road maintenance, were restructured to become one state-owned corporation, six state stock-shared companies, five region stock-shared companies and two privatized companies.

The Government changed the formation into company according to the Law on Company in 1992 and appointed the State Property Committee as a founder and stockholder. The State Property Committee is mandated to control the state property, while DOR utilizes the state property.

6.3 Evaluation of Road Maintenance System

6.3.1 System Improvement Measures

Under the current road maintenance system in the project area, the following jurisdictions are in force on the national road in the stretch of Erdene - Undurkhaan:

- Nalaikh branch of Road Repair and Maintenance Corporation "AZZAN" maintains 70 km from the beginning point.
- AZZAN also has jurisdiction over the Kherlen River Bridge.
- State Stock-shared Road Maintenance Company of Khentii Province maintains the remainder of the project road.

The present road maintenance system will be able to meet incremental demand brought about by the government policy of road improvement, especially development of "Millennium

Road", provided that the numbers of equipment and skilled operators is increased. Almost all the materials necessary to build a road are in existence along the route, and the increased equipment and skilled operators will be utilized for repair and maintenance after the road is open to the public.

The equipment presently utilized in the road sector was mostly procured from the Russian Federation and almost all of the road companies have much obsolete equipment whose effective operation life has already expired. In 1995 it was reported that only 57% of equipment was available for operation.

Since 1996, modern equipment has started to be procured through the official development assistance (ODA) to the road sector.

The following equipment has been procured in recent years:

- In 1996 - 7 excavators, 12 compactors, 26 computers - total cost US$ 603,478.0 (World Bank loan). This equipment has been supplied to the road companies.
- In 1999 - 3 rollers, 1 excavator, 3 motor graders, 2 wheel loaders, 5 water lorries, 5 sets of laboratory equipment - total cost US$ 1,997,258.0 (World Bank loan) and spare parts (US$ 44,448).

To ensure efficient use of this procured equipment, the Equipment Lending Company "TTT" within AZZAN was established to provide road companies with construction equipment.

On the other hand, the State-owned Construction Company "Erdene Zam" was established in 1996 to utilize 41 items of road construction equipment that were procured under the Japan's Grant Aid.

6.3.2 Capacity Building of Road Maintenance

(1) Jurisdiction and Mandate

Department of Roads (DOR) was established in 1995 and it was re-organized in 1996 as a government-implementing agency for implementation of the policy of the government.

Ministry of Infrastructure (MOI) formulates the government policy to develop national road network and supervises and coordinates its implementation through its agencies and departments. Meanwhile DOR under MOI conducts studies for development of the sector, organizes policy implementation, formulates projects for development of the road network and owns the state roads.

"Road Repair and Maintenance Corporation" (AZZAN) is a state-owned road maintenance corporation under DOR, in which all state-owned corporation/ companies which have been conducting repair and maintenance of state roads in the past were combined. AZZAN is mandated to undertake integrated and professional management of road repair and maintenance in the country and to have a separate administration from DOR.

(2) Organization and Personnel

DOR is legislatively defined to function as a government-implementing agency by the national "Law on Roads" ratified in 1998 and other relevant acts and regulations.

DOR operates four (4) divisions, two (2) client representative offices, one (1) material testing laboratory and project implementation units responsible for foreign funded projects.

DOR was financed from revenues of technical supervision in the period of 1996 to 1998, and since 1999 it has started to be financed from both revenues of technical supervision and the national budget. Table 6-3-1 shows budget and personnel of DOR.

Table 6-3-1 Budget and Personnel of DOR

Thousand Tg.

No.	Item	1996	1997	1998	1999
1	Revenue of Technical Supervision	102,636	147,700	156,938	49,758
2	National Budget				75,536
	Total of Revenue	102,636	147,700	156,938	125,294
4	Expenditure of Administration	97,959	120,411	150,527	138,440
5	Salary Fund	19,758	30,720	37,944	41,594
	Total of Expenditure	117,718	151,131	188,471	180,034
6	No. of personnel	41	54	56	50

The Road Repair and Maintenance Corporation "AZZAN" is under the Maintenance Management & Operation Division of DOR, and has the staff details as shown below:

Table 6-3-2 Personnel of AZZAN Corporation and State Stock-shared Road Maintenance Company of Khentii Province

		AZZAN	Kharkhorin AZZA	Govi-Altai AZZA	Selenge AZZA	Erdenesant AZZA	Dornogovi AZZA	Uvs AZZA	Tuv AZZA	Uvurhangai AZZA	TTI Company	State Stock-shared Road Maintenance Company of Khentii Province
Quota of Employees		150	67	39	56	41	34	38	170	59	27	34
Wage Fund (Thousand Tg.)		90,000	21,000	16,380	23,520	12,000	13,950.2	13,000	102,000	24,780	16,200	9,550.4
Total No. of Employees		150	67	39	64	40	34	35	164	59	24	34
Including	Engineers	27	9	2	5	2	4	1	21	9	6	2
	Technicians	15	7	7	8	6	5	6	18	7	-	5

(3) Strengthening of Road Maintenance Capability

For the country's economic development, it is critical to meet the increasing requirement for service of the road system. The Government gives the highest priority to arterial road improvement, especially the development of the "Millennium Road". Most existing roads are natural earth roads and they require both paving and improved alignment. Moreover, bridges also play an important role as a part of road netowork and many of these remain in serious condition and are heavily deteriorated due to lack of repair and maintenance and the recent increase of heavy traffic. Accordingly, the damaged bridges have become a serious traffic bottleneck which jeopardizes traffic safety and hinders smooth road transportation.

The state-owned Road Repair and Maintenance Corporation "AZZAN" and the state stock-shared road maintenance company of Khentii Province will both undertake road repair and maintenance works on the project road according to the present maintenance system. However, both of these two legal entities have the same issues to be resolved such as:

- Means by which adequate funds can be allocated for routine and periodic maintenance such that the project road can be properly maintained during its design life.
- Measures to ensure the efficient delivery of periodic maintenance using equipment-based methods supported by light equipment such as tractor/ trailers.
- Initiatives to encourage routine maintenance activities being carried out by local people/ villages under contract with DOR through AZZAN and the state stock-shared road maintenance company of Khentii Province, particularly in areas where local labor is readily available.
- Ways to boost road maintenance training capacity, both for equipment-based methods and for labor-based/ light equipment methods.

However, these two entities as well as the other maintenance and construction companies have similar problems as follows:

- Shortage of road and bridge construction equipment and machinery.
- Shortage of local engineers well-qualified in managing and supervising the operation of road and bridge construction equipment and machinery.
- Lack of skillful construction equipment operators, mechanics, and electricians.
- Lack of repair facility and tools.

In order to strengthen the road maintenance capability and to cope with incremental demand brought about by the government policy of road improvement, especially development of "Millennium Road", it is necessary to enhance fund availability and to reduce institutional weakness.

The scheme for a road rehabilitation/ maintenance center aims to establish personnel training with construction equipment and machinery required for the road development within AZZAN as shown in Figure 6-3-1. This will combine similar functions of TTT

company and the 5 other state stock-shared companies that are presently work in the field of road maintenance and construction.

It is expected that a road rehabilitation/ maintenance center may undertake actual site works as a pilot model to train operators, mechanics and managers, and such trained skills will eventually contribute to deliver effective construction equipment and to strengthen the road rehabilitation/ maintenance system.

The training center and its accumulation of road and bridge construction technology will also serve as a facility for educating construction equipment operators and mechanics in the transport sector.

The targets of the road rehabilitation/ maintenance center are:

a) To establish one road rehabilitation/ maintenance center that will serve as a training facility for construction operators and mechanics.
b) To procure equipment and machinery necessary for training and road rehabilitation/ maintenance.
c) To train operators, mechanics, road-maintenance personnel, and managers.
d) To upgrade and update the existing technically skilled operators, mechanics, road-maintenance personnel, and managers.
e) To utilize and accumulate those skills through actual practices as a pilot model.
f) To establish regional sub-centers for further development.

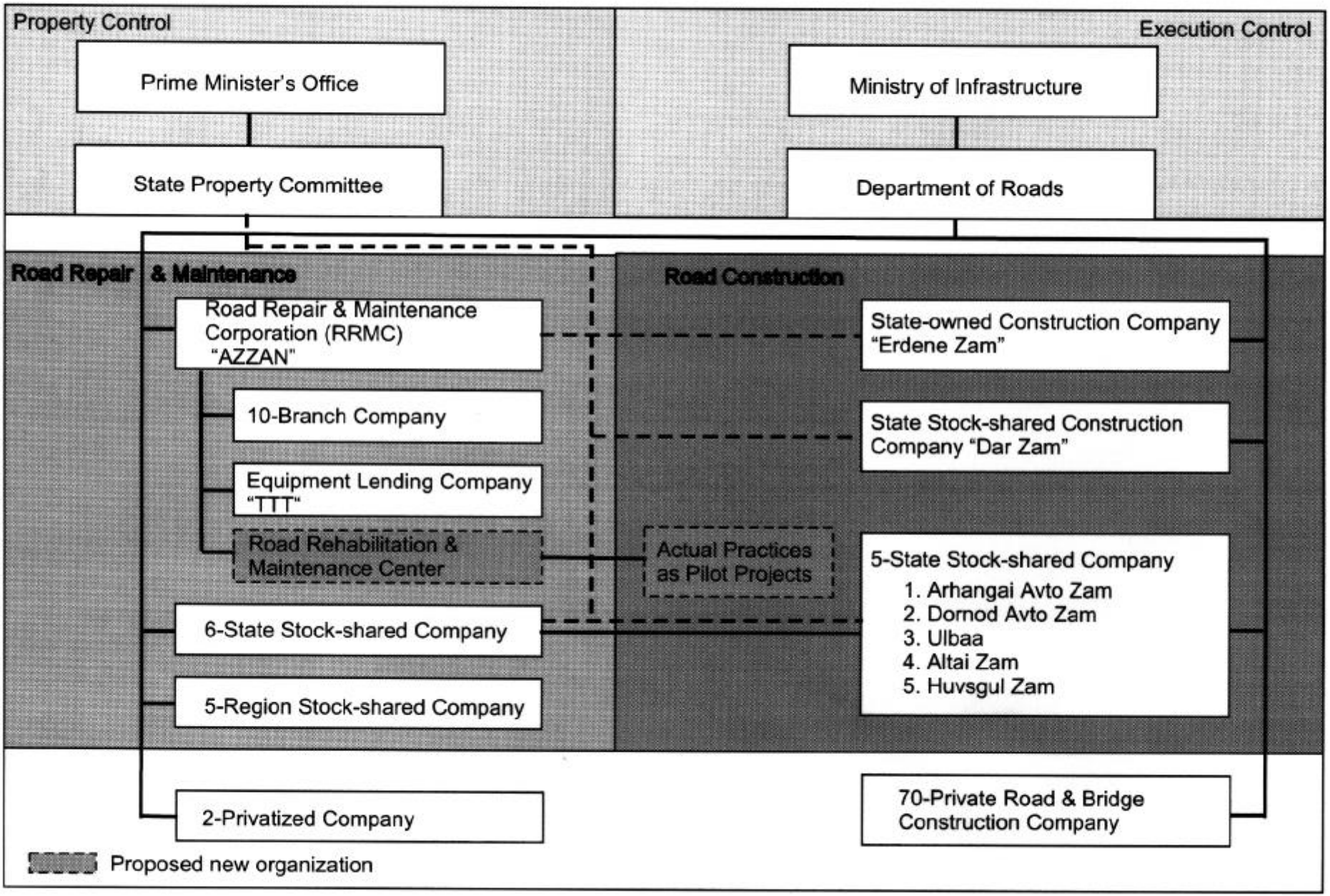

Figure 6-3-1 Proposed Road Rehabilitation & Maintenance Center in AZZAN

6.4 Estimated Cost of Routine Maintenance for the Project

DOR has carried out a unit cost analysis of annual maintenance by each type of pavement and type of bridge, and the annual required fund for each road link is estimated using these unit costs multiplied by its length. The type of road is classified into five, namely asphalt concrete, cement concrete, gravel, surface treatment and improved earth, while the type of bridge is two, reinforced concrete and wooden. DOR uses this analysis to make budgeting and refers to it as a basis to allocate annual fund to each maintenance company.

The actual practice on road maintenance is to carry out prioritized works within the allocated budget. In case of funding constraints, maintenance activities are limited to only the most seriously deteriorated road sections as a preventive maintenance. However, no provision is made for preventive and periodic maintenance, and even routine maintenance is performed on an ad hoc basis.

Based on the normative unit cost the maintenance cost for the study road is estimated as shown in Table 6-4-1,.

Table 6-4-1 Annual Required Fund for the Study Road

Unit: 1,000 Tg

	Road Length (km)	Bridge Length (m)	Total Required Fund
Section -I: Erdene～Baganuur	37.0	75.7	70,198
Section -II: Baganuur - Kherlen River East	30.6	301.3	66,296
Section -III: Kherlen River East - Tsenkhermandal	49.7	0	90,550
Section -IV: Tsenkhermandal～Jargaltkhaan	44.7	67.5	83,743
Section -V: Jargaltkhaan～Murun West	50.0	0	91,097
Section -VI: Murun West - Undurkhaan	46.8	52.5	87,199
Total	258.8	497.0	489,082

6.5 Road Development Fund

In 1995 by the decision of the Government, the Road Fund was established for construction and maintenance of roads and bridges in accordance with the Law on Taxes on gasoline and diesel fuel. The Road Fund (RF) comprises revenues derived as a part of fuel tax, vehicle registration fee, allocation of national treasury and other incomes. The RF is split into two, namely RF for DOR and RF for Ulaanbaatar City Government and since 1999, the revenue from vehicle registration fees which accrues from Ulaanbaatar City is transferred solely to the RF for Ulaanbaatar City Government. At present, most of the Road Fund revenues are used for development/ rehabilitation works (including periodic maintenance), with routine maintenance receiving only very small allocations.

For expansion of revenue sources of the Road Fund, the Department of Roads has proposed to the Government that the revenue of fuel special tax should not be transferred to the state budget, but instead it should be transferred it directly to the Road Fund. (Fuel tax comprises custom, normal and special.)

Table 6-5-1 Revenue of the Road Fund

Revenue	1997	1998	1999	2000
Fuel tax (M. Tg.)	4,200	4,434	3,481	4,234
State budget (M. Tg.)	51	1,156	2,341	3,716
Others (M. Tg.)	52	307	601	47
TOTAL (M. Tg.)	4,303	5,897	6,423	7,997
Exchange Rate (Tg./US$)	720	885	1,000	1,070
Equivalent US$ (Thousand $)	5,976	6,663	6,423	7,474

In the years 1996 - 2000, the total investment to the road sector was Tg. 53.1 billion including foreign loans, grants and domestic investments. Source of investments comprises;

- From the Road Fund - Tg. 17.6 billion (33.0%)
- From foreign loans - Tg. 28.1 billion (53.0%)
- From grant aids - Tg. 7.4 billion (14.0%).

To supplement the increase fund received from the Road Fund revenue, MOI/ DOR has examined the possibility to levy a toll on certain arterial roads or long-span bridges, to charge the private sector for the privilege of utilizing the roadside spaces and to restructure the State-owned Road Repair and Maintenance Corporation (AZZAN) by privatization.

CHAPTER 7 ROAD IMPROVEMENT PLAN

7.1 Project Component of Road Improvement Plan

The Road Improvement Plan aims to improve National Highway No. A0501 from the existing multiple shifting tracks to an all-weather paved road with well-designed horizontal and vertical alignment. The improvement plan aims to provide an arterial road to an international standard and to ensure that it can be maintained effectively on the completion of construction.

In addition to the facility improvement, the establishment of a road rehabilitation/ maintenance center is proposed to maintain the project road effectively by re-structuring the present road maintenance system as an institutional measure and by procuring equipment at a road rehabilitation/ maintenance center. This will serve not only for training and equipment leasing but also for undertaking actual construction practices as a pilot model.

7.2 Road Improvement

The project road will be improved within each design section and will be designed based on the following criteria:

1) Highway Classification: Category III (as per Mongolian Standards)
2) Road Width: 7m + 2@1.5m (total 10m road width)
3) Design Speed: 100 km/h for flat terrain, 80 km/h for rolling and 60 km/h for mountainous

The horizontal and vertical alignments are selected to secure driving safety considering Mongolian weather condition and to minimize earthwork volume.

The road embankment is designed considering embankment height and the use of non-frost susceptible materials to prevent frost actions such as swelling or capillary action.

The pavement thickness is designed on the basis of AASHTO design method considering the design CBR of each pavement design section and cumulative number of 8.2 ton equivalent axle load applications in one direction over ten years.

Road ancillaries such as road markings, guard posts, regulatory & warning signs, guide signs, kilometer posts and approach slope for domestic animals will be installed as traffic safety measures.

Road related facilities such as road station and observation platform are recommended to be installed as resting-places for long-distance drivers and as an amenity enhancement.

7.3 Bridge and Structure Improvement

The bridge and structure improvement plan includes construction of bridges, construction of box culverts and installation of pipe culverts. The type and location of each structure are determined based on the preliminary design and by referring to the results of engineering site survey.

The outline of bridge and structure improvement plan is envisaged as follows:

(1) Construction and Rehabilitation of Bridges

Six (6) bridges are proposed on the proposed route between Baganuur and Undurkhaan.

1) Replacement of Existing Three (3) Wooden Bridges

These 3 bridges are located at the Khutsaa river, the Tsenkher river and the Murun river and their present conditionis so poor that heavy vehicles cannot cross them.

RC-T girder bridges with the standard width of 9 m are proposed to meet the technical requirements of Millennium Arterial Road Plan.

2) Construction and Rehabilitation of Kherlen Bridge

The bridge structure does not have the structural strength for the design load of heavy vehicle nor the required width for the design vehicle. The opening beneath the bridge is insufficient for the peak discharge and some damage on the surface of the bridge detracts from the smooth riding condition. The existing bridge is planned to be repaired but will be used only for non-motorized vehicles, pedestrians and domestic animals.

The new PC-girder Bridge is proposed to meet the technical requirements of Millennium Road Plan. At the first stage, an 8-span bridge of 268,8m length and with 9.0m width will be constructed to meet the requirements on an international standard.

3) Replacement of Khujirt Bridge

The existing Khujirt River Bridge will be replaced by RC-T girder bridges, since the bridge does neither have structural strength for the design load of heavy vehicle nor sufficient opening for the peak discharge.

The Replacement bridge will meet the technical requirements of the Millennium Plan and ensure sufficient discharge capacity.

4) Construction of One (1) New Concrete Bridge

There will be one (1) new bridge to be constructed in the project and it is located in the Urt Valley. The detail design of the bridge was made by DOR in the past and this bridge requires pile foundation due to the soft ground condition.

(2) Construction of Twenty Nine (29) New Box Culverts

The route passes through the swamps and valleys and a large number of watercourses exist in the mountainous and marsh area. Box culverts will be installed at the crossing point of major watercourses to ensure that their flow is not affected by the new embankments. The box culverts will be utilized by stock-farming and wild animals to cross the high road embankment at times when the watercourses have no water. The preliminary design determines the location of each box culvert.

(3) Installation of Pipe Culverts

The study road will necessitate numerous cross drainages to drain storm water on pavement and its adjacent area, especially in the mountainous and rolling area. Pipe culverts are planned to be installed at the sag point of vertical alignment, in between box culverts and at the places where storm water will converge.

One hundred ninety seven (197) pipe culverts are estimated to require installation. The preliminary design determines the dimension but not the exact location of the pipe culverts.

7.4 Strengthening Road Maintenance Capability

The capability of road repair and maintenance will be strengthened by adequately re-structuring the present road maintenance system and procurement of modern equipment.

(1) Establishment of Road Rehabilitation/ Maintenance Center in AZZAN

The scheme of a road rehabilitation/ maintenance center aims to establish a system for personnel training with construction equipment and machinery required for the road development. It is expected that a road rehabilitation/ maintenance center may undertake actual site construction works as a pilot model to train operators, mechanics and managers. Such training and skills will eventually contribute to deliver effective use of the construction equipment, to strengthen the road maintenance capability, and to cope with incremental demand in the standard of the maintenance.

(2) Equipment Procured for the Road Rehabilitation/Maintenance Center

The equipment will be procured and will be commonly utilized for construction/ rehabilitation and maintenance for operator training, lending and actual practices as a pilot model.

(3) Construction of Operation Depot including Workshop in the State Stock-shared Road Maintenance Company of Khentii Province

To establish a regional sub-centre for further development, it is proposed to construct the operation depot including workshop in the state stock-shared road maintenance company of Khentii Province. The State stock-shared road maintenance company is responsible for the road maintenance of the study road in Khentii Province and the operation depot will consist of equipment pool yard, warehouse, administration office and other ancillary buildings and facilities. In the interests of cost efficiency, the existing facilities will be renovated as much as possible.