No.

BASIC DESIGN STUDY
ON
THE PROJECT FOR SUPPLY
OF
ROAD CONSTRUCTION AND MAINTENANCE
EQUIPMENT PHASE II
IN
THE REPUBLIC OF UZBEKISTAN

OCTOBER, 2004

JAPAN INTERNATIONAL COOPERATION AGENCY
CONSTRUCTION PROJECT CONSULTANTS, INC.

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PREFACE

In response to a request from the Government of the Republic of Uzbekistan, the Government of Japan decided to conduct a basic design study on the Project for Supply of Road Construction and Maintenance Equipment Phase II and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Uzbekistan a study team from 20th April to 14th May, 2004.

The team held discussions with the officials concerned of the Government of Uzbekistan, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Uzbekistan in order to discuss a draft basic design, and as this result, the present report was finalized.

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

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Uzbekistan for their close cooperation extended to the teams.

October 2004

Seiji Kojima
President
Japan International Cooperation Agency

October, 2004

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Supply of Road Construction and Maintenance Equipment Phase II in the Republic of Uzbekistan.

The study was conducted by Construction Project Consultants, Inc., under a contract to JICA, during the period from April, 2004 to October, 2004. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Uzbekistan and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

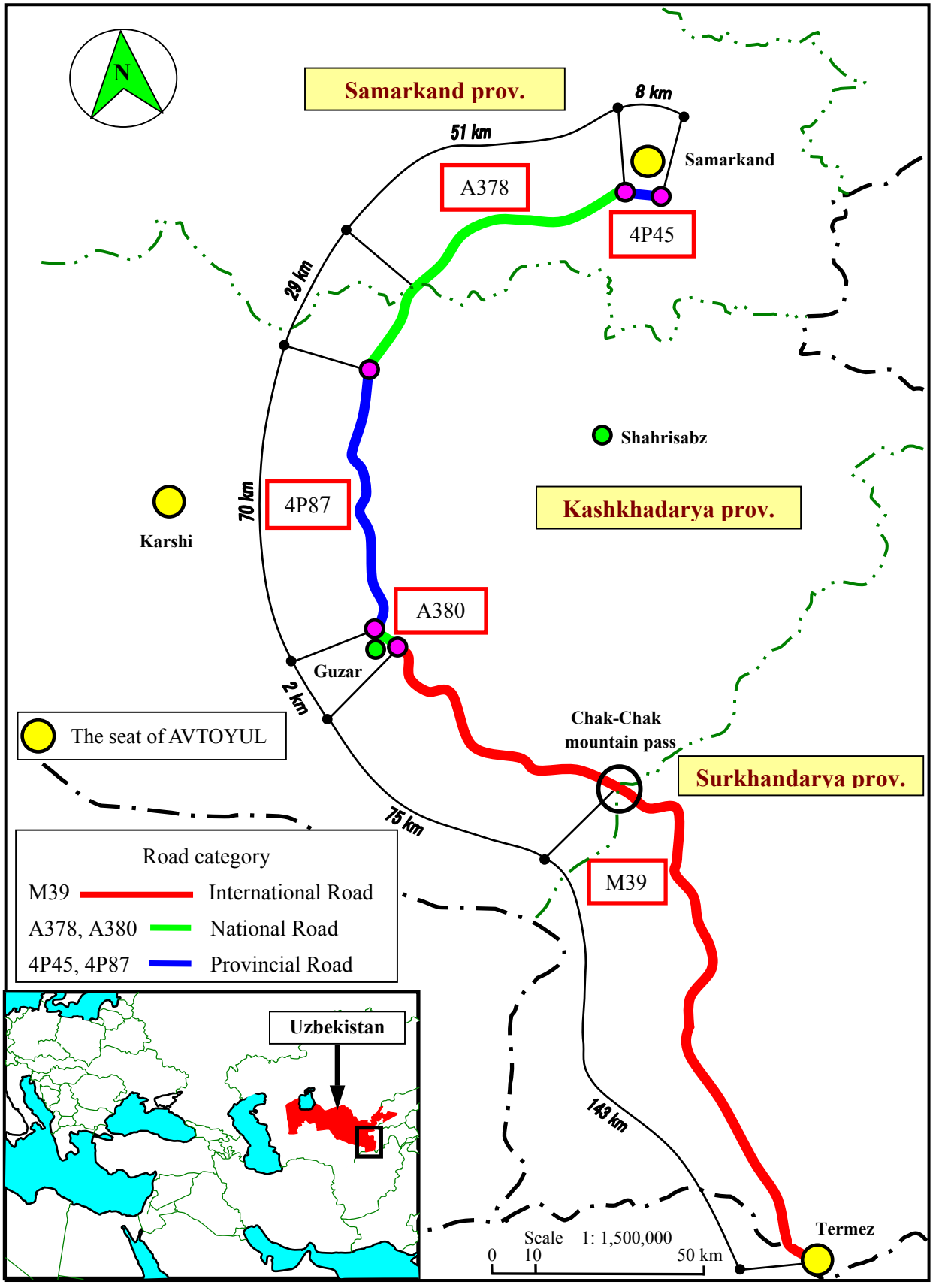
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Yoichi Higaki
Chief Consultant,

Basic design study team on
the Project for Supply of Road Construction
and Maintenance Equipment Phase II
Construction Project Consultants, Inc

Location Map



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Abbreviations

ADB	Asian Development Bank
AREO	Automobile Road Exploitation Organization
ARO	Automobile Road Organization
EBRD	European Bank for Reconstruction and Development
EU	European Union
FIDA	Fund for International Development of Agriculture
GDP	Gross Domestic Product
GET	Grand Engaged Tool
GNI	Gross National Income
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
OECF	Overseas Economic Cooperation Fund
S/W	Scope of Work
TRACECA	Transport Corridor Europe Caucasus Asia
WB	World Bank

Summary

Summary

The Republic of Uzbekistan (hereinafter referred to Uzbekistan), which became independent from the former Soviet Union in 1991, is the "double landlocked country" in Central Asia, from which two national borders must be crossed to reach the sea. Improvement and development of road transportation sector is the most important factor for the economic development of the country.

State Joint Stock Company "UZAVTOYUL" is an authorized government agency that has full responsibility for the international road (3,239 km), the national road (18,811 km) and the provincial road (21,488 km), a total length of 43,538 km.

Since the main trunk road was constructed and arranged in the Soviet Union era, no construction works for the new trunk roads are required. However, an increasing traffic volume due to transition to market economy causes a lot of damage on the roads (grow into pot hole, crack, rutting etc.) and the delay in repair. Moreover, expansion works of the roads create difficulty in organizing smooth distribution of goods.

UZAVTOYUL executes the maintenance of the roads. However, most of the construction machinery it owns was produced during the former Soviet Union era, does not perform well in road rehabilitation works because of its decrepitude. This hinders UZAVTOYUL from performing its duty effectively.

To improve such a situation, Uzbekistan government requested the Government of Japan to provide grant aid for the road construction machinery required to repair 278km section of route M-37 between Samarkand and Bukhoro. Then the Government of Japan approved it and directed Japan International Cooperation Agency (JICA) to execute the preparatory study.

However, as a result of the preparatory study conducted by JICA from 30th October to 26th November, 2003, the Government of Japan concluded that the project was unsuitable for the Japan's grant aid.

The reasons for this conclusion are as follows.

- The construction of the by-pass road is included in the road maintenance plan in this section.
- ADB executed project "The Project of Road Repair in Uzbekistan" in 1997, which included a repair plan for part of this section.
- The damage of the road doesn't need the rehabilitation work urgently.

Therefore the Government of Uzbekistan withdrew the section of the route requested at first, and presented the following two alternative plans.

- The rehabilitation works on 330 km section of trunk road from Kungrad to Kazakstan border.
- The rehabilitation works on 378 km section of trunk road from Samarkand to Termez (A-378 to

4P87 to M-39).

As a result of the field study executed in a hurry in the preliminary survey period and the conference with UZAVTOYUL, it was confirmed to be sufficiently worth further study for Japan's grant aid.

The reasons for worthiness of further study are as follows.

- The road condition from Samarkand via Guzar to Termez, a city bordering on Afghanistan, being a trunk road to this country, is deteriorating by the traffic volume of heavy vehicle.
- The effect of the benefit is large, with about 6,600,000 residents along the road.

On the basis of the above-mentioned research result, JICA dispatched the basic design study team from 20th April to 14th May 2004. This study team executed a detailed investigation about the existing road, the road repair history, workshops, asphalt mixing plants, crushing plants and existing road construction machinery owned by the provincial AVTOYULs.

Also the following items were confirmed through meeting with UZAVTOYUL and the site survey.

- The influence of a social environment and a natural environment
- The measures to the budget of UZAVTOYUL
- The detailed repair and maintenance plan of the target road

After returning to Japan, the team verified the adequacy of this project, established machinery specifications and an execution plan for the this project, and made a draft basic design based on the site survey result.

Then, a mission for explaining the outline of the basic design was sent to Uzbekistan in order to discuss the draft basic design from 3rd August to 13th August, 2004, and confirmed the detailed maintenance plan of the target road and securing the budget to be provided by the government of Uzbekistan if the grant aid project is implemented. As a result, it was confirmed that the repair work of the target road is able to be executed in five years from 2006 to 2010 in the machinery plan which Japan side made. Also there was not a problem in securing the budget for the project.

The purpose of this Project is to procure road construction and maintenance equipment that is required for the rehabilitation works for 378 km section of trunk road from Samarkand to Termez via Guzar. To make more appropriate the content of the machinery, the Study executed the procedure as below. Each provincial AVTOYULs does road works to the target road under its jurisdiction because the road extends over three provinces (the Samarkand prov., the Kashkhadarya prov. and the Surkhandarya prov.).

1) The maintenance method will be divided into four categories: Large-scale Maintenance, Medium-scale maintenance, Overlay and Small-scale Maintenance. Based on detail survey of the

target road, an applicable maintenance method will be assigned to every one-kilometer section.

2) Based on the above and the road construction procedures of each category, the volume of works will be calculated for each province.

3) What kind of machinery is needed for the calculated volume of works, and the necessary operation time of the machinery will be calculated.

4) The machinery that can be used for this project will be selected from among the machinery owned by provincial AVTOYULs and the volume of works that can be completed with that machinery will be checked.

5) In order to establish a machinery plan, the types and the specifications of machinery necessary to complete the residual volume of works will be selected, then the number of necessary machines will be calculated.

The outline of machinery plan is as follows.

Outline of machinery plan

No.	Name	Rough Spec	Qty.	Purpose of use
1	Motor Grader	150HP	3	Excavation and grading of base course, snow removal
2	Dump Track	Payload: 10 ton	4	Handling of materials for the maintenance works
3	Asphalt Sprayer	Tank capacity: 400 litter	3	Applying the tack coat on the surface of road prior to paving the asphalt mix
4	Vibration Roller	Operating weight: 6.5 ton or more	3	Compaction of the roads after grading the base course and/or paved surface
5	Pneumatic Roller	Operating weight: 8.5 ton or more	3	Compaction of the roads after paving the road surface
6	Pick-up Truck	Five getting on capacity or more	3	Communication between sites and office, patrolling the roads
7	Water Tank Truck	8,000 in capacity Litter	3	Applying water to materials for the base course construction, preventing the occurrence of dust
8	Multi Purpose Vehicle	Snowplow: 1,500 ton/h Chemical spreading	2	Blowing out the snow from the roads and/or spreading the de-icing chemicals on the roads
9	Road Line Marker	Line width: 100-300mm	2	Marking the roads with white paint lines
10	Asphalt Finisher	Paving width: 2.5-4.5m	3	Paving the road with asphalt mix
11	Asphalt Distributor	Tank capacity: 6,000 litter	2	Applying tack coat on the road before spreading and paving the road with asphalt mix
12	Trailer Truck	Loading capacity: 30 ton	2	Carrying construction machinery and/or materials
13	Road Harrow	Cutting width: 1.0 m	3	Milling the road surface and loading scrap
14	Mobile Material Testing Laboratory	Container type Inner size: 2.5x2.5x6.0 m	1	Testing the condition of road before and after the maintenance work, testing materials for asphalt mixing plant
15	Asphalt Mixing Plant	Capacity: 30 ton/h	2	Production of the hot asphalt mixture
16	Mobile Workshop	Tools and Equipment	3	Maintenance and repair work of construction machinery at construction site(s)
17	Excavator	0.8m3 Bucket	3	Excavating soil and sand at borrow pits. Removing stones from the slopes beside roads
18	Wheel Loader	2.5m3 Bucket	4	Handling of materials for sub base course, pavement and scrap of road
19	Track Crane	Lifting capacity: 25 ton	2	Loading/unloading the construction machinery and/or structures onto the trailer
20	Air Compressor	Capacity: 7 m3/min.	3	Blowing away the dust from the road prior to application of tack coat.
21	Tamper	Weight: 70 kg min.	9	Compacting the surface of road after applying asphalt mix to potholes.
22	Hand Guide Roller	Weight: 700 kg min.	6	Compacting the surface of road after applying asphalt mix during small repair jobs and maintenance

The total project cost is estimated at 991,000,000 yen in case of execution by Japan's grant aid. Japan side will bear 976,000,000 yen and the Uzbekistan side will bear15,000,000 yen. The execution of this project needs 13 months.

By the execution of this project, the direct effect of maintaining 378 km of international trunk road from Samarkand to Termez via Guzar in five years of 2006-2010 can be expected. And the following indirect effect can also be expected.

- The transportation time will be shortened due to a higher running speed of the traffic. Therefore the transportation cost is expected to decrease.
- Due to the above, the traffic from Samarkand or Tashkent to Termez will increase. Consequently, the living standard is improved in Kashkhadarya and Surkhandarya provinces.
- The number of traffic accident will be decreased by painting of the lane line in the whole target road.
- To clear away snow from the roads and spread the de-icing chemicals on the roads by a multi purpose vehicle, passing restriction of traffic will decrease in winter. Therefore there will be more chances to access social service of education and medical treatment than at present.
- The noise and the dust caused by vehicles will be decreased by the road repair and maintenance, and the environment along the road will be improved.
- The damage to vehicles will be reduced by the road repair and maintenance, and the vehicle maintenance cost will decrease.

It is judged that the execution of the project by Japan's grant aid is appropriate, by reason of the content of the project, the effect of the project and the machinery maintenance and management ability.

To achieve and continue the effect of this project more surely, we propose the following:

- In order to use machinery in a good condition for many years, the system which manages the data base (routine checks and regular check method, stock controls of the spare parts) with the computer should be built.
- To prevent deterioration of pavement road, the vehicles that exceed the limitation weight should be excluded. To enable this, the observation using the track scale (weight measurement machine) should be executed.
- To sufficiently maintain the functions of the trunk road after the procurement machinery passes the useful life, planned renewal of machinery will be necessary. Therefore budget for renewal of machinery should be secured in the annual budget.

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Chapter 1 Background of the Project

State Joint Stock Company ”UZAVTOYUL” has full responsibility for the maintenance of roads in Uzbekistan. UZAVTOYUL is exerting itself to advance the maintenance of road network. However, most of the construction machinery it owns is produced during the former Soviet Union days and doesn't perform well in road rehabilitation works because of its decrepitude. This hinders UZAVTOYUL from performing its duty effectively.

To improve such a situation, Uzbekistan is working on the challenges in the transportation sector, receiving support from Western countries and Japan. Especially, the maintenance of Asian highways which constitutes an international trunk road that connects Asia and Europe poses immense challenges. As a part of the maintenance of Asian highways, “The Project for Supply of Road Construction and Maintenance Equipment” to procure the road construction machinery necessary for maintain the route A373 that connects Fergana basin and Tashkent was executed as a Japan's grant aid project in 1996. The project procured 56 units of machinery for road construction and achieved the expected effects.

Upon the success of the above-mentioned project, Uzbekistan government requested Japan to provide grant aid to procure the road construction machinery required to repair 278km section of route M37 between Samarkand and Bukhoro. Then Japanese government approved it and directed Japan International Cooperation Agency (JICA) to execute the preliminary study.

However, as a result of the preliminary study, which JICA dispatched from 30th October to 26th November, 2003, the Japanese government concluded that the project was unsuitable for the Japan's grant aid.

The reasons for this conclusion are as follows.

- The construction of the by-pass road is included in the road maintenance plan on this section.
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- The effect of the benefit is large, with about 6,600,000 residents along the road.

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- The influence of a social environment and a natural environment
- The measures to the budget of UZAVTOYUL
- The detailed repair and maintenance plan of the target road

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

Uzbekistan is promoting the transition to market economy after getting independence from the former Soviet Union in August 1991. It is an important key to economic development how efficiently to transport goods including the cotton fiber which is the main product. Therefore Uzbekistan works on the maintenance of the trunk road as a national project, which was drawn up as "The project for maintenance plan of national road network" in 2002. The maintenance project of M39, A378 and 4P87 from Samarkand to Termez via Guzar is also one of the thirteen major road rehabilitation projects. However, the poor condition of road maintenance machinery of UZAVTOYUL is making it difficult to execute this plan.

The purpose of the Project is to improve the condition of road construction and maintenance equipment to be used for rehabilitation works of this route. As a result of the Project, the rehabilitation and maintenance works of the target road will be completed within five years.

The Project will contribute to the economic development of Uzbekistan by indirectly influencing the trade expansion and also improve the standard of living in Kashkhadarya and Surkhandarya provinces, where the economic activities are currently at a low level.

The requested Japanese assistance is to procure road construction and maintenance equipment that is required for the volume of works for rehabilitation of the target road that cannot otherwise be covered by the existing equipment of Uzbekistan side.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Basic policy

One of the outputs of this Project is the improvement of the condition of road construction and maintenance machinery which is required for the rehabilitation works of the target road for 37 8km. But the basic policy is to rehabilitate target road and improve the condition of road transportation (see Table 2-1).

So, the first step of the study should be to understand the whole procedure of rehabilitation works on target road based on the site survey by the study team and rehabilitation plan made by UZAVTOYUL. This step will give detailed information about rehabilitation works such as total volume of earth works and make it possible to determine the quantity and kind of machinery required. In this step, the study should assume that the rehabilitation works are executed by provincial AVTOYULs individually.

Then, the study team will investigate and check which units of the existing machinery owned by UZAVTOYUL can be used and finally identify needed machines to define the procurement of the

concerned machines as a grant aid project draft.

To select necessary machines, the study team will use the list of machinery requested by UZAVTOYUL as basic data for the study. However, it will compare the list against the planned construction works to check the necessity of each machine to determine whether it is really necessary. Conversely, any machine that it considers to be absolutely necessary for the implementation of the road rehabilitation works will be added to the machinery list as an additionally requested machine after consultation with UZAVTOYUL so that the machinery lineup will be complete to carry out the road rehabilitation works without problems.

Table 2-1 Extension of the Target road by Province and Classification of Pavement width

Province	Rout No.	Type 1	Type 2	Type 3	Type 4	Total (km)
Samarqand Prov.	4P45			8		8
	A378	19	2	30		51
Kashkhadarya Prov.	A378	12	6	2	9	29
	4P87	3	51	5	11	70
	A380	2				2
	M39	6	20	32	17	75
Surkhandarya Prov.	M39	37	96	10		143
Total Length (km)		79	175	87	37	378

* Types I to IV represent the types of road structures described in the section structure classifications on page 9.

(2) Natural conditions

Due to the inland climate, the annual amplitude of temperature in target road area is very big. Therefore, specification of some equipment will be considered for tropical and cold weather conditions and operator protection from falling, taking materials into account as well.

For the machinery to be used on mountain roads, examination will be made on the necessity of a function that eliminates safety hazards even if the engine fails or stops while running on a slope (e.g., a wheel loader's mechanism that supports running while the engine is stopped) or anti-slip parts (tire chains) to be used in winter.

The machinery to be used in winter when the minimum temperature drops nearly to minus 30 degrees centigrade (e.g., a motor grader) will cause no problem if minimum necessary measures are taken, e.g., the mounting of a high-capacity battery or an auxiliary unit for starting the engine in cold climates. However, optimal specifications should be chosen after thorough discussion with the persons in charge of machinery at UZAVTOYUL. For the machinery to be used in summer when the maximum temperature rises nearly to 50 degrees centigrade, tropical specifications with a larger radiator capacity will be used.

(3) Special condition of Uzbekistan

There are several dealers or agents of construction machinery and vehicles in Tashkent, but their business activities in the country are substantially limited by the economic policy of Uzbekistan. Therefore, it is very difficult to expect from dealers or agents service works such as periodical maintenance, trouble shooting, and/or prompt supply of spare parts. This means that UZAVTOYUL has to maintain construction machinery by itself, including periodical maintenance and repair of the machinery.

The major repair works such as overhauls will be done at main service workshop of UZAVTOYUL in Tashkent, which used to be government-run factory that produced hydraulic excavators and is now managed by UZAVTOYUL. However, medium or small repair works like engine repair must be carried out at workshops of provincial AVTOYULs.

Since the provincial AVTOYUL workshops do not have sufficient tools and equipment required for machine maintenance provincial AVTOYUL and the transportation of equipment from a site to a workshop on trailer trucks whenever a small problem happens on machinery is not effective, a workshop car will be provided at each province so that periodical maintenance and small or some medium-scale repair can be carried out at the sites.

For filters, elements, GET (Ground Engaged Tool), security-related parts to be needed for replacement during ordinary operations, as many spare parts as needed for about half of the five-year project period should be procured at the same time as the equipment under this project so that there will be no problem in the maintenance management of the machinery. Meanwhile, UZAVTOYUL will establish a route for obtaining spare parts and, for the second half of the project period and thereafter, procure spare parts for itself to carry out maintenance and management of the machinery.

(4) Operation capacity for machine maintenance of UZAVTOYUL

To allow the newly procured machinery to work without major malfunctions and cover the planned workload during the project period of five years, the operators should never fail to conduct daily inspections at the start and end of work every day as well as periodical maintenance works after operating for a certain amount of time such as 50, 100, and 500 hours or traveling for a certain distance such as 3,000, 5,000, and 10,000 kilometers.

The implementation agency UZAVTOYUL was significantly reorganized twice from the Ministry of Roads in the former Soviet Union era. However, UZAVTOYUL functions wonderfully, having chief mechanics leading mechanics with technical expertise developed in the Soviet era and maintaining a disciplined state. Since this organization has a sufficient capacity for maintenance management of the machinery, no particular consideration in terms of technological skills is needed.

Malfunctioning machines are first repaired at the workshop of a provincial AVTOYUL. However, they are not always repaired right away because of the lack of sufficient repair tools in addition to the difficulty of obtaining spare parts due to distribution problems.

The budget plan for procuring equipment, tools, and parts for repair works should be checked. If required, support should be provided to create a budget plan.

Overall, AVTOYUL still conducts maintenance management using written forms. If the number of operating machines increases in the future, the processing capacity may not be sufficient.

(5) Country of origin

There are several dealers or agents for construction machinery or vehicles in Tashkent, but they are not performing as full functioning dealers. Therefore, existence of dealers in Uzbekistan does not strongly affect the decision of the country of origin of machinery.

UZAVTOYUL sufficiently recognizes the high performance of road construction machinery made in Japan because of the machines procured in the Project for Supply of Road Construction and Maintenance Equipment Phase I. The organization is strongly requesting for Japanese-made machinery in the current project, too. On the other hand, UZAVTOYUL kept buying, little by little in divided payments, German-made road construction machinery using the budget of the National Road Fund since 1998. These machines, although a few in number, are operating in the three provinces.

In sum, the study team will suggest as first priority Japanese products, which is definitely recommendable in terms of performance and quality. If there are only one or two Japanese manufacturers for a certain product and thus, the principle of market mechanism is not likely to work, the study team will suggest Japanese and EU products.

(6) Procurement and schedule of works

In order to minimize the procurement term, the study team will basically consider procuring the basic machines with limited options as for the production models such as motor graders or wheel loaders etc. Concerning special equipment such as work shop cars or the test equipment for laboratory, the study team will establish specifications covering only essential points, but other specifications which do not affect basic functions will be left to the decisions by manufacturers to shorten the time of manufacture.

2-2-2 Basic Plan (Equipment Plan)

(1) Basic Idea of the Plan

There are several categories of roads with different widths on the target road from Samarkand to Termez via Guzar, however all of them are paved roads.

Therefore, the repair works for them will range from small-scale ones such as filling of pot holes to large-scale ones such as base course improvement, the study team will examine the result of the detailed field study and the road repair plans of UZAVTOYUL to identify for the entire length of the 375km road which of the four categories of work each section needs: (1) Small-scale Maintenance, (2) Overlay, (3) Medium-scale Maintenance, and (4) Large-scale Maintenance. Then, it will determine a specific work process for each repair work and necessary machinery and workload.

A similar examination process will be conducted for machinery to be used to secure road traffic in winter (such as snow blowers and snow-melting agent distributors). The actual execution agencies for road repair are the provincial AVTOYULs in Samarkand, Kashkhadarya, and Surkhandarya provinces and their subordinate organizations. Thus, necessary machinery should be considered for and allocated to each province.

Based on the result of the above examination, the machines that can be used for the current road repair project will be identified out of those owned by UZAVTOYUL. The workload minus that which can be covered with the usable existing machines will be the workload that must be covered using the machinery to be procured under the current project.

UZAVTOYUL is planning to complete the current road repair project in five years. The specifications and quantity of machinery should be considered based on the five-year base. However, the repair works can be done only from April to November, excluding the winter season, and one year should be assumed as eight months.

(2) Present Condition of the Road

The design of cross-section on target road is classified into four categories. The team investigated actual condition of the target road stopping every five kilometers. The team also acquired and studied maintenance and rehabilitation record of the target in the past. The figure 2-1 shows cross section of the entire target road.

Although the construction or major repair works on the target road are performed around 1980, no major systematic maintenance works were carried out thereafter until today. Therefore, each section of the target road is in such a condition that urgent maintenance work is required.

The specific road rehabilitation procedures are classified into four categories depending on the level of damage on the roads. One of these procedures will be applied to each section of the target road.

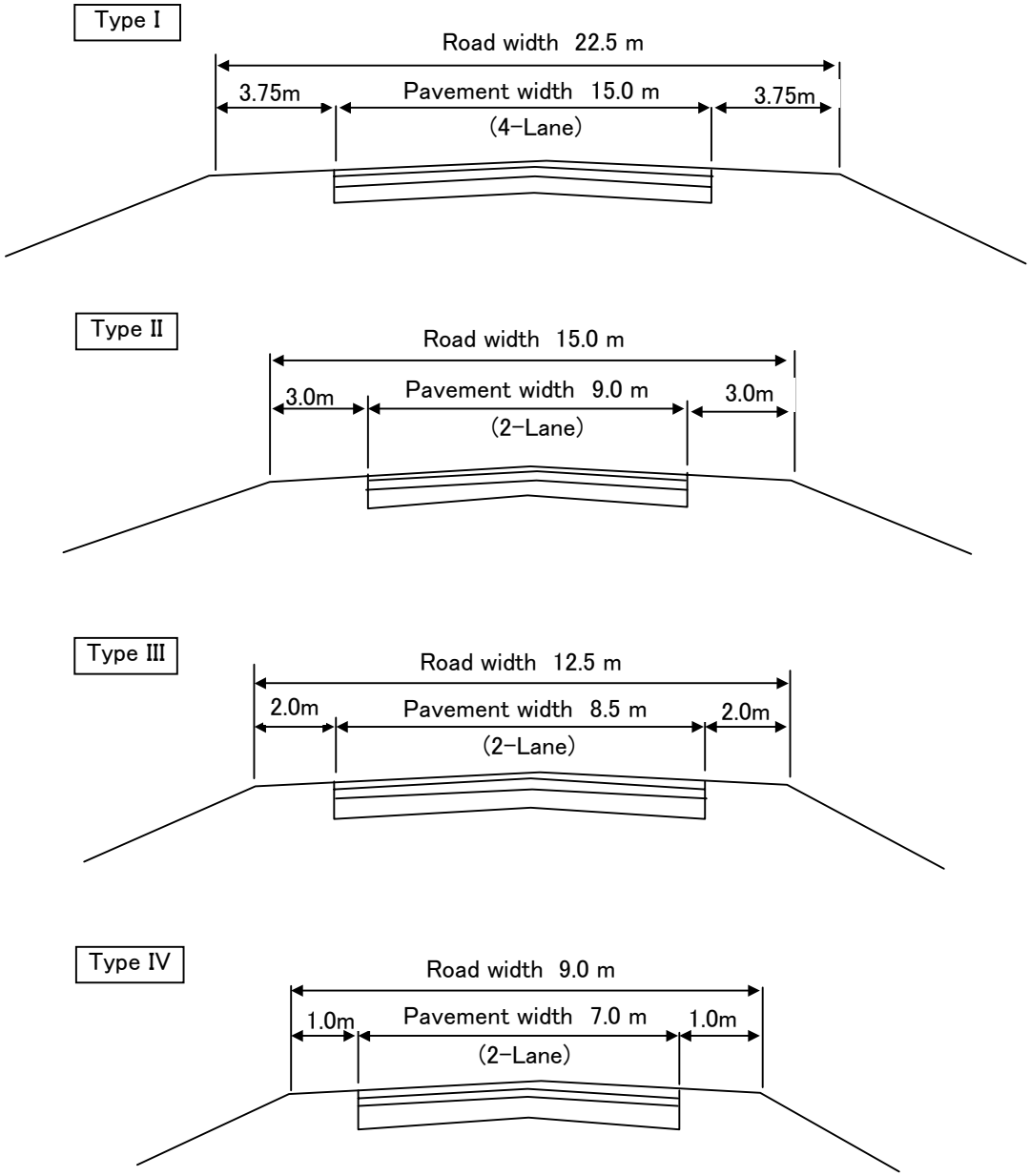


Fig. 2-1 Cross section of the Project Road

The procedure of road maintenance work is classified into four methods as follows according to the damage level of the pavement of the target road.

(1) Small-scale maintenance is defined as the repair of pot holes, and furthermore, classified into two types of methods according to the size of pot holes. Target length is 100km of 378km.

1) Repairing of small sized pot holes (Repairing of pot holes less than 5 m^2. Five percent (5%) of the pavement area will be repaired every year.)

Due to slight damage, the road will be repaired according to the following procedure.

Cleaning of pot hole → Tack Coat Spraying → Laying asphalt-concrete mixture → Paving → Tamping

2) Repairing of large sized pot holes
(Repairing of pot holes 5 m^2 or larger. Five percent (5%) of the pavement area will be repaired every year.)
Due to the growth of damage of small size pot holes, the road will be repaired according to the following procedure.

Ripping of wearing course → Carry out → Cleaning → Tack Coat Spraying → Laying asphalt-concrete mixture → Paving (4 cm)→ Compacting

(2) Overlay is defined as a surface treatment of 4cm thickness on the existing pavement of the road. Target length is 187km of 378km. The road will be repaired according to the following procedure.

Cleaning of surface → Tack Coat Spraying → Laying asphalt-concrete mixture →Paving (4cm) → Compacting

(3) Medium-scale Maintenance is defined as ripping of 4cm thickness, then paving of 4cm thickness.

Target length is 63km of 378km. The road will be repaired according to the following procedure.

Ripping of wearing course (road planer)→ Carry out → Cleaning of surface → Tack Coat Spraying → Laying asphalt-concrete mixture → Paving (4cm) → Compacting

(4) Large-scale Maintenance is defined as ripping of pavement slab and removing of base course and sub-base course, then paving of sub-base course, base course, binder course, intermediate course and wearing course.

Target length is 28km of 378km. The road will be repaired according to the following procedure.

Ripping of pavement slab (bulldozer)→ Loading → Carry out → Removing of base course and sub-base course → Loading → Carry out → Leveling of sub-base course and base course (40cm) → Loading → Compacting → Tack Coat Spraying → Paving of binder course (6cm) → Compacting→ Paving of intermediate course (4cm) → Compacting → Paving of wearing course (4cm) → Compacting

Table 2-2 shows the extension of the target road in Samarkand, Kashkhadarya and Surkhandarya provinces by the method of repair chosen based on the study result of the target road of maintenance and the classification of pavement widths.

Table 2-2 Extension of the Target road according to the classification of pavement width.

Province	Route No.	Method of Maintenance	Classification of Pavement width (km)				Classification of Method of Maintenance (km)			
			Type I	Type II	Type III	Type IV	Smalls-scale Maintenance	Overlay	Medium-scale Maintenance	Large-scale Maintenance
Samarkand Province.	4P45	Overlay			4			4		
		Medium-scale			4				4	
	A378	Smalls-scale			5		5			
		Overlay	16					16		
		Medium-scale			18				18	
		Large-scale	3	2	7					12
		Sub total	19	2	38		5	20	22	12
Kashkha-darya Province	A378	Smalls-scale	3	4			7			
		Overlay	9	2	2	9		22		
	4P87	Smalls-scale	3	19		3	25			
		Overlay		21	5	8		34		
		Medium-scale		11					11	
	A380	Smalls-scale	2				2			
	M39	Smalls-scale		4	6		10			
		Overlay	6	8	18	17		49		
		Large-scale		8	8					16
		Sub total	23	77	39	37	44	105	11	16
Surkhan-darya Province	M39	Smalls-scale	14	37			51			
		Overlay	23	37	2			62		
		Medium-scale		22	8				30	
		Sub total	37	96	10		51	62	30	
Total (km)			79	175	87	37	100	187	63	28

(3) Analysis of Volume of Road maintenance works

The result of calculation of work volumes is shown on Table 2-3～Table 2-5.

Table 2-3 Volume of Works according to pavement width type in Samarkand province

Type	Procedure		Length (km)	Ripping (m^2)	Pavement (m^2)	Asphalt Mix (m^3)	Removal of Base course (m^2)	Material for Base course (m^3)
I	Overlay		16		240,000	9,600		
	Large-scale maintenance		3	45,000	45,000	6,300	45,000	18,000
II	Large-scale maintenance		2	18,000	18,000	2,520	18,000	7,200
III	Small-scale maintenance	Small pot hole	5		10,625	425		
		Large pot hale		10,625	10,625	425		
	Overlay		4		34,000	1,360		
	Medium-scale maintenance		22	187,000	187,000	7,480		
	Large-scale maintenance		7	59,500	59,500	8,330	59,500	23,800
Total			59	320,125	604,750	36,440	122,500	49,000

Table 2-4 Volume of Works according to pavement width type in Kashkhadarya province

Type	Procedure		Length (km)	Ripping (m^2)	Pavement (m^2)	Asphalt Mix (m^3)	Removal of Base course (m^2)	Material for Base course (m^3)
I	Small-scale maintenance	Small pot hole	8		6,000	240		
		Large pot hale		6,000	6,000	240		
	Overlay		15		225,000	9,000		
II	Small-scale maintenance	Small pot hole	27		60,750	2,430		
		Large pot hale		60,750	60,750	2,430		
	Overlay		31		279,000	11,160		
	Medium-scale maintenance		11	99,000	99,000	3,960		
	Large-scale maintenance		8	72,000	72,000	10,080	72,000	28,800
III	Small-scale maintenance	Small pot hole	6		12,750	510		
		Large pot hale		12,750	12,750	510		
	Overlay		25		212,500	8,500		
	Large-scale maintenance		8	68,000	68,000	9,520	68,000	27,200
IV	Small-scale maintenance	Small pot hole	3		5,250	210		
		Large pot hale		5,250	5,250	210		
	Overlay				238,000	9,520		
Total			176	323,750	1,363,000	68,520	140,000	56,000

Table 2-5 Volume of Works according to pavement width type in Surkhandarya province

Type	Procedure		Length (km)	Ripping (m^2)	Pavement (m^2)	Asphalt Mix (m^3)	Removal of Base course (m^2)	Material for Base course (m^3)
I	Small-scale maintenance	Small pot hole	14		52,500	2,100		
		Large pot hale		52,500	52,500	2,100		
	Overlay				345,000	13,800		
II	Small-scale maintenance	Small pot hole	37		83,250	3,330		
		Large pot hale		83,250	83,250	3,330		
	Overlay				333,000	13,320		
	Medium-scale maintenance			198,000	198,000	7,920		
III	Overlay		2		17,000	680		
	Medium-scale maintenance		8	68,000	68,000	2,720		
Total			143	401,750	1,232,500	49,300		

Based on the calculation of the number of machinery required for these maintenance works, the team set the job performance for each machines. Table 2-6 shows the job-performance of each machine. Tables 2-7～Table 2-9 show the schedule of maintenance works. Tables 2-10～Table 2-12 show total volume of earth works for every machinery to execute the maintenance works described in Tables 2-7～Table 2-9.

Table 2-6 Job-capacity of Machinery

Method	Details of construction work		Machinery	Class	Job-cap. /unit*hr	Unit	Cause of Job-capacity per hour
Small-scale Maintenance	Removal of wearing course	Ripping	Road Planer	1m	720	m2	width 1.0m x 2.4km/h = 2,400m2 2,400m2 x operation rate 0.3 -720m2
		Carry out	Dump Truck	10 ton	20	m3	5m3 / 1time x 4 shuttle = 20m3
	Construction of wearing course	Tack Coat Spraying	Asphalt Hand Sprayer		100	liter	1place=4m x 5m = 20m2 20m2 x 4place = 80m2 80m2 x 1.26 l/m2 = 100 liter
		Carry Asphalt into	Cargo Truck with Crane	4 ton	4	m3	average paving thickness 0.05m x 80m2 = 4 m3
		Tamping	Tamper		80	m2	1place=4m x 5m = 20m2 20m2 x 4place = 80m2
		Compaction	Hand Guide Roller		80	m2	1place=4m x 5m = 20m2 20m2 x 4place = 80m2
Overlay	Construction of wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	1,100	liter	road width 4.5m x 200m x 1.26 l/m2 = 1,100 liter
		Carry Asphalt into	Dump Truck	10 ton	15	m3	5m3 / 1time x 3 shuttle = 15m3
		Paving	Asphalt Finisher	2.5～4.5m	760	m2	1,900m2 / day 1,900m2 / 2.5h = 760m2
		Compaction	Vibrating Roller	5 ton	900	m2	compaction width 1.2m x 5.0km/h = 6,000m2 6,000m2 / 6 = 1,000m2 (6 times compacting / place) 1,000m2 x operation rate 0.9 = 900m3
		Compaction	Pneumatic Tired Roller	10 ton	900	m2	compaction width 1.2m x 5.0km/h = 6,000m2 6,000m2 / 6 = 1,000m2 (6 times compacting / place) 1,000m2 x operation rate 0.9 = 900m3
Medium-scale Maintenance	Removal of wearing course	Ripping	Road Planer	1m	86	m3	width 1.0m x 2.4km/h = 2,400m2 cutting depth 0.04m x 2,400m2 = 96m3 96m3 x operation rate 0.9 =86m3
		Carry out	Dump Truck	10 ton	20	m3	5m3 / 1time x 4 shuttle = 20m3
	Construction of wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	1,100	liter	road width 4.5m x 200m x 1.26 l/m2 = 1,100 liter
		Carry Asphalt into	Dump Truck	10 ton	15	m3	5m3 / 1time x 3 shuttle = 15m3
		Paving	Asphalt Finisher	2.5～4.5m	760	m2	1,900m2 / day 1,900m2 / 2.5h = 760m2
		Compaction	Vibrating Roller	5 ton	900	m2	compaction width 1.2m x 5.0km/h = 6,000m2 6,000m2 / 6 = 1,000m2 (6 times compacting / place) 1,000m2 x operation rate 0.9 = 900m3
		Compaction	Pneumatic Tired Roller	10 ton	900	m2	compaction width 1.2m x 5.0km/h = 6,000m2 6,000m2 / 6 = 1,000m2 (6 times compacting / place) 1,000m2 x operation rate 0.9 = 900m3
Large-scale Maintenance	Removal of Pavement slab	Ripping	Bull Dozer	20 ton	100	m3	width 0.4m x 2.0km/h = 800m2 cutting depth 0.14m x 800m2 = 112m3 112m3 x operation rate 0.9 = 100m3
		Loading	Wheel Loader	2.5m3	100	m3	Load volume is same volume of ripping
		Carry out	Dump Truck	10 ton	20	m3	5m3 / 1time x 4 shuttle = 20m3
	Removal of Sub-base course and Base course	Removing	Motor Grader	3.6～3.7m	200	m3	blade width 2.5m x 2.0km/h = 5,000m2 cutting depth 0.05m x 5,000m2 = 250m3 250m3 x operation rate 0.8 = 200m3
		Loading	Wheel Loader	2.5m3	160	m3	bucket size 2.5m3 x loading rate 0.8 = 2.0m3 cycle time 40sec.=90times/h operation rate 0.9 therefore 2.0m3 x 90 times x 0.9 = 160m3
		Removing	Dump Truck	10 ton	20	m3	5m3 / 1time x 4 shuttle = 20m3
	Construction of Sub-base course and Base course	Carry Base course material into	Dump Truck	10 ton	20	m3	5m3 / 1time x 4 shuttle = 20m3
		Leveling (2 layers)	Motor Grader	3.6～3.7m	1,000	m2	blade width 2.5m x 2.0km/h = 5,000m2 5,000m2 / 4 = 1,250m2 (4 times compacting / place) 1,250m2 x operation rate 0.8 = 1,000m2
		Compaction (2 layers)	Vibrating Roller	5 ton	900	m2	compacting width 1.2m x 5.0km/h = 6,000m2 6,000m2 / 6 = 1,000m2 (6 times compacting / place) 1,000m2 x operation rate 0.9 = 900m3
		Water spraying	Water Tank Truck	8,000 l	900	m2	spraying area is same area of compacting
	Construction of Binder course, Intermediate course and wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	1,100	liter	road width 4.5m x 200m x 1.26 l/m2 = 1,100 liter
		Carry Asphalt into	Dump Truck	10 ton	15	m3	5m3 / 1time x 3 shuttle = 15m3
		Paving (3 layers)	Asphalt Finisher	2.5～4.5m	760	m2	1,900m2 / day 1,900m2 / 2.5h = 760m2
		Compaction (3 layers)	Vibrating Roller	5 ton	900	m2	compaction width 1.2m x 5.0km/h = 6,000m2 6,000m2 / 6 = 1,000m2 (6 times compacting / place) 1,000m2 x operation rate 0.9 = 900m3
		Compaction (3 layers)	Pneumatic Tired Roller	10 ton	900	m2	compaction width 1.2m x 5.0km/h = 6,000m2 6,000m2 / 6 = 1,000m2 (6 times compacting / place) 1,000m2 x operation rate 0.9 = 900m3
Asphalt Plant		Loading	Wheel Loader	2.1 m3	14	m3	asphalt concrete production volume x 0.7
		Put aggregate into	Bull Dozer	20 ton	14	m3	asphalt concrete production volume x 0.7
		Production	Asphalt Plant	50 ton/h	20	m3	50 ton/h / 2.5 = 20m3
		Transportation	Dump Truck	10 ton	15	m3	5m3 / 1time x 3 shuttle = 15m3

Table 2-7 Calculation of the required number of machinery in Samarkand province

Working months per year = 7 months (April ～ October) Working days per month Average=18 days Working time = 5h/day

Type	Method	Details of construction work		Machenery	Class	Qty. job	Unit	Job-cap. /unit*hr	Total time unit*hr	Needs unit*month	Working month	Unit needed	2006 Qty. of Job	2006 Needs unit*month	2006 Working month	2006 Unit needed	2007 Qty. of Job	2007 Needs unit*month	2007 Working month	2007 Unit needed	2008 Qty. of Job	2008 Needs unit*month	2008 Working month	2008 Unit needed	2009 Qty. of Job	2009 Needs unit*month	2009 Working month	2009 Unit needed	2010 Qty. of Job	2010 Needs unit*month	2010 Working month	2010 Unit needed
Type I	Overlay	Construction of wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	302,400	liter	1,100	275	3.1		1.0	302,400	3.1		1.0																
			Carry Asphalt into	Dump Truck	10 ton	9,600	m3	15	640	7.1		2.4	9,600	7.1		2.4																
			Paving	Asphalt Finisher	2.5～4.5m	240,000	m2	760	316	3.5	3	1.2	240,000	3.5	3	1.2																
			Compaction	Vibrating Roller	5 ton	240,000	m2	900	267	3.0		1.0	240,000	3.0		1.0																
			Compaction	Pneumatic Tired Roller	10 ton	240,000	m2	900	267	3.0		1.0	240,000	3.0		1.0																
	Large-scale Maintenance	Removal of Pavement slab	Ripping	Bull Dozer	20 ton	6,300	m3	100	63	0.7		0.2	6,300	0.7		0.2																
			Loading	Wheel Loader	2.5m3	6,300	m3	100	63	0.7	3	0.2	6,300	0.7	3	0.2																
			Carry out	Dump Truck	10 ton	6,300	m3	20	315	3.5		1.2	6,300	3.5		1.2																
		Removal of Base course	Removing	Motor Grader	3.6～3.7m	18,000	m3	200	90	1.0		0.3	18,000	1.0		0.3																
			Loading	Wheel Loader	2.5m3	18,000	m3	160	113	1.3	3	0.4	18,000	1.3	3	0.4																
			Removing	Dump Truck	10 ton	18,000	m3	20	900	10.0		3.3	18,000	10.0		3.3																
		Construction of Sub-base course and Base course	Carry material into	Dump Truck	10 ton	18,000	m3	20	900	10.0		3.3	18,000	10.0		3.3																
			Leveling (2 layers)	Motor Grader	3.6～3.7m	90,000	m2	1,000	90	1.0	3	0.3	90,000	1.0	3	0.3																
			Compaction (2 layers)	Vibrating Roller	5 ton	90,000	m2	900	100	1.1		0.4	90,000	1.1		0.4																
			Water spraying	Water Tank Truck	8,000 l	90,000	m2	900	100	1.1		0.4	90,000	1.1		0.4																
		Construction of Binder course, Intermediate course and wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	56,700	liter	1,100	52	0.6		0.2	56,700	0.6		0.2																
			Carry Asphalt into	Dump Truck	10 ton	6,300	m3	15	420	4.7		1.6	6,300	4.7		1.6																
			Paving (3 layers)	Asphalt Finisher	2.5～4.5m	135,000	m2	760	178	2.0	3	0.7	135,000	2.0	3	0.7																
			Compaction (3 layers)	Vibrating Roller	5 ton	135,000	m2	900	150	1.7		0.6	135,000	1.7		0.6																
			Compaction (3 layers)	Pneumatic Tired Roller	10 ton	135,000	m2	900	150	1.7		0.6	135,000	1.7		0.6																
Type II	Large-scale Maintenance	Removal of Pavement slab	Ripping	Bull Dozer	20 ton	2,520	m3	100	25	0.3		0.0					2,520	0.3		0.0												
			Loading	Wheel Loader	2.5m3	2,520	m3	100	25	0.3	6	0.0					2,520	0.3	6	0.0												
			Carry out	Dump Truck	10 ton	2,520	m3	20	126	1.4		0.2					2,520	1.4		0.2												
		Removal of Base course	Removing	Motor Grader	3.6～3.7m	7,200	m3	200	36	0.4		0.1					7,200	0.4		0.1												
			Loading	Wheel Loader	2.5m3	7,200	m3	160	45	0.5	6	0.1					7,200	0.5	6	0.1												
			Removing	Dump Truck	10 ton	7,200	m3	20	360	4.0		0.7					7,200	4.0		0.7												
		Construction of Sub-base course and Base course	Carry material into	Dump Truck	10 ton	7,200	m3	20	360	4.0		0.7					7,200	4.0		0.7												
			Leveling (2 layers)	Motor Grader	3.6～3.7m	36,000	m2	1,000	36	0.4	6	0.1					36,000	0.4	6	0.1												
			Compaction (2 layers)	Vibrating Roller	5 ton	36,000	m2	900	40	0.4		0.1					36,000	0.4		0.1												
			Water spraying	Water Tank Truck	8,000 l	36,000	m2	900	40	0.4		0.1					36,000	0.4		0.1												
		Construction of Binder course, Intermediate course and wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	22,680	liter	1,100	21	0.2		0.0					22,680	0.2		0.0												
			Carry Asphalt into	Dump Truck	10 ton	2,520	m3	15	168	1.9		0.3					2,520	1.9		0.3												
			Paving (3 layers)	Asphalt Finisher	2.5～4.5m	54,000	m2	760	71	0.8	6	0.1					54,000	0.8	6	0.1												
			Compaction (3 layers)	Vibrating Roller	5 ton	54,000	m2	900	60	0.7		0.1					54,000	0.7		0.1												
			Compaction (3 layers)	Pneumatic Tired Roller	10 ton	54,000	m2	900	60	0.7		0.1					54,000	0.7		0.1												
Type III	Small-scale Maintenance	Repairing of small size pot hole	Tack Coat Spraying	Asphalt Hand Sprayer	400 l	13,388	liter	100	134	1.5		0.6	2,678	0.3		0.6	2,678	0.3		0.6	2,678	0.3		0.6	2,678	0.3		0.6	2,678	0.3		0.6
			Carry Asphalt into	Cargo Truck with Crane	4 ton	425	m3	4	106	1.2	2.5	0.5	85	0.2	0.5	0.5	85	0.2	0.5	0.5	85	0.2	0.5	0.5	85	0.2	0.5	0.5	85	0.2	0.5	0.5
			Tamping	Tamper	80 kg	10,625	m2	80	133	1.5		0.6	2,125	0.3		0.6	2,125	0.3		0.6	2,125	0.3		0.6	2,125	0.3		0.6	2,125	0.3		0.6
		Repairing of large size pot hole	Ripping	Road Planer	1m	10,625	m2	720	15	0.2		0.1	2,125	0.0		0.1	2,125	0.0		0.1	2,125	0.0		0.1	2,125	0.0		0.1	2,125	0.0		0.1
			Carry out	Dump Truck	10 ton	425	m3	15	28	0.3		0.1	85	0.1		0.1	85	0.1		0.1	85	0.1		0.1	85	0.1		0.1	85	0.1		0.1
			Tack Coat Spraying	Asphalt Hand Sprayer	400 l	13,388	liter	100	134	1.5	2.5	0.6	2,678	0.3	0.5	0.6	2,678	0.3	0.5	0.6	2,678	0.3	0.5	0.6	2,678	0.3	0.5	0.6	2,678	0.3	0.5	0.6
			Carry Asphalt into	Cargo Truck with Crane	4 ton	425	m3	4	106	1.2		0.5	85	0.2		0.5	85	0.2		0.5	85	0.2		0.5	85	0.2		0.5	85	0.2		0.5
			Compaction	Hand Guide Roller	800 kg	10,625	m2	80	133	1.5		0.6	2,125	0.3		0.6	2,125	0.3		0.6	2,125	0.3		0.6	2,125	0.3		0.6	2,125	0.3		0.6
	Overlay	**Construction of wearing course**	Tack Coat Spraying	Asphalt Distributor	6,000 l	42,840	liter	1,100	39	0.4		0.4												0.4	44,200	0.4						
			Carry Asphalt into	Dump Truck	10 ton	1,360	m3	15	91	1.0		1.0												1.0	1,360	1.0						
			Paving	Asphalt Finisher	2.5～4.5m	34,000	m2	760	45	0.5	**1**	0.5												0.5	34,000	0.5	**1**					
			Compaction	Vibrating Roller	5 ton	34,000	m2	900	38	0.4		0.4												0.4	34,000	0.4						
			Compaction	Pneumatic Tired Roller	10 ton	34,000	m2	900	38	0.4		0.4												0.4	34,000	0.4						
	Medium-scale Maintenance	Removal of wearing course	Ripping	Road Planer	1m	7,480	m3	86	87	1.0	6	0.2																7,480	1.0	6	0.2			
			Carry out	Dump Truck	10 ton	7,480	m3	20	374	4.2		0.7																7,480	4.2		0.7			
		Construction of wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	235,620	liter	1,100	214	2.4		0.4																235,620	2.4		0.4			
			Carry Asphalt into	Dump Truck	10 ton	7,480	m3	15	499	5.5		0.9																7,480	5.5		0.9			
			Paving	Asphalt Finisher	2.5～4.5m	187,000	m2	760	246	2.7	6	0.5																187,000	2.7	6	0.5			
			Compaction	Vibrating Roller	5 ton	187,000	m2	900	208	2.3		0.4																187,000	2.3		0.4			
			Compaction	Pneumatic Tired Roller	10 ton	187,000	m2	900	208	2.3		0.4																187,000	2.3		0.4			
	Large-scale Maintenance	Removal of Pavement slab	Ripping	Bull Dozer	20 ton	8,330	m3	100	83	0.9		0.2												0.2	8,330	0.9						
			Loading	Wheel Loader	2.5m3	8,330	m3	100	83	0.9	5	0.2												0.2	8,330	0.9	5					
			Carry out	Dump Truck	10 ton	8,330	m3	20	417	4.6		0.9												0.9	8,330	4.6						
		Removal of Base course	Removing	Motor Grader	3.6～3.7m	23,800	m3	200	119	1.3		0.3												0.3	23,800	1.3						
			Loading	Wheel Loader	2.5m3	23,800	m3	160	149	1.7	5	0.3												0.3	23,800	1.7	5					
			Removing	Dump Truck	10 ton	23,800	m3	20	1,190	13.2		2.6												2.6	23,800	13.2						
		Construction of Sub-base course and Base course	Carry material into	Dump Truck	10 ton	23,800	m3	20	1,190	13.2		2.6												2.6	23,800	13.2						
			Leveling (2 layers)	Motor Grader	3.6～3.7m	119,000	m2	1,000	119	1.3	5	0.3												0.3	119,000	1.3	5					
			Compaction (2 layers)	Vibrating Roller	7 ton	119,000	m2	900	132	1.5		0.3												0.3	119,000	1.5						
			Water spraying	Water Tank Truck	6,000 l	119,000	m2	900	132	1.5		0.3												0.3	119,000	1.5						
		Construction of Binder course, Intermediate course and wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	74,970	liter	1,100	68	0.8		0.2												0.2	74,970	0.8						
			Carry Asphalt into	Dump Truck	10 ton	8,330	m3	15	555	6.2		1.2												1.2	8,330	6.2						
			Paving (3 layers)	Asphalt Finisher	2.5～4.5m	178,500	m2	760	235	2.6	5	0.5												0.5	178,500	2.6	5					
			Compaction (3 layers)	Vibrating Roller	5 ton	178,500	m2	900	198	2.2		0.4												0.4	178,500	2.2						
			Compaction (3 layers)	Pneumatic Tired Roller	10 ton	178,500	m2	900	198	2.2		0.4												0.4	178,500	2.2						
Asphalt Plant			Loading	Wheel Loader	2.5m3	25,508	m3	14	1,822	20.2		0.7	11,249	8.9		1.3	1,824	1.4		0.2	6,902	5.5		0.8	5,355	4.3		0.6	119	0.1		0.1
			Put aggregate into	Bull Dozer	20 ton	25,508	m3	14	1,822	20.2	28	0.7	11,249	8.9	7	1.3	1,824	1.4	7	0.2	6,902	5.5	7	0.8	5,355	4.3	7	0.6	119	0.1	1.0	0.1
			Production	Asphalt Plant	50 ton/h	36,440	m3	20	1,822	20.2		0.7	16,070	8.9		1.3	2,605	1.4		0.2	9,860	5.5		0.8	7,650	4.3		0.6	170	0.1		0.1
			Transportation	Dump Truck	10 ton	36,440	m3	15	2,429	27.0		1.0	16,070	11.9		1.7	2,605	1.9		0.3	9,860	7.3		1.0	7,650	5.7		0.8	170	0.1		0.1
Others Works			Falling rock removing	Excavator	0.8m3																											
				Wheel Loader	2.5m3																											
				Dump Truck	10 ton																											
			Snow removing	Multi Purpose Truck																												
				Wheel Loader	2.5m3																											
				Motor Grader	3.6～3.7m																											
				Dump Truck	10 ton																											
			Surface leveling	Motor Grader	3.6～3.7m																											
			Pavement marking	Road Line Marker																												
			Transportation of machineries	Trailer Truck																												
				Truck Crane	25 ton																											
				Pick-up Truck																												
			Repairing of Machiner	Mobile Workshop																												
			in-situ test	Mobile materials testing laboratory																												
			Road cleaning	Water Tank Truck	8,000 l																											
				Air Compressor	8m3/min																											
			Carriage of concrete pipe	Cargo Truck with Crane	4 ton																											

Table 2-8 Calculation of the required number of machinery in Kashkhadarya province

Working months per year = 7 months (April ～ October) Working days per month Average=18 days Working time = 5h/day

Type	Method	Details of construction work		Machenery	Class	Qty. job	Unit	Job-cap. /unit*hr	Total time unit*hr	Needs unit*month	Working month	Unit needed	2006 Qty. of Job	2006 Needs unit*month	2006 Working month	2006 Unit needed	2007 Qty. of Job	2007 Needs unit*month	2007 Working month	2007 Unit needed	2008 Qty. of Job	2008 Needs unit*month	2008 Working month	2008 Unit needed	2009 Qty. of Job	2009 Needs unit*month	2009 Working month	2009 Unit needed	2010 Qty. of Job	2010 Needs unit*month	2010 Working month	2010 Unit needed
Type I	Smale-scale Maintenance	Repairing of small size pot hole	Tack Coat Spraying	Asphalt Hand Sprayer	400 l	37,800	liter	100	378	4.2	5	0.8	7,560	4.2		0.8	7,560	4.2		0.8	7,560	4.2		0.8	7,560	4.2		0.8	7,560	4.2		0.8
			Carry Asphalt into	Cargo Truck with Crane	4 ton	1,200	m3	4	300	3.3		0.7	240	3.3	1	0.7	240	3.3	1	0.7	240	3.3	1	0.7	240	3.3	1	0.7	240	3.3	1	0.7
			Tamping	Tamper	80 kg	30,000	m2	80	375	4.2		0.8	6,000	4.2		0.8	6,000	4.2		0.8	6,000	4.2		0.8	6,000	4.2		0.8	6,000	4.2		0.8
		Repairing of large size pot hole	Ripping	Road Planer	1m	30,000	m2	720	42	0.5		0.1	6,000	0.5		0.1	6,000	0.5		0.1	6,000	0.5		0.1	6,000	0.5		0.1	6,000	0.5		0.1
			Carry out	Dump Truck	10 ton	1,200	m3	15	80	0.9		0.2	240	0.9		0.2	240	0.9		0.2	240	0.9		0.2	240	0.9		0.2	240	0.9		0.2
			Tack Coat Spraying	Asphalt Hand Sprayer	400 l	37,800	liter	100	378	4.2	5	0.8	7,560	4.2	1	0.8	7,560	4.2	1	0.8	7,560	4.2	1	0.8	7,560	4.2	1	0.8	7,560	4.2	1	0.8
			Carry Asphalt into	Cargo Truck with Crane	4 ton	1,200	m3	4	300	3.3		0.7	240	3.3		0.7	240	3.3		0.7	240	3.3		0.7	240	3.3		0.7	240	3.3		0.7
			Compaction	Hand Guide Roller	800 kg	30,000	m2	80	375	4.2		0.8	6,000	4.2		0.8	6,000	4.2		0.8	6,000	4.2		0.8	6,000	4.2		0.8	6,000	4.2		0.8
	Overlay	**Construction of wearing course**	Tack Coat Spraying	Asphalt Distributor	6,000 l	283,500	liter	1,100	258	2.9	**4**	0.7	283,500	2.9	**4**	0.7																
			Carry Asphalt into	Dump Truck	10 ton	9,000	m3	15	600	6.7		1.7	9,000	6.7		1.7																
			Paving	Asphalt Finisher	2.5～4.5m	225,000	m2	760	296	3.3		0.8	225,000	3.3		0.8																
			Compaction	Vibrating Roller	5 ton	225,000	m2	900	250	2.8		0.7	225,000	2.8		0.7																
			Compaction	Pneumatic Tired Roller	10 ton	225,000	m2	900	250	2.8		0.7	225,000	2.8		0.7																
Type II	Smale-scale Maintenance	Repairing of small size pot hole	Tack Coat Spraying	Asphalt Hand Sprayer	400 l	76,545	liter	100	765	8.5	7.5	1.1	15,309	1.7		1.1	15,309	1.7		1.1	15,309	1.7		1.1	15,309	1.7		1.1	15,309	1.7		1.1
			Carry Asphalt into	Cargo Truck with Crane	4 ton	2,430	m3	4	608	6.8		0.9	486	1.4	1.5	0.9	486	1.4	1.5	0.9	486	1.4	1.5	0.9	486	1.4	1.5	0.9	486	1.4	1.5	0.9
			Tamping	Tamper	80 kg	60,750	m2	80	759	8.4		1.1	12,150	1.7		1.1	12,150	1.7		1.1	12,150	1.7		1.1	12,150	1.7		1.1	12,150	1.7		1.1
		Repairing of large size pot hole	Ripping	Road Planer	1m	60,750	m2	720	84	0.9		0.1	12,150	0.2		0.1	12,150	0.2		0.1	12,150	0.2		0.1	12,150	0.2		0.1	12,150	0.2		0.1
			Carry out	Dump Truck	10 ton	2,430	m3	15	162	1.8		0.2	486	0.4		0.2	486	0.4		0.2	486	0.4		0.2	486	0.4		0.2	486	0.4		0.2
			Tack Coat Spraying	Asphalt Hand Sprayer	400 l	76,545	liter	100	765	8.5	7.5	1.1	15,309	1.7	1.5	1.1	15,309	1.7	1.5	1.1	15,309	1.7	1.5	1.1	15,309	1.7	1.5	1.1	15,309	1.7	1.5	1.1
			Carry Asphalt into	Cargo Truck with Crane	4 ton	2,430	m3	4	608	6.8		0.9	486	1.4		0.9	486	1.4		0.9	486	1.4		0.9	486	1.4		0.9	486	1.4		0.9
			Compaction	Hand Guide Roller	800 kg	60,750	m2	80	759	8.4		1.1	12,150	1.7		1.1	12,150	1.7		1.1	12,150	1.7		1.1	12,150	1.7		1.1	12,150	1.7		1.1
	Overlay	**Construction of wearing course**	Tack Coat Spraying	Asphalt Distributor	6,000 l	351,540	liter	1,100	320	3.6	**7**	0.5									351,540	3.6	**7**	0.5								
			Carry Asphalt into	Dump Truck	10 ton	11,160	m3	15	744	8.3		1.2									11,160	8.3		1.2								
			Paving	Asphalt Finisher	2.5～4.5m	279,000	m2	760	367	4.1		0.6									279,000	4.1		0.6								
			Compaction	Vibrating Roller	5 ton	279,000	m2	900	310	3.4		0.5									279,000	3.4		0.5								
			Compaction	Pneumatic Tired Roller	10 ton	279,000	m2	900	310	3.4		0.5									279,000	3.4		0.5								
	Medium-scale Maintenance	Removal of wearing course	Ripping	Road Planer	1m	3,960	m2	86	46	0.5	4	0.1	3,960	0.5	4	0.1																
			Carry out	Dump Truck	10 ton	3,960	m3	20	198	2.2		0.6	3,960	2.2		0.6																
		Construction of wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	124,740	liter	1,100	113	1.3	4	0.3	128,700	1.3	4	0.3																
			Carry Asphalt into	Dump Truck	10 ton	3,960	m3	15	264	2.9		0.7	3,960	2.9		0.7																
			Paving	Asphalt Finisher	2.5～4.5m	99,000	m2	760	130	1.4		0.4	99,000	1.4		0.4																
			Compaction	Vibrating Roller	5 ton	99,000	m2	900	110	1.2		0.3	99,000	1.2		0.3																
			Compaction	Pneumatic Tired Roller	10 ton	99,000	m2	900	110	1.2		0.3	99,000	1.2		0.3																
	Large-scale Maintenance	Removal of Pavement slab	Ripping	Bull Dozer	20 ton	10,080	m3	100	101	1.1	7	0.2					10,080	1.1	7	0.2												
			Loading	Wheel Loader	2.5m3	10,080	m3	100	101	1.1		0.2					10,080	1.1		0.2												
			Carry out	Dump Truck	10 ton	10,080	m3	20	504	5.6		0.8					10,080	5.6		0.8												
		Removal of Base course	Removing	Motor Grader	3.6～3.7m	28,800	m3	200	144	1.6	7	0.2					28,800	1.6	7	0.2												
			Loading	Wheel Loader	2.5m3	28,800	m3	160	180	2.0		0.3					28,800	2.0		0.3												
			Removing	Dump Truck	10 ton	28,800	m3	20	1,440	16.0		2.3					28,800	16.0		2.3												
		Construction of Sub-base course and Base course	Carry material into	Dump Truck	10 ton	28,800	m3	20	1,440	16.0	7	2.3					28,800	16.0	7	2.3												
			Leveling (2 layers)	Motor Grader	3.6～3.7m	144,000	m2	1,000	144	1.6		0.2					144,000	1.6		0.2												
			Compaction (2 layers)	Vibrating Roller	5 ton	144,000	m2	900	160	1.8		0.3					144,000	1.8		0.3												
			Water spraying	Water Tank Truck	8,000 l	144,000	m2	900	160	1.8		0.3					144,000	1.8		0.3												
		Construction of Binder course, Intermediate course and wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	90,720	liter	1,100	82	0.9	7	0.1					90,720	0.9	7	0.1												
			Carry Asphalt into	Dump Truck	10 ton	10,080	m3	15	672	7.5		1.1					10,080	7.5		1.1												
			Paving (3 layers)	Asphalt Finisher	2.5～4.5m	216,000	m2	760	284	3.2		0.5					216,000	3.2		0.5												
			Compaction (3 layers)	Vibrating Roller	5 ton	216,000	m2	900	240	2.7		0.4					216,000	2.7		0.4												
			Compaction (3 layers)	Pneumatic Tired Roller	10 ton	216,000	m2	900	240	2.7		0.4					216,000	2.7		0.4												
Type III	Smale-scale Maintenance	Repairing of small size pot hole	Tack Coat Spraying	Asphalt Hand Sprayer	400 l	16,065	liter	100	161	1.8	2.5	0.7	3,213	0.4	0.5	0.7	3,213	0.4	0.5	0.7	3,213	0.4	0.5	0.7	3,213	0.4	0.5	0.7	3,213	0.4	0.5	0.7
			Carry Asphalt into	Cargo Truck with Crane	4 ton	510	m3	4	128	1.4		0.6	102	0.3		0.6	102	0.3		0.6	102	0.3		0.6	102	0.3		0.6	102	0.3		0.6
			Tamping	Tamper	80 kg	12,750	m2	80	159	1.8		0.7	2,550	0.4		0.7	2,550	0.4		0.7	2,550	0.4		0.7	2,550	0.4		0.7	2,550	0.4		0.7
		Repairing of large size pot hole	Ripping	Road Planer	1m	12,750	m2	720	18	0.2		0.1	2,550	0.0		0.1	2,550	0.0		0.1	2,550	0.0		0.1	2,550	0.0		0.1	2,550	0.0		0.1
			Carry out	Dump Truck	10 ton	510	m3	120	4	0.0		0.0	102	0.0		0.0	102	0.0		0.0	102	0.0		0.0	102	0.0		0.0	102	0.0		0.0
			Tack Coat Spraying	Asphalt Hand Sprayer	400 l	16,065	liter	100	161	1.8	2.5	0.7	3,213	0.4	0.5	0.7	3,213	0.4	0.5	0.7	3,213	0.4	0.5	0.7	3,213	0.4	0.5	0.7	3,213	0.4	0.5	0.7
			Carry Asphalt into	Cargo Truck with Crane	4 ton	510	m3	4	128	1.4		0.6	102	0.3		0.6	102	0.3		0.6	102	0.3		0.6	102	0.3		0.6	102	0.3		0.6
			Compaction	Hand Guide Roller	800 kg	12,750	m2	80	159	1.8		0.7	2,550	0.4		0.7	2,550	0.4		0.7	2,550	0.4		0.7	2,550	0.4		0.7	2,550	0.4		0.7
	Overlay	**Construction of wearing course**	Tack Coat Spraying	Asphalt Distributor	6,000 l	267,750	liter	1,100	243	2.7	**3**	0.9													267,750	2.7	**3**	0.9				
			Carry Asphalt into	Dump Truck	10 ton	8,500	m3	15	567	6.3		2.1													8,500	6.3		2.1				
			Paving	Asphalt Finisher	2.5～4.5m	212,500	m2	760	280	3.1		1.0													212,500	3.1		1.0				
			Compaction	Vibrating Roller	5 ton	212,500	m2	900	236	2.6		0.9													212,500	2.6		0.9				
			Compaction	Pneumatic Tired Roller	10 ton	212,500	m2	900	236	2.6		0.9													212,500	2.6		0.9				
	Large-scale Maintenance	Removal of Pavement slab	Ripping	Bull Dozer	20 ton	9,520	m3	100	95	1.1	4	0.3													9,520	1.1	4	0.3				
			Loading	Wheel Loader	2.5m3	9,520	m3	100	95	1.1		0.3													9,520	1.1		0.3				
			Carry out	Dump Truck	10 ton	9,520	m3	20	476	5.3		1.3													9,520	5.3		1.3				
		Removal of Base course	Removing	Motor Grader	3.6～3.7m	27,200	m3	200	136	1.5	4	0.4													27,200	1.5	4	0.4				
			Loading	Wheel Loader	2.5m3	27,200	m3	160	170	1.9		0.5													27,200	1.9		0.5				
			Removing	Dump Truck	10 ton	27,200	m3	20	1,360	15.1		3.8													27,200	15.1		3.8				
		Construction of Sub-base course and Base course	Carry material into	Dump Truck	10 ton	27,200	m3	20	1,360	15.1	4	3.8													27,200	15.1	4	3.8				
			Leveling (2 layers)	Motor Grader	3.6～3.7m	136,000	m2	1,000	136	1.5		0.4													136,000	1.5		0.4				
			Compaction (2 layers)	Vibrating Roller	5 ton	136,000	m2	900	151	1.7		0.4													136,000	1.7		0.4				
			Water spraying	Water Tank Truck	8,000 l	136,000	m2	900	151	1.7		0.4													136,000	1.7		0.4				
		Construction of Binder course, Intermediate course and wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	8,568	liter	1,100	8	0.1	4	0.0													8,568	0.1	4	0.0				
			Carry Asphalt into	Dump Truck	10 ton	9,520	m3	15	635	7.1		1.8													9,520	7.1		1.8				
			Paving (3 layers)	Asphalt Finisher	2.5～4.5m	204,000	m2	760	268	3.0		0.7													204,000	3.0		0.7				
			Compaction (3 layers)	Vibrating Roller	5 ton	204,000	m2	900	227	2.5		0.6													204,000	2.5		0.6				
			Compaction (3 layers)	Pneumatic Tired Roller	10 ton	204,000	m2	900	227	2.5		0.6													204,000	2.5		0.6				
Type IV	Smale-scale Maintenance	Repairing of small size pot hole	Tack Coat Spraying	Asphalt Hand Sprayer	400 l	6,615	liter	100	66	0.7	2.5	0.3	1,323	0.1	0.5	0.3	1,323	0.1	0.5	0.3	1,323	0.1	0.5	0.3	1,323	0.1	0.5	0.3	1,323	0.1	0.5	0.3
			Carry Asphalt into	Cargo Truck with Crane	4 ton	210	m3	4	53	0.6		0.2	42	0.1		0.2	42	0.1		0.2	42	0.1		0.2	42	0.1		0.2	42	0.1		0.2
			Tamping	Tamper	80 kg	5,250	m2	80	66	0.7		0.3	1,050	0.1		0.3	1,050	0.1		0.3	1,050	0.1		0.3	1,050	0.1		0.3	1,050	0.1		0.3
		Repairing of large size pot hole	Ripping	Road Planer	1m	5,250	m2	720	7	0.1		0.0	1,050	0.0		0.0	1,050	0.0		0.0	1,050	0.0		0.0	1,050	0.0		0.0	1,050	0.0		0.0
			Carry out	Dump Truck	10 ton	210	m3	20	11	0.1		0.0	42	0.0		0.0	42	0.0		0.0	42	0.0		0.0	42	0.0		0.0	42	0.0		0.0
			Tack Coat Spraying	Asphalt Hand Sprayer	400 l	6,615	liter	100	66	0.7	2.5	0.3	1,323	0.1	0.5	0.3	1,323	0.1	0.5	0.3	1,323	0.1	0.5	0.3	1,323	0.1	0.5	0.3	1,323	0.1	0.5	0.3
			Carry Asphalt into	Cargo Truck with Crane	4 ton	210	m3	4	53	0.6		0.2	42	0.1		0.2	42	0.1		0.2	42	0.1		0.2	42	0.1		0.2	42	0.1		0.2
			Compaction	Hand Guide Roller	800 kg	5,250	m2	80	66	0.7		0.3	1,050	0.1		0.3	1,050	0.1		0.3	1,050	0.1		0.3	1,050	0.1		0.3	1,050	0.1		0.3
	Overlay	**Construction of wearing course**	Tack Coat Spraying	Asphalt Distributor	6,000 l	299,880	liter	1,100	273	3.0	**7**	0.4																	299,880	3.0	**7**	0.4
			Carry Asphalt into	Dump Truck	10 ton	9,520	m3	15	635	7.1		1.0																	9,520	7.1		1.0
			Paving	Asphalt Finisher	2.5～4.5m	238,000	m2	760	313	3.5		0.5																	238,000	3.5		0.5
			Compaction	Vibrating Roller	5 ton	238,000	m2	900	264	2.9		0.4																	238,000	2.9		0.4
			Compaction	Pneumatic Tired Roller	10 ton	238,000	m2	900	264	2.9		0.4																	238,000	2.9		0.4
Asphalt Plant			Loading	Wheel Loader	2.5 m3	47,964	m3	14	3,426	38.1	35	1.1	10,290	8.2	7	1.2	8,274	6.6	7	0.9	9,030	7.2	7	1.0	13,832	11.0	7	1.6	7,882	6.3	7	0.9
			Put aggregate into	Bull Dozer	20 ton	47,964	m3	14	3,426	38.1		1.1	10,290	8.2		1.2	8,274	6.6		0.9	9,030	7.2		1.0	13,832	11.0		1.6	7,882	6.3		0.9
			Production	Asphalt Plant	50 ton/h	68,520	m3	20	3,426	38.1		1.1	14,700	8.2		1.2	11,820	6.6		0.9	12,900	7.2		1.0	19,760	11.0		1.6	11,260	6.3		0.9
			Transportation	Dump Truck	10 ton	68,520	m3	15	4,568	50.8		1.5	14,700	10.9		1.6	11,820	8.8		1.3	12,900	9.6		1.4	19,760	14.6		2.1	11,260	8.3		1.2
Others Works			Falling rock removing	Excavator	0.8m3																											
				Wheel Loader	2.5m3																											
				Dump Truck	10 ton																											
			Snow removing	Multi Purpose Truck																												
				Wheel Loader	2.5m3																											
				Motor Grader	3.6～3.7m																											
				Dump Truck	10 ton																											
			Surface leveling	Motor Grader	3.6～3.7m																											
			Pavement marking	Road Line Marker																												
			Transportation of machineries	Trailer Truck																												
				Truck Crane																												
				Pick-up Truck																												
			Repairing of Machiner	Mobile Workshop																												
			in-situ test	Mobile materials testing laboratory																												
			Road cleaning	Water Tank Truck	8,000 l																											
				Air Compressor	8m3/min																											
			Carriage of concrete pipe	Cargo Truck with Crane	3 ton																											

Table 2-9 Calculation of the required number of machinery in Surkhandarya province

Working months per year = 7 months (April ～ October) Working days per month Average=18 days Working time = 5h/day

Type	Method	Details of construction work		Machenery	Class	Qty. job	Unit	Job-cap. /unit*hr	Total time unit*hr	Needs unit*month	Working month	Unit needed	2006 Qty. of Job	2006 Needs unit*month	2006 Working month	2006 Unit needed	2007 Qty. of Job	2007 Needs unit*month	2007 Working month	2007 Unit needed	2008 Qty. of Job	2008 Needs unit*month	2008 Working month	2008 Unit needed	2009 Qty. of Job	2009 Needs unit*month	2009 Working month	2009 Unit needed	2010 Qty. of Job	2010 Needs unit*month	2010 Working month	2010 Unit needed
Tipe I	Smale-scale Maintenance	Repairing of small size pot hole	Tack Coat Spraying	Asphalt Hand Sprayer	400 l	66,150	liter	100	662	7.4	7.5	1.0	13,230	1.5	1.5	1.0	13,230	1.5	1.5	1.0	13,230	1.5	1.5	1.0	13,230	1.5	1.5	1.0	13,230	1.5	1.5	1.0
			Carry Asphalt into	Cargo Truck with Crane	4 ton	2,100	m3	4	525	5.8		0.8	420	1.2		0.8	420	1.2		0.8	420	1.2		0.8	420	1.2		0.8	420	1.2		0.8
			Tamping	Tamper	80 kg	52,500	m2	80	656	7.3		1.0	10,500	1.5		1.0	10,500	1.5		1.0	10,500	1.5		1.0	10,500	1.5		1.0	10,500	1.5		1.0
		Repairing of large size pot hole	Ripping	Road Planer	1m	52,500	m2	720	73	0.8		0.1	10,500	0.2		0.1	10,500	0.2		0.1	10,500	0.2		0.1	10,500	0.2		0.1	10,500	0.2		0.1
			Carry out	Dump Truck	10 ton	2,100	m3	15	140	1.6		0.2	420	0.3		0.2	420	0.3		0.2	420	0.3		0.2	420	0.3		0.2	420	0.3		0.2
			Tack Coat Spraying	Asphalt Hand Sprayer	400 l	66,150	liter	100	662	7.4	7.5	1.0	13,230	1.5	1.5	1.0	13,230	1.5	1.5	1.0	13,230	1.5	1.5	1.0	13,230	1.5	1.5	1.0	13,230	1.5	1.5	1.0
			Carry Asphalt into	Cargo Truck with Crane	4 ton	2,100	m3	4	525	5.8		0.8	420	1.2		0.8	420	1.2		0.8	420	1.2		0.8	420	1.2		0.8	420	1.2		0.8
			Compaction	Hand Guide Roller	800 kg	52,500	m2	80	656	7.3		1.0	10,500	1.5		1.0	10,500	1.5		1.0	10,500	1.5		1.0	10,500	1.5		1.0	10,500	1.5		1.0
	Overlay	Construction of wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	434,700	liter	1,100	395	4.4	7	0.6	434,700	4.4	7	0.6																
			Carry Asphalt into	Dump Truck	10 ton	13,800	m3	15	920	10.2		1.5	13,800	10.2		1.5																
			Paving	Asphalt Finisher	2.5～4.5m	345,000	m2	760	454	5.0		0.7	345,000	5.0		0.7																
			Compaction	Vibrating Roller	5 ton	345,000	m2	900	383	4.3		0.6	345,000	4.3		0.6																
			Compaction	Pneumatic Tired Roller	10 ton	345,000	m2	900	383	4.3		0.6	345,000	4.3		0.6																
Type II	Smale-scale Maintenance	Repairing of small size pot hole	Tack Coat Spraying	Asphalt Hand Sprayer	400 l	104,895	liter	100	1,049	11.7	10	1.2	20,979	2.3	2	1.2	20,979	2.3	2	1.2	20,979	2.3	2	1.2	20,979	2.3	2	1.2	20,979	2.3	2	1.2
			Carry Asphalt into	Cargo Truck with Crane	4 ton	3,330	m3	4	833	9.3		0.9	666	1.9		0.9	666	1.9		0.9	666	1.9		0.9	666	1.9		0.9	666	1.9		0.9
			Tamping	Tamper	80 kg	83,250	m2	80	1,041	11.6		1.2	16,650	2.3		1.2	16,650	2.3		1.2	16,650	2.3		1.2	16,650	2.3		1.2	16,650	2.3		1.2
		Repairing of large size pot hole	Ripping	Road Planer	1m	30,000	m2	720	42	0.5		0.0	6,000	0.1		0.0	6,000	0.1		0.0	6,000	0.1		0.0	6,000	0.1		0.0	6,000	0.1		0.0
			Carry out	Dump Truck	10 ton	3,330	m3	15	222	2.5		0.2	666	0.5		0.2	666	0.5		0.2	666	0.5		0.2	666	0.5		0.2	666	0.5		0.2
			Tack Coat Spraying	Asphalt Hand Sprayer	400 l	104,895	liter	100	1,049	11.7	10	1.2	20,979	2.3	2	1.2	20,979	2.3	2	1.2	20,979	2.3	2	1.2	20,979	2.3	2	1.2	20,979	2.3	2	1.2
			Carry Asphalt into	Cargo Truck with Crane	4 ton	3,330	m3	4	833	9.3		0.9	666	1.9		0.9	666	1.9		0.9	666	1.9		0.9	666	1.9		0.9	666	1.9		0.9
			Compaction	Hand Guide Roller	800 kg	83,250	m2	80	1,041	11.6		1.2	16,650	2.3		1.2	16,650	2.3		1.2	16,650	2.3		1.2	16,650	2.3		1.2	16,650	2.3		1.2
	Overlay	Construction of wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	419,580	liter	1,100	381	4.2	7	0.6									419,580	4.2	7	0.6								
			Carry Asphalt into	Dump Truck	10 ton	13,320	m3	15	888	9.9		1.4									13,320	9.9		1.4								
			Paving	Asphalt Finisher	2.5～4.5m	333,000	m2	760	438	4.9		0.7									333,000	4.9		0.7								
			Compaction	Vibrating Roller	5 ton	333,000	m2	900	370	4.1		0.6									333,000	4.1		0.6								
			Compaction	Pneumatic Tired Roller	10 ton	333,000	m2	900	370	4.1		0.6									333,000	4.1		0.6								
	Medium-scale Maintenance	Removal of wearing course	Ripping	Road Planer	1m	7,920	m3	86	92	1.0	7	0.1													7,920	1.0	7	0.1				
			Carry out	Dump Truck	10 ton	7,920	m3	20	396	4.4		0.6													7,920	4.4		0.6				
		Construction of wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	249,480	liter	1,100	227	2.5	7	0.4													249,480	2.5	7	0.4				
			Carry Asphalt into	Dump Truck	10 ton	7,920	m3	15	528	5.9		0.8													7,920	5.9		0.8				
			Paving	Asphalt Finisher	2.5～4.5m	198,000	m2	760	261	2.9		0.4													198,000	2.9		0.4				
			Compaction	Vibrating Roller	5 ton	198,000	m2	900	220	2.4		0.3													198,000	2.4		0.3				
			Compaction	Pneumatic Tired Roller	10 ton	198,000	m2	900	220	2.4		0.3													198,000	2.4		0.3				
Type III	Overlay	Construction of wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	21,420	liter	1,100	19	0.2	2	0.1																	21,420	0.2	2	0.1
			Carry Asphalt into	Dump Truck	10 ton	680	m3	15	45	0.5		0.3																	680	0.5		0.3
			Paving	Asphalt Finisher	2.5～4.5m	17,000	m2	760	22	0.2		0.1																	17,000	0.2		0.1
			Compaction	Vibrating Roller	5 ton	17,000	m2	900	19	0.2		0.1																	17,000	0.2		0.1
			Compaction	Pneumatic Tired Roller	10 ton	17,000	m2	900	19	0.2		0.1																	17,000	0.2		0.1
	Medium-scale Maintenance	Removal of wearing course	Ripping	Road Planer	1m	2,720	m3	86	32	0.4	5	0.1																	2,720	0.4	5	0.1
			Carry out	Dump Truck	10 ton	2,720	m3	20	136	1.5		0.3																	2,720	1.5		0.3
		Construction of wearing course	Tack Coat Spraying	Asphalt Distributor	6,000 l	85,680	liter	1,100	78	0.9	5	0.2																	85,680	0.9	5	0.2
			Carry Asphalt into	Dump Truck	10 ton	2,720	m3	15	181	2.0		0.4																	2,720	2.0		0.4
			Paving	Asphalt Finisher	2.5～4.5m	68,000	m2	760	89	1.0		0.2																	68,000	1.0		0.2
			Compaction	Vibrating Roller	5 ton	68,000	m2	900	76	0.8		0.2																	68,000	0.8		0.2
			Compaction	Pneumatic Tired Roller	10 ton	68,000	m2	900	76	0.8		0.2																	68,000	0.8		0.2
Asphalt Plant			Loading	Wheel Loader	2.1 m3	34,510	m3	14	2465	27.4	35	0.8	11,180	8.9	7	1.3	1,520	1.2	7	0.2	10,844	8.6	7	1.2	7,064	5.6	7	0.8	3,900	3.1	7	0.4
			Put aggregate into	Bull Dozer	20 ton	34,510	m3	14	2465	27.4		0.8	11,180	8.9		1.3	1,520	1.2		0.2	10,844	8.6		1.2	7,064	5.6		0.8	3,900	3.1		0.4
			Production	Asphalt Plant	50 ton/h	49,300	m3	20	2465	27.4		0.8	15,972	8.9		1.3	2,172	1.2		0.2	15,492	8.6		1.2	10,092	5.6		0.8	5,572	3.1		0.4
			Transportation	Dump Truck	10 ton	49,300	m3	15	3,287	36.5		1.0	15,972	11.8		1.7	2,172	1.6		0.2	15,492	11.5		1.6	10,092	7.5		1.1	5,572	4.1		0.6
Others Works			Falling rock removing	Excavator	0.8m3																											
				Wheel Loader	2.5m3																											
				Dump Truck	10 ton																											
			Snow removing	Multi Purpose Truck																												
				Wheel Loader	2.5m3																											
				Motor Grader	3.6～3.7m																											
				Dump Truck	10 ton																											
			Surface leveling	Motor Grader	3.6～3.7m																											
			Pavement marking	Road Line Marker																												
			Transportation of machineries	Trailer Truck																												
				Truck Crane																												
				Pick-up Truck																												
			Repairing of Machiner	Mobile Workshop																												
			in-situ test	Mobile materials testing laboratory																												
			Road cleaning	Water Tank Truck	8,000 l																											
				Air Compressor	8m3/min																											
			Carriage of concrete pipe	Cargo Truck with Crane	3 ton																											

Table 2-10 Total Work Volume by individual Machine in Samarkand province

Type	Method	Details of construction work		Motor Grader		Dump Truck	Asphalt Splaier	Vibration Roller	Tired Roller	Water Tanker	Asphalt Finisher	Destributor	Road Planer		Asphalt Plant	Wheel Loader	Bulldozer	Tamper	Handguide Roller	Cargo Truck w/ Crane
				(m3)	(m2)	(m3)	(liter)	(m2)	(m2)	(m2)	(m2)	(liter)	(m3)	(m2)	(m3)	(m3)	(m3)	(m2)	(m2)	(m3)
Type-I	Overlay	Construction of wearing course	Tack Coat Spraying									302,400								
			Carry Asphalt into			9,600														
			Paving								240,000									
			Compaction					240,000												
			Compaction						240,000											
	Large-scale Maintenance	Removal of Pavement slab	Ripping														6,300			
			Loading													6,300				
			Carry out			6,300														
		Removal of Base course	Removing	18,000																
			Loading													18,000				
			Removing			18,000														
		Construction of Sub-base course and Base course	Carry material into			18,000														
			Leveling (2 layers)		90,000															
			Compaction (2 layers)					90,000												
			Water spraying							90,000										
		Construction of Binder course, Intermediate course and wearing course	Tack Coat Spraying									56,700								
			Carry Asphalt into			6,300														
			Paving (3 layers)								135,000									
			Compaction (3 layers)					135,000												
			Compaction (3 layers)						135,000											
Type-II	Large-scale Maintenance	Removal of Pavement slab	Ripping														2,520			
			Loading													2,520				
			Carry out			2,520														
		Removal of Base course	Removing	7,200																
			Loading													7,200				
			Removing			7,200														
		Construction of Sub-base course and Base course	Carry material into			7,200														
			Leveling (2 layers)		36,000															
			Compaction (2 layers)					36,000												
			Water spraying							36,000										
		Construction of Binder course, Intermediate course and wearing course	Tack Coat Spraying									22,680								
			Carry Asphalt into			2,520														
			Paving (3 layers)								54,000									
			Compaction (3 layers)					54,000												
			Compaction (3 layers)						54,000											
Type-III	Smale-scale Maintenance	Repairing of small size pot hole	Tack Coat Spraying				13,388													
			Carry Asphalt into																	425
			Tamping															10,625		
			Tamping																	
		Repairing of large size pot hole	Ripping											10,625						
			Carry out			850														
			Tack Coat Spraying				13,388													
			Carry Asphalt into																	425
			Compaction																	
			Compaction																10,625	
	Overlay	Construction of wearing course	Tack Coat Spraying									42,840								
			Carry Asphalt into			1,360														
			Paving								34,000									
			Compaction					34,000												
			Compaction						34,000											
	Medium-scale Maintenance	Removal of wearing course	Ripping										7,480							
			Carry out			7,480														
		Construction of wearing course	Tack Coat Spraying									235,620								
			Carry Asphalt into			7,480														
			Paving								187,000									
			Compaction					187,000												
			Compaction						187,000											
	Large-scale Maintenance	Removal of Pavement slab	Ripping														8,330			
			Loading													8,330				
			Carry out			8,330														
		Removal of Base course	Removing	23,800																
			Loading													23,800				
			Removing			23,800														
		Construction of Sub-base course and Base course	Carry material into			23,800														
			Leveling (2 layers)		119,000															
			Compaction (2 layers)					119,000												
			Water spraying							119,000										
		Construction of Binder course, Intermediate course and wearing course	Tack Coat Spraying									74,970								
			Carry Asphalt into			8,330														
			Paving (3 layers)								178,500									
			Compaction (3 layers)					178,500												
			Compaction (3 layers)						178,500											
Asphalt Plant			Loading													25,508				
			Put aggregate into														25,508			
			Production												36,440					
			Transportation			36,440														
Other Works			Falling rock removing																	
			Snow removing																	
			Surface leveling																	
			Pavement marking																	
			Transportation of machineries																	
			Repairing of Machinery																	
			in-situ test																	
			Road cleaning																	
Total Volume of Road Maintenance Works				49,000	245,000	195,510	26,775	1,073,500	828,500	245,000	828,500	735,210	7,480	10,625	36,440	91,658	42,658	10,625	10,625	850

Table 2-11 Total Work Volume by individual Machine in Kashkhadarya province

Type	Method	Details of construction work		Motor Grader		Dump Truck	Asphalt Splaier	Vibration Roller	Tired Roller	Water Tanker	Asphalt Finisher	Destributor	Road Planer		Asphalt Plant	Wheel Loader	Bulldozer	Tamper	Handguide Roller	Cargo Truck w/ Crane
				(m3)	(m2)	(m3)	(liter)	(m2)	(m2)	(m2)	(m2)	(liter)	(m3)	(m2)	(m3)	(m3)	(m3)	(m2)	(m2)	(m3)
Type-I	Smale-scale Maintenance	Repairing of small size pot hole	Tack Coat Spraying				37,800													
			Carry Asphalt into																	1,200
			Tamping															30,000		
			Tamping																	
		Repairing of large size pot hole	Ripping											30,000						
			Carry out			1,200														
			Tack Coat Spraying				37,800													
			Carry Asphalt into																	1,200
			Compaction																	
			Tamping																30,000	
	Overlay	Construction of wearing course	Tack Coat Spraying									283,500								
			Carry Asphalt into			9,000														
			Paving								225,000									
			Compaction					225,000												
			Compaction						225,000											
Type-II	Smale-scale Maintenance	Repairing of small size pot hole	Tack Coat Spraying				76,545													
			Carry Asphalt into																	2,430
			Tamping															60,750		
			Tamping																	
		Repairing of large size pot hole	Ripping											60,750						
			Carry out			2,430														
			Tack Coat Spraying				76,545													
			Carry Asphalt into																	2,430
			Compaction																	
			Tamping																60,750	
	Overlay	Construction of wearing course	Tack Coat Spraying									351,540								
			Carry Asphalt into			11,160														
			Paving								279,000									
			Compaction					279,000												
			Compaction						279,000											
	Medium-scale Maintenance	Removal of wearing course	Ripping										3,960							
			Carry out			3,960														
		Construction of wearing course	Tack Coat Spraying									124,740								
			Carry Asphalt into			3,960														
			Paving								99,000									
			Compaction					99,000												
			Compaction						99,000											
	Large-scale Maintenance	Removal of Pavement slab	Ripping														10,080			
			Loading													10,080				
			Carry out			10,080														
		Removal of Base course	Removing	28,800																
			Loading													28,800				
			Removing			28,800														
		Construction of Sub-base course and Base course	Carry material into			28,800														
			Leveling (2 layers)		144,000															
			Compaction (2 layers)					144,000												
			Water spraying							144,000										
		Construction of Binder course, Intermediate course and wearing course	Tack Coat Spraying									90,720								
			Carry Asphalt into			10,080														
			Paving (3 layers)								216,000									
			Compaction (3 layers)					216,000												
			Compaction (3 layers)						216,000											
Type-III	Smale-scale Maintenance	Repairing of small size pot hole	Tack Coat Spraying				16,065													
			Carry Asphalt into																	510
			Tamping															12,750		
			Tamping																	
		Repairing of large size pot hole	Ripping											12,750						
			Carry out			12,750														
			Tack Coat Spraying				16,065													
			Carry Asphalt into																	510
			Compaction																	
			Tamping																12,750	
	Overlay	Construction of wearing course	Tack Coat Spraying									267,750								
			Carry Asphalt into			8,500														
			Paving								212,500									
			Compaction					212,500												
			Compaction						212,500											
	Large-scale Maintenance	Removal of Pavement slab	Ripping														9,520			
			Loading													9,520				
			Carry out			9,520														
		Removal of Base course	Removing	27,200																
			Loading													27,200				
			Removing			27,200														
		Construction of Sub-base course and Base course	Carry material into			27,200														
			Leveling (2 layers)		136,000															
			Compaction (2 layers)					136,000												
			Water spraying							136,000										
		Construction of Binder course, Intermediate course and wearing course	Tack Coat Spraying									8,568								
			Carry Asphalt into			9,520														
			Paving (3 layers)								204,000									
			Compaction (3 layers)					204,000												
			Compaction (3 layers)						204,000											
Type-IV	Smale-scale Maintenance	Repairing of small size pot hole	Tack Coat Spraying				6,615													
			Carry Asphalt into																	210
			Tamping															5,250		
			Tamping																	
		Repairing of large size pot hole	Ripping											5,250						
			Carry out			210														
			Tack Coat Spraying				6,615													
			Carry Asphalt into																	210
			Compaction																	
			Tamping																5,250	
	Overlay	Construction of wearing course	Tack Coat Spraying									299,880								
			Carry Asphalt into			9,520														
			Paving								238,000									
			Compaction					238,000												
			Compaction						238,000											
Asphalt Plant			Loading													47,964				
			Put aggregate into														47,964			
			Production												68,520					
			Transportation			68,520														
Other Works			Falling rock removing																	
			Snow removing																	
			Surface leveling																	
			Pavement marking																	
			Transportation of machineries																	
			Repairing of Machinery																	
			in-situ test																	
			Road cleaning																	
Total Volume of Road Maintenance Works				56,000	280,000	282,410	274,050	1,753,500	1,473,500	280,000	1,473,500	1,426,698	3,960	108,750	68,520	123,564	67,564	108,750	108,750	8,700

Table 2-12 Total Work Volume by individual Machine in Surkhandarya province

Type	Method	Details of construction work		Motor Grader	Dump Truck	Asphalt Splaier	Vibration Roller	Tired Roller	Water Tanker	Asphalt Finisher	Destributor	Road Planer		Asphalt Plant	Wheel Loader	Bulldozer	Tamper	Handguide Roller	Cargo Truck w/ Crane
				(m2)	(m3)	(liter)	(m2)	(m2)	(m2)	(m2)	(liter)	(m3)	(m2)	(m3)	(m3)	(m3)	(m2)	(m2)	(m3)
Type-I	Smale-scale Maintenance	Repairing of small size pot hole	Tack Coat Spraying			66,150													
			Carry Asphalt into																2,100
			Tamping														52,500		
			Tamping																
		Repairing of large size pot hole	Ripping										52,500						
			Carry out		2,100														
			Tack Coat Spraying			66,150													
			Carry Asphalt into																2,100
			Compaction																
			Tamping															52,500	
	Overlay	Construction of wearing course	Tack Coat Spraying								434,700								
			Carry Asphalt into		13,800														
			Paving							345,000									
			Compaction				345,000												
			Compaction					345,000											
Type-II	Smale-scale Maintenance	Repairing of small size pot hole	Tack Coat Spraying			104,895													
			Carry Asphalt into																3,330
			Tamping														83,250		
			Tamping																
		Repairing of large size pot hole	Ripping										30,000						
			Carry out		3,330														
			Tack Coat Spraying			104,895													
			Carry Asphalt into																3,330
			Compaction																
			Tamping															83,250	
	Overlay	Construction of wearing course	Tack Coat Spraying								419,580								
			Carry Asphalt into		13,320														
			Paving							333,000									
			Compaction				333,000												
			Compaction					333,000											
	Medium-scale Maintenance	Removal of wearing course	Ripping									7,920							
			Carry out		7,920														
		Construction of wearing course	Tack Coat Spraying								249,480								
			Carry Asphalt into		7,920														
			Paving							198,000									
			Compaction				198,000												
			Compaction					198,000											
Type-III	Overlay	Construction of wearing course	Tack Coat Spraying								21,420								
			Carry Asphalt into		680														
			Paving							17,000									
			Compaction				17,000												
			Compaction					17,000											
	Medium-scale Maintenance	Removal of wearing course	Ripping									2,720							
			Carry out		2,720														
		Construction of wearing course	Tack Coat Spraying								85,680								
			Carry Asphalt into		2,720														
			Paving							68,000									
			Compaction				68,000												
			Compaction					68,000											
Asphalt Plant			Loading												34,510				
			Put aggregate into													34,510			
			Production											49,300					
			Transportation		49,300														
Other Works			Falling rock removing																
			Snow removing																
			Surface leveling																
			Pavement marking																
			Transportation of machineries																
			Repairing of Machinery																
			in-situ test																
			Road cleaning																
Total Volume of Road Maintenance Works					103,810	342,090	961,000	961,000		961,000	1,210,860	10,640	82,500	49,300	34,510	34,510	135,750	135,750	10,860

(4) Specification of equipment

The team set rough specification of machinery based on the table 2-7～2-9 as follows.

Table 2-13 Rough specifications and purpose of machinery

No.	Name	Rough Spec	Purpose of use
1	Motor Grader	Blade: 3.7 m Eng power 150 PS min	Excavation and grading of base course, snow removal
2	Dump Truck	Payload: 10 ton	Handling of materials for the maintenance works
3	Asphalt Sprayer	Tank capacity: 400 l Towing type	Applying the tack coat on the surface of road prior to paving the asphalt mix
4	Vibration Roller	Operating weight 7 ton	Compaction of the roads after grading the base course and/or paved surface
5	Pneumatic Roller	Operating weight 10 ton	Compaction of the roads after paving the road surface
6	Pick-up Truck	Double Cab (5 persons) Eng power 80 PS min.	Communication between sites and office, patrolling the roads
7	Water Tank Truck	Tank capacity 8,000 l Eng power 165 PS min	Applying water to materials for the base course construction, preventing the occurrence of dust
8	Multi Purpose Vehicle	Snowplow 1,500 ton/h Chemical spreading	Blowing out the snow from the roads and/or spreading the de-icing chemicals on the roads
9	Road Line Marker	Line width 100-300 mm Paint capacity 600 l	Marking the roads with white paint lines
10	Asphalt Finisher	Paving width 2.5-4.5 m Thickness 10–200 mm	Paving the road with asphalt mix
11	Asphalt Distributor	Tank capacity 6,000 l Spread width 2.4-3.6 m	Applying tack coat on the road before spreading and paving the road with asphalt mix
12	Trailer Head	G.V.W. 45,000 kg min Eng power 360 PS min	Towing a trailer loaded with construction machinery
13	Trailer	Loading capacity 30 ton Width of bed 2,900 mm	Carrying construction machinery and/or materials
14	Road Harrow	Cutting width 1.0 m Cutting depth 100 min	Milling the road surface and loading scrap
15	Mobile Material Testing Laboratory	Container type Inner size 2.5*2.5*6 m	Testing the condition of road before and after the maintenance work, testing materials for asphalt mixing plant
16	Asphalt Mixing Plant	Capacity 30 ton/h	Production of the hot asphalt mixture
17	Mobile Workshop	G.V.W. 10,000 kg Tools & Equipment	Maintenance and repair work of construction machinery at construction site(s)
18	Excavator	0.8 m^3 Bucket Eng power 135 HP min	Excavating soil and sand at borrow pits. Removing stones from the slopes beside roads
19	Wheel Loader	2.5 m^3 Bucket Eng power 160 HP min	Handling of materials for sub base course, pavement and scrap of road
20	Truck Crane	Lifting capacity 25 ton Boom length 30 m min	Loading/unloading the construction machinery and/or structures onto the trailer
21	Bulldozer	Operating weight 20 ton Eng power 180 HP min	Ripping off the pavement slab and feeding materials for the asphalt mixing plant.
22	Air Compressor	Capacity 7 m^3/min Pressure 700 kpa	Blowing away the dust from the road prior to application of tack coat.
23	Cargo Truck with Crane	Loading capacity 4 ton Lifting capacity 3 ton	Transporting small-sized equipment to the site for small scale maintenance works
24	Tamper	Weight 70 kg min	Compacting the surface of road after applying asphalt mix to pot holes.
25	Hand Guide Roller	Weight 700 kg min.	Compacting the surface of road after applying asphalt mix during small repair jobs and maintenance

(5) Selection of equipment

Based on the result of calculation of volume of road maintenance works at each province, the team fixed the quantity of the necessary machines. This quantity is the total number of new machines and existing machines of UZAVTOYUL. The team set the number of existing machines which can be involved in the road maintenance work of target roads based on lists of existing machines of three provincial AVTOYULs. Table 2-14 shows the sample data sheet that the team used for this procedure.

Table2-14 The calculation procedure and calculated number of the machinery

	Item	Name of works		Samarkand	Kashkhadarya	Surkhandarya
MOTOR GRADER	Number of existing machines			11	27	13
	Number of movable machines			7	13	9
	Number of machines for special use e.g. for the plants			0	0	0
	Available number of machines for road maintenance			7	13	9
	Available number of machines for the target road	20～30% ?		2	3	2
	Available volume of the maintenance works by existing machines described on upper line	Pushing soil (m^3)	9,000	18,000	27,000	18,000
		Grading (m^2)	27,000	54,000	81,000	54,000
		Snow removal (m^2)	36,000	72,000	87,750	72,000
		Leveling of asphalt (m^2)	22,500	45,000	67,500	45,000
	Actual work done by the existing machinery	Pushing soil (m^3)	2～3 month	41,800	56,000	
		Grading (m^2)	5months	209,000	280,000	0
		Snow removing (m^2)	15months	1,080,000	1,316,250	1,080,000
		Leveling of asphalt (m^2)	5months	225,000	337,500	225,000
	Calculation result of maintenance work volume on the target roads	Pushing soil (m^3)		49,000	56,000	0
		Grading (m^2)		245,000	280,000	0
		Snow removing (m^2)		8,000,000	9,000,000	9,000,000
		Leveling of asphalt (m^2)		400,000	800,000	800,000
	Total volume of the road maintenance work on target road done by the new machine.	Pushing soil (m^3)		7,200	0	0
		Grading (m^2)		36,000	0	0
		Snow removing (m^2)	432,000	6,920,000	7,683,750	7,920,000
		Leveling of asphalt (m^2)	259,200	175,000	462,500	575,000
	Requested number			2	2	2
	Number of work months during 5 years			8.3	9.8	10.3
	Decided number			1	1	1
	Number of work months during 5 years			16.7	19.6	20.6

The result of study is shown on the table 2-15.

Table2-15 Allocation plan of machinery by provinces

No.	Machine	Samarkand		Kashkhadarya		Surkhandarya	
		Unit	Work month	Unit	Work month	Unit	Work month
1	Motor Grader	1	16.7	1	19.6	1	20.6
2	Dump Truck	1	45.5	2	51.2	1	35.2
3	Asphalt Sprayer	1	14.1	1	60.9	1	76.0
4	Vibration Roller	1	8.4	1	18.0	1	8.9
5	Pneumatic Roller	1	10.2	1	18.2	1	11.9
6	Pick-up Truck	1	12.8	1	36.8	1	34.0
7	Water Tank Truck	1	23.2	1	33.5	1	29.2
8	Multi Purpose Vehicle	0	-	1	31.6	1	31.0
9	Road Line Marker	0	-	1	23.4	1	19.0
10	Asphalt Finisher	1	11.3	1	27.1	1	12.6
11	Asphalt Distributor	0	-	1	18.0	1	15.3
12	Trailer Head	1	26.3	1	26.3	0	-
13	Trailer	1	26.3	1	26.3	0	-
14	Road Harrow	1	7.5	1	14.6	1	17.8
15	Mobile Material Test Laboratory	Controlled and operated by the UZAVTOYUL H. Q. Tashkent					
16	Asphalt Mixing Plant	1	22.8	1	32.5	0	-
17	Mobile Workshop	1	29.2	1	29.2	1	29.2
18	Excavator	1	23.6	1	19.3	1	29.8
19	Wheel Loader	1	34.0	2	55.8	1	67.5
20	Truck Crane		-	1	28.5	1	24.O
21	Bulldozer	0	-	0	-	0	-
22	Air Compressor	1	17.2	1	36.8	1	31.0
23	Cargo Truck with Crane	0	-	0	-	0	-
24	Tamper	1	24.0	4	30.3	4	37.8
25	Hand Guide Roller	1	11.8	2	30.2	3	25.1

Work months mean total working time scaled by months during the project term - five years. Workable months of the year are from April till November (total eight months per year). So, above number of work months is acceptable.

(6) Specification of machinery

Table 2-16 is the main specification of machinery to be used for the road maintenance works on target road.

Table 2-16 Main specifications and Reason for decision

No.	Machine	Works	Main specification	Reason for decision of specification
1	Motor Grader	Grading of material Snow removal	Blade width 3.7 m Eng power 150HP up Front Blade ROPS CAB	Using it on steep road near the Chak-Chak path requires high power. The front blade is useful for snow removing. ROPS CAB is for the safety of an operator.
2	Dump Truck	Transporting the materials	Loading Cap. 10 ton Eng power 300 PS up Under carriage 6*4	The average distance of transportation is around 50 km. This situation requires dump truck of size larger than 10 ton capacity for efficient work.
3	Asphalt Sprayer	Applying tack coat	Tank capacity 400 l With heating system Pump for spraying Towed type	This equipment is used for the small scale maintenance works e.g. the repairing of pot holes. Tank capacity is required to be more, about 400 liters for one day's operation.
4	Vibration Roller	Compacting the soil and the pavement	Weight 6.5 ton up Drum width 1.45 m Eng power 70 PS up Compaction power 60	This machine is used for the medium and large scale maintenance works. Standard size of machine is 4 ton or 7 ton class. The performance of 7 ton class fits the medium or large sized maintenance works.
5	Pneumatic Roller	Compacting the paved roads	Weight 8.5 ton up Width 2.2 m Eng. power 90 PS up	10 ton class pneumatic roller fits compaction work for the medium or large size road maintenance works
6	Pick-up Truck	Communicatio ns Road patrol	Number of crew 5 G.V.W. 2,500 kg Eng. power 80 PS up	There is the mountain section on the target road with certain steepness. This situation requires enough power and large space for passengers. The manual transmission is easy to maintain.
7	Water Tanker	Carrying water Splaying water	Tank capacity 8,000 l Eng power 165 PS up Spray width 2.4 m	Tank capacity 8,000 liters is of medium size and is the most efficient size for the road maintenance works of the target roads.
8	Multi purpose Truck	Plowing snow Spreading de-icing chemical	Eng power 150 PS up Plowing cap. 1500ton With road sweeper With weeding equip.	This equipment works as the snowplow and de-icing chemicals spreader in winter and road sweeping or weeding machine in summer. Four functions are selected in order to make it possible to work all year round.
9	Road Line Marker	Marking of white paint line on the roads	Line width 10-30 cm Paint capacity 600 l Marking speed 4 km	The most of target road is not marked with lines. Marking of lines on the road is important for safety. This specification also satisfies the GOST.
10	Asphalt Finisher	Paving roads with asphalt mix	Pave width 2.5 -4.5 m Thickness 10-200mm Hopper Cap. 12 ton Speed 40 m/min	The maintenance works will be executed by one lane at a time because the target road is the existing road. 4.5 m pavement width is just fit for this.The capacity of hopper corresponds to a dump truck.
11	Asphalt Distributor	Applying tack coat on roads for medium or large maintenance	Tank capacity 6,000 l Applying width 3.6 m Apply qty. 0.2-1.2 l/m	Asphalt will be filled up at the asphalt plant located about 50 km away from the site. So, 6,000 liter tank capacity is reasonable for the effective work of asphalt distributor.
12	Trailer Head	Towing Trailer	G.V.M. 45,000 kg up Eng power 360 PS up Under carriage 6*4	The carrying capacity of trailer is 30 ton. So, the minimal required power of engine is more than 350 PS.

13	Trailer	Load and carry machinery	Capacity 30 ton Height 1.3 m max Width 2.9 m min With loading boards	In order to transport the construction machinery, like the asphalt finisher, roller, excavator etc, load carrying capacity is required to be around 30 ton. Also, the low bed trailer type is required.
14	Road Harrow	Milling the surface of road	Milling width 1.0 m Milling Depth 10 cm With front conveyor Working speed 25 m	For milling the surface of road during small scale maintenance the required milling depth should be from 50 mm to 100 mm. And 1000 mm milling width is just fit for this purpose.
15	Mobile Material Test Laboratory	Inspection of road condition before and after road maintenance	Container type truck Inner size 2.5*2.5*6 Soil test equipments Asphalt test equip. Road test equipments	Total length of target road is 378 km from Samarqand to Termez. The mobility of laboratory is very important. Test equipments are limited for use at the site.
16	Asphalt Mixing Plant	Production of asphalt mix	Capacity 30 ton/h Wet type filter Drier with kerosene or light/heavy A oil	As the result of study, the production capacity 30 ton per hour is enough to maintain the target roads. The mobile type does not have any reason for the asphalt plant. So, the standard type was selected.
17	Mobile Workshop Car	Maintenance works and repair works at the site	G.V.W. 10,000 kg up Drive system 4*2 Tools and equipments for machine maintenance work	The provincial workshops are equipped not so well. So, the mobile type of workshop is very important in order to maintain new construction machinery at the site and provides enough tools and equipment for small scale repairing works.
18	Hydraulic Excavator	Excavating soil and sand	Bucket cap. 0.8 m^3 Eng power 135 HP up ROPS CAB w/Air conditioner Operating weight 20t	The main functions are the excavation of the river gravel as a raw material for asphalt-concrete mixture and the removal of rock-slides in the mountainous areas of target road and so on. Uzavtoyul has few fully operating excavators. Therefore, widespread 20 ton class excavators are suitable for the road maintenance works. In order to protect an operator from falling materials or rolling over, ROPS CAB is required.
19	Wheel Loader	Loading materials to dump trucks	Bucket cap. 2.5 m^3 Eng power 160 HP up Supplemental Steer ROPS CAB w/Air conditioner	2.5 m^3 bucket matches to dump trucks of 10 ton carrying capacity. Operating on steep sections of target road requires safety steering system. Air conditioning system is required in summer.
20	Truck Crane	Loading heavy machines to trailer	Lifting Cap. 25 ton Boom length 30 m Hydraulic operation	For long distance drive, truck type crane is required. It will be also used for the assembling and erecting the asphalt plant. So, 25 ton lifting capacity is required.
22	Portable Air Compressor	Blowing away dust from the road	Capacity 7 m^3/min Air pressure 700 kPa Eng power 80 PS up	Capacity of 7 m^3 is the most popular type and is easy to tow for small scale road maintenance works.
24	Tamper	Compacting the small surfaces of repaired road	Weight 70 -75 kg Vibration 550-650 Eng power 3.3 PS up	70 kg class is the most popular tamper for the pot hall repairing works.
25	Hand Guide Roller	Compacting the small surfaces of repaired road	Weight 700 kg up Vibration power 1.4 t Width Roller 650 mm Dual roller drive	For easy operation and high performance of the hand guide roller, 700 kg class matches best for small and medium road maintenance works.

(7) Comparison between the request and study result

Table 2-17 shows the comparison between the request by UZAVTOYUL and study result by the team. There are several items which were reduced in quantity and whose specifications were changed. Reason of change is described in the following section of the table 2-17.

Table2-17 The comparison between the request and the study result

No.	Machine	Samarqand		Kashkhadarya		Surkhandarya		Notes
		Request	Result	Request	Result	Request	Result	
1	Motor Grader	2	1	2	1	2	1	Reduction
2	Dump Truck	2	1	2	2	2	1	Reduction
3	Asphalt Sprayer	2	1	2	1	2	1	Reduction
4	Vibration Roller	1	1	1	1	1	1	5ton -> 7 ton
5	Pneumatic Tired Roller	1	1	1	1	1	1	
6	Pick-up Truck	1	1	2	1	1	1	Reduction
7	Water Tank Truck	1	1	1	1	1	1	
8	Multi Purpose Vehicle	1	0	1	1	1	1	Reduction
9	Road Line Marker	1	0	1	1	1	1	Reduction
10	Asphalt Finisher	1	1	1	1	1	1	
11	Asphalt Distributor	1	0	1	1	1	1	Reduction & spec chg.
12	Trailer Head	0	1	1	1	1	0.	Chg. Allocation Plan
13	Trailer	0	1	1	1	1	0	Chg. Allocation Plan
14	Road Harrow	1	1	1	1	1	1	
15	Mobile Material Test Labo.	Controlled and operated by the Uzavtoyul H. Q. Tashkent						Change Spec
16	Asphalt Mixing Plant	1	1	1	1	1	0	Reduction & spec chg.
17	Mobile Workshop	1	1	1	1	1	1	
18	Excavator	1	1	1	1	2	1	Reduction
19	Wheel Loader	2	1	2	2	3	1	Reduction
20	Truck Crane			1	1	1	1	
21	Bulldozer	1	0	1	0	1	0	Deletion
22	Air Compressor	1	1	1	1	1	1	
23	Cargo Truck w/Crane	1	0	1	0	1	0	Deletion
24	Tamper	3	1	3	4	3	4	Chg. Allocation Plan
25	Hand Guide Roller	2	1	2	2	2	3	Chg. Allocation Plan
	Total	28	18	32	28	33	24	
Total number of the last requested is 94 units, Total number in the result of study is 71 units								

- means the change has occurred.

The contents of change in the quantity and specifications of each machine are as follows.

(1) Motor Grader:

The requested number of machines (two machines) give only about 10 months of machine operating time in road maintenance work (a workload of 25%) for each province during 5 years. This is too low a workload. So, one machine will be procured for each province instead.

(2) Dump Truck:

For Samarkand province, one truck will be procured although two were requested. There, the number of operating months for dump trucks is 45.5, exceeding 40 months at a workload of 100%. However, this can be dealt with by extending the operating time of 6 hours per day. For Surkhandarya province, one truck will be procured although two were requested. There, the number of operating months is 32.5. For Kashkhadarya province, two trucks will be procured as requested. There, the number of operating months is 51.2, which cannot be dealt with by extending the operating time.

(3) Asphalt hand sprayer:

One unit of asphalt hand sprayer in each province is reasonable allocation plan of them. But some parts of tack coat applying works in medium scale road maintenance work must be executed by the asphalt distributor in Surkhandarya province.

(4) Vibration Roller:

While five-ton vibration rollers were requested, the mass production models come in four-ton and seven-ton classes. The main purpose of this machinery is compaction of base and surface courses in medium-scale and large-scale construction works. Since the machinery gives significant influence on the road quality and the two classes have more-than-double differences in performance (a four-ton model has a centrifugal force of 29 kN while a seven-ton model 69 kN when models of the same manufacturer were compared), the team decided to procure seven-ton class.

(5) Pick-up Truck:

Kashkhadarya province will have the largest number of operating months, which is 36.8 months or a workload of 92%. One unit of vehicle for each province will be sufficient to execute the whole duty.

(6) Multi purpose Truck:

The workload of this machine in Samarqand province is very low (about 8 months during five years). One machine will be sufficient to execute all works in both Samarqand and Kashkhadarya provinces.

(7) Road Line Marker:

The workload of this machine in Samarqand province is very low (about 8 months during five years). One machine will be sufficient to execute all works in both Samarqand and Kashkhadarya provinces.

(8) Asphalt distributor:

The workload of this machine in Samarqand province is very low (9 months during five years) and the workload in Kashkhadarya province is 18 months during five years. One machine will be sufficient to execute all works in both Samarqand and Kashkhadarya provinces. Although the

requested spreading bar width is 4.5 m, the maximum width of spreading bar of production models is designed at 3.6 m. Considering the workload of the machine, it will not cause any problem if it distributes asphalt over a lane in a round-trip. So, the team decided on the maximum spreading bar width of 3.6 m.

(9) Mobile Material Testing Laboratory:

The purpose of test apparatuses must comply with the goal of road maintenance project on the target road (traveling to a road repair work site, checking the road conditions to supply data to determine an appropriate repair method, and verifying that the repair work is completed as stipulated in the specification and that the repaired road meets the specification; alternatively, traveling to a mobile asphalt mixing plant, conducting a test to check that materials conforming to the specifications are used and that an asphalt mix conforming to the specifications are being produced). So, the following apparatuses were rejected. For example, the contents analyzer for cement does not match to the road maintenance project.

(10) Asphalt Mixing Plant:

Although the list of requested equipment specified a production capacity of 50 tons per hour, that of 30 tons per hour will be sufficient to cover the current volume of road maintenance work. The storage unit to store a completed concrete mix will not be necessary. The machine for Surkhandarya province is rejected because it currently uses the least amount of concrete mix and the necessary amount can be supplied from the existing asphalt plants.

(11) Hydraulic Excavator:

Although Kashkhadarya province requested two units to eliminate falling rocks in excavations, one unit for each province will be provided because then a sufficient workload can be covered.

(12) Wheel Loader:

One unit shall be provided for each of Samarqand and Surkhandarya provinces because the number of operating months is about 34 and the workload is about 85% in both of them. In Kashkhadarya province, the number of operating months is 111.6, which will be 55.8 if two units are supplied, causing us to expect that it would be a rather difficult to complete all the work in the project period of five years. However, two units will be provided because the work to do includes clearing of snow and thus can be completed.

(13) Bulldozer:

The existing machines of UZAVTOYUL should be used to execute all of road maintenance works for them, which are ripping of road pavement, supply of aggregate to asphalt plants, and fundamental safety measures for excavations.

(14) Cargo trucks (with cranes):

As for bulldozers, the existing machines of UZAVTOYUL should be used to transfer equipment for small maintenance works to the site.

2-2-3 Basic Design Drawing

All equipment to be procured in this project should be delivered from supplier(s) to Uzyulmashservis (UZAVTOYUL's subsidiary which takes charge of machinery repair) at its central machinery maintenance factory located in Tashkent.

This maintenance factory, at which a governmental enterprise had manufactured excavators before, was purchased by UZAVTOYUL in 2003 to be remodeled into a factory that can conduct large-scale repairs of the road construction machinery.

The received machinery will be first temporarily stored inside the building of this factory and then transferred by UZAVTOYUL to each province.

The following shows an arrangement drawing of the asphalt mixing plant, the only machinery that requires installation and assembly among the procured equipment The basic machinery arrangement is mostly the same for all the machinery of different manufacturers, and about 10,000 ㎡ land is needed, including the storage facility of materials and the passage for product transportation vehicles.

Figure 2-2 shows a typical layout of an asphalt mixing plant.

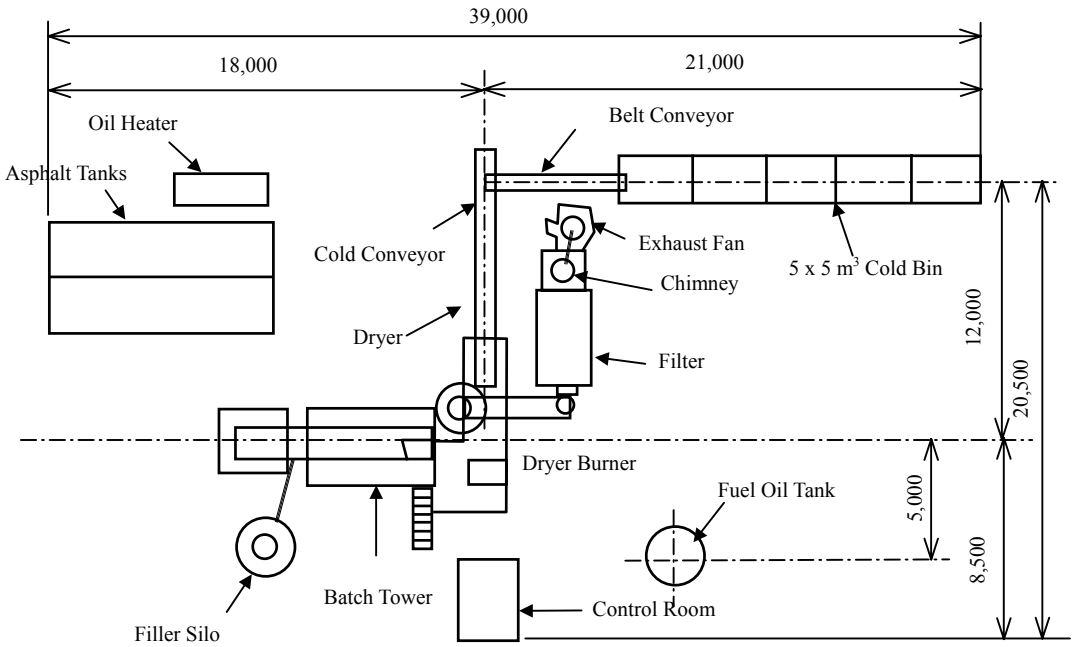


Fig. 2-2 Typical layout plan of asphalt mixing plant

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Project implementation Agency

In case of implementation of the project under Japan's grant aid, the organizations concerned will function according to the following mechanism illustrated in Fig. 2-3

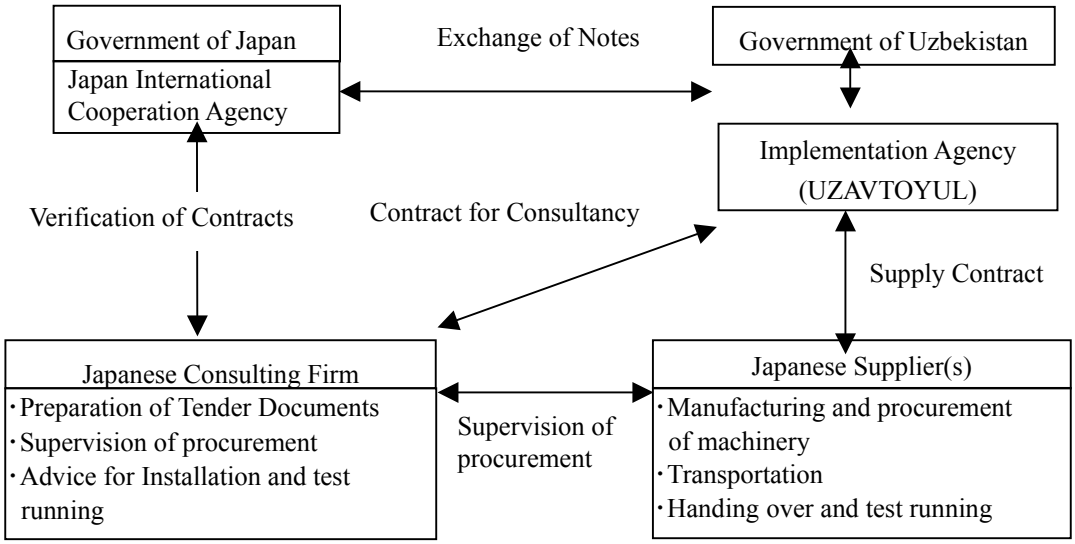


Fig. 2-3 Mechanism of Project implementation

The project implementing agency in Uzbekistan is the State Joint Stock Company UZAVTOYUL. In accordance with Japan's grant aid system, a Japanese consulting firm will undertake the detailed design and supervision of the Project, and Japanese trading firm(s) will undertake the supply of equipment under the project.

(2) Consultant

After the signing of Exchange of Notes (E/N) between the Government of Japan and the Government of Uzbekistan, UZAVTOYUL will speedily conclude a contract with a Japanese consulting firm for the procurement of consultancy services (Contract for Consultancy). The said firm will provide engineering services for the procurement of equipment including detailed design, preparation of tender documents, assistance for tender(s) and contract(s), and supervision of procurement, in accordance with the contract until the completion of delivery of the equipment under the Project.

(3) Supplier(s)

UZAVTOYUL will conclude contract(s) for the supply of equipment under the project with qualified Japanese trading firm(s) who can offer required specification and quality and has (have) been awarded the tender(s) after successfully having passed the bidding procedures in the open tender. The said firm(s) will have the obligation to diligently deliver the equipment requested by UZAVTOYUL and provide instructions on the operations and daily inspection and maintenance within the time frame stipulated in the contract.

2-2-4-2 Implementation Conditions

The equipment to be procured by Japan shall be unloaded at Nakhodka port of the Russian Republic, transported via the Trans-Siberian Railway, and pass customs clearance at Sirghali customs terminal in Tashkent. After customs clearance, the equipment shall be transported to Uzyulmashservis workshop in Tashkent and shall be handed over to Uzbekistan side.

After the hand-over of the equipment, UZAVTOYUL will assume full responsibility for the storage and transportation of the equipment to the sites specified by the three provincial AVTOYULs. The supplier(s) shall take necessary precautions and make arrangements with UZAVTOYUL, concerning the products liability due to breakage, theft, etc. that could occur during marine transport and unloading.

2-2-4-3 Scope of Works

The procurement cost of the equipment including its transportation up to Uzyulmashservis workshop is to be born by Japan side. Further handling of the equipment such as the reassembly of the equipment and transportation to the equipment handover sites in each province is on the account and responsibility of the Uzbekistan side. All procedures necessary for the exemption of import duties /other taxes will be taken by Uzbekistan side.

2-2-4-4 Consultant Supervision

(1) Principles of Procurement Supervision

In case of implementation of the project under the grant aid scheme of the Japanese government, the consultant shall carry out the preparation of tender documents and the supervision of procurement with thorough understanding of the following:

- Background of the implementation program
- Contents of the basic design report
- System of Japan's grant aid
- Contents of the Exchange of Notes between the two governments

Based on the above understanding, the contents, division of responsibilities, and special notes for the detailed design and supervision of procurement are explained below.

(2) Scope of Consulting Services

After the signing of Exchanges of Notes (E/N), the consultant concludes contract for consulting services with the implementing agency within the scope of services specified in the Exchange of Notes (E/N).

The scope of services are summarized below.

① Detailed Design

- Consultancy agreement (in Uzbekistan) and verification (in Japan)
- Prompting the procedures for issuance of the Authorization to Pay (A/P) (Uzbekistan)
- Preparation and discussion of tender documents (Japan, Uzbekistan)
- Obtaining approval for tender documents from the Uzbekistan side (Uzbekistan)
- Announcement of tender and distribution of tender documents (Japan)
- Execution of tender(s), evaluation of tenders, preparation of evaluation report, approval of report (Uzbekistan/Japan)
- Witnessing of the contract(s) for equipment supply (Uzbekistan/Japan), and verification of contract(s) (Japan)
- Confirmation of obligations of Uzbekistan side (Uzbekistan/Japan)

②Supervision of Procurement of Equipment

- Confirmation of the manufacturing order
- Follow-up of the procurement
- Ex-factory inspection
- Attendance to the delivery inspection
- Progress report
- Witnessing of final hand-over
- Preparation of completion note and final report

③Initial Operation of the Equipment

Instructions for reassembly on site, initial running, and preventive and routine maintenances should be provided by the supplier's engineer(s) under the supervision of the consultant.

(3) Special Points to Note

1) The consultant shall check whether there is any change in the machinery procurement conditions defined at the basic design stage.

2) In accordance with the objectives of Japan's grant aid for equipment procurement project, the consultant shall have sufficient meetings with Uzbekistan side before the final

confirmation of the content of the project and obtain the approval of Uzbekistan as a tender document including a detailed design.

2-2-4-5 Procurement Plan

(1) Country of Origin

After discussing with UZAVTOYUL concerning the country of origin for equipment to be procured under this project, it was agreed that the equipment shall be basically made in Japan because UZAVTOYUL has recognized the excellent performance of Japanese products through the experiences of procurement in the first Japanese grant aid project for A373. However, the possibility of obtaining quotes from three companies or more shall also be considered as an important factor in order to apply the principle of market mechanism at the time of bidding.

As a result of investigation in Japan, it was found that there are not three companies or more for the equipment listed below, so equipment of a third country must also be considered.

In this case, to have the competitive bidding, EU countries shall be included because equal or higher quality than Japanese products can be expected from the equipment made in EU, EU countries are geographically closely related to Uzbekistan, and EU-made equipment has a good reputation in Uzbekistan because of its quality and experiences of operation.

Thus, the team decided to set the country of origin of the following equipment as Japan and EU.

However, pickup trucks shall be either made in Japan or Thailand because almost all the Japanese makers (except one) have moved production bases to Thailand.

No.	Equipment	No.	Equipment
1	Motor Grader	4	Road Planer
2	Multi Purpose Truck	5	Truck Crane
3	Asphalt Finisher	6	Pick-up Truck

(2) Spare Parts

The businesses of dealers of construction equipment and vehicles were very hard until September 2003 because of the economic policy of Uzbekistan. The local equipment dealers were not allowed to exchange the local currency Sum to foreign money such as U.S. dollars and were virtually unable to procure spare parts.

Although this restriction is now alleviated and the dealers can procure parts from another country, they store only a small amount of spare parts due to the fewness of equipment in Uzbekistan

and the problems in the tax system. Under the current conditions, users of road repair and maintenance equipment are unable to obtain replacement parts and periodical replacement parts such as periodical replacement parts that will become necessary at an early stage after the start of operation and GET (Ground Engaged Tool) parts that will become necessary after the elapse of a certain period of time during normal use.

The team decided that a certain amount of initial spare parts should be procured in addition to the equipment under this project so that the equipment can continue to be used in a good condition not only in the five-year project period but also in the same amount of time after that. It seems appropriate that the initial spare parts should cover the first half of the project period and in the second half, UZAVTOYUL should purchase spare parts through self-help.

The initial spare parts shall include the following:

(1) Periodical maintenance parts: Air Filters, Oil Filters, Other Filters, Elements, etc.
(2) GET (Ground Engaged Tool): Cutting Edges, Tooth, Bits, etc. that needs replacement after a certain amount of time of use
(3) First removing parts: Lamps, O-Rings and Seals, Brake Lining, Hoses, etc.

2-2-4-6 Implementation Schedule

The project shall be implemented according to the schedule shown in Fig. 2-4.

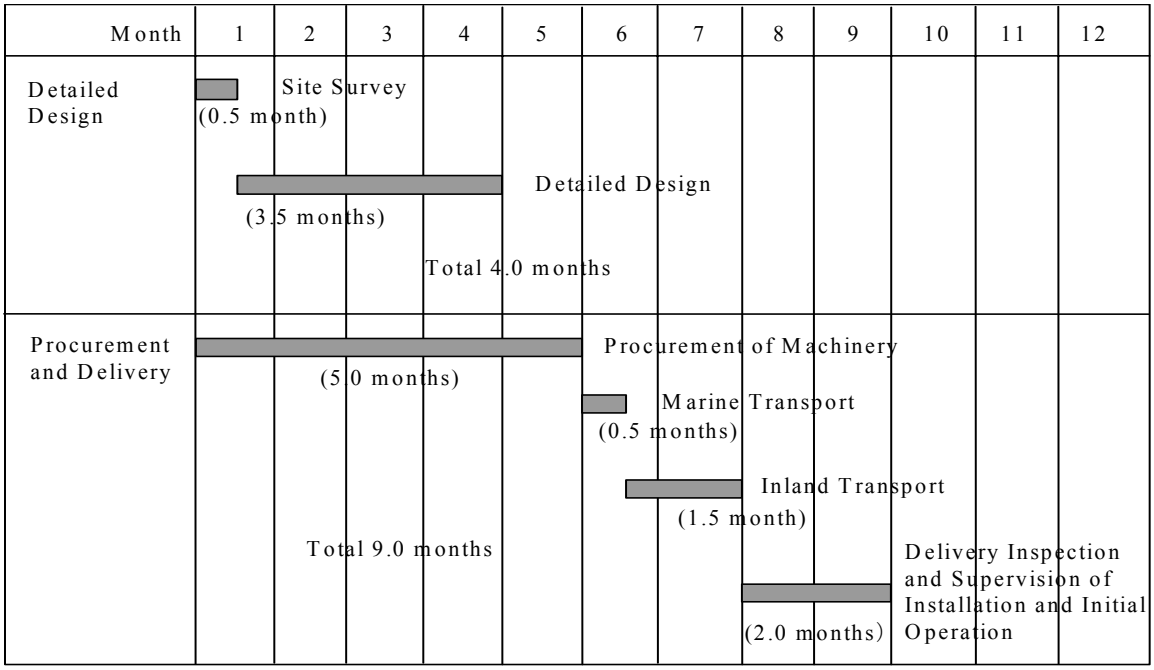


Fig. 2-4 Implementation Schedule

2-3 Obligations of Uzbekistan

In case the Project is implemented under Japan's grant aid scheme, the following obligations are to be fulfilled by the Uzbekistan side.

(1) Payment of commissions to the foreign exchange banks according to the banking arrangement (B/A).

(2) Assistance to the Japanese personnel engaged in the project for entering and staying in Uzbekistan and for visiting government organizations and officials.

(3) Exemption from customs duties and taxes in Uzbekistan for the Japanese firm(s) and personnel engaged in the project (except consumption taxes).

(4) Tax exemption and preparation of documents necessary for smooth customs clearance of the equipment related to this project at Sirghali customs terminal and inland transportation of the equipment from Tashkent to the three provincial offices

(5) Transportation cost from Uzyulmashservis workshop in Tashkent to the site (three provincial offices)

(6) Installation and assembly cost of equipment (Japan side shall provide advisory service by engineers while Uzbekistan side shall provide labor and needed equipment)

(7) Cost for fuel, oil and materials required for the trial run and adjustment of the equipment as well as for the training of personnel.

(8) Cost for registration and obtaining of license plates for dump trucks and other vehicles that travel on roads

(9) Assembly and installation cost of the asphalt mixing plant and so on

- Construction cost of the foundation and assembly cost of the plant (A supervisor shall be dispatched at the cost of the supplier).
- Cost of test and adjustment
- Construction cost of the bitumen pool
- Other costs of faculties and equipment required for installation and running of asphalt plant

(10) Appropriate and effective use and maintenance of the equipment to be procured.

(11) Payment of all expenses other than those to be paid by Japan under the grant aid.

2-4 Project Operation Plan

(1) Operation and Maintenance Plan

Taking charge of the maintenance management service of this project is three provincial AVTOYULs in Samarkand, Kashkhadarya and Surkhandarya provinces. Substantially taking charge is Automobile Road Exploitation Organization (AREO) which provides the maintenance management service for international roads with "M" numbers and Automobile Road Organization (ARO) which mainly provides the maintenance management service for national roads with "A" numbers and other organizations under the jurisdiction.

Because the provincial AVTOYULs may have 15 people or less as staff according to the cabinet decree No.361, the organizations under the provincial AVTOYULs jurisdiction are set up as different company organizations. However, they sufficiently maintain functions as part of the AVTOYULs in actual operations.

The system concerning the maintenance management service of the road construction machinery is composed of the chief mechanic and many engineers and technicians (there are a total of 1,333 engineers and technicians in three provincial AVTOYULs and they are 23.7 % of a total number of 5,626 staffers in provincial AVTOYULs) who take full responsibly of the maintenance and management of equipment owned. Many of the personnel are graduates of universities, colleges and technical institutes. The team confirmed that they have inherited most the technical know-how and skills that had been cultivated in the Soviet Union era.

There are many old road construction machines which were produced in the former Soviet Union era around the 1980s. The team found that some of those machines for which parts could be obtained were repetitiously repaired and are still kept in a usable state despite some deterioration of the machine capability.

Moreover, the team recognized that provincial AVTOYULs store and manage the plans for maintenance and management of machinery and records of repairs at their offices and, overall, UZAVTOYUL has an appropriate level of technology and knowledge for the maintenance and management of machinery.

Therefore, as described in the preceding clause, the team concluded that UZAVTOYUL is capable of carrying out maintenance management of the machinery which is procured under this project only if initial spare parts and mobile workshops are provided.

(2) Personnel plan

The total number of staff and managers of UZAVTOYUL and 13 provincial offices and affiliates was 34,622 in November 2003. An organizational reform made in September 2003 decreased the number of staff in the head quarters to 29 and provincial AVTOYULs office to 15. The majority of the staff that used to belong to UZAVTOYUL and provincial offices were reassigned to

newly formed subordinate organizations and related departments. As the result of this re-structuring, the organizational structure of UZAVTOYUL became very simple on the surface. But the total number of staff and workers still remains about the same.

Table 2-18 shows a total number of staff and workers in three provincial AVTOYULLs, namely those in Samarkand, Kashkhadarya, and Surkhandarya provinces.

As shown on table 2-18, the average percentage of engineers and mechanics is 23.7% at the three provincial AVTOYULs. The actual total number is 1,333 persons. UZAVTOYUL does not have any plan to hire additional personnel for this project and will assign existing engineers, mechanics and operators for the new machinery to be procured under this project. The expected numbers of operators, mechanics and assistants for the new machinery are given on the table 2-19.

Table 2-18 Total numbers of staff and workers in three provincial AVTOYULs

	Title or Position	Samarqand		Kashkhadarya		Surkhandarya		Total	
		Number	Share(%)	Number	Share(%)	Number	Share(%)	Number	Share(%)
Provincial Office	Director	1	0.04	1	0.06	1	0.07	3	0.05
	Chief Engineer	1	0.04	1	0.06	1	0.07	3	0.05
	Deputy Director	1	0.04	1	0.06	1	0.07	3	0.05
	Engineer/mechanic	122	4.87	108	6.13	87	6.39	317	5.63
	Sub total	125	4.99	111	6.30	90	6.61	326	5.79
District Office	Engineer/mechanic	356	14.22	366	20.77	294	21.60	1,016	18.06
	Staff and labor	2,022	80.78	1,285	72.93	977	71.79	4,284	76.15
	Sub total	2,378	95.01	1,651	93.70	1,271	93.39	5,300	94.21
	total	2,503	100.00	1,762	100.00	1,361	100.00	5,626	100.00
Total of engineers /mechanics		473	19.10	474	26.90	381	27.99	1,333	23.69

Table 2-19 Numbers of workers needed for the operation of the equipment

	Equipment	Qty	O*	A*	M*		Equipment	Qty	O*	A*	M*
1	Motor Grader	3	3		6	13	Road Plainer	3	3	3	3
2	Dump Truck	4	4			14	Mobile Test Labo.	1	1	3	
3	Asphalt Sprayer	3	3	3		15	Asphalt Mixing Plant	2	2	6	2
4	Vibration Roller	3	3			16	Mobile Workshop	3	3		6
5	Pneumatic tired roller	3	3			17	Hydraulic Excavator	3	3		6
6	Pick-up Truck	3	3		3	18	Wheel Loader	4	4		
7	Water Tanker	3	3			19	Truck Crane	2	2	4	
8	Multi Purpose Truck	2	2	2	3	20					
9	Road Line Marker	2	2	2	3	21	Air Compressor	3	3	3	
10	Asphalt Finisher	3	3	15		22					
11	Asphalt distributor	2	2			23	Tamper	9	9		
12	Truck Trailer	2	2	2		24	Hand Guide Roller	6	6		
Sub Total		33	33	24	15	Sub Total		36	36	19	17
In total: 69 Operators, 43 Assistant Workers, 32 Mechanics Grand total of 144 persons											

Note* O: Operator A: Assistant Worker M: Mechanic

(3) Budget

The budget concerning the maintenance repair works of the road is distributed by UZAVTOYUL to each provincial AVTOYULs based on the budget plan which is made, applied, conferred and approved based on the result of investigation executed in the previous year.

The content of revenue and expenditure of five years from fiscal year 1998 to fiscal years 2002 of UZAVTOYUL, Samarkand AVTOYUL, Kashkhadarya AVTOYUL and Surkhandarya AVTOYUL is shown in tables 2-21, 2-22, 2-23 and 2-24. Under the expense item ”New road Construct” in these tables, none of the three provincial AVTOYULs reports results values. This shows that, in five years, no new road construction work was done and only repair works were executed. The results values of three provincial AVTOYULs in total is about 7,230 million Sum per year (about 26.7 million US dollars).

The authorized budget for improvement and rehabilitation of the target road in 2004(now executed) is 798 million Sum in total.(Samarqand - 331 million Sum, Kashkhadarya - 250 million Sum, Surkhandarya - 135 million Sum)

As shown in table 2-20, the estimated cost for this project is about 17,000 million Sum in total and about 3,400 million Sum on a yearly average, which were estimated by UZAVTOYUL based on the content of the target road repair works described in Section 2-2-2, “Basic Plan (Equipment Plan)”. This amount corresponds to about 50% of a total yearly budget on which three provincial AVTOYULs operated in the past several years.

UZAVTOYUL obtained an official document which promised a budget of 32,500 million Sum in total (covering other construction works other than the project) from the National Road Fund for this matter as shown in attached document 10. In order to obtain an official document, UZAVTOYUL explained to the National Road Fund about the importance of the target road and that it will receive support from Japan to execute this project.

As a result, the team concluded that required cost of the road repair works under this project and the maintenance and management of the machinery to be used can be secured.

Table 2-20 Budget of the repair works for the target road

Unit: million Yen (1 Sum=0.108 Yen)

	2006	2007	2008	2009	2010	Total
Budget for the project (million Sum)	3,076.6	3,230.4	3,391.9	3,561.5	3,739.6	17,000.0
Amount in yen (million Yen)	334.3	351.1	368.6	387.0	406.4	1,847.5

Table 2-21 Annual Income and Expenditure （1998～2002）

（Unit：million Sum）

	Item	1998		1999		2000		2001		2002		Total	
		Sum	US $	Sum	US $	Sum	US $	Sum	US $	Sum	US $	Sum	US $
Income	Federal Road Fund	23,648.80	248.46	32,209.90	257.12	52,010.10	218.74	72,285.90	168.10	108,193.00	139.65	288,347.70	1,032.08
	Provincial Road Fund												
	Local Road Fund												
	Road Passing Charge												
	Other Income												
	Total	23,648.80	248.46	32,209.90	257.12	52,010.10	218.74	72,285.90	168.10	108,193.00	139.65	288,347.70	1,032.08
Expenditure	Admini. expenses	831.70	8.74	1,118.70	8.93	1,667.00	7.01	1,980.80	4.61	3 ,367.40	4.35	8,965.60	33.63
	Equipment expense			2,171.20	17.33	2,508.90	10.55	2,407.80	5.60	5,055.70	6.53	12,143.60	40.01
	New road Construct												
	Road Maintenance	22,493.70	236.33	29,254.80	233.53	42,125.20	177.17	56,163.60	130.61	79,245.30	102.28	229,282.40	879.92
	Other Expenditure	3,047.50	32.02	1,454.00	11.61	2,631.90	11.07	9,691.60	22.54	30,677.20	39.60	47,502.20	116.83
	Total	26,372.70	277.08	33,998.70	271.40	48,933.00	205.80	70,243.80	163.35	118,345.60	152.75	297,893.80	1,070.39
Balance		-2,723.90	-28.62	-1,788.80	-14.28	3,077.10	12.94	2,042.10	4.75	-10,152.60	-13.10	-9,546.10	-38.31

Table 2-22 Annual Income and Expenditure in Samarkand AVTOYUL （1998～2002）

（Unit：million Sum）

	Item	1998		1999		2000		2001		2002		Total	
		Sum	US $	Sum	US $	Sum	US $	Sum	US $	Sum	US $	Sum	US $
Income	Federal Road Fund												
	Provincial Road Fund	952.91	10.01	1,776.50	14.18	3,125.60	13.15	3,684.30	8.57	5,566.70	7.19	15,106.01	53.09
	Local Road Fund												
	Road Passing Charge												
	Other Income												
	Total	952.91	10.01	1,776.50	14.18	3,125.60	13.15	3,684.30	8.57	5,566.70	7.19	15,106.01	53.09
Expenditure	Admini. expenses	48.40	0.51	61.20	0.49	90.10	0.38	164.30	0.38	204.00	0.26	568.00	2.02
	Equipment expense			244.00	1.95	210.00	0.88	102.60	0.24	193.00	0.25	749.60	3.32
	New road Construct												
	Road Maintenance	1,318.50	13.85	1,500.20	11.98	2,287.30	9.62	3,487.60	8.11	5,774.70	7.45	14,368.30	51.01
	Other Expenditure			26.10	0.21	1.80	0.01	5.00	0.01			32.90	0.23
	Total	1,366.90	14.36	1,831.50	14.62	2,589.20	10.89	3,759.50	8.74	6,171.70	7.97	15,718.80	56.58
Balance		Balance	-4.35	-55.00	-0.44	536.40	2.26	-75.20	-0.17	-605.00	-0.78	-612.79	-3.49

Table 2-23 Annual Income and Expenditure in Kashkhadarya AVTOYUL （1998～2002）

（Unit：million Sum）

Item		1998		1999		2000		2001		2002		Total	
		Sum	US $	Sum	US $	Sum	US $	Sum	US $	Sum	US $	Sum	US $
Income	Federal Road Fund												
	Provincial Road Fund	988.36	10.38	2,489.70	19.87	3,019.40	12.70	2,949.40	6.86	4,252.00	5.49	13,698.86	55.30
	Local Road Fund												
	Road Passing Charge												
	Other Income												
	Total	988.36	10.38	2,489.70	19.87	3,019.40	12.70	2,949.40	6.86	4,252.00	5.49	13,698.86	55.30
Expenditure	Admini. expenses	63.90	0.67	91.20	0.73	126.60	0.53	144.20	0.34	214.60	0.28	640.50	2.54
	Equipment expense			286.20	2.28	92.90	0.39			116.30	0.15	495.40	2.83
	New road Construct												
	Road Maintenance	985.4	10.35	1,977.60	15.78	2,745.60	11.55	3,350.30	7.79	4,421.10	5.71	13,480.00	35.40
	Other Expenditure			400	0.03	97.10	0.41					101.10	0.44
	Total	1,049.30	11.02	2,359.00	18.83	3,062.20	12.88	3,494.50	8.13	4,752.00	6.13	14,717.00	56.99
Balance		Balance	-0.64	130.70	1.04	-42.80	-0.18	-545.10	-1.27	-500.00	-0.65	-1,018.14	-1.69

Table 2-24 Annual Income and Expenditure in Surkhandarya AVTOYUL（1998～2002）

（Unit：million Sum）

Item		1998		1999		2000		2001		2002		Total	
		Sum	US $	Sum	US $	Sum	US $	Sum	US $	Sum	US $	Sum	US $
Income	Federal Road Fund												
	Provincial Road Fund	482.00	5.06	756.00	6.03	1,457.20	6.13	1,816.00	4.22	2,833.40	3.66	7,344.60	25.11
	Local Road Fund												
	Road Passing Charge												
	Other Income												
	Total	482.00	5.06	756.00	6.03	1,457.20	6.13	1,816.00	4.22	2,833.40	3.66	7,344.60	25.11
Expenditure	Admini. expenses	30.70	0.32	30.50	0.24	45.20	0.19	81.60	0.19	131.30	0.17	319.30	1.12
	Equipment expense			70.20	0.56	116.70	0.49	47.00	0.11	170.20	0.22	404.10	1.38
	New road Construct												
	Road Maintenance	723.70	7.60	1,021.70	8.16	1,420.00	5.97	1,749.20	4.07	2,393.90	3.09	7,308.50	28.89
	Other Expenditure			3.60	0.03	4.20	0.02	6.00	0.01			13.80	0.06
	Total	754.40	7.93	1,126.00	8.99	1,586.10	6.67	1,883.80	4.38	2,695.40	3.48	8,045.70	31.45
Balance		Balance	-2.86	-370.00	-2.95	-128.90	-0.54	-67.80	-0.16	138.00	0.18	-701.10	-6.34

2-5 Estimated Cost of Project

2-5-1 Estimated Cost of Grant Aid Project

In case of implementation of the project under Japan's grant aid, the total estimated cost will be about 991 million Japanese yen. The amounts of cost to be shared by the Japanese and Uzbekistan governments, based on the following estimation conditions, will be as follows:

(1) Cost to be shared by Japan for the project

This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.

Project cost group	Amount (million yen)
(1) Equipment	949
(2) Design and Consulting	27
Total	976

(2) Cost to be shared by Uzbekistan side for the project

1) Preparation of fuel and material for training on operation and maintenance management of equipment (0.45 million yen)
2) Cost of transportation of the equipment from Tashkent to each of the provincial sites after completion of training (1.60 million yen)
3) Foundation and other appurtenant work and installation work required to install two asphalt mixing plants (except for technical guidance on installation, which will be provided by the supplier) (13.00 million yen)

(3) Conditions of cost estimation

1) Time of estimation: May 2004
2) Exchange late: 1 US$ = 108.74 Yen (mean of 180 days)
(from 3rd November 2003 to 30th April 2004)
1 Euro = 133.42 Yen (mean of 180 days)
(from 3rd November 2003 to 30th April 2004)
3) Procurement Schedule: The periods for detailed design and machinery procurement are shown in the Implementation Schedule.
4) Others: This project will be executed under the Japan's grant aid scheme.

2-5-2 Operation and Maintenance Cost

The estimation of cost for fuel, oil, lubricants and maintenance works is shown in tables 2-26 and 2-27. The expenditure for fuel and oil for the equipment to be procured under this project is estimated around 224.5 thousand US dollars per year, and the expenditure for maintenance works of this equipment is estimated at 287.0 thousand US dollars per year. The total of expenditure is estimated around 511.5 thousand US dollars per year.

In and after fiscal year 2006 when equipment is procured under this project, UZAVTOYUL is planning to submit a plan for this project. As show in table 2-25, the expenditure for maintenance works estimated at 287.0 thousand US dollars per year corresponds to 8.81% of the annual budget in 2006. But this percentage will decrease year by year (7.99% in 2007, 7.25% in 2008, 6.57% in 2009, 5.96% in 2010).

This percentage of the operation and management cost is a feasible figure because the lease fee chalked up for the repair of the target road will decrease by as much as that for the equipment to be procured under the grant aid project (about 80% of all the equipment).

Table 2-25 Management and maintenance cost (2006 – 2010)

	2006	2007	2008	2009	2010
Target road maintenance budget（million sum）	3,076.6	3,230.4	3,391.9	3,561.5	3,739.6
Converted into dollars （thousand dollars）	3,058.3	3,211.1	3,371.7	3,540.3	3,717.3
Management and maintenance cost （thousand dollars）	287.0	287.0	287.0	287.0	287.0
Proportion of management and maintenance cost in budget	8.81%	7.99%	7.25%	6.57%	5.96%

Table 2-26 Cost estimation of Fuel and Oil

Unit: litter

No.	Equipment	Spec	Qty.	Fuel Consumption (litter /day. machine)	Total Qty. of Fuel (litter /days. Machines)
1	Motor Grader	150HP	3 (10)	0.081x150HPx5h = 61	183 (610)
2	Dump Truck	340HP	4 (11)	0.040x340HPx5h = 68	272 (748)
3	Asphalt Sprayer	4HP	3	0.170x4HPx5h = 3	9
4	Vibration Roller	27HP	3 (6)	0.114x27HPx5h = 15	45 (90)
5	Pneumatic Tired Roller	90HP	3	0.075x90HPx5h = 34	102
6	Pick-up Truck	80HP	3	0.040x80HPx5h = 16	48
7	Water Tank Truck	160HP	3	0.030x160HPx5h = 24	72
8	Multi Purpose Vehicle	150HP	2	0.058x150HPx5h = 44	88
9	Road Line Marker	130HP	2	0.037x130HPx5h = 24	48
10	Asphalt Finisher	50HP	3	0.114x50HPx5h = 29	87
11	Asphalt Distributor	200HP	2	0.069x200HPx5h = 69	138
12	Trailer Truck	350HP	2	0.037x350HPx5h = 65	130
13	Road Plainer	500HP	3	0.107x500HPx5h = 268	804
14	Mobile Material Test Laboratory.	160HP	1	0.037x160HPx5h = 30	30
15	Asphalt Mixing Plant	200HP	2 (4)	0.365x200HPx5h = 365	730 (1,460)
16	Mobile Workshop	170HP	3	0.038x170HPx5h = 32	96
17	Excavator	135HP	3 (4)	0.133x135HPx5h = 90	270 (360)
18	Wheel Loader	160HP	4 (6)	0.115x160HPx5h = 92	368 (552)
19	Truck Crane	220HP	2	0.077x220HPx5h = 85	170
20	Bulldozer				
21	Air Compressor	80HP	3	0.156x80HPx5h = 62	186
22	Cargo Truck with Crane				
23	Tamper	3HP	9	0.229x3HPx5h = 3	27
24	Hand Guide Roller	5HP	6	0.151x5HPx5h = 4	24
Total					3,927 (5,879)

Note:（number） means total number of new machines and existing machines.
Condition for estimation
1. Working days per year: 126 days
2. Working hours per day ：5 hours
3. Fuel and Oil consumption Ratio （litter/HP-h）:「Construction equipment owning cost table」
4. Expenditure for oil is almost equal.1 % of the expenditure for the fuel
5. Price of the diesel fuel :30cents/litter＝32.6Yen/litter （$1=108.74Yen）
6. Annual Expenditure for the Fuel and Oil
New Equipment (3,927 + 39) x 126days x 30cents= 149,914$dollar = 16.3 million Yen
New and Old Equipment (5,879 + 59) x 126days x 30cents= 224,456 dollar = 24.4 million Yen

Table 2-27 Estimation of Maintenance Cost

Unit thousand Yen

No.	Equipment	Spec	Qty	Maintenance charge rate /machine. year	Maintenance Cost / machine year	Annual Cost /Total number of machine
1	Motor Grader	150HP	3 (10)	0.35/24=0.015	230	690 (2,300)
2	Dump Truck	340HP	4 (11)	0.60/18=0.033	280	1,120 (3,080)
3	Asphalt Sprayer	4HP	3	0.35/9=0.039	60	180
4	Vibration Roller	27HP	3 (6)	0.35/22=0.016	140	420 (840)
5	Pneumatic Tired Roller	90HP	3	0.45/26=0.017	120	360
6	Pick-up Truck	80HP	3	0.70/16=0.044	90	270
7	Water Tank Truck	160HP	3	0.45/19=0.024	140	420
8	Multi Purpose Vehicle	150HP	2	0.45/20=0.023	790	1,580
9	Road Line Marker	130HP	2	0.40/16=0.025	560	1,120
10	Asphalt Finisher	50HP	3	0.45/22=0.020	360	1,080
11	Asphalt Distributor	200HP	2	0.50/20=0.025	310	620
12	Trailer Truck	350HP	2	0.45/20=0.023	390	780
13	Road Plainer	500HP	3	0.55/19=0.029	590	1,770
14	Mobile Material Test Laboratory	160HP	1	0.45/20=0.023	840	840
15	Asphalt Mixing Plant	200HP	2 (4)	0.50/18=0.028	2,750	5500 (11,000)
16	Mobile Workshop	170HP	3	0.45/20=0.023	300	900
17	Excavator	135HP	3 (4)	0.45/15=0.030	310	930 (1,240)
18	Wheel Loader	160HP	4 (6)	0.70/22=0.032	330	1,320(1,980)
19	Truck Crane	220HP	2	0.30/20=0.015	290	580
20	Bulldozer					
21	Air Compressor	80HP	3	0.30/22=0.014	40	120
22	Cargo Truck with Crane					
23	Tamper	3HP	9	0.40/10=0.040	10	90
24	Hand Guide Roller	5HP	6	0.35/22=0.016	10	60
Total			69 (91)			20,750 (31,210)

Note:（number） means total number of new machines and existing machines.

Condition for Cost Estimation
1. Maintenance Cost Ratio: From Construction Equipment Owning Cost Table
2. Service Life: Set it twice of normal service life in Japan
3. Maintenance Cost of Machine: Estimated Cost of Machine(CIF Price)× Maintenance Cost Ratio
4. Annual Maintenance Cost
New Machines 20.75 million Yen (190.8 Thousand dollar)
New Machines and Existing Machines 31.21 million Yen (287.0 Thousand dollar)

Chapter 3 Project Evaluation and Recommendations

3-1 Project Effects

Now that more than ten years have passed after getting independence, it is an absolutely indispensable condition for Uzbekistan promoting the transition to market economy to transport the cotton fiber (37.6% in value terms) and gold (20.0% in value terms), the country's main export products in an efficient, sure, and low cost way for the sake of future economic development of this country.

Since a network of main trunk roads in Uzbekistan was constructed in the Soviet Union era, no more new trunk roads need to be constructed.. However, an increasing traffic volume is causing a lot of damages on the roads (occurrence of pot holes, cracks, rutting, etc.) and a delay in expansion works of roads, which are hindering smooth distribution of goods.

Therefore, Uzbekistan has been working on the maintenance of the international trunk road as an emphasis policy of the transportation section in these years. As a part of the plan, large-scale improvement of trunk road A373 that links Tashkent and Ferghana basin was implemented under a grant aid project by the government of Japan from 1996 to 2002 using construction machinery purchased in a grant aid project, achieving a great deal of economic effects.

The current project's target section of the trunk road from Samarkand to Termez via Guzar is a very important route used to go out of Uzbekistan to harbors in Pakistan or Iran via Afghanistan though it is under a significant influence from a political situation in Afghanistan. A route for prompt distribution, once constructed, will surely give tremendous influences on the domestic economy.

The execution of this project has the following direct and indirect effects:

1. Direct effect:

- The 378 km section of the international trunk road from Samarkand to Termez via Guzar will be rehabilitated completely.

2. Indirect effects

- The transportation time will be shortened due to a higher running speed of the traffic. Therefore the transportation cost is expected to decrease.
- Due to the above, the traffic from Samarkand or Tashkent to Termez will increase. Consequently, the living standard is improved in Kashkhadarya and Surkhandarya provinces.
- The number of traffic accident will be decreased by painting of the lane line in the whole target road.

- To clear away snow from the roads and spread the de-icing chemicals on the roads by a multi purpose vehicle, passing restriction of traffic will decrease in winter. Therefore there will be more chances to access social service of education and medical treatment than at present.
- The noise and the dust caused by vehicles will be decreased by the road repair and maintenance, and the environment along the road will be improved.
- The damage to vehicles will be reduced by the road repair and maintenance, and the vehicle maintenance cost will decrease.

3-2 Recommendations

This project, when implemented, will have significant effects as described in the preceding clause. However, the following problems need to be solved in order to manifest the effects of this project and continue the effects even after the completion of this project.

(1) Adequate maintenance management need to be executed to keep using the machinery to be procured under this project not only in the project period but also for a long term of ten years or more after that. Though UZAVTOYUL stores maintenance and repair records concerning regular maintenance and repair of the owned machinery as well as inventory records for spare parts at each provincial AVTOYUL, an increase in the number of machinery and parts after the implementation of this project will exceed the limit of the management that relies only on record sheets. We propose that office automation or computer-based data management should be promoted.

(2) The availability of the target road after the completion of this project is expected to sharply increase the traffic of heavy trucks. To maintain the repaired road in a good condition for a long time, it will be necessary to impose weight limitation on heavy vehicles that are expected to increase. Currently, the truck scales (weight measurement apparatuses) are installed only in three places of the country. Moreover, only one of them is functional so that it is nearly impossible to impose weight limitation on passing vehicles. It is desirable that the faulty truck scales will be repaired and more measuring apparatuses, even simple ones, will be installed to promote countermeasures against trucks with excessive weight.

(3) The amount of budget for the maintenance management operation on the target road under the repair project is estimated at 17,000 million Sum (about 1,848 million yen) in total. An official document that promises the required budget was issued by the National Road Fund, a subordinate organization of Ministry of the Treasury. To secure the budget more certainly in the future, the headquarters and the execution sections of UZAVTOYUL are expected to make a detailed construction plan will be earlier than scheduled, even before the beginning of the project, and

provide careful follow-ups so that the construction can be started and completed exactly as planned.

(4) Medium-scale or larger road repair works after 1990 were executed mainly using the Black Top Method. This simple pavement method used only in Uzbekistan involves mixing of aggregate and crude oil on the target road, leveling and compaction. The global-standard pavement method of using hot mixed asphalt is only beginning to be used, little by little, since several years ago. On the other hand, there are increasingly more engineers who went to study cutting-edge technologies in Japan and the U.S. and European countries as well as operators who took training at EU manufacturers when they purchased road construction machinery from EU countries. In the current road maintenance project using equipment to be procured for this project, their knowledge and experience will prove very useful. It is strongly recommended to provide chances to transfer their knowledge and expertise to other engineers and operators regardless of whether or not to assign them to site works or trainer positions.

(5) Not too much of a problem is expected for ordinary maintenance management of the machinery. However, the machinery may include some electronic control parts or high precision hydraulic parts not found in the old Soviet-made machinery.

The team is planning to provide detailed explanation and training when the machinery is delivered. If this seems insufficient, it is recommended to examine making a request to the Japanese government for the short-term expert training and the technical cooperation concerning the maintenance management of the road construction machinery, the repair skills, and the failure diagnosis skills, etc.

(6) In this project, spare parts needed for ordinary maintenance management of the machinery for about half the project term will be procured together with the machinery. However, it will be difficult to obtain new spare parts after using up the initial parts or other parts required for repair of the machinery because there is no agency with the parts stock in Uzbekistan.

The change (improvement) of the monetary management rules in October, 2003 is causing the tide to turn for the better but the situation is still as bad as before. Therefore, it is recommended that UZAVTOYUL will establish a route for obtaining spare parts as promptly as possible after procuring the machinery.

Appendix 1. Member List of the Study Team

Appendix 1. Member List of the Study Team

(1) Basic Design Study Team

Ms. Kae Yanagisawa	Leader	Resident Representative, JICA Uzbekistan Office
Mr. Yoshimoto Koyanagi	Project Coordinator	Officer, Traffic Infrastructure Team, Project Management Group II, Grant Aid Department, JICA
Mr. Yoichi Higaki	Chief Consultant / Road Maintenance Planner	Construction Project Consultants, Inc.
Mr. Kazuhiko Kamachi	Equipment Planner / Environmental and Social Considerations I	Construction Project Consultants, Inc.
Mr. Yasuhiro Okubo	Procurement Planner / Cost Estimator	Construction Project Consultants, Inc.
Mr. Hiroshi Ibaraki	Equipment Planner / Environmental and Social Considerations II	Construction Project Consultants, Inc.
Ms. Masayo Murakami	Interpreter (Russian)	Construction Project Consultants, Inc.

(2) Study Team for basic design draft explanation

Ms. Kae Yanagisawa	Leader	Resident Representative, JICA Uzbekistan Office
Mr. Yoichi Higaki	Chief Consultant / Road Maintenance Planner	Construction Project Consultants, Inc.
Mr. Kazuhiko Kamachi	Equipment Planner / Environmental and Social Considerations I	Construction Project Consultants, Inc.
Ms. Masayo Murakami	Interpreter (Russian)	Construction Project Consultants, Inc.

Appendix 2. Study Schedule

Appendix 2. Study Schedule

(1) Basic Design Study Team

No.	Date	Schedule		
		Ms. K. Yanagisawa (Leader)	Mr. Y. Koyanagi (Project Coordinator)	Mr.Y. Higaki (Chief Consultant / Road Maintenance Planner) Mr. K. Kamachi (Equipment Planner / Environmental and Social Considerations I) Mr. Y.Okubo (Procurement Planner / Cost Estimator) Mr. H. Ibaraki (Equipment Planner / Environmental and Social Considerations II) Ms. M. Murakami (Interpreter)
1	April 20 (Tue)		Tokyo 13：30→Seoul 16：00 (OZ101) Seoul 17：20→Tashkent 21：10 (OZ573)	
2	21 (Wed)		Courtesy Call to EOJ, JICA Discussion with UZAVTOYUL	
3	22 (The)		Explanation and confirmation of Inception Report	
4	23 (Fri)		Explanation and confirmation of Inception Report Moving from Tashkent to Samarkand	
5	24 (Sat)		Survey on the road condition from Samarkand to Termez	
6	25 (Sun)		Moving from Termez to Tashkent	
7	26 (Mon)	Discussion on the Minutes with UZAVTOYUL		
8	27 (Tue)	Signing on the Minutes with UZAVTOYUL Mr.Y. Koyanagi leaves Tashkent for Tokyo (22：30)→Seoul OZ574		
9	28 (Wed)		Seoul 10：00→ Tokyo 12：10 (OZ102)	Discussion with Donnor Organization, Discussion with UZAVTOYUL
10	29 (Thu)			Site Survey (Tashkent～Samarkand)
11	30 (Fri)			Discussion with Samarkand provincial AVTOYUL, AROs, AREOs, etc.
12	May 1 (Sat)			Discussion with Samarkand provincial AVTOYUL, AROs, AREOs, etc.
13	2 (Sun)			Site Survey（4R45, A378 L=88 km）
14	3 (Mon)			Discussion with Kashukadarya provincial AVTOYUL, AROs, AREOs, etc.
15	4 (Tue)			Discussion with Kashukadarya provincial AVTOYUL, AROs, AREOs, etc.
16	5 (Wed)			Site Survey (4R87, A380, a part of M39 L=148 km）
17	6 (Thu)			Discussion with Surkhandarya provincial AVTOYUL, AROs, AREOs, etc.
18	7 (Fri)			Site Survey（M39 L=142 km）
19	8 (Sat)			Discussion with Surkhandarya provincial AVTOYUL, AROs, AREOs, etc.
20	9 (Sun)			Site Survey (Termiz～Tashikent)
21	10 (Mon)			Discussion with UZAVTOYUL
22	11 (Tue)			Discussion with UZAVTOYUL
23	12 (Wed)			Discussion with UZAVTOYUL
24	13 (Thu)			Discussion with UZAVTOYUL
25	14 (Fri)			Discussion with UZAVTOYUL, Report to JICA, EOJ Leaves Tashkent for Tokyo 22 :30 (OZ574) →
26	15 (Sat)			→ Seoul 08 :50, Seoul 10 :00→Tokyo 12:10 (OZ102)

(2) Study Team for basic design draft explanation

No.	Date	Schedule	
		Ms. K. Yanagisawa (Leader)	Mr.Y. Higaki (Chief Consultant / Road Maintenance Planner) Mr. K. Kamachi (Equipment Planner / Environmental and Social Considerations I) Ms. M. Murakami (Interpreter)
1	August 3 (Tue)		Tokyo 13:30→Seoul 16:00(OZ101) Seoul 17:30→Tashkent 21:10(OZ573)
2	4 (Wed)	Courtesy Call to EOJ, JICA（Explanation and discussion of basic design draft） Courtesy Call to UZAVTOYUL	
3	5 (Thu)	Explanation and discussion of basic design draft with UZAVTOYULL	
4	6 (Fri)	Explanation and discussion of basic design draft with UZAVTOYULL Courtesy Call toDonner Organizations	
5	7 (Sat)	Internal Meeting	
6	8 (Sun	Internal Meeting	
7	9 (Mon)	Explanation and discussion of basic design draft with UZAVTOYULL	
8	10 (Tue)	Discussion on the Minutes with UZAVTOYUL	
9	11 (Wed)	Discussion on the Minutes with UZAVTOYUL	
10	12 (Thu)	Signing on the Minutes with UZAVTOYUL	
11	13 (Fri)		Report to JICA, EOJ Leaves Tashkent for Tokyo 22:30(OZ574) →
12	14 (Sat)		→ Seoul 08 :50, Seoul 10 :00→Tokyo 12:10 (OZ102)

Appendix 3. List of Parties Concerned in the Recipient Country

Appendix 3. List of Parties Concernd in the Recipient Country

UZAVTOYUL

RASTAM YUNUSOV	President
AZLAR MUKHAMEDOV	Director of Road Consulting Bureau
RASUL ABDUKADIROV	Leading specialist of budget planning
AZAM KHOLMANOV	Deputy Head of Road Network Planning Dept.
DILSHOD MIHMANOV	Senior Specialist of Finance Dept.
ZILOLA MUKHAMEDOVA	Senior Specialist of International Economic Relations Dept.
MANSUR NURMATOV	Head of Marketing & Modern Technology Implementation Dept.
UMIDJON MAHMATOV	Head of International Economic Relations Dept.
NISHANOWA FERUZA	Senior Specialist of Germany Center
PAZILOV AVAZHON	Senior Specialist of Marketing Dept.
OYDIN SATTOROW	Ecologist
HUDOJAR KAMALOV	Chief of Environment Dept.
ERKIN MIRZABEKOV	Director of Sirghaliulgurjisavdo
BOHODIR ZOKIROV	Deputy Director of Sirghaliulgurjisavdo
BAKHADIR HOJAEV	First Deputy Director of Uzyulmashservis
ALISHER DEHKONOV	Chier of Procurement Dept. of Uzyulmashservis

Samarkand AVTOYUL

MADIEV AHTAM	Chairman
ROSTAMOV BOHODIZ	Mechanical Engineer
ZOKIZOV SOBIZ	Design Engineer
KADAMOV ANVAR	Production Engineer
ALISHOV ASLASH	Head of Samarkand AYB
TEIROV TOLIP	Chief mechanic of of Samarkand AYB
TURSUNOV SHAROF	Assistant of Chief mechanic of Samarkand ARO
ERMAMATOV DEHKONBOI	Head of Afrosiyob AYB
NAZAROV UTKIL	Chief Engineer of of Afrosiyob AYB
ISAEV RAJABBOI	Director of Samarkand Asphalt Plant
MUSURIMONKULOV SHODIYOR	Head of Sazagan Workshop

Kashkhadarya AVTOYUL

PANJIEV KURBAN	Chairman
SHOIMOV NURMUROD	Senior Engineer
HAMROYEV ADASH	Director of Kashkhadarya Road design Institute
POYON JURAEV	Deputy Director of Shayhali AYB
ERKIN ZOIROV	Chief Mechanic of Guzar AYB
SHODIEV ABDURAIM	Chief Engineer of Tankhoz AYB
MAHKAMOV KAMOL	Director of Kitab AYB

Surkhandarya AVTOYUL

JURAEV TOHIR	Chairman
MUQIMOV FURKAT	Chief Engineer
ERGASHEV SULTON	Design Engineer
KHAMZA SHABBOZOV	Chief Mechanic
ASLIDIN AROMOV	Director of Surkhandarya Bridge & Road constructing Org.
ABDULAHAT NORTOJI	Director of Sharabad Asphalt Plant
RAVSHANOV SALIM	Director of Boisun AYB
MAMADELIEV ABDURAIM	Director of Jarkurgan AYB

Donner Organizations

OLEG BOROVIKOV	Operation Officer of World Bank
SEAN M. O'SULLIVAN	Directoe of ADB Uzbekstan Bureau
RAFAEL NADYRSHIN	Officer of ADB Uzbekstan Bureau
Mark GRAILLE	Program Analyst of UNDP

Embassy of Japan in Uzbekistan

Kiyomi Miyagawa	First Secretary
Hiroko Kitamura	Third Sscretary

JICA Uzbekistan Office

Kae Yanagisawa	Resident Representative
Eiji Asami	Assistant Resident Representative

Other visiting place

Manufacturer agency and partnership companies in Tashkent and Karshi

Appendix 4. Minutes of Discussions

1. Minutes of Discussions on the Basic Design Study

2. Minutes of Discussions on the Basic Design Study (Explanation on the Draft Report)

3. Technical Note on additional equipment

Minutes of Discussions
on the Basic Design Study
on the Project for Improvement of Equipment
for Road Construction and Maintenance
in the Republic of Uzbekistan

Based on the results of the Preparatory Study which was conducted in November, 2003, the Government of Japan decided to conduct a Basic Design Study on the Project for Improvement of Equipment for Road Construction and Maintenance (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to the Republic of Uzbekistan (hereinafter referred to as "Uzbekistan") the Basic Design Study Team (hereinafter referred to as "the Team"), headed by Ms. Kae Yanagisawa, Resident Representative of JICA Uzbekistan Office, and is scheduled to stay in the country from April 20 to May14, 2004.

The Team held discussions with the officials concerned of the Government of Uzbekistan and conducted a field survey at the study area.

In the course of the discussions and field survey, both sides have confirmed the main items described in the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Tashkent, April 27, 2004

Kae Yanagisawa
Leader
Basic Design Study Team
Japan International Cooperation Agency

Azlar Mukhamedov
Leader of Working Group
Director of Road Consulting Bureau
State Joint Stock Company UZAVTOYUL

ATTACHMENT

1. Objective

The objective of the Project is to improve and maintain roads in Uzbekistan by procuring the equipment for road construction and maintenance.

2. Project Site

The sites of the Project are shown in Annex-1.

3. Responsible and Implementing Organizations

The responsible and implementing organization is State Joint Stock Company UZAVTOYUL.

The organization chart of the implementing agency is shown in Annex-2.

4. Items Requested by the Government of Uzbekistan

After discussions with the Team, the items described in Annex-3 were finally requested by the Uzbekistan side. JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

5. Japan's Grant Aid Scheme

(1) The Uzbekistan side understood the Japan's Grant Aid scheme and the necessary measures to be taken by the Government of Uzbekistan explained by the Team as described in Annex-4.

(2) The Uzbekistan side shall take necessary measures, as described in Annex-5, for smooth implementation of the Project as a condition for the Japan's Grant Aid to be implemented.

6. Schedule of the study

(1) The Team will proceed to further studies in Uzbekistan until May 14, 2004.

(2) JICA will prepare the draft report in English and dispatch a team to Uzbekistan in order to explain its contents around the end of July, 2004.

(3) In case that the contents of the report are accepted in principle by the Government of Uzbekistan, JICA will complete the final report and send it to the Government of Uzbekistan by October, 2004.

7. Other Relevant Issues

(1) The Uzbekistan side shall make road rehabilitation prospects of the target roads covering several years within Samarkand, Kashkadarya and Surkhandarya province respectively, and forward them to the Team by May 14, 2004.

(2) The Uzbekistan side shall make maintenance and operation plans for the procured equipment within each province according to the above mentioned prospects, and forward them to the Team by May 14, 2004.

(3) The Team explained the outline of a new JICA Environmental and Social Considerations Guidelines (hereinafter referred to as "the new JICA Guidelines") to the Uzbekistan side. The Uzbekistan side took the new JICA Guideline into consideration, and shall complete the necessary procedures. The Uzbekistan side shall submit the Environmental Impact Report to the State Committee for Nature Protection to

receive the consultation, and to the Ministry of Finance to get an approval for the Project by the end of August, 2004.

(4) The Uzbekistan side shall submit answers in English to the Questionnaire, which the Team handed to the Uzbekistan side by April 28, 2004 for those available in Tashkent, and by May 10, 2004 for the remaining.

(5) The Uzbekistan side shall provide necessary number(s) of counterpart personnel to the Team during the period of their studies in Uzbekistan.

(6) The Uzbekistan side shall allocate an appropriate budget for the procured equipment. The expenditure for purchasing the spare parts except for the initial spare parts of the procured equipment shall be included in the budget.

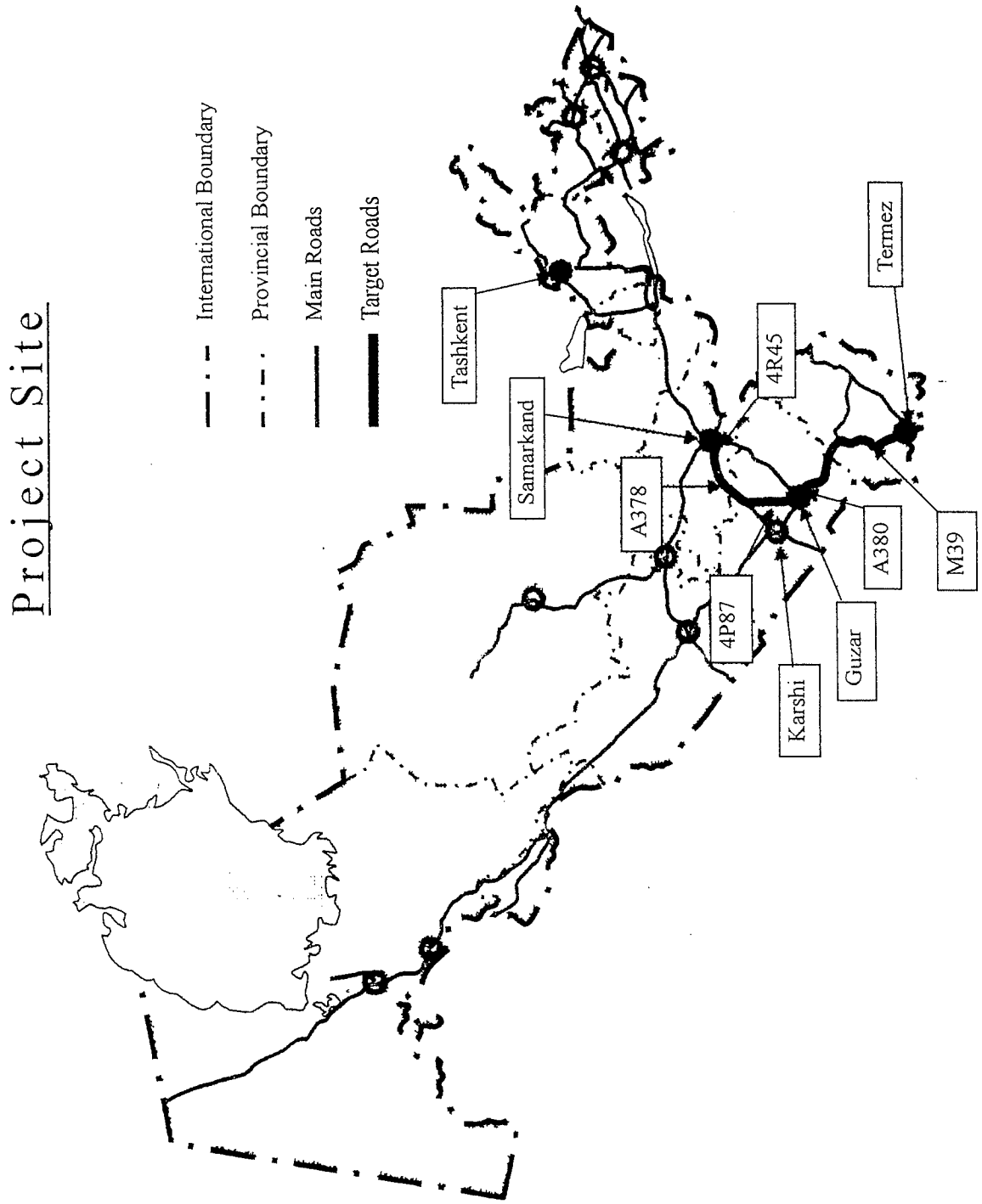
(7) The Headquarters of UZAVTOYUL shall be responsible for supervising for maintenance and operation of the procured equipment allocated to each provincial office.

(8) The Uzbekistan side shall allocate the appropriate budget for undertakings to be done by the Uzbekistan side described in Annex-5.

(9) The Uzbekistan side understood that if the installation work is required for some equipment, the work shall be conducted by the Uzbekistan side at their own expenses.

(10) The Uzbekistan side understood that it is necessary to assign an appropriate number of counterpart personnel(s) during the installation and workout period for the procured equipment to obtain the operation skills from the Japanese side.

Annex-1


Project Site
International Boundary
Provincial Boundary
Main Roads
Target Roads
Tashkent
Samarkand
A378
4R45
Termez
4P87
A380
M39
Karshi
Guzar

Organization Chart of the State Joint Stock Company "Uzavtoyul"

SJSC "Uzavtoyol"

Provincial maintenance branches of SJSC "Uzavtoyul":

"Karakalpakavtoyul"
"Andijanavtoyul"
"Bukharaavtoyul"
"Djizzakavtoyul"
"Kashkadaryoavtoyul"
"Navoiavtoyul"
"Namanganavtoyul"
"Samarkandavtoyul"
"Surhandaryoavtoyul"
"Sirdaryoavtoyul"
"Karakalpakavtoyul"
"Toshkentavtoyul"
"Ferghanaavtoyul"
"Horezmavtoyul"

Highway construction, rehabilitation and maintenance units of provincial maintenance branches

Road construction and repair organizations:

1. Road-repair and construction union "Avtomagistral"
2. JSC "Avtoyulqurilish"
3. JSC "Yul qurilish"
4. JV "Trans-Osiyo-Evropa"
5. "Uzuraldorstroy" unit
6. "Uztyumendorstroy" unit
7. JSC "Surhandaryo yul va kuprik qurilish"
8. LLC "Nukus tamirlov qurish uchastkasi"
9. "Yakkatutyultamir"
10. JSC "Kitobavtoyul"
11. JSC "Gijduvon yul qurilish va tamirlash"
12. JSC "Yulchi"
13. JSC "Namangan qurilish"
14. JSC "Narpay yul qurilish"
15. JSC "Karakalpak jol tamirlov"
16. JSC "Jolshi"
17. JSC "Sarbon"

Organizations specialized on drilling-and-blasting works:

1. Tashkent (Tashkent province)
2. Angren (Tashkent province)
3. Karatau (Republic of Karakalpakistan)

Industrial and transport organizations:

1. Kuyluk ferroconcrete bridge structures experimental Plant;
2. Almazar experimental, mechnical, repairing and subsidiary-producing organization;
3. "Nazarbekavtoyul";
4. "Buhoroyolgranit";
5. "Yangiyeryulindustriya";
6. "Bekobodyulindustriya";
7. "Uzyulmashservis";
8. "Chinozyulindustriya";
9. JSC "Pop Gavosoy ACP";
10. "Kitab tuman temir beton mahsulotlari cehi";
11. JSC "Namangan-avtoyultrans".

United directorate on implementation of road reconstruction and construction works

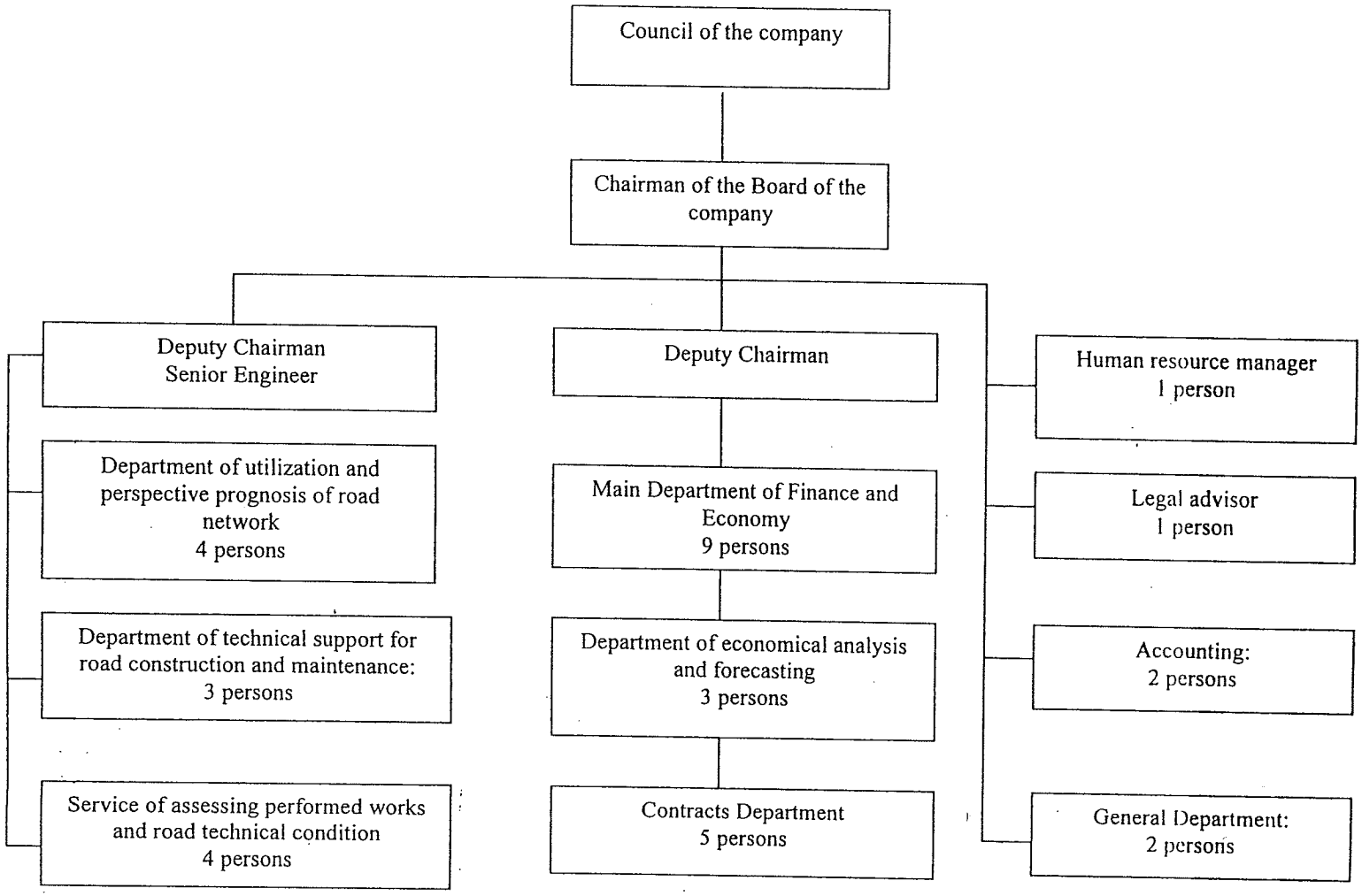
"Yul loyiha burosi" Road Consulting Bureau including provincial private consulting bureaus

"Uzyulbutlash" Department

Annex -2

CHART OF THE EXECUTIVE BODY OF SJSC "UZAVTOYUL"

Number of management
Is limited 29 employees

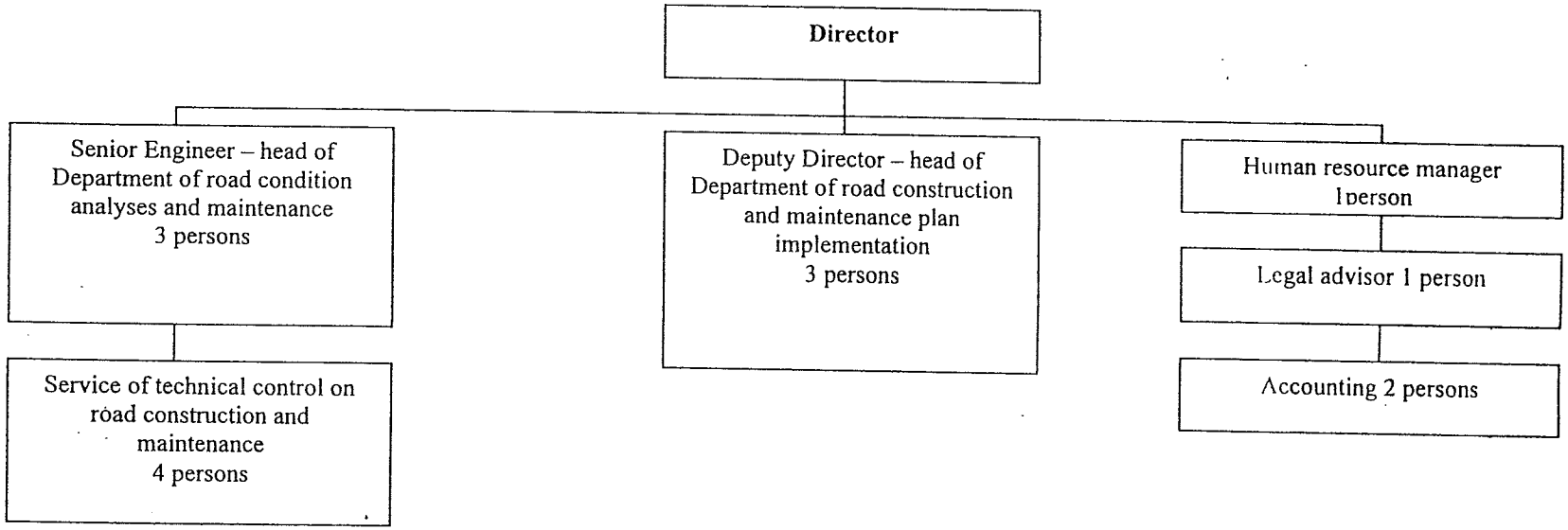


TYPICAL CHART OF PROVINCIAL MAINTENANCE BRANCHES OF THE SJSC "UZAVTOYUL"

"Karakalpakavtoyul", "Andijanavtoyul",
"Bukharaavtoyul", "Djizzakavtoyul",
"Kashkadaryoavtoyul", "Navoiavtoyul",

"Namanganavtoyul", "Samarkandavtoyul",
"Surhandaryoavtoyul", "Sirdaryoavtoyul",

"Karakalpakavtoyul", "Toshkentavtoyul",
"Ferghanaavtoyul", "Horezmavtoyul"



Number of management is limited to 15 employees

Annex-3

The List of Requested Road Construction Equipment for the Maintenance of Roads Samarkand - Termez

No.	Name of Equipment	Specification etc.	Qty.
1	Motor Grader	blade 3.7 m	6
2	Dump Truck	3 – 5 ton	6
3	Asphalt Hand Sprayer	w/asphalt heater, air compressor,	3
4	Roller	5 ton	3
5	Pneumatic Tired Roller	10 ton	3
6	Lifting car for bridge check and bridge maintenance	Two workers deck	2
7	Pick-up Truck	4 x 4, 5 persons, Diesel Eng	4
8	Water Tank Truck	8,000 l, w/pump & spray	3
9	Multi Purpose Truck	Sand distribution, Crain, Sweeper, Excavator & Loader	3
10	Road Line Marker	Truck mounted type,	3
11	Asphalt Finisher	Wheel Type, 2.0m-4.5 m(w)	3
12	Asphalt Distributor	4.5 m(w), 6000 l, 4x2	3
13	Trailer Head		2
14	Trailer Truck	30 ton	2
15	Road Planer	500-1,000 mm(W), 160mm(D)	3
16	Rotary snow blower	2 m(w)	2
17	Anti and De-Icing Chemicals Spreader	4000 l, 2 - 8 m(w)	3
18	Materials-testing laboratory equipment	For Soil and Asphalt, Mobile	3
19	Mobile Asphalt mixing plant	20 – 50 ton/hour	3
20	Mobile Workshop	w/Crane, Generator/Welder,	3
21	Excavator	0.8 m^3	4
22	Wheel Loader	2.5m^3	4
23	Truck Crane	25 ton	2

JAPAN'S GRANT AID

The Grant Aid Scheme provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

Japan's Grant Aid Scheme is executed through the following procedures.

Application	(Request made by the recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal &Approval	(Appraisal by the Government of Japan and Approval by the Cabinet)
Determination of Implementation	(The Note exchanged between the Governments of Japan and recipient country)

Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study) using (a) Japanese consulting firm(s).

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Scheme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes (E/N) signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

(1) Contents of the study

The aim of the Basic Design Study (hereafter referred to as "the Study") conducted by JICA on a requested project (hereafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- Preparation of a basic design of the Project.
- Estimation of costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of the Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA. The consultant firm(s) used for the Study is (are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

3.Japan's Grant Aid Scheme

(1) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

(2) "The period of the Grant Aid" means the one fiscal year, which the Cabinet approves, the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed. However, in case of delays in delivery, installation or construction due to unforeseen factors such as national disaster, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

(3) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, consulting, constructing and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(4) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(5) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as the following:

a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction,

b) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,

c) To secure buildings prior to the procurement in case the installation of the equipment,

d) To ensure all the expenses and prompt excursion for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,

e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,

f) To accord Japanese nationals, whose services may be required in connection with the supply of the products and services under the Verified contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(6) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) "Re-export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

(End)

Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To bear the following commissions to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
2	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	1) Marine and land transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		●
	3) Internal transportation from the handing over point to the project site		●
3	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contact, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.		●
4	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts		●
5	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		●
6	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the transportation and installation of the equipment		●

(B/A: Banking Arrangement, A/P: Authorization to pay)

Minutes of Discussions
on the Basic Design Study
on the Project for Improvement of Equipment
for Road Construction and Maintenance
in the Republic of Uzbekistan
(Explanation on the Draft Report)

In April 2004, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Basic Design Study Team on the Project for Improvement of Equipment for Road Construction and Maintenance (hereinafter referred to as "the Project") to the Republic of Uzbekistan (hereinafter referred to as "Uzbekistan"), and through discussions, field survey and technical examination of the results in Japan, JICA prepared a draft report of the study.

In order to explain and to consult with the officials concerned of the Government of Uzbekistan on the components of the draft report, JICA sent to Uzbekistan the Basic Design Explanation Team (hereinafter referred to as "the Team"), headed by Ms. Kae Yanagisawa, Resident Representative of the JICA Uzbekistan Office, from August 3 to 13, 2004.

In the course of the discussions, both sides confirmed the main items described in the attached sheets.

Tashkent, August 12, 2004

Kae Yanagisawa
Leader
Basic Design Study Team
Japan International Cooperation Agency

Azlar Mukhamedov
Leader of Working Group
Director of Road Consulting Bureau
State Joint Stock Company UZAVTOYUL
Republic of Uzbekistan

ATTACHMENT

1. Contents of the Draft Report

The Uzbekistan side agreed and accepted in principle the contents of the Draft Report explained by the Team.

2. Japan's Grant Aid Scheme

The Uzbekistan side understood the Japan's Grant Aid scheme and the necessary measures to be taken by the Government of Uzbekistan explained by the Team as described in Annex-4 and Annex-5 of the Minutes of Discussions (M/D) signed by both sides on April 27, 2004.

3. Schedule of the Study

JICA will complete the Final Report in accordance with the confirmed items and send it to the Uzbekistan side by the end of November, 2004.

4. Other Relevant Issues

(1) The Uzbekistan side shall allocate the budget for undertakings to be done on a timely manner by the Uzbekistan side, which were shown in Annex-5 of the M/D signed by both sides on April 27, 2004.

(2) The Uzbekistan side shall allocate the budget for transportation of the equipment from the handing over point in Tashkent to each provincial office.

(3) The Uzbekistan side shall conduct the installation work at their own expenses for the equipment for which installation work is required

(4) The Uzbekistan side shall allocate the necessary budget required for test-running and adjustment of the equipment, and fuel and materials for training.

(5) The Uzbekistan side shall conduct the necessary procedures including vehicle registration and acquisition of license plate at their own expenses required for vehicle type equipment like dump truck.

(6) The Uzbekistan side shall assign an appropriate number of counterpart personnel(s) during the installation and workout period for the mobile asphalt plant in Kashkadarya and Surkhandarya Provinces to obtain the operation skills from the Japanese side.

(7) Both sides agreed to set following six items as objectively verifiable indicators of the road rehabilitation project which will be implemented as the results of this Project.

a) Quantity of rehabilitation works on the target roads.
b) Service hours/distance of equipment procured through this Project.
c) Traffic data on target roads.
d) Running hours of regular buses between Samarkand and Termez.
e) Hours/days of road closure of vehicle in winter.
f) Total length of painted lane marks.

Uzbekistan side shall start the base-line survey of the above mentioned items from September 2004 to collect quarterly data and submit the results to Japanese side by the end of 2005. Uzbekistan side shall also collect quarterly data and submit the results to Japanese side once a year in the period of 2006 to 2013.

The Basic Design Study
on the Project for Improvement of Equipment
for Road Construction and Maintenance (Phase II)
in the Republic of Uzbekistan

Technical note on additional requirement for the equipment within the project for road construction and maintenance

We confirm that the UZAVTOYUL headquarter submits to request additional equipment as follows under this project:

1. Bulldozer (As for outline spec. and quantity by Provincialavtoyul, please be referred to an attached list)

Reasons: Although this item was not contained in the initial request list of the equipment, the Provincialavtoyuls recognize that it is required to supplement feeding operation of the aggregate at the newly procured asphalt mixing plant, to improve the lower / upper slopes of the mountainous high cut sections, and to reinforce any other earth works/base course works for the expansion scheme of the target roads.

2. Cargo Truck with Crane(As for outline spec. and quantity by Provincialavtoyul, please be referred to an attached list)

Reasons: Currently the pothole repair works are mostly accomplished by the following method;- A cold asphaltic materials loaded onto the Russian truck of 1980s make together with several workers is brought to the spot. Workers lay that cold asphalts right into the potholes and let them be compacted naturally by the running automobiles on the road. Since such compaction of the materials on potholes would not be finished sufficiently, the duration life due from the repairs could not be expected for a long time. Therefore, after discussions with the consulting team, the Uzavtoyul headquarter submits to request the cargo truck with a crane for the loading, unloading and transportation of the specified equipment, the Tamper and Hand guide Roller which are listed to be requested below for the improved repair method of potholes/deteriorated area on the target road in the process of the routine and medium repairs program.

While, this equipment will be generally used for the works which requires the operations of loading, transportation and unloading of the variety of construction materials, such as a sample materials, soil/stone materials, concrete secondary products, and an installment works of the concrete curbs/median concrete blocks/ concrete pipe culverts, or masonry work and stone pitching/ concrete

block works.

3. Tamper (As for outline spec. and quantity by Provincialavtoyul, please be referred to an attached list)

Reasons: In case of small pothole repair, the Uzavtoyul considers that this equipment should be used in order to maintain the specified compaction quality. While, this item shall be generally used for the compaction works of the slope protection or the basement for the structures including new asphaltic mixing plant, etc. Hereupon the Uzavtoyul submit to request this item under the project.

4. Hand Guide Roller(As for outline spec. and quantity by Provincialavtoyul, please be referred to an attached list)

Reasons: In case of repair works of larger pothole or deteriorated strips on the target road, Uzavtoyul considers that Hand Guide Roller should be used for a compaction works of the repaired subgrade, base course and asphaltic materials in order to maintain the specified quality, so Uzavtoyul submit to request this item under this project.

Tashkent, May 13, 2004

Yoichi Higaki
Chief Consultant
Basic Design Study Team
Japan International Cooperation Agency

Azlar Mukhamedov
Leader of Working Group
Director of Road Consulting Bureau
State Joint Stock Company UZAVTOYUL

Annex 2. The Expected equipment for road rehabilitation by provincial Avtoyul

			Specification	UZAVTOYUL HQ	Samarqand Avtoyul	Kashkadaria Avtoyul	Surkhondaria Avtoyul	**Total**
1	Motor Grader	M	meduim type; blade 3,7 m;		2	2	2	**6**
2	Dump Truck	S	10 ton		2	2	2	**6**
3	Asphalt Hand Sprayer	S	bitumen tank with asphalt heater, compressor, sparyer; diesel or propane		2	2	2	**6**
4	Roller	M	smooth, 5 ton, vibratory		1	1	1	**3**
5	Pneumatic Tired Roller	M	10 ton		1	1	1	**3**
6	Pick-up Truck	O	4x4, 5 person		1	2	1	**4**
7	Water Tank Truck	M	8000 litres		1	1	1	**3**
8	Multi Purpose Truck	S	snow blowing, de-icing		1	1	1	**3**
9	Road Line Marker	O	truck-mounted, line width 10-15 cm, hot or cold paint		1	1	1	**3**
10	Asphalt Finisher	M	wheel type, 2-4,5 m (w)		1	1	1	**3**
11	Asphalt Distributor	M	4,5 m (max), 6000 litres		1	1	1	**3**
12	Trailer Head	M				1	1	**2**
13	Trailer Truck	M	30 ton capacity			1	1	**2**
14	Road Planer	S	cutting width 1000 mm		1	1	1	**3**
15	Mobile materials testing laboratory	O		1*				**1**
16	Mobile Asphalt mixing plant	A	50 cubic meters per hour		1	1	1	**3**
17	Mobile Workshop	O	crane, generator/welder, compressor, electric grinder, drill, hydraulic press, engine and mechanic tools, lubrication equipment		1	1	1	**3**
18	Excavator	M	0,8 cubic meters bucket		1	1	2	**4**
19	Wheel Loader	A	2,5 m3, 12 ton		2	2	3	**7**
20	Truck Crane	O	25 ton			1	1	**2**
21	Bull Dozer	A	medium, single ripper, 19-20 ton, universal blade		1	1	1	**3**
22	Air Compressor with Wheel	M	8 m^3 per minute, on wheels, draw-type		1	1	1	**3**
23	Cargo Truck with Crane	S	hydraulic crane 3 ton, cargo truck - 4 ton		1	1	1	**3**
24	Tamper	S	60 - 80 kg		3	3	3	**9**
25	Hand Guide Roller	S	700 - 900 kg, width 0,8 - 1.0m		2	2	2	**6**
								0
	Total			**1**	**28**	**32**	**33**	**94**

* UZAVTOYUL HQ is responsible for the use of the mobile materials testing laboratory in the required work sites of all three provinces

The Basic Design Study
on the Project for Improvement of Equipment
for Road Construction and Maintenance (Phase II)
in the Republic of Uzbekistan

Technical note on additional requirement for the equipment within the project for road construction and maintenance

We confirm that the UZAVTOYUL headquarter submits to request additional equipment as follow under this project:

1. Air Compressor (As for outline spec. and quantity by Provincialavtoyul, please be referred to an attached list)

Reasons: Although this item was not contained in the initial request list of the equipment, the Provincialavtoyuls recognize that it is required to clean up the surface of roads before spraying the emulsion in order to get a good result of the repairing works of roads. Air compressor with wheel is the most popular and necessary equipment to clean up the surface of roads.

Tashkent, May 13, 2004

Yoichi Higaki
Chief Consultant
Basic Design Study Team
Japan International Cooperation Agency

Azlar Mukhamedov
Leader of Working Group
Director of Road Consulting Bureau
State Joint Stock Company UZAVTOYUL

Appendix 5. Decision (Conclusion) of State Ecological Expertise

Appendix 5

STATE COMMITTEE FOR NATURE PROTECTION OF THE REPUBLIC OF UZBEKISTAN

September 8, 2004 No. 18/302

To: A.C. Mukhamedov
Director of "Road Consulting Bureau"

Copy to: R. T. Safarova - Chairman of Surkhandaria province committee for nature protection

Copy to: S. S. Isambaev – Chairman of Samarkand province committee for nature protection

Copy to: P. R. Suvanov - Chairman of Kashkadaria province committee for nature protection

DECISION (CONCLUSION)
of State Ecological Expertise

Project title	- Assessment of Environmental Impact of the road rehabilitation works on the road "Samarkand – Guzar - Termez"
Client	- State Joint Stock Company "UZAVTOUL"
Implementing Agency	- Road Consulting Bureau

Materials of ecological aspects of the project of rehabilitation of automobile road "Samarkand – Guzar - Termez", including procurement of road construction equipment for the road maintenance organizations, were submitted for the State Ecological Expertise.

According to the project, necessity for procurement of equipment related with the present condition of roads and road maintenance organizations. The roads are worn-out and 50% of existing machinery is not operating.

Condition of the road "Samarkand – Guzar - Termez" was found unsatisfactory by the specialists. Length of the road is 378 km, and the longest section is in Kashkadaria province (176 km). The survey of the road by Japanese specialists confirmed the necessity of urgent rehabilitation works. Assessment of present condition showed that all the road pavement along this road and bridge piers were greatly damaged. In the first phase of rehabilitation works road construction equipment and machinery, such as graders, excavators, towing tractors, wheel loaders, rollers, asphalt finishers and asphalt plants, will be procured for provincial road maintenance organizations.

Number of equipment necessary for the rehabilitation of each section of the target road is justified in the project. Each province has an asphalt mixing plants, but most of them are too old, with decreased productivity and can not answer to the requirements of air pollution norms. That's why this project justifies the necessity of new asphalt mixing plants for each province.

Selection of placement of equipment, especially asphalt mixing plants will be carried out by other projects.

Execution of next phase - 5 year road rehabilitation works will be carried out with ecological control stated in the law.

Calculated environmental effectiveness of the project of procurement of road construction equipment to the provincial road maintenance organizations is 40% decrease of air pollution – emission of contaminants to the atmosphere.

The ecological expertise showed, that the project of procurement 70 of road construction equipment to the provincial (Samarkand, Kashkadaria and Surkhandaria provinces) road maintenance organizations will reduce potential ecological risk, emerging from the use of old equipment and machinery. Project includes control and diagnostics of contaminants emission.

The State Ecological Expertise of the Nature Protection Committee of the Republic of Uzbekistan approves the project of Assessment of Environmental Impact of the project of procurement 70 of road construction equipment to the provincial road maintenance organizations for the road rehabilitation works on the road “Samarkand – Guzar - Termez”.

Ecological control of the installation of asphalt plants and the road rehabilitation works will be carried out as separate projects according to the law.

Nature Committees of Samarkand, Kashkadaria and Surkhandaria provinces shall control observance of nature protection laws during the implementation of this project of procurement of road construction equipment to the provincial road maintenance organizations for the road rehabilitation works on the road “Samarkand – Guzar - Termez”.

Acting Chairman B. Alikhanov

O`ZBEKISTON RESPUBLIKASI
TABIATNI MUHOFAZA QILISH
DAVLAT QO`MITASI

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STATE COMMITTEE FOR
NATURE PROTECTION OF
THE REPUBLIC OF
UZBEKISTAN

700084. Tashkent, A.Temur St 99.
tel.: 135-18-65; 135-16-65 fax: 135-07-61

200 4 yil « 8 » сентября № 18/302

на № 397 от 28.08.2004 г.

Директору
«Йул-лойиха бюроси»
МУХАМЕДОВУ А.С.

копии: И.о. Председателя
Самаркандоблкомприроды
ИСАМБАЕВУ С.С.

Председателю
Сурхандарьяоблкомприроды
САФАРОВОЙ Р.Т.

Председателю
Кашкадарьяоблкомприроды
СУВАНОВУ П.Р.

ЗАКЛЮЧЕНИЕ

Государственной экологической экспертизы

По объекту - ОВОС техперевооружения дорожных служб, обслуживающих автомобильную дорогу «Самарканд-Гузар-Термез».
Заказчик - ГАК «Узавтойул».
Разработчик – «Йўл-лойиха бюроси».

На государственную экологическую экспертизу представлены материалы первого этапа экологического сопровождения проекта реабилитации автомобильной дороги «Самарканд-Гузар-Термез», включающей техперевооружение дорожных служб.

Необходимость техперевооружения, по данным проекта, связана с тем, что система автомобильных дорог и дорожных служб на территории Самаркандской, Кашкадарьинской и Сурхандарьинской областей в настоящее время изношена и не обеспечивает потребности автотранспорта, т. к. ~50 % техники находится в нерабочем состоянии.

Состояние дороги «Самарканд-Гузар-Термез» также признано специалистами неудовлетворительным. Протяженность трассы составляет 378 км, из которых самым протяженным является Кашкадарьинский участок (176 км). Обследование дороги японской миссией подтвердило необходимость срочного проведения реабилитационных работ. Оценка современного состояния, представленная проектом показала, что на протяжении всей трассы наблюдаются повреждения дорожного покрытия и разливы мостовых опор. В качестве первого этапа реабилитационных мероприятий проектом предлагается техперевооружение дорожных служб с оснащением их следующей техникой: автогрейдеры, бульдозеры, экскаваторы, тракторы, погрузчики, катки, асфальтоукладчики, асфальтобетонные заводы.

По каждому участку, обслуживаемой дороги проектом обосновывается количество требуемой техники и оборудования. В областях имеются асфальтобетонные установки, но они изношены и не могут обеспечить необходимую производительность и очистку выбросов загрязняющих веществ в атмосферу, поэтому проектом обосновывается необходимость размещения в каждой из областей по одному АБЗ.

Выбор площадок для размещения технологического оборудования, в частности АБЗ, планируется производить отдельными проектами.

Разработка следующего этапа реабилитации автомобильной дороги – её реконструкция, предусматривается отдельным 5-летним проектом с соответствующим законодательству экологическим сопровождением.

Расчетная экологическая эффективность от улучшения технического состояния транспортных средств и дорожной техники основана на снижении выбросов загрязняющих веществ в атмосферу и составляет ~40 %.

Проектом рекомендовано оснащение дорожных служб оборудованием для проведения диагностики двигателей и топливной аппаратуры, газоанализаторами, дымомерами, приборами для контроля режима потребления топлива.

Экологическая экспертиза показала, что проект техперевооружения дорожных служб с поставкой 70 единиц дорожно-строительной техники в Самаркандскую, Кашкадарьинскую и Сурхандарьинскую области приведет к снижению потенциального экологического риска, возникающего при эксплуатации изношенной техники. Следует согласиться с необходимостью предложенной проектом системы диагностики, включающей контроль эмиссии отработанных газов.

Государственная экологическая экспертиза Госкомприроды Республики Узбекистан **согласовывает** проект ЗВОС техперевооружения дорожных служб, обслуживающих трассу «Самарканд-Термез».

Экологическое сопровождение строительства асфальтобетонных заводов и реконструкции автодороги следует разработать отдельным проектом и представить на государственную экологическую экспертизу в установленном законодательством порядке.

Самаркандскому, Кашкадарьинскому и Сурхандарьинскому областным комитетам по охране природы необходимо взять под контроль соблюдение природоохранного законодательства при техперевооружении дорожных служб трассы «Самарканд-Термез».

И.о. Председателя Б. АЛИХАНОВ

Королёва Н.В., тел.133-54-61

Appendix 6. The letter from the Republican Road Fund

Appendix 6

Unofficial translation

Republican Road Fund of the Ministry of Finance of the Republic of Uzbekistan

Dated: September 6, 2004 No. 28-06-637

To: SJSC "UZAVTOYUL"

After careful review of the presented documents regarding the possibility of obtaining Government of Japan's Grant Aid for the procurement of the road construction equipment and machinery for the repair and maintenance of the target road "Samarqand – Guzar – Termez" in the length of 378 km, Republican Road Fund of the Ministry of Finance of the Republic of Uzbekistan approves the project budget for the period of 2006-2010 for the repair and maintenance of the above-mentioned route in the amount of 32.5 billion uzbek sums according to the approved annual budgets.

Executive Director T. Vahabov

O'ZBEKISTON RESPUBLIKASI
MOLIYA VAZIRLIGI
HUZURIDAGI
RESPUBLIKA YO'L JAMG'ARMASI

РЕСПУБЛИКАНСКИЙ
ДОРОЖНЫЙ ФОНД ПРИ
МИНИСТЕРСТВЕ ФИНАНСОВ
РЕСПУБЛИКИ УЗБЕКИСТАН

«6» сентября 2004 у. № ЙЙВ/28-06-637

«____» _____ 200___г. №_____

Государственно-акционерной

компании "Узавтойул"

На Ваше письмо № 5/5-673 от 04.08.2004 г.

Изучив представленную документацию, касательно предоставления безвозмездной помощи Правительства Японии в виде дорожно-строительной техники и оборудования для содержания и ремонта автодорожного маршрута по направлению «Самарканд-Гузар-Термез» протяженностью 378 км, Республиканский дорожный фонд при Министерстве финансов Республики Узбекистан одобряет проект лимитов на период 2006-2010 г.г. на реконструкцию, ремонт и содержание по указанному маршруту в сумме 32,5 млрд. сум с обеспечением финансирования в соответствии с утвержденными титульными списками в установленном порядке.

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