NO.

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR IMPROVEMENT OF EQUIPMENT FOR ROAD MAINTENANCE
IN
NARYN OBLAST
IN
THE KYRGYZ REPUBLIC

MAY 2006

JAPAN INTERNATIONAL COOPERATION AGENCY

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Preface

In response to a request from the Government of the Kyrgyz Republic, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Equipment for Road Maintenance in Naryn Oblast in the Kyrgyz Republic and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to the Kyrgyz Republic a study team from September 27 to October 24, 2005.

The team held discussions with the officials concerned of the Government of the Kyrgyz Republic, 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 the Kyrgyz Republic 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 Kyrgyz Republic for their close cooperation extended to the teams.

May 2006

KUROKI Masafumi
President
Japan International Cooperation Agency

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Improement of Equipment for Road Maintenace in the Kyrgyz Republic.

This study was conducted by Katahira & Engineers International, under a contract to JICA, during the period from September 2005 to May 2006. In conducting the study, we have examined the feasibility and rationale of the Project with due consideration to the present situation of the Kyrgyz Republic and formulated the most appropriate basic design for the Project under Japan's grant aid scheme.

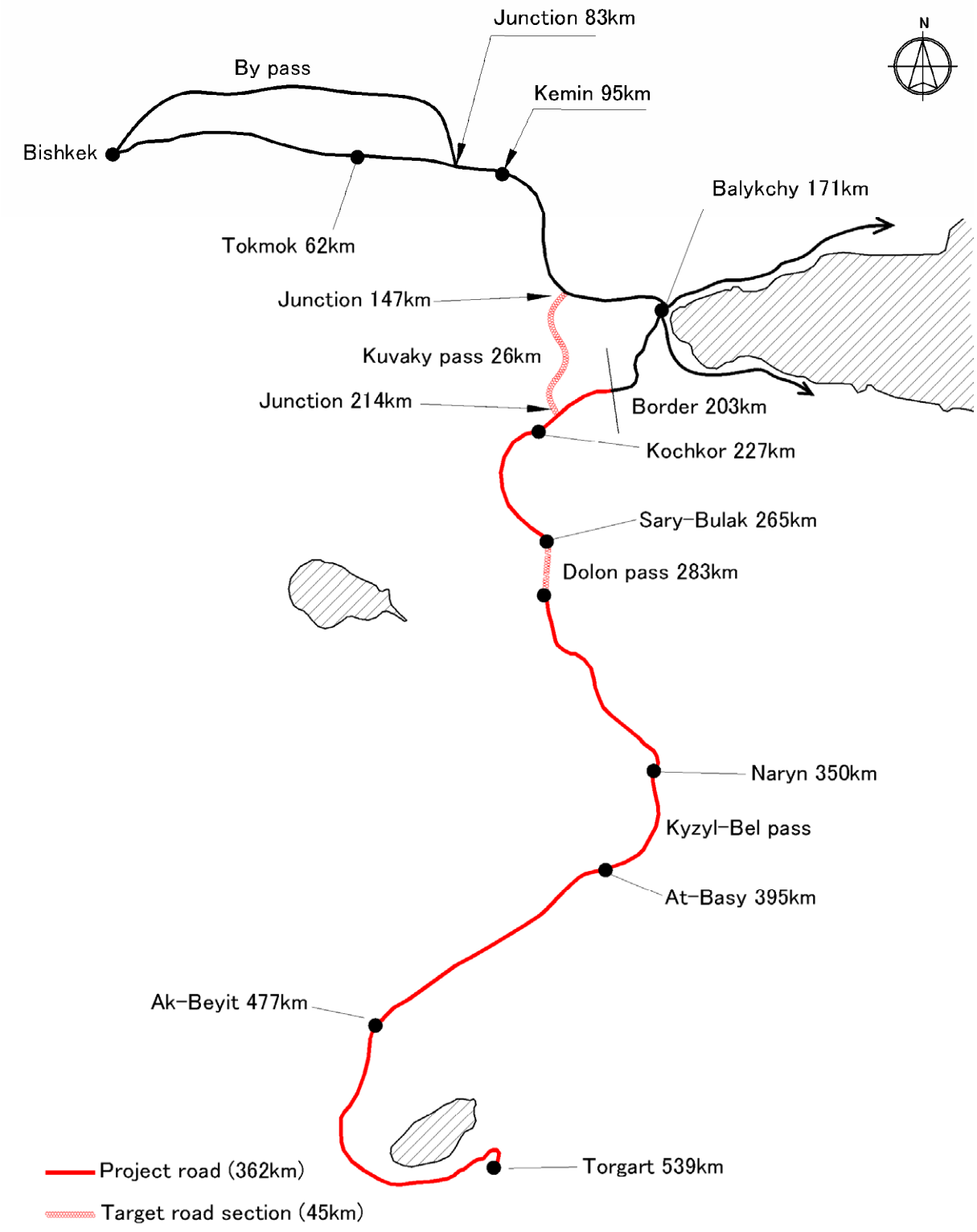
Finally, we hope that this report will contribute to further promotion of the Project.

Very truly yours,

May 2006

SATO Tadashi
Chief Consultant,
Basic Design Study Team on The Project for
Improvement of Equipment for Road Maintenance
in Naryn Oblast in the Kyrgyz Republic
Katahira & Engineers International

Location Map


Junction 83km
N
By pass
Kemin 95km
Bishkek
Balykchy 171km
Tokmok 62km
Junction 147km
Kuvaky pass 26km
Junction 214km
Border 203km
Kochkor 227km
Sary-Bulak 265km
Dolon pass 283km
Naryn 350km
Kyzyl-Bel pass
At-Basy 395km
Ak-Beyit 477km
Torgart 539km
Project road (362km)
Target road section (45km)

Route Map

Procuament Eguipment

Excavator

Wheel Loader (1)

Wheel Loader (2)

Dump Truck

Truck with Crane

Truck Trailor

Hand Breaker

Hydraulic Breaker

Aggregate Plant

Motor Grader

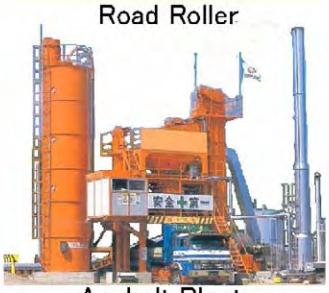
Stabilizer

Hand Guide Roller

Road Roller

Tire Roller

Vibration Compactor



Asphalt Plant

Asphalt Finisher

Asphalt Sprayer

Water Tank Truck

Mobile Workshop Truck

Concrete Cutter

Snow Removing Truck

Compressor

List of Figures & Tables

Abbreviations

AC	Asphalt Concrete
A/C	Approval by Cabinet
ADB	Asian Development Bank
BHN	Basic Human Needs
CIS	Commonwealth of Independent States
DAC	Development Assistance Committee
E/N	Exchange of Notes
F/R	Final Report
F/S	Feasibility Study
GDP	Gross Domestic Product
GNI	Gross National Income
IDB	Asian Development Bank
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
M/D	Minutes of Discussions
MOTC	Ministry of Transport and Communication
ODA	Offical Development Assistance
RMC	Road maintenance Companies
SBST	Single Bituminous Surface Treatment
T/N	Tender Notice
UN	United Nations
V/C	Verification of Contract
WB	World Bank

Summary

The Kyrgyz Republic is situated in the north-east of Central Asia, with a population of 5.26 million people. In the Kyrgyz Republic, road transport is the predominant mode of transportation, accounting for more than 90% of freight and passenger movements, and is the important economic infrastructure. Both freight and passenger transport heavily relies on road network constructed during the Soviet era, and since achieving its independence in 1991, civil wars and stagnation of the economy have made it difficult to secure adequate road maintenance, and road surface condition has been heavily deteriorated. Furthermore, breakdown or overage of road maintenance equipment are making recovery works from an avalanche or a landslide extremely difficult. It is detrimental not only to transportation of goods necessary for people's lives, but also to trading with neighboring countries, and is the bottleneck for the economic growth.

An investment in the road sector in the Kyrgyz Republic has been focused mainly on the Bishkek-Osh road, which connects the capital of the Kyrgyz Republic and southern part of the Fergana basin as well as southern region, where about half of the pollution lives. The Bishkek-Osh road is the largest road for freight traffic and leads to each neighboring countries. As a result, the budget allocated for the Bishkek-Torugart road, which is the subject of this study, has been limited, and thus the road maintenance has not been adequately provided for more than 10 years, causing severe damages to road pavement over the years.

It was against this background that the Kyrgyz Republic has prepared, as the trunk road development plans for the future, the construction plans for 1) Bishkek-Torugart section of the trunk road which connects the capital and the southern region (539 km) and 2) Balykchy – Karakol – Balykchy section of the road (512 km) which runs around the lake Issyk-Kul, famous for its rich tourist resources, and requested grand aid for procuring construction and maintenance equipment necessary for rehabilitation of both trunk roads.

Although both rehabilitation plans are to secure smooth road transportation, the Japanese Government has decided to conduct the baseline survey on procurement of road construction and maintenance equipment necessary for rehabilitating the Bishkek-Torugart section of the trunk road (539km), which mostly runs through the mountain area and is considered more in need of urgent rehabilitation. The Japan International Cooperation Agency (JICA) dispatched the baseline study team to the Kyrgyz Republic from September 27 to October 25, 2005. The study team confirmed and discussed details of the requests with the Ministry of Transport and Communications (MOTC), the executing agency of the plans, and conducted studies on capabilities for implementing road rehabilitation, as well as site survey and other related surveys on upper level plans and other donors. From the data collected by the study team, the road section subject to this project was finalized based on the following view points. The changes in equipment which this project aims to provide were also confirmed.

The Bishkek-Torugart road (539 km) surveyed runs through Chui, Issyk-Kul and Naryn regions. Of these three, Naryn region's major industry is stock farming such as grazing, and the number of poor people is high due to the poor industry activities. It is hoped that securing road traffic as the local infrastructure will invigorate the local economy, and contribute to the poverty reduction. Since most of the surveyed road (64%) is located in Naryn region, the road section in Naryn region is considered to have the high priority. On the other hand, since Chui region is blessed with rather good socioeconomic conditions, and the section of the road in Issyk-Kul is short, the priorities of Chui and Issyk-Kul are evaluated to be rather low. After having discussed with the Kyrgyz Republic side, it was agreed that this project will target 362km section of the road in Naryn region.

Also, in the original request, the major types of work in the trunk road rehabilitation plans by means of road construction equipment maintenance, was to improve the roads by widening, easing steep slopes and road curve, and implementing rock fall prevention measures, mainly in mountainous region such as the Dolon Pass. However, the survey showed that this rehabilitation would require large scale road rehabilitation works, and that larger equipment are required. The costs of construction works and the construction period will be enormous, beyond the range of normal road maintenance activities. Furthermore, advance surveying and geological research are required, and capabilities of the Kyrgyz Republic to implement road construction were found not to be enough. Therefore, it was agreed with the Kyrgyz Republic to reduce the number of equipment that are subject for cooperation, to those that are related to road maintenance activities, as listed below. Also, the types of major road maintenance works to be implemented on the target road in Naryn region are as follows:

- Pot hole repair
- Snow removal
- Recovery works in case of landslide disaster
- Repaving of Asphalt paved roads

Based on the results of field studies, the study team reviewed the range of this project, details on procurement of equipment, as well as details of technical cooperation and project expenses, and compiled them in the Basic Design Outline. JICA dispatched the study team from March 16 to March 28 in 2006 to explain and discusses about this outline with the Kyrgyz Republic, and reached a basic agreement on this issue.

The following shows an outline of the basic plans that are agreed upon.

① Necessary Equipment to be Procured

No.	Designation of the Equipment	Use	Specification	Q'ty
1	Excavator	Existing pavement excavation, removal and loading	Bucket Capacity $0.8m^3$ (pile) Class	1
2	Wheel Loader (1)	Material delivery within plant area	Bucket Capacity $2.0m^3$ Class	1
3	Wheel Loader (2)	Existing pavement excavation, removal and loading	Bucket Capacity $2.5m^3$ Class	1
4	Dump Truck	Delivery of excavated debris and asphalt mixture	Load Capacity 10t、4×4 Class	6
5	Truck with Crane	Equipment delivery	Load Capacity 4t、Crane Capacity 3t Class	4
6	Truck Trailer	Equipment deadhead	Load Capacity 25t Class	1
7	Hand Breaker	Existing pavement exvation	Equipment Body 7kg Class	8
8	Hydraulic Breaker	Existing pavement excavation at the time of reinstallation	Weight 1,600kg Class	1
9	Aggregate Plant	Production of material	Capacity 35t/h Class	1
10	Motor Grader	Grading of new roadbed	Blade Length 3.7m Class	1
11	Stabilizer	Excavation and improvement of existing roadbed	Revamp Width 2.0m Class	1
12	Hand Guide Roller	Compacting of repair material	Weight 600kg Class	4
13	Road Roller	Initial compaction of roadbed material and asphalt mixture	Weight 9,500kg Class	1
14	Tire Roller	Secondary compaction of roadbed material and asphalt mixture	Empty Weight 8,500kg Class	1
15	Vibration Compactor	Compaction of repair material (Road edge)	Weight 54kg Class	8
16	Asphalt Plant	Production of asphalt mixture	Capacity 35t/h Class	1
17	Asphalt Finisher	Leveling of applied asphalt mixture	Finish Width 2.0～4.4m Class	1
18	Asphalt Sprayer	Spreading of tack coat	Tank Capacity 400ℓ Class、Towed	5
19	Water Tank Truck	Adjustment of water content of roadbed material and roller water supply	Tank Capacity 8,000ℓ Class	1
20	Mobile Workshop Truck	Maintenance of machinery within the site	Load Capacity 3.9t、4×4 Class, Crane Equipped	1
21	Concrete Cutter	Cutting of existing pavement	Cutting Depth 120mm Class	5
22	Snow Removing Truck	Removal of snow	Snowplow3.1m、4×4 Class	4
23	Compressor	Supply of compressed air and cleaning of the road surface	Discharge Rate $5.0m^3$/min Class Towed	4
24	Spare Parts	Maintenance of equipment to be procured	—	1Set

② Technical Assistance

In this project, in order to strengthen the road maintenance capabilities of the executing agency, mixture of various equipment will be installed on the field. Also, by assisting road rehabilitation technique such as comprehensive use of equipment to effectively implement the work, a soft component will be introduced with the goal set to effectively and efficiently perform road maintenance and rehabilitation under the limited budget.

In case this plan is to be implemented by grant aid, the total project cost amounts to be 573 million yen by estimate (572 million yen will be financed by Japan and 1.40 million yen by the Kyrgyz Republic).

Also, in order to implement this plan, a total of 15 months will be needed; 4 months for creating execution design, 6 months for manufacturing equipment, 2 months for transporting equipment, 2 months for installation, adjustments, handover, and initial operation instruction, and 1 month for a soft component (on site).

The major effects expected by implementing this plan are as follows:

Direct Effects

1) Improvement of the road function in Bishkek-Torugart Section in Naryn Region

By improving the road conditions of the Bishkek-Torugart road (362 km) in Naryn region and promptly taking measures against snowfall or landslide disaster, traveling on roads will become smoother. Especially, for heavily traveled areas that have high priority , such as 26km to 214 km section (Kuwakui Pass) and 262km to 281 km section (around Sary-Bulak), it is confirmed that the Kyrgyz Republic will repave the roads within 4 years of procuring equipment.

2) Improvement in road maintenance equipment.

Since 62 units of road maintenance equipment will be procured, efficiency of road maintenance work as well as its quality will be improved.

3) Improvement in road maintenance

As spare parts of equipment and a truck designated to repair equipment will be procured, periodic maintenance of equipment can be realized.

4) Improvement in technology necessary for designing and supervising construction works effectively using road maintenance equipment.

Besides Initial operation instruction of equipment by contractors, a soft component will be implemented, which will provide diagnostic technique on deterioration of pavement, construction technique on how to combine equipment in each rehabilitation method, and management technique of equipment by forms control. By doing so, it is expected that the level of technical capabilities of the Kyrgyz Republic will be improved. As a result, more effective and efficient road maintenance and rehabilitation will be performed and construction performance (volume, quality, etc) will increase.

Indirect Effects

1) Promotion of physical and human exchanges

As it becomes easier to travel by roads and the functions as international trunk roads improve, smooth distribution of daily commodity, agricultural products, and stock farm products will be secured and interaction or movement of people as well as development of new land will be promoted, contributing to reduction of the poverty in Naryn region (about 286 thousand people in Naryn region will benefit).

2) Social and economic revitalization

With increased physical and human exchanges, living conditions will be improved and revitalization of social and economic activities is expected (about 5.06 million people in the Kyrgyz Republic will benefit).

3) Improvement in living conditions during winter time

As snow will be removed more easily in the snow zone during winter time, closure of the road due to snowfall will be prevented, and transportation of residents in the vicinity of this area as well as smooth distribution of goods will be secured, contributing to the improvement in living conditions.

It is considered reasonable that this project is executed with the grant aid by Japan, based on the perspectives that the road section subject to this project is heavily deteriorated and urgent rehabilitation is necessary to restore its function, operation and maintenance of equipment procured can be carried out by the Kyrgyz Republic using their own resources, personnel and technology, and smooth transportation in Naryn region is expected as the outcome of the project, which contributes to the socioeconomic development and poverty reduction in the region.

The following suggestions are made in order to better manifest and maintain the effectiveness of this project plan.

1) In this project, in order for the executing agency to perform road maintenance effectively and efficiently under the limited budget, a soft component will be introduced so that comprehensive road maintenance technique, including equipment operation, can be acquired. This soft component needs to be completed by October, before suspending the works during the winter time due to heavy snowfall in the region. Therefore, it is necessary to have a thorough discussion with parties involved so that the delivery of equipment procured to the field and installation works are performed according to the project operation process, and the budgetary steps are taken by the Kyrgyz Republic side for the portion to be borne.

2) In order to secure a budget needed for road maintenance, it is necessary to develop a concrete road rehabilitation work plan on the target road section, and to try to obtain cooperation from agencies involved so that the plan is executed steadily.

3) It is desirable to promote the introduction of computer system to ensure efficient management of maintenance history, as well as the records of stock, usage, order and delivery of parts and components.

4) Recently, in the road section subject to this project, the traffic of heavy vehicles is increasing. In order to maintain good road conditions which are expected to be realized by this plan for a long period of time, it is necessary to promote installation of vehicle weighing equipment, and to enhance regulations on the passage of heavy vehicles.

Table of Contents

Chapter 1　Background of the Project

1-1　Background and Summary of the Grant Request

The Kyrgyz Republic is a landlocked country situated in the northeastern part of Central Asia. In the Kyrgyz Republic, road transport is the predominant mode of transportation, accounting for more than 90% of freight and passenger movements, and is the important economic infrastructure. Both freight and passenger transport greatly rely on road network established during the Soviet era, however, the road condition has been deteriorated because of civil wars and the stagnant economy since its achievement of independence in 1991. It is detrimental not only to transportation of goods necessary for people's lives, but also to trading with neighboring countries, and has become the bottleneck for the economic growth.

The current situation of the road sector is that road surface condition has been heavily deteriorated due to lack of appropriate maintenance in the Soviet era as well as insufficient financial resources and its resultant inadequate maintenance after its independence. In addition, breakdown or overage of road maintenance equipment makes recovery works from avalanches or snowmelt landslides extremely difficult.

MOTC, which is the implementing body, fully recognizes the importance of enhancing both domestic and international logistics through appropriate road transportation in order to develop industries, both in urban and rural areas, and established the Road Network Development Plan in 1993, targeting the year 2000. In 1996, the Kyrgyz government received loans from JBIC and ADB on road rehabilitation between Bishkek and Oshu, that is the only trunk road connecting the north and south regions, which greately contributed to the economic development in both regions.

It was against this background that the Kyrgyz Republic has prepared, as the trunk road rehabilitation plans for the future, the construction plans for 1) Bishkek-Torugart section of the trunk road which connects the capital and the southern region (539 km) and 2) Balykchy – Karakol – Balykchy section of the road (512 km) which runs around the lake Issyk-Kul, famous for its rich tourist resources, and requested grand aid for procuring construction and maintenance equipment necessary for rehabilitation of both trunk roads.

Although both rehabilitation plans are to secure smooth road transportation, the Japanese Government has decided to conduct the basic design study on the procurement of road construction and maintenance equipment necessary for rehabilitating the Bishkek-Torugart section of the trunk road (539km), which mostly runs through the mountain area and is considered more in need of urgent rehabilitation.

Responding to this request, the Japan International Cooperation Agency (JICA) dispatched the basic design study team to the Kyrgyz Republic from September 27 to October 25, 2005. The study team confirmed and discussed details of the requests with the Ministry of Transport and Communications (MOTC), the executing agency of the plans, conducted studies on its capabilities for implementing road rehabilitation, as well as a site survey and other related surveys on upper level plans and with other donors and collected the data necessary for the implementation of the Project.

Chapter 2 Contents of the Project

2-1 Outline of the Project

The Kyrgyz Republic has prepared, as the trunk road rehabilitation plans for the future, the construction plans for 1) Bishkek-Torugart section of the trunk road which connects the capital and the southern region (539 km) and 2) Balykchy – Karakol – Balykchy section of the road (512 km) which runs around the lake Issyk-Kul, famous for its rich tourist resources, and requested grand aid for procuring construction and maintenance equipment necessary for rehabilitation of both trunk roads.

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The Bishkek-Torugart road (539 km) surveyed runs through Chui, Issyk-Kul and Naryn provinces. Of these three, Naryn province's only major industry is stock raising such as grazing, and a large percentage of population is impoverished due to its poor industry activities. It is hoped that securing road traffic as the local infrastructure will invigorate the local economy, and contribute to the poverty reduction. Since most of the surveyed road (64%) lies in Naryn region, the road section in Naryn region is judged to have the high priority. On the other hand, since Chui region is blessed with rather good socioeconomic conditions, and the section of the road in Issyk-Kul is short, the sections of Chui and Issyk-Kul are evaluated to be of rather low priority. After having discussed with the Kyrgyz Republic side, it was agreed that this Project will target 362km section of the road in Naryn region.

Also, in the original request, the major types of work in the trunk road rehabilitation plans by means of road construction equipment maintenance, was to improve the roads by

widening, easing steep slopes and road curve, and implementing rock fall prevention measures, mainly in mountainous region such as the Dolon Pass. However, the survey found out that this rehabilitation would require large scale road rehabilitation works requiring civil engineering, and that many large-types of equipment would be required. The costs of construction works and the construction period will be enormous exceeding the range of normal road maintenance activities. Furthermore, preliminary surveying and geological research are required, and capabilities of the Kyrgyz Republic to implement road construction were revealed insufficient. Accordingly, it was agreed with the Kyrgyz Republic to select the equipment related to road maintenance activities, as listed below. Also, the types of major road maintenance works to be implemented on the Project road in Naryn region are as follows:

- Pot hole patchwork
- Snow removal
- Recovery works after landslide disaster
- Repaving of Asphalt paved roads

Based on the results of these field studies, the study team reviewed the range of this Project, details on procurement of equipment, as well as details of technical cooperation and Project expenses, and compiled them in the Basic Design Report. JICA dispatched the study team in March 2006 to explain and discusses about this outline with Kyrgyz Republic, and reached a basic agreement on this issue.

The Project aims to carry out regular and quality road maintenance works between Bishkek and Torugart by procuring necessary road maintenance equipment. The Project is designed to assure smooth transportation in Naryn region and contributes to social and economic developments as well as to poverty reduction.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Narrowing Down the Project Route

The Bishkek- Torgart road, to be covered in the study ("the Project road"), runs through three provinces—Chui, Issyk Kul and Naryn—and has a length of 539 km. If, instead of passing through Balykchy in Issyk Kul province, a shortcut constituted by the 26 km section of the Kuvaky Pass is added, the total length becomes 565 km. Table 2-2-1.1 hereunder shows an overview of the Project road management.

Table 2-2-1.1 Overview of the Project Road Management

Motor Road Line Control Divisions (MRLCDs)	Total length of roads under its jurisdiction	Average budget per km	Existing equipment and rate of operation		Section of the Project road for which it is responsible		Degree of priority
MRLCD No. 1 (Chui)	3,052.9km	18,800som/km	312 machines	70%	129km	23%	△
MRLCD No. 3 (Naryn)	3,452.8km	5,097som/km	287 machines	51%	362km	64%	◎
MRLCD No. 4 (Issyk Kul)	2,977.9km	5,070som/km	229machines	55%	74km*)	13%	○

*): The section under the jurisdiction of MRLCD No. 4 becomes 18 km (from Km 129 to Km 147) if the road takes the route through the Kuvaky Pass.

As can be seen from the above table, Chui province, where the capital is located and which constitutes the center of the Republic, has a favorable road maintenance environment and has been able to keep its road surfaces in relatively good condition.
In Naryn and Issyk Kul provinces, however, the road surfaces have been significantly deteriorated due to the aged road maintenance equipment and also perennial budget shortages.

Naryn province's only major industry is stock raising such as grazing, and a large percentage of population is impoverished due to its poor industry activities. It is hoped that securing road traffic as the local infrastructure will invigorate the local economy, and contribute to the poverty reduction. Since most of the surveyed road (64%) lies in Naryn region, the road section in Naryn region is judged to have the high priority. On the other hand, since Chui region is blessed with rather good socioeconomic conditions, and the section of the road in Issyk-Kul is short, the sections of Chui and Issyk-Kul are evaluated to be of rather low priority.

As a result of discussions with those concerned in the Kyrgyz government regarding the scope of the Project with consideration given to the above, it was agreed, as stated in the

minutes of discussion (M/D), that the Project road sections should be narrowed down to the 362 km length lying in Naryn Province. Also confirmed in the M/D is exclusion of the Kyzyl-bel Pass section from the Project in spite of its inclusion in those target sections, because a separate request for grant aid has been submitted as to the section.

(2) Types of Maintenance Works to be Implemented (Contents of Works)

Table 2-2-1.2 below lists up the maintenance works implemented and to be implemented by MRLCD in Naryn province.

Table 2-2-1.2 Contents of Road Maintenance Works

Type of works (work content)	Presently	In the Project	Remarks
Pothole patching	○	○	For the entire route (362 km)
Filling of cracks	○	×	(continuation of present work)
Surface treatment of deteriorated sections	○	×	(continuation of present work)
Correction of surface irregularity on gravel road sections	○	×	(continuation of present work)
Snow removal in the winter	○	○	For the sections under the jurisdiction of RMC No. 957
Recovery work after rock falls, avalanches, etc.	○	○	Coping with them by emergency mobilization
Overlaying	×	×	(sufficient effect cannot be expected)
Repaving	×	○	For selected sections with damaged pavement

In case of sections that require urgent repair due to pronounced deterioration of the pavement and those where the pavement has already been stripped at places and the damage is growing extensive, repaving is necessary since it is not possible to cope with just basic maintenance work or overlaying.

Based on analyses of the issues currently faced by the MRLCD in implementing road maintenance works under the supervision of the implementing body and the latest pavement condition regarding the trunk roads in Naryn province, the four types of road works were finally selected to be covered in this Project.

1) Pothole Patching

The current pothole patching work is a tentative method which allows vehicles to access to the repaired roads right after filling paving materials into the damaged parts, and expects the pressing effects by the passing vehicles, since there are no appropriate machineries and equipment. The fixing of repair materials is not sufficient and the inefficient works soon lead to repeated damages.

Therefore, a series of machineries and equipment for pothole repair is to be provided in order to carry out quality construction and sustainable and efficient repair works.

2) Snow Removal

During winter between October and March, the snowfall measures max. 1.5m in some areas, and therefore, clearing away snow that aims to secure traffic is the main task as a road maintenance activity. Roads, however, are sometimes closed without mobility because of absolute shortage of snowplows and low efficiency by decrepitude. The implementing agency clears snow by borrowing snowplows from other districts and governmental agencies, however, these snowplows are old and no efficient improvement has been achieved.

Therefore, machineries with high mobility and efficiency are to be provided in order to carry out effective snow clearing.

3) Recovery Work after Landslide Disaster

Rockfall continues around valleys and passes in the areas where exposed rocks have become vulnerable because of weathering. It often takes place during thaw in March and April and it takes time to arrange necessary machineries to remove collapsed earth, sand and rocks, since majority of such machineries are allocated in the areas of heavy snowfall in this season.

Therefore, minimum quantity of machineries, which can deal with large-scale landslides and large rocks, should be allocated for urgent situations.

4) Repaving of Road Sections with Damaged Pavement

Regarding the sections of excessively degraded pavements and already damaged by exfoliation, it is difficult to recover the pavement by such repair work as overlay, and is necessary to carry out pavement renovation, including roadbed improvement. Concerned department, however, does not have machineries for pavements and can not prevent the advance of degradation and damage. Therefore, machineries for renovation, including roadbed improvement, should be allocated to renew pavements of the sections with excessive degradation and damage.

(i) Road Sections Subject to Repaving

The condition of the road surface has been surveyed over the entire length of the target section. The survey items are as indicated below, and the road surface condition has been judged per lometer. In assigning evaluation points, an emphasis has been laid on items closely related to progressive destruction of the pavement, and mere deterioration of negotiability and slight damage have not been taken intoaccount.

- Flatness : evaluation of surface flatness on the basis of vehicle behavior (not of the smoothness of the surface course)
- Cracking : evaluation of extent of cracking by visual inspection
- Rutting : evaluation of depth of wheel ruts by visual inspection

The results of evaluation are provided in Figure 2-2-1. 1.

These results have been discussed with the Kyrgyz government, and an technical agreement has been signed between the Kyrgyz side and the study team on the candidacy for repaving of a total of 45 km of road length with considerable volume of traffic and high priority—from

Km 26 up to Km 214 (Kuvaky Pass) and from Km 262 to Km 281 (in the vicinity of Sary-Bulak).

(ii) Hypothetical Cross Section (assumed for the sake of calculation of the volume of work)

According to the Kyrgyz road classification system the entire Project road is classified asCategory 3. This category is defined as having a road width of 7.0 m consisting of two 3.50–m lanes. 10 cm has been chosen as the thickness of the AC layer referring to the IDB feasibility study report.

Since it is considered that subsidence, undulation, sharp drops in road level, ruts, etc. of the existing road affect as far as the roadbed, it will not be possible to achieve road surface flatness unless they are remedied before placement of the AC layer. That being the case, it will be necessary to break up the existing roadbed, correct irregularity and restore roadbed flatness before roller compacting as preparation for laying the AC layer.

The hypothetical cross section based on these conditions is indicated below as Figure 2-2-1.2 .

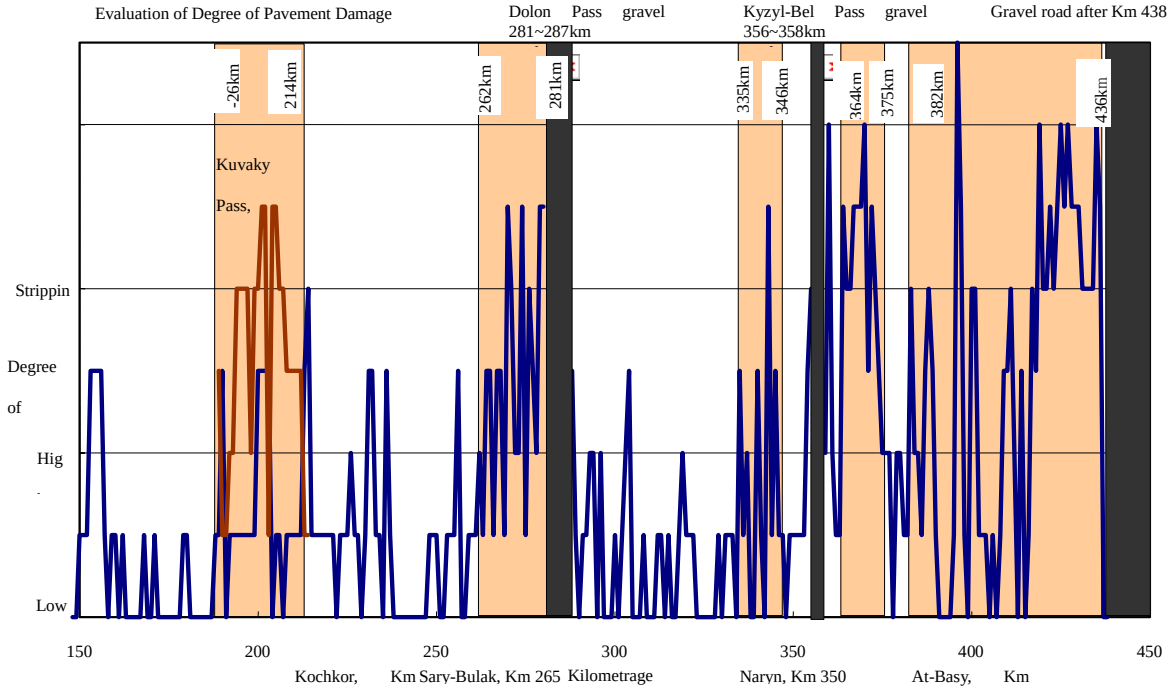

Figure 2-2-1.1 Results of Evaluation of Condition of Road Surface

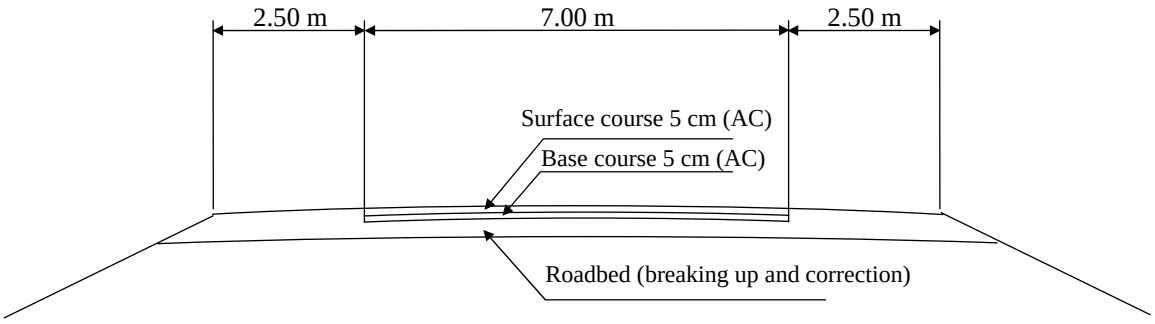

Figure 2-2-1.2 Hypothetical Cross Section of Repavement

2-2-2 Equipment Plan

2-2-2-1 Basic Idea of the Plan

(1) Maintenance Work in the Project Road Section

There are four items of maintenance work conducted in the Project road section in Naryn province.

- Pothole patching
- Snow removal
- Recovery works after natural disaster
- Repaving of asphalt pavement

The Project road for repaving of asphalt pavement will be the section of Kuvaky Pass (26 km) and Sary-Bulak (262 km - 281 km). The total length of the Project road is 45 km and repavement works including rehabilitation of roadbed will be completed within four years after the procurement of equipment by the Kyrgys Republic.

Pothole patching and snow removal (winter time) will be continuously implemented as dairy maintenance works. Recovery works will be carried out after natural disasters on a case-by-case basis.

(2) Examination of the Existing Equipment

The condition and problems of the existing equipment in MRLCD No.3 are summarized in Table 2-2-2-1.1and 2-2-2-1.2.

Table 2-2-2-1.1 Present Condition of Equipment

RMC	No. of existing machines (unit)	No. of movable machines (unit)	Rate of movable machines (%)	Problems
No. 955	25	15	60	• Insufficient number of movable machines can not apply for various kinds of maintenance work. • The whole movable machines are aged and often cause trouble therefore they have to be repaired. - The kind of movable machine is limited and many accidents have happened. Therefore, the present maintenance work is inefficient and of low quality.
No. 41	47	20	43	
No. 957	36	18	50	
Average	36	18	50	

Table 2-2-2-1.2 Present Condition of Supporting Machine and Facilities

	Present condition	Problems
Asphalt mixing plant	• - Only one mixing plant in the Project area (Production capacity : 10 t/h)	• High frequency of trouble due to superannuation, making stable supply of asphalt impossible • Low production capacity, hindering adequate output volume • Inability to ensure the asphalt quality due to a decline in the performance caused by superannuation • Inability to control mix since aggregate is not stocked separately for different gain sizes
Aggregate plant	• - Only one plant in the Project area (Production capacity : 45 t/h)	• High frequency of trouble due to superannuation, making stable supply of aggregate impossible • Limited production to only two sizes of aggregate, which makes it impossible to supply aggregate of the required grain sizes for asphalt mix • Poor work efficiency due to the absence of dedicated small transport equipment to carry raw stone and produced aggregate
Workshop machine/tool	• - Hand tool and small lathe for assembling and disassembling • - The operator of a machine works as mechanic for his maintenance • - No spare parts of breakdown are stored. Therefore, obtaining necessary parts takes time	• Lack of systematized maintenance knowledge, and of facilities necessary for such maintenance • Lack of awareness for preventing breakdown, despite the broad experience in dealing with it • Due to lack of spare parts in stock, it takes time until completing repairs

Due to the above situation, the present movable equipment is not considered as an appropriate composition of the equipment fleet of the Project.

(3) Need for Asphalt Mixing Plant and Aggregate Plant

The aim of the Project is to enable MOTC to carry out by itself efficient, economical and durable road repairs on the road between BishkekTorugar in NarynRayon that has suffered considerable damage by providing the necessary road maintenance equipment.

At present MOTC's road maintenance work consists mainly of repairing potholes. Total repair of the road surface is not being carried out due to lack of the necessary equipment. That has resulted in damage extending even to the roadbed, and mere partial repair of potholes can no longer prevent further progression of damage on many road sections.

Considering such a present situation, the study team has proposed repaving works, and the core part of the equipment necessary for such works is an asphalt plant and an aggregate production plant.

The first thing that should be noted in formulation of an equipment plan is the low quality of the asphalt mixture used in road maintenance works by the implementing body. The study

team has ascertained the present situation and the problems concerning the mix produced in the present asphalt plants as indicated in Table 2-2-2-1.3 below

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Table 2-2-2-1.3 Present Situation and Problems of Asphalt Mixture

Present situation	Problems caused by the present situation
• Only 2 kinds of grain size of aggregate are being produced in the present plants for use in asphalt mixture whereas 4 kinds are needed in principle.	• Because of absence of aggregate of intermediate grain size in the mix intermeshing of the different aggregates is poor, and as a result there are more voids within the mix than there should be, which makes for infiltration of too much asphalt into the voids, resulting in a mix of a quality characterized by lack of durability and insufficient strength.
• At the asphalt plants aggregate is not being stocked separately by grain size.	• Mix control is impossible, and the mix suffers from too much fine-grain component, which detracts from durability.
• With the present plants the temperature of the asphalt mixture at output is only 80 °C max., which is too low.	• At the work site the roller compacting temperature is still lower, detracting from the effect of roller compacting and resulting in a coarse surface. Accordingly heavier rollers are required.
• Since the plants are manually operated, there is frequent occurrence of adjustments during operation, which makes it impossible to have continuity of output of the mix.	• Waiting time at the work site is longer than usual, and there is more joining of successive pours than usual, which makes for poor finishing.

In this way, poor-quality asphalt mixture is currently used in road maintenance works, which only allows repeated works without achieving good results and eventually results in progression of road damage in spite of the repair work.

That being the case, it is considered indispensable that good quality of the asphalt mixture produced be ensured in order to enhance the effectiveness of the repair works and to increase road durability through repaving works in this Project.

On the basis of these observations the methods of use of plants in the target area of this Project have been studied and drawn up as shown in the following Table 2-2-2-1.4.

Table 2-2-2-1.4 Utilization of Existing Plants

Plants involved	Places installed	Present situation	Problems	Evaluation	Disadvantages of use in this Project
Those in the MOTC equipment park	At Km 323 in Naryn Province	• Made in Russia in 1989 • Design production capacity: 45 t/h (presently 10 t/h) • Output for March-September 2005, actual figure: approx. 270 t	• High frequency of trouble due to superannuation, making stable supply of product impossible. Low production capacity, which makes for inability to achieve adequate output volume. • Inadequate product quality due to decline in performance. • Not possible to control mix since aggregate is not stocked separately for different grain sizes • Work efficiency very poor because of lack of dedicated small transport equipment in the yard.	×	• Because of inability to ensure the quality of the work in repaving with that product, repaving with it would be ineffective, with reoccurrence of damage to pavement before long. • The machinery provided in the grant would have to be in waiting whenever the plant went out of order, preventing effective utilization thereof. • It would take more than 10 years to complete the target sections (45 km) with such low production capacity (10 t/h) and instability of supply.
	At Km 400 in Naryn Province	• Made in Russia in 1980 • Design production capacity: 45 t/h • Out of order and out of use since 1992	• Out of order (needs to be scrapped)	×	• No possibility of utilization (in view of the difficulty of ordering parts since the collapse of the Soviet Union, it would be necessary to take parts from the plant mentioned above, and it, in turn, would fall into a state of impossibility of restoration to operating condition).
Those in the equipment park of the city of Bishkek	10 km north of the city center	• Made in Italy in 2000 • Design production capacity: 150 t/h • In operation (in good condition)	• A long way from the site of this Project (150-280 km)	△	• The product temperature would fall during the more than 3 hours that transport would take, making it impossible to ensure the quality of the work. • With the planned number of transport vehicles it would be impossible to complete the work in the 4 years time that has been set (3 times that number of vehicles would be needed).
Privately owned plants	At Km 171, Balykchy, Issyk Kul Province	• Details unknown • In operation • Sales price: 800 som (2,160 yen)/ton	• Product quality assurance unclear	△	• The 82,502 tons of mix necessary for the 45 km of repaving set in this Project would cost 66,001,600 som (178,200,000 yen).

The following Table 2-2-2-1.5 shows the results of comparison of the effectiveness of using the plants owned by the city of Bishke and the privately owned plants, which are judged worth using in the above evaluation, and new plants to be supplied in the Project.

Table 2-2-2-1.5 Effectiveness of Suppling New Asphalt Plants

Items of comparison		Evaluation	Effectiveness
Asphalt mixture productivity and quality	Supply of new plants	• Control of mix possible • Control of temperature of mix at shipment possible • Shortening of maintenance time • Continuous output and shipment possible • Improvement of mix quality	High
	Use of the plants of the city of Bishkek	• Quality of mix ensured • Priority to shipments for work in the city of Bishkek	Medium
	Use of privately owned plant	• Quantity of mix not assured	Low
Ease/difficulty of doing the work	Supply of new plants	• Control of output and shipment possible because of proximity of plants • High temperature of mix making for adequate roller compaction effect • Reduction of joints and higher precision of the work thanks to continuousness thereof • Work possible with small quantity of transport equipment	High
	Use of the plants of the city of Bishkek	• Control of output and shipment not possible because of the distance of the plant • Adequate roller compaction effect not obtained (too coarse surface course) because of too low temperature of the mix upon arrival at the site • Need to arrange for large quantity of transport equipment • Constant need to make adjustments in work process planning because of priority given to shipment to work in the city of Bishkek	Low
	Use of privately owned plant	• In the absence of assured quality of the mix, effect on the work is unknown.	Low
Economical efficiency	Supply of new plants	• Asphalt mixture production cost of 39.8 million som (107,460,000 yen) for the quantity needed for the 45 km of repaving • Shipment for road maintenance work other than on the road to be repaired in the Project also possible • Reduction of plant maintenance cost • Lower road maintenance costs as road durability is improved	High
	Use of the plants of the city of Bishkek	• Cost of purchase of the asphalt mixture needed for the 45 km of repaving the same as in the case of supply of new plants • Would not lead to lower road maintenance cost because of lack of assurance of precision of the work.	Medium
	Use of privately owned plant	• Cost of 66.0 million som (178,200,000 yen) for purchase of the asphalt mixture needed for the 45 km of repaving	Low

As a result of consideration of the matter, it has been concluded that furnishing of asphalt plants and aggregate production plants in this Project is expected to have the following effects:

(i) It will be possible to produce and ship high-quality asphalt mixture.
(ii) Road durability will increase with repair works using high-quality asphalt mixture.
(iii) With improvement of work precision, the flatness of the road surface will be maintained, making for good negotiability by vehicles.
(iv) There will be lower road maintenance cost after the repair works.
(v) Plant maintenance cost will be lowered by less plant trouble.
(vi) After repair of the Project road in the Project, the plants can be used for maintenance of all of the roads in the province, which will contribute to improvement of the road network.

The following points are to be taken into account in deciding the plant specifications:

(i) Asphalt Plant Capacity

The asphalt plants should be planned for the minimum capacity needed in order to be able to complete the Project work on the 45 km of Project road in four years (operating 130 days/year).

(ii) Possibility of Exclusion of Surge Bin

Ordinarily an asphalt plant has a surge bin (a thermally insulated silo for storage of asphalt mixture) as accessory equipment. That makes for a system in which continuous shipment can be accomplished without the vehicles having to wait since there is storage of one dump truck's volume of mix in the surge bin. However, it is possible to dispense with installation of a surge bin through guidance of operation of the plant with close liaison between the work site and the plant.

(iii) Aggregate Production Plant Capacity

An aggregate production plant supplies materials to the asphalt plant. Its production capacity should be about 1.5 times that of the asphalt plant so as to avoid insufficient supply to the asphalt plant, with maintenance of a constant stock of materials.

In this case the operating time of the aggregate production plant is set at 1.5 times that of the asphalt plant (8 hours/day), and it will be considered possible to maintain a stock of materials through such lengthening of operating time. Hence, the capacity of the aggregate production plant will be made the same as that of the asphalt plant.

(4) Provision of Equipment

Procured machineries and equipment will be managed by the MOTC Road Management Office covering Bishkek-Naryn-Torugart, which controls the road section Bishkek-Torugart. These machineries and equipment will be allocated, according to needs, at road maintenance/management offices of 955th, 41st and 957th, which are managed by the Road

Management Department of Bishkek-Naryn-Torugart. These offices each have a total personnel strength of about 60 persons, divided into a management department and a work department (including operators and mechanics). At the same time, they are accomplishing equipment management on grounds consisting of about 10,000 m2 for the offices and the repair yard/equipment parking facility, which is sufficient for accommodation of the equipment to be furnished in the Project.

In the final discussion regarding the BD outline with the implementing organization held in March 2006, locations set for asphalt plant and aggregate plant have been confirmed at currently unused land which the 955th road maintenance/management office possesses at the point of 243km between the section of Bishkek-Naryn-Torugart.

The space of the concerned place is approximately 8,000m^2 (80m×100m) and there are no problems regarding the location, since i) it is located along the road between Bishkek-Naryn- Torugart, where it is easy to carry in/out materials, ii) there are no residences, and therefore, there are no social and environmental problems, iii) it is easy to draw power and (industrial) water, and iv) aggregate collection site exists within 5km.

(5) Equipment Maintenance

At present the equipment operators themselves are responsible for accomplishing maintenance and repair of their equipment at each RMC, and there are no specialized mechanics assigned. Each RMC has a repair shed equipped with repair pits, but the manual repair tools and lathes provided are not sufficient repair facilities for the equipment.

That being the case, a mobile workshop truck will be assigned to MRLCD No. 3 under this Project, which will make the rounds of the different RMCs under its jurisdiction for to carry out periodical maintenance of the supplied equipment, thereby accomplishing efficient maintenance and effective prevention of trouble and establishing a system in which in case of occurrence of trouble with the equipment, it will urgently proceed to the place where the equipment is assigned to do the necessary repair works on it.

2-2-2-2 Equipment Plan

(1) Equipment Used for the Different Work

Table 2-2-2-2.1 below shows the equipment described in the preceding section that will be needed for the road maintenance work covered by the Project.

Table 2-2-2-2.1 List of Equipment for Use in the Different Work

Work	Equipment	Purposes used for	
Repairing potholes	Concrete cutter	Cutting of the existing pavement of the places to be repaired	
	Compressor	Supply of pressurized air, cleaning of the road surface	
	Hand breaker	Breaking up of the existing pavement	
	Asphalt sprayer	Spraying of the repair materials with stable fixing agent	
	Hand guide roller	Compacting of the repair materials	
	Vibration compactor	Compacting of the repair materials (at the road edge)	
	Truck with crane	Transportation of the above-mentioned equipment	
Snow removal	Snow removing truck	Clearing snow from the road after snowfalls	
Recovery work after landslides and rockfalls	Hydraulic breaker	Breaking up of fallen rocks	(use for this purpose as well of the corresponding equipment for repaving)
	Excavator	Excavation and removal of fallen rocks and earth	
	Wheel loader	Removal and loading of fallen rocks and earth	
	Dump truck	Taking away of fallen rocks and earth	
Repaving	Concrete cutter	Cutting of existing pavement at the edge of the repaving	
	Hydraulic breaker	Breaking up of the existing pavement	
	Excavator	Equipment equipped with hydraulic breaker	
	Wheel loader	Removal and loading of the pieces of broken up pavement	
	Dump truck	Transport of the pieces of broken up pavement and asphalt mixture	
	Stabilizer	Improvement and breaking up of the existing roadbed	
	Motor grader	Correction of the new roadbed	
	Water tank truck	Adjustment of water content of roadbed materials and re-supply of water for roller sprinkling	
	Road roller	Initial roller compacting of roadbed materials and asphalt mixture	
	Tire roller	Secondary roller compacting of roadbed materials and asphalt mixture	
	Asphalt sprayer	Spraying of tack coat	
	Asphalt finisher	Leveling of applied asphalt mixture	
	Truck trailer	Returning of machinery	
	Asphalt plant	Production of asphalt mixture	
	Aggregate plant	Production of aggregate for asphalt mixture	
	Wheel loader	Small-scale transportation of materials on the plant grounds	
	Mobile workshop truck	Maintenance of machinery within the site	

(2) Basic Specifications of the Equipment

The basic specifications of the equipment have been considered in line with the Project design policy and the standard specifications for pavement breaking work, road repaving work, roadbed restoration work and snow removal indicated in "Road Maintenance and Repair" of the "Standard of Estimation for Civil Construction" of the Ministry of Land, Infrastructure and Transport, Japan. The basic specifications found as suitable for the equipment on that basis are given in the Table 2-2-2-2.2 below.

Table 2-2-2-2.2 Basic Specifications of the Equipment

Equipment	Consideration of specifications	Basic specification
Excavator	Since it will be used not only for repaving but also for recovery work after rockfalls and landslides, the specifications of "Machinery Earthwork (Rocks)" of the "Estimation Standards" shall be applied to it.	Bucket capacity 0.8 m^3 (pile) class
Wheel loader (1) (for use at the asphalt plant)	Volume of shipment of asphalt mixture of approx. 160 t/day. Assuming an asphalt additive volume of 5.5%, the aggregate content of 160 t of asphalt mixture will be about 152 t = about 64 m^3/day. The daily operating time of the wheel loader is taken as 4.4 h/day from the "Calculation table of depreciable value". Therefore the volume of work will be: 64 m^3/day ÷ 4.4 h/day = 15 m^3/h The bucket capacity can be calculated as follows on the basis of 180 s of time required for one cycle, a work efficiency rate of 0.5, an equivalent factor of soil volume of 1 and a loading coefficient of 0.75: (15 x 180) ÷ (3600 x 0.75 x 1 x 0.5) = 2 m^3	Bucket capacity 2.0 m^3 (pile) class
Wheel loader (2) (for loading of the waste from breaking up the existing pavement and of rocks and earth from rockfalls and landslides)	Since it will be used not only for loading of broken up existing pavement but also for recovery work after landslides and rockfalls, the condition of being able to cope with such recovery work has been applied to deciding of the specifications. Since it is considered that the state of the rocks after landslides and rockfalls will be equivalent to the state of the waste materials after tunnel blasting, the bucket capacity will be decided on the ground of "Tunnel Work" of the "Estimation Standards".	Bucket capacity 2.5 m^3 (pile) class
Dump truck	Based on the "Estimation Standards"	Loading weight 10-ton class
Truck with crane	Considering the weight of the machinery to be used for patching work, a vehicle of the 4-ton load class is suitable. The truck has to be equipped with a crane for loading and unloading of such equipment.	Loading weight 4-ton class, with crane
Truck trailer	It needs to be capable of loading the heaviest equipment to be procured, excavators of the 20-ton class.	Loading weight 25-ton class
Hand breaker	Of a weight such that they will not be too heavy for those doing manual work with them.	Weight 7 kg class

Equipment	Consideration of specifications	Basic specification
Hydraulic breaker	Suitable for the excavator specifications.	Operating weight 1,600 kg class
Aggregate plant	Same capacity as that of the asphalt plant.	Production capacity 35 t/h class
Motor grader	Consideration of work efficiency in work on the 3.5 m of one side of the road width. Considering the need to break up the existing pavement, it should be equipped with a scarifier.	Blade length 3.7 m class, with scarifier
Stabilizer	Based on the "Estimation Standards".	Improved width 2 m class
Hand guide roller	Based on the "Estimation Standards".	Operating weight 600 kg class
Road roller	Based on the "Estimation Standards".	Operating weight 10-ton class
Tire roller	Based on the "Estimation Standards".	Deadweight 8-ton class
Vibration compactor	Based on the "Estimation Standards".	Operating weight 60 kg class
Asphalt plant	Calculation of the amount of asphalt mixture that will be needed for 45 km of pavement with a width of 7 m and a thickness of 10 cm carried out over a period of 4 years considering a loss rate of 10% and a mix specific gravity of 2.381: 7 m x 0.1 m x 45,000 m x 1.1 x 2.381 = 82,500 t Assuming 5 hours of operation of the plant a day and 130 days a year on which it will be possible to do the work, one obtains the following as the production capacity that it has to have: 82,500 t ÷ 4 years ÷ 130 days ÷ 5 h = 31.7 t/h	Production capacity 35 t/h class
Asphalt finisher	Based on the "Estimation Standards".	Max. paving width 4.5m class, Wheel type
Asphalt sprayer	The amount of bituminous binder that has to be sprayed is obtained as 43 ℓ / 100 m^2 from the "Estimation Standards". The area that has to be paved each day is 45km ÷ 4 years ÷ 130 days/year x 7 m = 606 m^2 Considering the dead level due to pump blowing height and work loss, a tank capacity 1.5 times the daily amount of spraying is needed as follows: 43 ℓ x 606 m^2 x 1.5 ≒390 ℓ	Tank capacity 400ℓ class
Water tank truck	Considering the road roller and tire roller water tank capacities, the water tank truck will have to carry at least 6,500 ℓ at a time, which means that it needs to have a tank capacity of at least that.	Tank capacity 8,000 ℓ class
Mobile workshop truck	Considering the weight of the field maintenance equipment and repair materials that it will have to carry, the 4t-class vehicle is appropriate. 4-wheel drive is necessary considering field conditions and the fact that it needs to be equipped with a crane for removal of the broken parts in the field.	Load capacity of 4t class, with a crane and 4WD

Equipment	Consideration of specifications	Basic specification
Concrete cutter	Since the thickness of the existing pavement is about 100-120 mm, the maximum cutting depth needs to be at least 120 mm.	Blade size 350 mm class
Snow removing truck	It needs to be equipped with a snow plow for clearing new snowfalls, and at least 4-wheel drive considering the work conditions.	Equipped with snow plow and with at least 4WD
Compressor	It needs to have a good mobility considering the hand brake air consumption, the high-elevation conditions and considerable moving from place to place in the work.	Output 5.0 m^3/min class, towed type

(3) Necessary Quantities of the Equipment

The necessary quantities of the types of equipment of which more than one unit will be needed are calculated based on the following work conditions, the quantities of the other types of equipment being taken as one unit each:

- 130 work days a year, from mid-April to mid-October.
- 45 km of repaving work, including roadbed improvement, over a target period of 4 years.
- A pavement structure defined by a road width of 7 m and a pavement thickness of 10 cm.
- A maximum distance of 70 km one way from the place of installation of the asphalt plant to the work site.
- Installation of the asphalt plant and the aggregate plant near each other (with movement of materials between them by wheel loader).
- A pothole size of 2 m square and an average frequency of occurrence of one every 20 m.
- 172 km of road requiring clearance of snow, to be accomplished by RMC No. 957, with a total width of 10 m having to be cleared considering both directions of traffic.

(i) Equipment for Patching Work

Pothole repair works are daily carried out by road maintenance/management office in charge of the concerned section and are necessary to continue to be conducted in order to maintain safe road transportation. Pothole repair machineries and equipment, therefore, will be provided for the 955th road maintenance/management office (2 sets) and for the 41st and the 957th offices (1 set at each office). The reason why 2 sets are provided for the 955th road maintenance/management office is that the road maintenance/management of 246km～279km between Bishkek and Torugart has been incorporated into the 955th office by the reorganization conducted in March 2006. The workload, therefore, will be doubled at the 955th office and consequently requires 2 sets of machineries and equipment.

- Hand breaker

  Considering an average frequency of occurrence of potholes of one every 20 m, an air hose length of 20 m, three men on a work team and other factors, work efficiency can be best served by working on 2 potholes at a time, which will require 2 hand breakers.

- Vibration compactor

  The Ministry of Land, Infrastructure and Transport's "Standard of Estimation for Civil Construction" stipulate the number of vibration compactors in manual work as being two for roadway and road shoulder work. Therefore, the number will be two in this Project.

(ii) Snow Removal Machine

Assuming a snow clearing speed of about 35 km in one hour, the time required to clear snow on the entire 172 km length of road will be

172 km ÷ 35 km/h ≒4.9 h

The standard working time for a snow removal truck as indicated in the "Calculation table of depreciable value for construction machinery, etc." is 5h, and since the above figure lies within the working time, snow removal can be accomplished by one such vehicle as far as working time is concerned.

As for the width of clearing of snow, however, the effective width that one snow removal truck can clear, assuming that it is 80% of 3.1m of the total length of the snow plow, is

3.1 m x 0.8 ≒ 2.5 m

Since the width of snow that has to be cleared is 10 m,

10 m ÷ 2.5 m/truck = 4 trucks

Therefore four snow removal trucks will be needed in view of the required working time and the working width of such trucks.

(iii) Equipment for Recovery Work After Landslides, Rockfalls, etc.

Since it is not possible to know when or the scale on which such events might occur and since it is considered that earthwork equipment included in the repaving equipment can be used for this purpose, provision of equipment dedicated to this purpose is not necessary.

(iv) Equipment for Asphalt Repaving

The item of equipment of which more than one unit will be needed per set is dump trucks among the equipment for repaving previously indicated in Table 2-2-2-2.1.

Although the concrete cutter and the asphalt sprayer are equipment items also included in the equipment for patching work, it is not considered possible to use them for this purpose since patching work is carried out on a daily basis while the place of the work constantly changes.

Thus, it will be necessary to provide a concrete cutter and an asphalt sprayer for asphalt repaving separately from those for the patching work.

- Dump Truck

  As previously mentioned in consideration of the specifications of the asphalt plant in Table 2-2-2-2.2, the daily volume of output and shipment of asphalt mixture will be approximately 160 t (31.7 t/h x 5h).

  Assuming a maximum transport distance of 70 km, a speed of about 45 km/h in running

with a load and a speed of about 60 km/h when running without load, the time required for a round trip will be

(70 km ÷ 45 km/h) + (70 km ÷ 60 km/h) = 2.72h

Taking 8 hours as the number of hours worked a day, the number of times that a dump truck can make a round trip each day is

8h ÷ 2.72h/ round trip ≒3 round trips

With a dump truck load of 10 t, a dump truck will be able to transport in one day

10 t / round trip x 3 round trips = 30 t

The number of dump trucks that will be needed is therefore

160 t ÷ 30 t / truck = 5.33 trucks

That means that 6 dump trucks will be needed.

As the result of the study, the equipment necessary to procure on this Project is listed in Table 2-2-2-2.3.

Table 2-2-2-2.3 Necessary Equipment to Be Procured

No.	Designation of the Equipment	Quantity	Quantity to Be Placed at Each Offices			No.	Designation of the Equipment	Quantity	Quantity to Be Placed at Each Offices			
			No. 955	No. 41	No. 957				Kachkor Office	No. 955	No. 41	No. 957
1	Excavator	1	1	—	—	13	Road Roller	1	—	1	—	—
2	Wheel Loader (1)	1	1	—	—	14	Tire Roller	1	—	1	—	—
3	Wheel Loader (2)	1	1	—	—	15	Vibration Compactor	8	—	2	4	2
4	Dump Truck	6	6	—	—	16	Asphalt Plant	1	—	1	—	—
5	Truck with Crane	4	1	2	1	17	Asphalt Finisher	1	—	1	—	—
6	Truck Trailer	1	1	—	—	18	Asphalt Sprayer	5	—	2	2	1
7	Hand Breaker	8	2	4	2	19	Water Tank Truck	1	—	1	—	—
8	Hydraulic Breaker	1	1	—	—	20	Mobile Workshop Truck	1	1	—	—	—
9	Aggregate Plant	1	1	—	—	21	Concrete Cutter	5	—	2	2	1
10	Motor Grader	1	1	—	—	22	Snow Removing Truck	4	—	—	—	4
11	Stabilizer	1	1	—	—	23	Compressor	4	—	1	2	1
12	Hand Guide Roller	4	1	2	1	24	Spare Parts	1 Set	1 Set	—	—	—

Eguipment for Patching Work

→Working Procedure

Concrete Cutter

Hand Breaker

Compressor

Asphalt Sprayer

Hand Guide Roller

Vibration Compactor

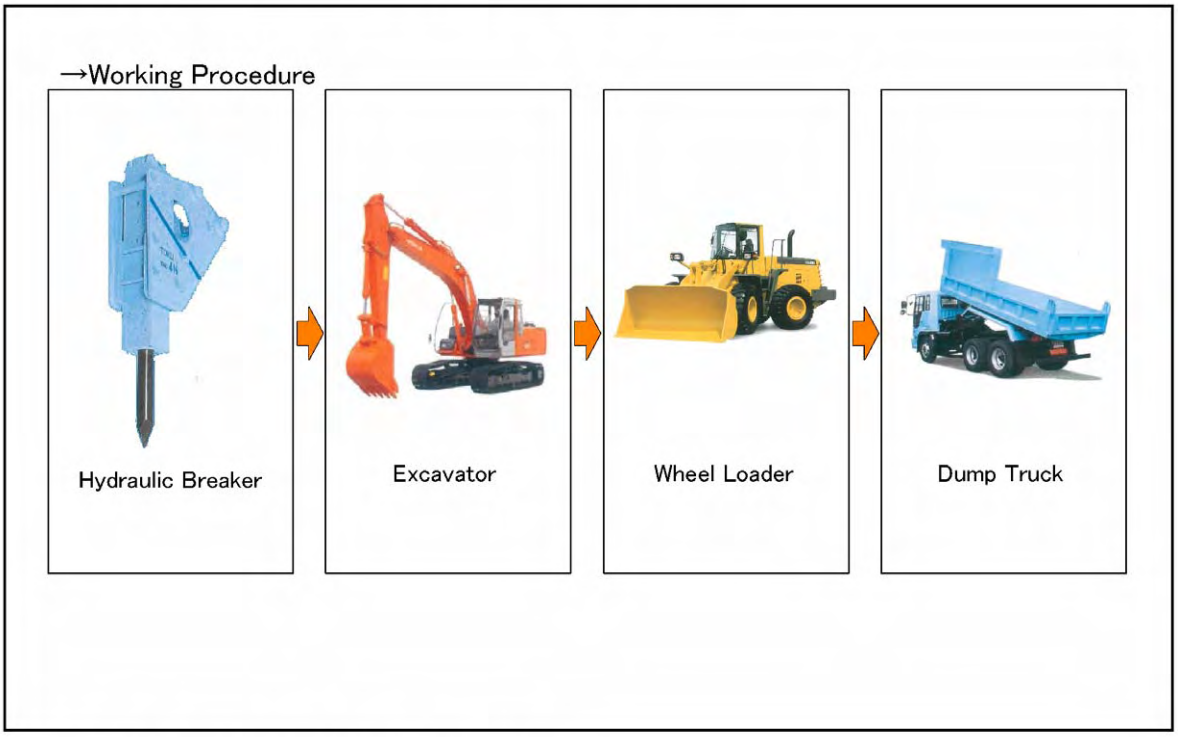
Truck with Crane

Eguipment for Snow Removal

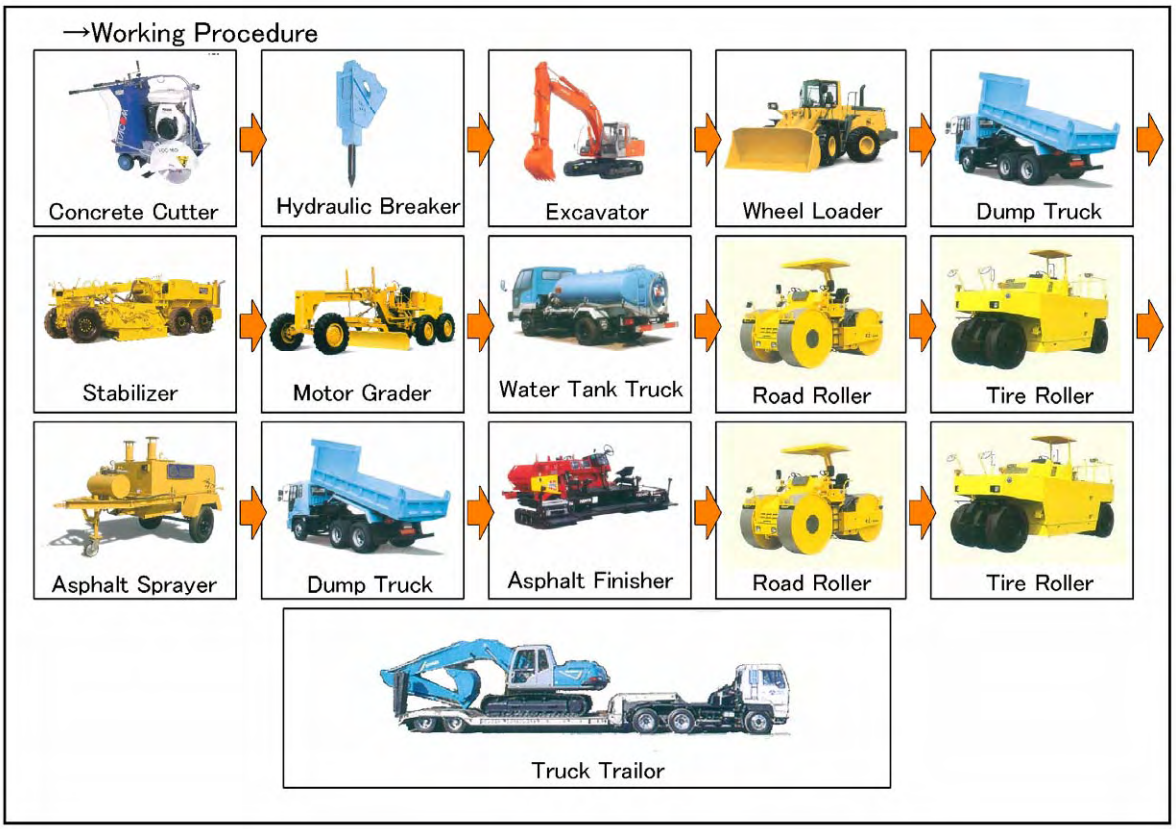
Snow Removing Truck

Working Condition

Eguipment for Recovery Work after Disaster



Eguipment for Asphalt Repaving



(4) Spare Parts for the Equipment

In this Project the spare parts for the equipment to be procured will be selected based on the criteria set forth below at the expense of the Japanese side in order to ensure smooth operation of the equipment.

From the viewpoint of keeping the equipment in good working condition and preventing trouble from happening, the spare parts to be selected will be mainly those for periodical replacement and consumables.

The quantity of spare parts will be the amount which will roughly be used for asphalt re-pavement of 45km.

The ceiling for the cost of the spare parts is about 5% of the cost of the equipment itself.

These spare parts are stored within the 955th road maintenance/management office. Kachkor office under the Road Management Department of Bishkek-Naryn-Torugart will be equipped with computers, hold spare parts, and manage carry in/out as well as inventory of these parts.

2-2-3 Basic Design Specifications

2-2-3-1 Detailed Equipment Specifications

Taking into account the basic specifications of the equipment indicated in the preceding section, the detailed specifications for the tender(s) have been considered on the basis of the catalogs of the equipment manufacturers and the "Japan Construction Machinery Handbook (2004)" and are indicated in Table 2-2-3-1.1.

Incidentally, equipment to be procured will be the diesel-powered one with energy situation of the Kyrgys Republic taken into consideration. However, vibration compacter, asphalt player(engine for spraying) and concrete cutter will be gasoline-powered because gasoline engine is the standard engine for these small-sized equipment.

2-2-3-2 Equipment Layout

In this Project the asphalt plant and the aggregate plant will be procured as equipment to be installed at a particular place.

For your information layout of the asphalt plant and the aggregate plant are given in Figures 2-2-3-2.1 and 2-2-3-2.2, respectively.

Table 2-2-3-1.1 SPECIFICATIONS FOR EQUIPMENT（1/4）

EXCAVATOR		
Engine Output	KW	≧100
Operating Weight	kg	≧19,500
Dimensions		
・Shoe Width	mm	≧600
Performance		
・Max. Travel Speed	km/h	≧5.0
・Swing Radius	mm	≦2,800
・Max. Swing Speed	rpm	≧11.0
・Max. Digging Force	kN	≧130
Working Range		
・Max. Digging Depth	mm	≧6,600
・Max. Dumping Height	mm	≧6,500
・Max. Vertical Wall		
Digging Depth	mm	≧5,950
・Max. Digging Height	mm	≧9,400
・Max. Digging Reach	mm	≧9,700
Engine		
・Type	Cold district conrrespondence	
		Water Cooled Diesel
・Displacement	cc	≧5,800
・Battery	Cold district conrrespondence	
Hydraulic		
・Max. Flow	ℓ/min	≧380
Undercarriage		
・Type		Crawler
Bucket		
・Capacity (heaped)	m^3	≧0.8
Optional Items		Breaker Port

WHEEL LOADER (1)		
Engine Output	KW	≧85
Operating Weight	kg	≧10,000
Dimensions		
・Wheel Base	mm	≧2,900
Performance		
・Max. Travel Speed		
Forward－Reverse	km/h	≧34-23
・Max. Digging Force	kN	≧92
Working Range		
・Dumping Clearance	mm	≧2,650
・Dumping Reach	mm	≧1,000
・Digging Depth	mm	≧50
Engine		
・Type	Cold district conrrespondence	
		Water Cooled Diesel
・Displacement	cc	≧5,850
・Battery	Cold district conrrespondence	
Tire		
・Size		≧17.5-25-12PR
Bucket		
・Type		General Purpose Bucket
・Capacity (heaped)	m^3	≧2.0
Cab		
・Type		Steel Cab
Optional Items		
・Tire Chain		Heavy-duty Non-skid Chain
・Heater		Cab Heater

WHEEL LOADER (2)		
Engine Output	KW	≧115
Operating Weight	kg	≧12,500
Dimensions		
・Wheel Base	mm	≧3,000
Performance		
・Max. Travel Speed		
Forward－Reverse	km/h	≧31-23
・Max. Digging Force	kN	≧115
Working Range		
・Dumping Clearance	mm	≧2,600
・Dumping Reach	mm	≧1,050
・Digging Depth	mm	≧50
Engine		
・Type	Cold district conrrespondence	
		Water Cooled Diesel
・Displacement	cc	≧6,450
・Battery	Cold district conrrespondence	
Tire		
・Size		≧20.5-25-12PR
Bucket		
・Type		General Purpose Bucket
		with Teeth
・Capacity (heaped)	m^3	≧2.5
Cab		
・Type		Steel Cab
Optional Items		
・Tire Chain		Heavy-duty Non-skid Chain
・Heater		Cab Heater

DUMP TRUCK		
Engine Output	KW	≧175
Weight		
・Max. Loading Capacity	kg	≧10,000
・Gross Vehicle Weight	kg	≧19,150
Dimensions		
・Wheel Base	mm	≧3,800
・Dump Vessel（inside）		
Length	mm	≧4,800
Width	mm	≧2,200
Height	mm	≧590
Performance		
・Max.Travel Speed	km/h	≧85
・Gradeability	deg	≧25
Engine		
・Type	Cold district conrrespondence	
		Water Cooled Diesel
・Displacement	cc	≧9,800
・Battery	Cold district conrrespondence	
Power Line		
・Transmission		≧6＋1
・Driving System		≧4×4
Tire		
・Size		≧10.00-20-16
Optional Items		
・Tire Chain	Heavy-duty Non-skid Chain	

TRUCK WITH CRANE		
Engine Output	KW	≧125
Weight		
・Max. Loading Capacity	kg	≧4,000
・Gross Vehicle Weight	kg	≧9,550
Dimensions		
・Wheel Base	mm	≧4,100
・Dump Vessel（inside）		
Length	mm	≧5,300
Width	mm	≧2,300
Height	mm	≧450
Performance		
・Max.Travel Speed	km/h	≧100
・Gradeability	deg	≧25
Engine		
・Type	Cold district conrrespondence	
		Water Cooled Diesel
・Displacement	cc	≧6,900
・Battery	Cold district conrrespondence	
Power Line		
・Transmission		≧5＋1
Tire		
・Size		≧8.25-20-14
Performance of Crane		
・Max. Lifting Capacity	kg	≧3,000
・Boom Length		
Retracted×Extended	mm	≧3,250×5,500
・Boom Section		≧2
・Swing Speed	rpm	≧2.5
・Max. Lifting Height	mm	≧7,000
・Outriggers Max. Extended	mm	≧3,500
Optional Items		
・Tire Chain	Heavy-duty Non-skid Chain	

Symbol
≧ : equal or over
≦ : equal or less

Table 2-2-3-1.1 SPECIFICATIONS FOR EQUIPMENT（2/4）

TRUCK TRAILER（TRUCK TRACTOR）		
Engine Output	KW	≧210
Weight		
・Max. Combination Mass.	kg	≧30,000
・Gross Vehicle Weight	kg	≧26,000
Dimensions		
・Wheel Base	mm	≧3,200
Performance		
・Max.Travel Speed	km/h	≧85
・Gradeability	deg	≧20
Engine		
・Type	Cold district conrrespondence	
		Water Cooled Diesel
・Displacement	cc	≧12,000
・Battery	Cold district conrrespondence	
Power Line		
・Transmission		≧9＋2
Tire		
・Size		≧11.00-20-16
Optional Items		
・Tire Chain	Heavy-duty Non-skid Chain	

TRUCK TRAILER（SEMI TRAILER）		
Weight		
・Max. Loading Capacity	kg	≧25,000
・Gross Vehicle Weight	kg	≧32,000
Dimensions		
・Cargo Vesel (inside)		
Length	mm	≧6,500
Width	mm	≧2,900
Height	mm	≦800
Performance		
・Rear Fitting Radius	mm	≦2,200
Tire		
・Size		≧8.25-16-14
Optional Items		
・Loading Ramp		Manual or Spring

HAND BREAKER		
Body Weight	kg	≧7.0
Dimensions		
・Body Length	mm	≦550
・Cylinder Dia.	mm	≧35
・Shank Dia.	mm	≧25
・Shank Length	mm	≧80
・Hose Dia.	mm	≧19
Performance		
・Blows	bpm	≧1,300
・Air Consumption	m^3/min	≦1.5
・Piston Stroke	mm	≧120
Optional Items		
・Hose		
Length	m	20
Number of Supply	pcs	2
・Hose Band	pcs	4
・Chisel		
Type		Moil Point
Length	mm	450
Number of Supply	pcs	5

HYDRAULIC BREAKER		
Operating Weight	kg	≧1,600
Dimensions		
・Length (with chisel)	mm	≦2,900
・Chisel		
Dia.	mm	≧125
Length	mm	≧1,100
Weight	kg	≧90
・Hose Dia.	mm	≧25
Performance		
・Blows	bpm	≧300-450
・Oil Flow	ℓ/min	≧120-160
・Oil Pressure	Mpa	≧10-13

AGGREGATE PLANT		
Production Capacity	t／h	≧35
Primary Unit		
・Hopper Capacity	m^3	≧3.0
・Feeder		
Width×Length	mm	≧600×1,800
・Feed Opening		
Width×Length	mm	≧600×370
・Motor Output	kw	≧30
Secondary Unit		
・Vibrating Screen		
Width×Length	mm	≧900×3,000
・Screen Net Mesh Size	mm	40-20-13-5
・Motor Output	kw	≧45
Belt Conveyors		
・Main Belt Conveyor		
Width×Length×pcs	mm	≧500×15,000×1
・Return Belt Conveyor		
Width×Length×pcs	mm	≧400×12,000×1
・Product Belt Conveyor		
Width×Length×pcs	mm	≧400×12,000×4
Generator		
・Capacity	KVA	Correspondence to
・Engine Output	kw	Total Electric Power
Optional Items		
・Control Panel		
Waterproof Out-door Control type		
・Electric Cable	Each kind more than 30m	

MOTOR GRADER		
Engine Output	KW	≧100
Operating Weight	kg	≧10,700
Dimensions		
・Blade		
Length	mm	≧3,700
Height	mm	≧600
・Wheel Base	mm	≧5,700
Performance		
・Max. Travel Speed		
Forward－Reverse	km/h	≧42-42
・Min. Turning Radius	mm	≦6,600
・Front Axle Oscillation	deg	≧30
・Max. Blade Lift	mm	≧450
・Articulation	deg	≧25
Engine		
・Type	Cold district conrrespondence	
		Water Cooled Diesel
・Displacement	cc	≧4,800
・Battery	Cold district conrrespondence	
Tire		
・Size		≧13.00-24-8
Attachment		
・Scarifier		
Number of Teeth	pcs	≧9
Width	mm	≧1,000
・Cab		Steel Cab
Optional Items		
・Tire Chain	Heavy-duty Non-skid Chain	
・Safety Devices	Head lamps、Stop tail lamps、	
Turn signal lamps、Backup lamps、Warning beacon		
・Heater		Cab Heater

Symbol
≧ : equal or over
≦ : equal or less

Table 2-2-3-1.1 SPECIFICATIONS FOR EQUIPMENT (3/4)

STABILIZER		
Engine Output	KW	≧260
Operating Weight	kg	≧21,000
Dimensions		
・Wheel Base	mm	≧5,500
Performance		
・Max. Operating Speed	m/min	≧45
・Max.Travel Speed	km/h	≧20
・Max. Pulverize Width	mm	≧2,000
・Max. Pulverize Depth	mm	≧350
・Gradeability	deg	≧20
Engine		
・Type	Cold district conrrespondence	
		Water Cooled Diesel
・Displacement	cc	≧11,300
・Battery	Cold district conrrespondence	
Under Carriage		
・Type		Wheel or Crawler
・Tire(Crawler)Size		
Tire Size		≧15.5-25-12
Crawler Shoe Width		≧650

HAND GUIDE ROLLER		
Engine Output	KW	≧3.7
Operating Weight	kg	≧600
Dimensions		
・Wheel Base	mm	≧510
Performance		
・Max.Travel Speed	km/h	≧3.0
・Frequency	Hz	≧55
・Centrifugal Force	kN	≧9.8
Engine		
・Type	Cold district conrrespondence	
		Water Cooled Diesel
・Displacement	cc	≧300
Roller		
・Type		Smooth Drum
・Drum Dia.	mm	≧350
・Drum Width	mm	≧600
・Number of Drum	pcs	2

ROAD ROLLER		
Engine Output	KW	≧55
Operating Weight	kg	≧9,500
Dimensions		
・Wheel Base	mm	≧3,400
Performance		
・Max.Travel Speed	km/h	≧16
・Rolling Width	mm	≧2,100
Engine		
・Type	Cold district conrrespondence	
		Water Cooled Diesel
・Displacement	cc	≧3,000
・Battery	Cold district conrrespondence	
Roller		
・Front		
Type		Smooth Drum
Drum Dia.	mm	≧1,620
Drum Width	mm	≧550
Number of Drum	pcs	2
・Rear		
Type		Smooth Drum
Drum Dia.	mm	≧1,620
Drum Width	mm	≧1,100
Number of Drum	pcs	1

TIRE ROLLER		
Engine Output	KW	≧67
Weight		
・Empty Mass.	kg	≧8,500
・Gross Mass.	kg	≧12,900
Dimensions		
・Wheel Base	mm	≧3,600
Performance		
・Max.Travel Speed	km/h	≧24
・Rolling Width	mm	≧2,200
Engine		
・Type	Cold district conrrespondence	
		Water Cooled Diesel
・Displacement	cc	≧4,000
・Battery	Cold district conrrespondence	
Tire		
・Type		Smooth
・Size		14/70-20-12
・Number of Front Tire	pcs	≧3
・Number of Rear Tire	pcs	≧4

VIBRATION COMPACTOR		
Engine Output	KW	≧2.5
Operating Weight	kg	≧54
Dimensions		
・Plate Length	mm	≧510
・Plate Width	mm	≧340
Performance		
・Max. Working Speed	m/min	≧22
・Frequency	Hz	≧90
・Centrifugal Force	kN	≧7.8
Engine		
・Type		Air Cooled Gasoline
・Displacement	cc	≧120

ASPHALT PLANT		
Production Capacity	t／h	≧35
Dryer Unit		
・Drum Dia.	mm	≧1,300
・Drum Length	mm	≧4,500
・Burner Fuel		Diesel Fuel
・Blower Capacity	m^3/min	≧65
Scale Unit		
・Type		Load-cell
・Weighing Capacity		
Agg×As×Filler	kg	≧600×80×100
・Hot Oil Heater	kw	≧1.00
Asphalt Supply Unit		
・Storage Tank Capacity	ton	≧30t×2pcs
・Spray Pump Capacity	ℓ/min	≧220
・Transfer Pump Capacity	ℓ/min	≧190
・Burner Fuel		Diesel Fuel
・Fuel Storage Tank Capacity	ℓ	≧15,000
・Fuel Supply Pump Capacity	ℓ/min	≧35
Mixer Unit		
・Type		Twin Shaft Pug-mill Mixer
・Capacity	kg/batch	≧500
Aggregate Supply Unit		
・Capacity	m^3	≧5
・Number of Hopper	pcs	≧4
・Feeder Type		Belt Feeder with Inverter
Filler Supply Unit		
・Capacity	m^3	≧4
・Feeder Type		Screw
Dust Collector Unit		
・Primary Dust Collector		Cyclone
・Secondary Dust Collector		Venturi Wet Scrubber
・Water Pump Capacity	ℓ/min	≧600
Control Unit		
・Control Panel Type		In-door Automatic Control
・Control Items		Weighing/Burner/Feeder
・Operation Room		Steel Plate with glass window
		and air conditioner

Symbol
≧ : equal or over
≦ : equal or less

Table 2-2-3-1.1 SPECIFICATIONS FOR EQUIPMENT（4/4）

ASPHALT FINISHER		
Engine Output	KW	≧39
Operating Weight	kg	≧7,400
Dimensions		
・Overall Width	mm	≦2,500
Under Carriage		
・Type		Wheel
・Size		
Front		≧18×6×12
Rear		≧13.50-20-14
Performance		
・Max. Paving Speed	m/min	≧12
・Hopper Capacity	ton	≧8
Working Range		
・Standard Paving Width	mm	≧2,000
・Max. Paving Width	mm	≧4,400
・Max. Paving Thickness	mm	≧150
Engine		
・Type		Cold district conrrespondence
		Water Cooled Diesel
・Displacement	cc	≧3,000
・Battery		Cold district conrrespondence
Feeder		
・Max. Speed	m/min	≧18
Spreader		
・Max. Revolution	rpm	≧59
Screed		
・Max. Frequency	Hz	≧47
Heater		LPG
Optional Items		Canopy

ASPHALT SPRAYER		
Engine Output	KW	≧2
Performance		
・Spray Pump Capacity	ℓ/min	≧30
・Asphalt Tank Capacity	ℓ	≦400
Engine		
・Type		Air Cooled Gasoline
Burner		
・Fuel Type		Diesel Fuel
Under Carriage		
・Type		Wheel (The round-shape reinforced Draw Bar with towing eyelet and hand operated parking brake provided with.)
・Tire Size		≧3.50-16-4
・Number of Tire	pcs	2
Optional Items		
・Spray Hose		
Dia.×Length	mm	≧19×5,000
Number of Hose	pcs	3
・Spray Bar		
Dia.×Length	mm	≧19×1,600
Number of Spray Bar	pcs	3
・Spray Nozzle		
Number of Spray Nozz	pcs	5

WATER TANK TRUCK		
Engine Output	KW	≧130
Weight		
・Max. Loading Capacity	kg	≧8,000
・Gross Vehicle Weight	kg	≧14,100
Dimensions		
・Wheel Base	mm	≧4,200
・Tank		
Capacity	ℓ	≧8,000
Length	mm	≧4,400
Width	mm	≧2,200
Height	mm	≧1,100
Performance		
・Max.Travel Speed	km/h	≧95
・Gradeability	deg	≧20
Engine		
・Type		Cold district conrrespondence
		Water Cooled Diesel
・Displacement	cc	≧6,900
・Battery		Cold district conrrespondence
Power Line		
・Transmission		≧6＋1
Tire		
・Size		≧10.00-20-14

MOBILE WORKSHOP TRUCK		
Engine Output	KW	≧145
Weight		
・Max. Loading Capacity	kg	≧3,900
・Gross Vehicle Weight	kg	≧10,000
Dimensions		
・Wheel Base	mm	≧4,200
・Aluminum Van Body		
Length×Width×Height	mm	
		≧2,500×2,450×2,000
Performance		
・Max.Travel Speed	km/h	≧80
・Gradeability	deg	≧20
Engine		
・Type		Cold district conrrespondence
		Water Cooled Diesel
・Displacement	cc	≧8,200
・Battery		Cold district conrrespondence
Power Line		
・Transmission		≧5＋1
・Driving System		≧4×4
Tire Size		≧9.00-20-14
Optional Items		
・Tire Chain		Heavy-duty Non-skid Chain
Maintenance Facilities ・Diesel Engine driven Generator / Welder Set（with welding accessories）・Gas Welder Set（with welding accessories and cylinder carrier）・Air Compressor・Workbench ・Mechanic Vise・Measuring Tools・Mechanic Tools（hand、power）・Lockable Steel Cabinet・Battery Service Tools・Portable Power Tools・Manual Drum Pump・Grease Pump・Grease Gun・Oil Measure、Portable Hydraulic Jack ・Lever Block・Wire Rope・Nylon Sling・Fire Extinguisher ・Hydraulic Crane（Lifting Capacity：３ｔ）		

CONCRETE CUTTER		
Engine Output	KW	≧5.0
Operating Weight	kg	≧120
Dimensions		
・Overall Length	mm	≦1,900
・Overall Width	mm	≦550
・Overall Height	mm	≦1,100
Performance		
・Cutter Blade Dia.	mm	≧350
・Max. Cutting Dipth	mm	≧120
Engine		
・Type		Air Cooled Gasoline
・Displacement	cc	≧200
Optional Items		
・Number of Cutter Blade	pcs	5

COMPRESSOR		
Engine Output	KW	≧36
Operating Weight	kg	≧880
Performance		
・Free Air Delivery	m^3/min	≧5.0
・Working Pressure	MPa	≧0.65
Engine		
・Type		Cold district conrrespondence
		Water Cooled Diesel
・Displacement	cc	≧2,150
・Battery		Cold district conrrespondence
Under Carriage		
・Type		Wheel Traction
・Tire Size		≧5.00-10-6
Outlet Valve		
・Valve Size	mm	≧19
・Number of Outlet Valve	pcs	≧2

SNOW REMOVING TRUCK		
Engine Output	KW	≧145
Weight		
・Vehicle Weight	kg	≧9,000
・Gross Vehicle Weight	kg	≧11,000
Dimensions		
・Wheel Base	mm	≧3,500
・Snow Plow		
Length	mm	≧3,100
Height	mm	≧1,150
Performance		
・Max.Travel Speed	km/h	≧90
・Gradeability	deg	≧25
Engine		
・Type		Cold district conrrespondence
		Water Cooled Diesel
・Displacement	cc	≧8,200
・Battery		Cold district conrrespondence
Power Line		
・Transmission		≧5＋1
・Driving System		≧4×4
Tire		
・Size		≧9.00-20-14
Optional Items		
・Tire Chain		Heavy-duty Non-skid Chain
・Front & Rear Window、Side Mirror		with Thermic Rays
・Side Window		with Defroster
・Ghost Visor		provide

Symbol
≧ : equal or over
≦ : equal or less

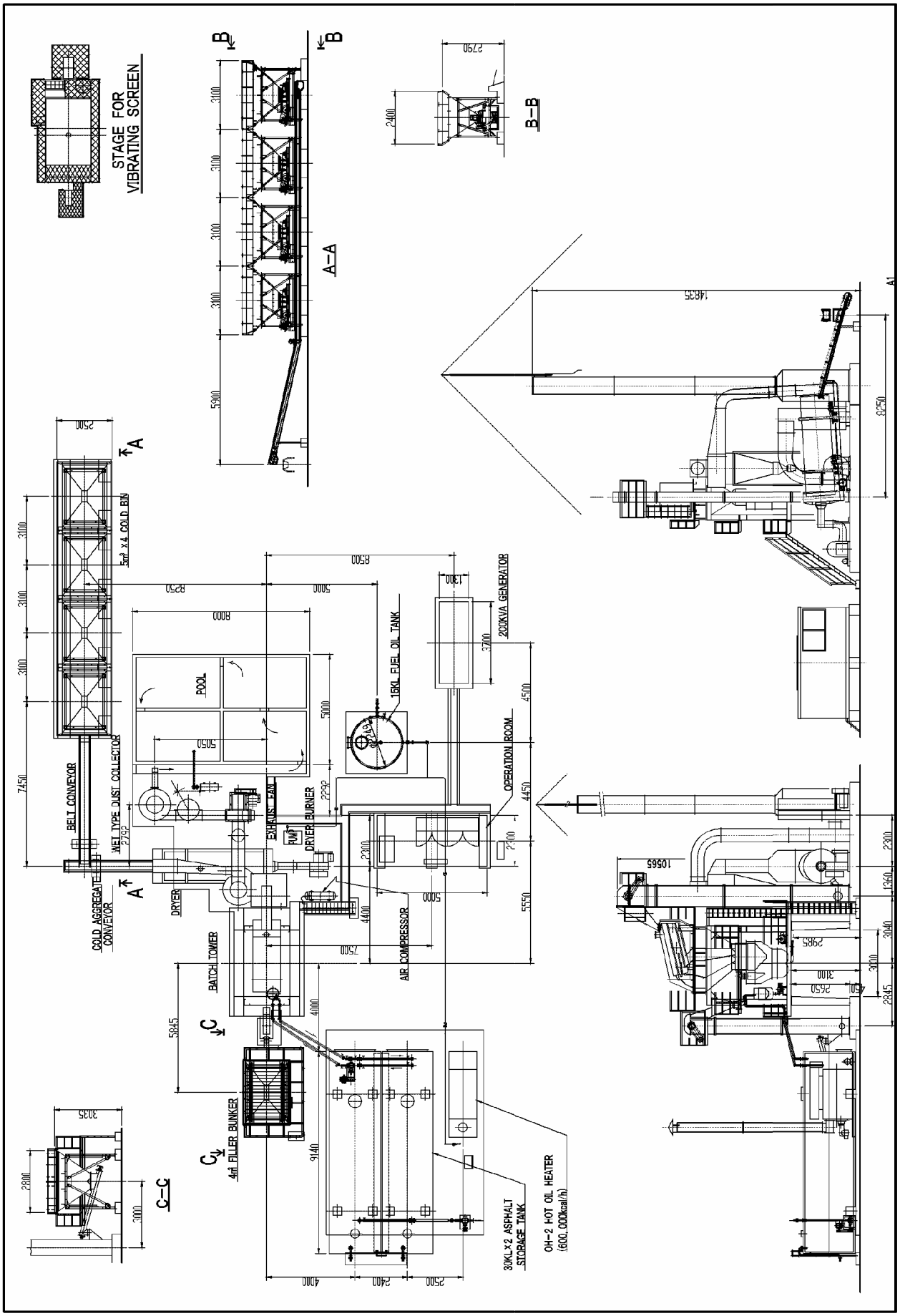


Figure 2-2-3-2.1 Layout Plan of Asphalt Plant

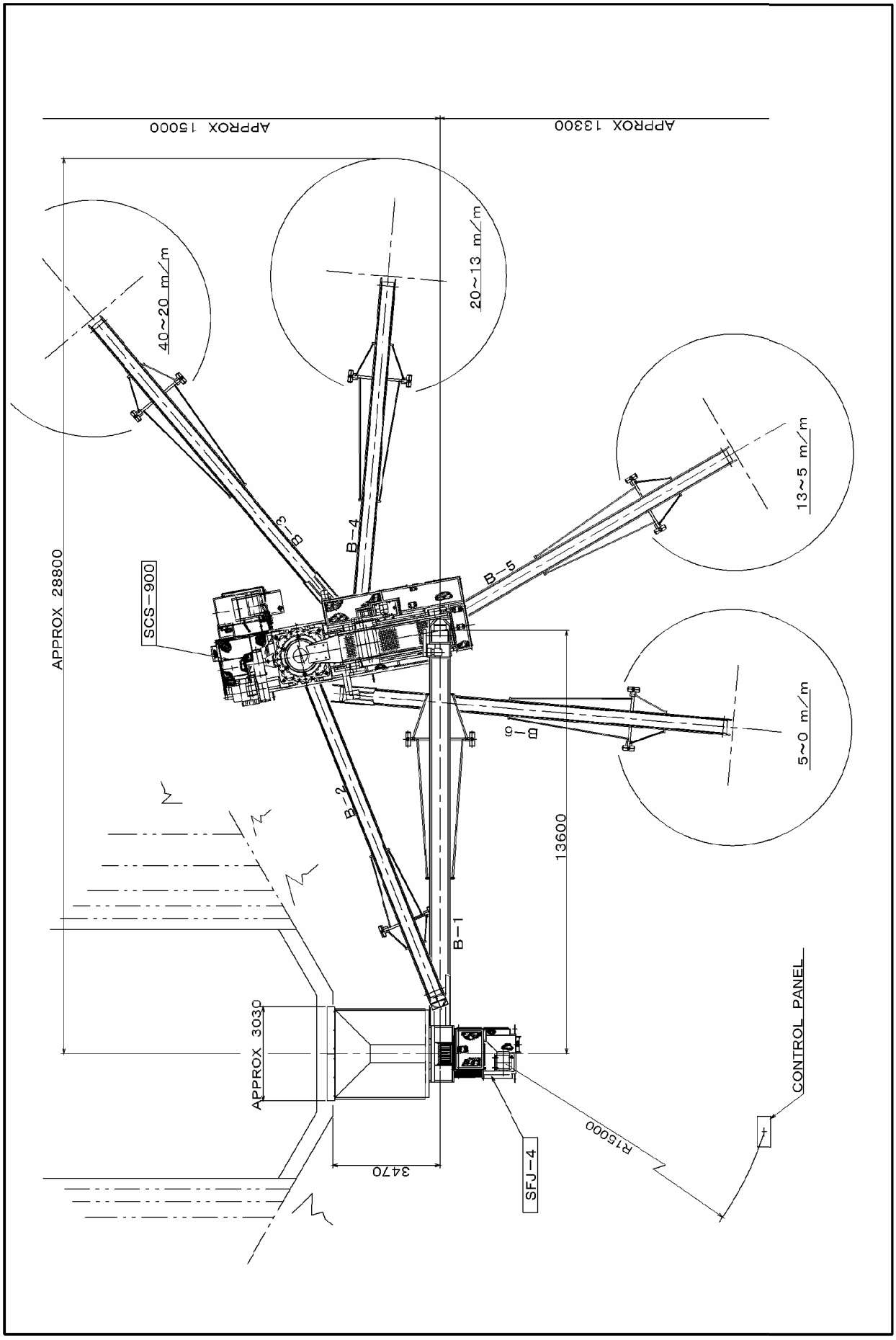


Figure 2-2-3-2.2 Layout Plan of Aggregate Plant

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Implementation System

In case of implementing this Project under the framework of grant aid by the Japanese government, the overall organization for its implementation will be as indicated in the diagram below.

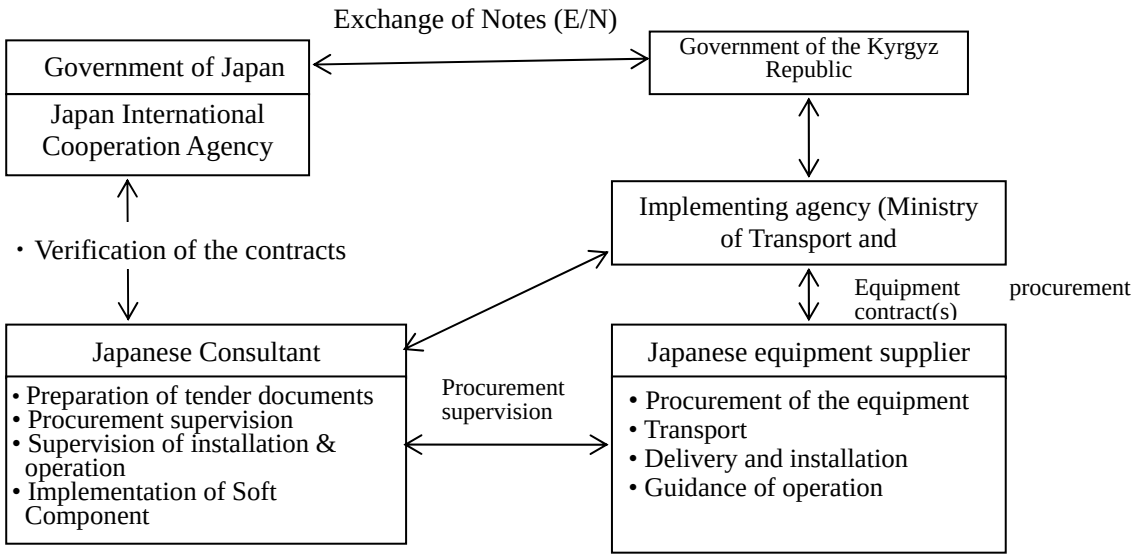


Diagram of Organization of Project Implementation

The implementing agency of the Kyrgyz side is the Ministry of Transport and Communications. In accordance with the guidelines for Japan's grant aid scheme, a Japanese consultant is in charge of the detailed design and the procurement supervision, and a Japanese juridical person shall be a contractor for the procurement of the equipment in the Project.

(2) Consultant

After the signing of the E/N the Ministry of Transport and Communications is to promptly conclude an agreement for the consulting services on the execution of this Project with a Japanese consulting firm. The consultant contracted with the Ministry of Transport and Communications shall provide the engineering services on the detailed design, preparation of tender documents, assistance in tender, procurement supervision, etc., and shall take a responsibility up to the turning over of the equipment and the completion of the Soft Component.

(3) Supplier

The successful tenderer (supplier), qualified by the evaluation on the required quality and specifications through the general competitive bidding with conditions of applicants qualification, will make a contract with the Ministry of Transport and Communications for the delivery of the equipment of this Project. The Supplier shall take a responsibility for the honest execution of the delivery of the equipment and the provision of guidance for installation, and daily inspection in conformity to the schedule requested by the Ministry.

2-2-4-2 Matters to be Observed Concerning Procurement of the Equipment

Machineries and equipment to be procured will be supplied by deliverer to the following designated places.

- The place of delivery of machineries, equipment and spare parts to be procured, except plants, will be the Kachkor office of Road Management Office of MOTC covering Bishkek-Naryn-Torugart (the 955th road maintenance/management office).
- The place of plant delivery will be the land managed by the 955th road maintenance/management office at the point of 243km of Bishkek-Torugart road.

As shown in Table 3-2-2-2.3, the actual location of machineries and equipment will be the 955th, 41st and 957 th road maintenance/management offices under the Department of Road Management. The delivery will be carried out by the implementing organization. After the delivery at the designated places, a deliverer will hand over machineries and equipment to the Ministry of Transportation and Communication subsequent to the trial run and the confirmation of normal operation. A deliverer will soon conduct instructions on the initial operation and regular inspection after delivery.

2-2-4-3 Bearing of Cost of Procurement and Installation

The cost of procurement of the equipment, including inland transportation, is to be borne by the Japanese side.

The Kyrgyz side is to take the necessary steps for exemption of the equipment from all import duties and fees.

The division of bearing of the costs relating to the installation of the asphalt plant and the aggregate plant shall be as follows:

- The Japanase side will be responsible for costs of installation, including basic wall construction
- The Kyrgyz side shall be responsible for providing the land for installing the plants, preparing it for use, furnishing the primary side of the electric power supply and accomplishing the water supply and drainage work for the plants.
- The Kyrgyz side shall be responsible for removing and relocating any existing structures that might pose an obstacle to the installation of the procured equipment.

The following are to be provided or indicated to the Kyrgyz side in advance by the Japanese side:

- Site maps and drawings needed for installation
- Foundation drawings
- Installation drawings (including water supply and drainage network drawings)
- The necessary amount of electric power
- The necessary amount of water

2-2-4-4 Procurement Supervision

(1) Basic Policy of Procurement supervision

In case of implementing this Project under Japan's grant aid scheme, the sufficient understanding particularly on the following matters is essential for the preparation of tender documents and the execution of the procurement supervision.

- The background of formulation of the work plans
- The Basic Design Study Report
- The Japan's Grant Aid Scheme
- The Exchange of Notes concluded between the two countries

Based on the above, the following explains the summary of the work, demarcation and remarks on the detailed design and procurement supervision.

(2) Consulting Services

After the signing of E/N, the consultant shall conclude the agreement for consulting services with implementing agency based on the scope of works mentioned in E/N. The major works of theconsultant are as follows:

(i) Detailed design

- Discussion & preparation of tender documents (Kyrgyz /Japan)
- Approval by the Kyrgyz side on the tender documents (Kyrgyz)
- Execution of tender, evaluation, report & approval on its result (Japan)
- Contract promotion work (Kyrgyz / Japan)
- Confirmation of the obligation borne by the Kyrgyz side (Kyrgyz/Japan)

(ii) Procurement supervision

- Confirmation of the issuance of order sheets for the equipment
- Observation of the progress of the procurement
- Carrying out a factory inspection
- Assignment of an inspection agency for a pre-shipment inspection
- Report the progress
- Presence at the turning over
- Issuance of certificate of the completion

(iii) Guidance of the equipment

Regarding procured machineries and equipment, engineers of a delivering company will conduct instructions on the initial operation and regular inspection under the direction of consultants.

(3) Remerks on the Service

(i) Checking to make sure whether or not any changes have been made to the equipment procurement conditions set forth in the basic design stage.

(ii) Reviewing the design contents after signing of the E/N to ensure that the detailed design conforms to the purpose of supply of equipment under the grant aid scheme, preparing the tender documents accordingly and having them approved by the Kyrgyz side.

2-2-4-5 Quality Control

To confirm that the equipment satisfies the technical specifications appointed in the contract with the supplier, the consultant shall carry out the following inspections on each stage of the procurement of equipment.

- Confirmation of the issuance of the order sheets for the equipment
- Carrying out a factory inspection
- Assignment of an inspection agency for a pre-shipment inspection
- Carrying out a turning over inspection

2-2-4-6 Procurement Plan

Selection of the equipment to be procured is to be made on the basis of comprehensive comparative consideration of such factors as the conditions of operation and maintenance in Kyrgyz, the technical level in they count, economy and so on so as to select products that are to the greatest advantage of Kyrgyz.

(1) Method of Procurement

Almost all of the equipment that the Ministry of Transport and Communications has was made in the former Soviet Union. Furthermore, there is no production of construction equipment in Kyrgyz, and neither is there wide appearance of Japanese products or those of other countries on the market. Nor are there any local representative offices of construction equipment manufacturers.

Regarding Russian construction machineries widely used in the market, the following issues are reported; i) there is a fact that an agent does not exist in the Kyrgyz Republic, ii) there was a case that expense for dispatching an engineer was requested even during the term of guarantee, and iii) there was a case that responsibility was shifted by saying that the breakdown was due to a mistake/accident, without any examination on the regulations of

guarantee/repair. It can be judged, based on these facts, that the repair and after-care system is not satisfactory.

On the ground of the following reasons it is deemed unnecessary to consider any other countries than Japan as being suitable for procurement of the equipment to be furnished in the Project.

- All of the equipment to be procured is manufactured in Japan.
- There is no production of that equipment in Kyrgyz.
- Even if the tender is held with restriction to procurement in Japan, many Japanese firms manufacture the equipment in question, which means that there will not be any problem in terms of competition.
- No clear cost advantage, including transportation cost, can be seen for European machinery as a source of third-country procurement in comparison with Japanese equipment.
- The Ministry of Transport and Communications wants the equipment to be procured from Japan.

(2) Delivery Route

The following three transport routes have been considered:

(i) From the Russian port of Nakhodka to Bishkek via the Trans-Siberian Railroad

(ii) From the Chinese port of Tianjin to Bishkek via Chinese railroad

(iii) From the Iranian port of Bandarbas to Bishkek via road/railroad.

According to the Project implementation schedule the time of bringing in of the equipment should be around May, when there should not be any transport problems like snow.

Route (i): Owing to increased volume of freight from South Korea bound for Europe it has become difficult to secure use of freight cars on the Trans-Siberian Railroad from Nakhodka. Furthermore, there are only limited voyages of general conventional ships to Nakhodka from Japanese ports of shipment, which would make it difficult to fix the transport schedule.

Route (ii): Transshipment would be necessary at Drujhba in Kazakhstan because of change in railroad gauge, but in recent years the Chinese railroad route has become increasingly used and has now established itself as an alternative to the Trans-Siberian Railroad. Furthermore, it is cheaper for shipments to Central Asia than the Trans-Siberian Railroad.

Route (iii): A considerable portion of the overland distance is by truck. Transshipment to railroad at Mashhad, Iran, would be necessary, and transport time would be long considering factors like the need to transit through five countries on the way.

The route using the Chinese railroad is considered to be the best choice considering the

lowest expense and highest safety. The Japanese side will assume responsibility for customs clearance in transit countries, but the Kyrgyz side will have to do so for Kyrgyz.

(3) Transport within Kyrgyz

In this Project procurement of an asphalt plant and an aggregate plant is scheduled, and it is intended that the Japanese side be responsible for the work of installation of these plants. It will therefore be necessary to bear the following in mind regarding transport of the plant components.

- The need to bring in the components in accordance with the installation work schedule, with strict observance of the delivery dates
- The need for appropriate arrangement of availability of transport vehicles, particularly in view of the large number of packing units involved
- The need to plan the bringing in of the packing units in the order of assembly
- The need to make sure that the loading is done appropriately so as to avoid any distorting of the components

For the sake of smooth accomplishment of the plant installation work it is necessary to strictly observe the above considerations. For this end, the Japanese side should assume responsibility for transport of the plant components in Kyrgyz, with delivery at the place designated for installation of the plants.

Regarding the other equipment, in view of the need to complete bringing in, assembly and trial operation on time for smooth implementation of technical assistance (Soft Component), the Japanese side should assume responsibility for transport of it, too, within Kyrgyz, with delivery to the Kachkor office under the Department of Road Management covering Bishkek-Naryn-Torugart.

(4) Spare Parts

For the sake of smooth operation of the equipment to be procured in this Project, its spare parts are to be selected based on the criteria indicated below and procured at the expense of the Japanese side.

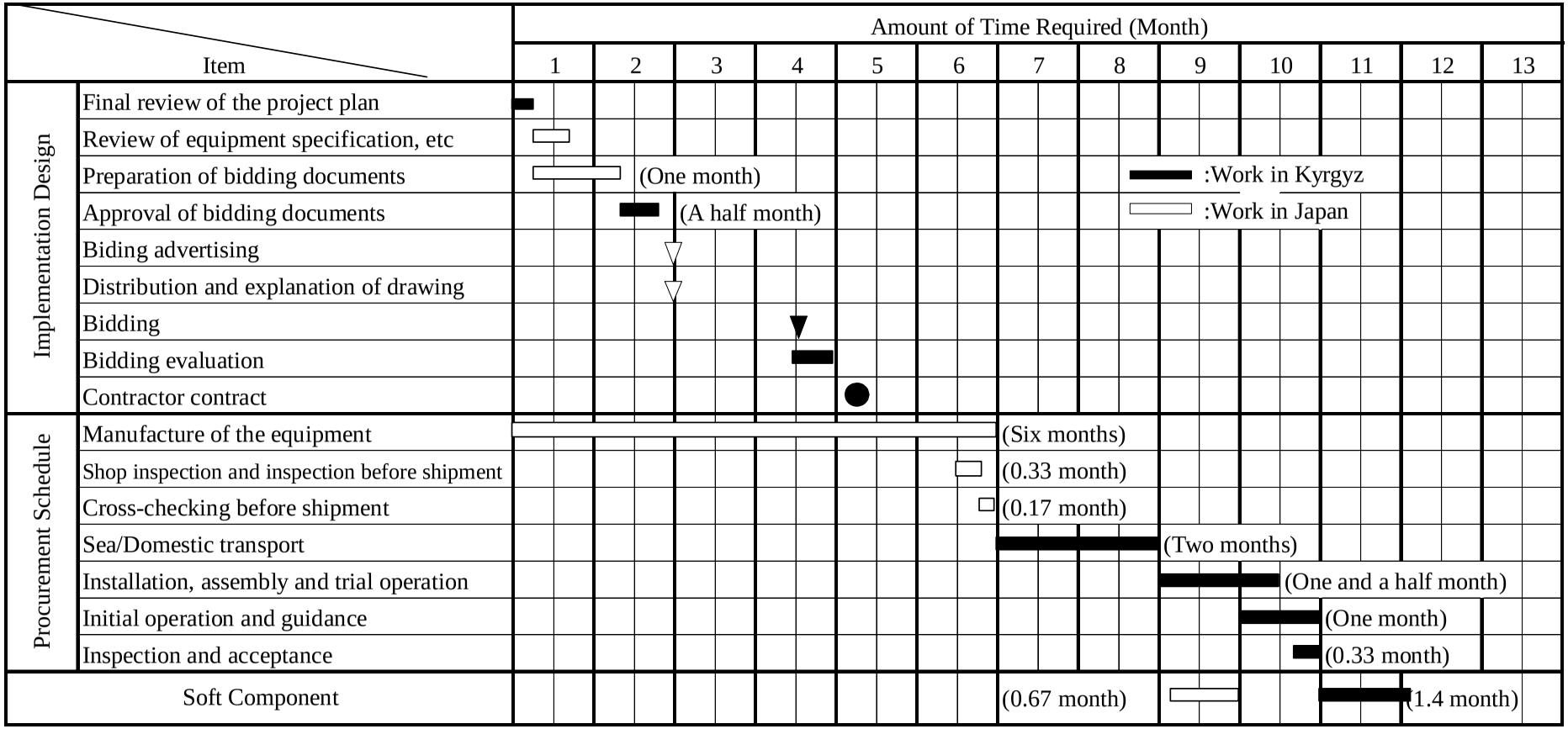
- Regarding the content of the spare parts, there should be selection mainly of those for periodical replacement aimed at maintaining the functionality of the equipment and preventing trouble before it happens and of consumables.
- The quantity of spare parts will be the amount which will roughly be used for asphalt re-pavement of 45km.
- A ceiling cost of the spare parts should be set at about 5% of the price of the equipment itself.

Management and inventory of these spare parts are conducted at the Kachkor office under the Road Management Department of Bishkek-Naryn-Torugart, by equipping computers.

2-2-4-7 Implementation Schedule

Table 2-2-4-7.1 shows the work schedule plans for the implementation design, tender and supervision of procurement and Soft Components.

Table 2-2-4-7.1 Project Implementation Schedule



2-3 Summary of the Kyrgyz Side's Share of the Project Work

The items for which the Kyrgyz Government and Ministry of Transport and Communications will be responsible in implementating this Project are as follows:

(1) Items to be borne by the Kyrgys Republic

- Bearing of the handling charges for the bank account to be opened in Japan concerning this Project.
- Exemption of the equipment imported for the Project from customs duties and fees, facilitation of customs clearance thereof and implementation of measures to ensure prompt inland transport to the Project site.
- Legal steps necessary for entry to and stay in Kyrgyz by the Japanese who will be engaged in the Project work there.
- Exemption of the Japanese who will be engaged in the Project work in Kyrgyz and the goods and service purchases necessary for Project implementation from taxation.
- Issue of the authorizations, permits, approvals, certificates, etc. necessary for Project implementation.
- Furnishing of the necessary information and information materials needed for Project implementation.
- Securing of the land for installation of the asphalt plant and aggregate plant among the equipment to be procured in the Project, removing of existing structures on that land and preparing the ground there for installation of the plants.
- Doing the primary-side electric power work and the water supply and drainage work for servicing of the asphalt and aggregate plants.
- Securing land for parking of the procured mobile machinery.
- Accomplishing appropriate operation and maintenance of the procured equipment.
- Doing the maintenance work on the Project road.
- Securing the personnel to participate in the Soft Components and bearing the expenses thereof.
- Costs for carrying out soft components, such as securing participants, materials and fuels necessary for practical training

(2) Expenses by the Kyrgyz side

Costs for land acquisition and leveling for asphalt plant and aggregate plant

50,000som (approximately 141,000yen)

Costs for appurtenant work of asphalt plants and aggregate plants

200,000som (approximately 563,000yen)

Costs for soft component implementation

15,000 som (approximately 42,000yen)

Commission for a bank

244,000som (approximately 687,000yen)

(3) Calculation Conditions

- Time of calculation March 2006
- Exchange rate 1 $U.S. = 117.07 yen

  1 som (local currency)= 2.82 yen

2-4 Project Operation and Maintenance Plan

The maintenance work on the Project road will be carried out directly by the Ministry of Transport and Communications using the equipment procured in the Project, as will also the maintenance work on the procured equipment.

The following Table 2-4.1 shows for each RMC where the procured equipment will be deployed both the number of foremen, operators, workers, etc. that will have to be assigned for the road maintenance to be done in the Project and their present personnel strengths.

Table 2-4.1 Assignment of Necessary Personnel

No. of personnel / Work items	Kachkor office of Road Management Agency	Road Maintenance and Management Office		
		955th	41st	957 th
Pothole repair	0	8	4	4
Clearing away snow	0	0	0	8
Re-pavement of Asphalt	0	15	0	0
Plant operation	0	9	0	0
Regular maintenance of machineries and equipment	3	0	0	0
Management of spare parts	2	0	0	0
Number of necessary personnel	5	32	4	12
Current number of personnel	unfixed	36	65	56

The deputy governor has made a definite promise to secure necessary personnel at the Kachkor office under the Department of Road Mangement covering Bishkek-Naryn-Torugart. As the table shows, each road maintenance/management office already has responsible personnel, under the system, the Project will be carried out and maintained/managed.

Table 2-4.2 Annual Cost of Operation of the Equipment

ypes of wo	Equipment	① Basic price (thousands of yen)	② Standard No. of years of use (years)	③ Standard annua operating time (h)	④ nual maintenan repair cost rate (%)	⑤ Fuel consumption (ℓ/h)	⑥ Maintenance and ①×④× (4/②) 2÷4 (thousands of yen)	⑦ Fuel cost ⑤×③ ×0.055 (thousands of yen)	⑧ Annual operating labor cost (thousands of yen)	⑨ quipment expens ⑥＋⑦＋⑧ (thousands of yen)	⑩ Planned o. of uni (unit)	⑪ Total equipment cost ⑨×⑩ (thousands of yen)	⑫ Total equipment cost ⑪÷2,66 (thousands of som)
Repairing of potholes	Concrete cutter	358	6.0	260	40	(G) 1.40	16	23	—	39	4	155	58.4
	Compressor	1,940	11.0	390	30	7.40	19	159	36.0	214	4	856	321.8
	Hand breaker	132	5.0	—	30	—	6	—	—	6	8	51	19.1
	Asphalt sprayer	160	4.5	260	50	(G) 0.54	16	9	36.0	61	4	243	91.2
	Hand guide roller	862	11.0	470	35	0.60	10	16	43.2	69	4	275	103.3
	Vibration compactor	130	5.0	390	50	(G) 0.90	10	22	—	33	8	260	97.8
	Truck with crane	6,010	10.0	850	45	6.60	108	309	43.2	460	4	1,840	691.6
Repaving	Concrete cutter	358	6.0	260	40	(G) 1.40	16	23	36.0	75	1	75	28.1
	Hydraulic breaker	2,600	6.5	—	25	—	62	—	—	62	1	62	23.1
	Excavator	11,900	7.5	840	45	18.00	381	832	43.2	1,256	1	1,256	472
	Wheel loader	14,200	11.0	610	70	17.00	329	570	43.2	942	1	942	354.2
	Dump truck	9,850	9.0	1,000	60	12.00	292	660	43.2	995	6	5,970	2,244.50
	Stabilizer	41,100	9.0	260	65	25.00	1,319	358	79.2	1,756	1	1,756	660.1
	Motor grader	13,200	12.0	470	35	12.00	128	310	43.2	482	1	482	181.1
	Water tank truck	8,280	9.5	710	45	8.00	165	312	43.2	521	1	521	195.8
	Road roller	7,740	13.0	440	35	6.00	64	145	43.2	253	1	253	94.9
	Tire roller	7,050	13.0	460	45	7.10	75	180	43.2	298	1	298	112.0
	Asphalt sprayer	160	4.5	260	50	(G) 0.54	16	9	36.0	61	1	61	22.8
	Asphalt finisher	20,800	11.0	440	45	5.90	309	143	230.4	683	1	683	256.6
	Truck trailer	15,600	10.0	700	35	18.00	218	693	43.2	955	1	955	358.9
	Asphalt plant	55,900	9.0	—	50	244,140 ℓ	1,380	13,428	158.4	14,966	1	14,966	5,626.40
	Aggregate production plan	39,100	8.9	—	70	12,480 ℓ	1,382	686	122.4	2,191	1	2,191	823.7
	Wheel loader	12,500	11.0	610	70	14.00	289	470	79.2	838	1	838	315.1
	Mobile workshop truck	10,100	10.0	850	45	9.90	182	463	122.4	767	1	767	288.4
Snow removal	Snow removal truck	10,200	13.0	300	62	18.00	150	297	86.4	533	4	2,132	801.6
Total							6,943	20,115	1,454	28,512	62	37,885	14242.5

Remarks:

• Items ①-⑤ in the table are based on the "Rental Calculation Table for Construction Equipment, Etc." (complied under the editorial supervision of the Construction Work Planning Department of the General Policy Division of the Ministry of Land, Infrastructure and Transport).

• The unit prices for fuel are the actual local market prices in Kyrgyzstan at the time of the basic design local survey (October 2005): 55 yen/ ℓ (20.7 som/ℓ)of gas oil and 63 yen/ ℓ (23.7 som/ℓ) of gasoline.

• Total equipment cost is ① x ⑩ = 379,504,000 yen. Since the cost of 4 years' worth of parts (5% of equipment cost ≈ 19 million yen) will be provided, the burden of maintenance and repair cost will be reduced by (19 million yen ÷ 4) 4,750,000 yen, and therefore that cost as revised will come to 37,885,000 yen - 4,750,000 yen = 33.135,000 yen (12,457,000 som).

• Assuming an annual production volume of 21,000 t of asphalt mix on the basis of the work volume, the materials (bitumin, aggregate) cost thereof comes to 12,865,000 yen (4,836,000 som). Therefore the operating and maintenance cost borne by the Kyrgyz side comes to 33,135,000 yen + 12,865,000 yen = 46 million yen (12,793,000 som).

2-5 Other Relevant Issues

Soft Component

(1) Need for Implementation of Soft Component

The Project aims to arrange machineries and equipment for road maintenance and management between Bishkek and Torugart (target section: 362km). The following problems have been identified in terms of maintenance/management of machineries and equipment as well as road maintenance/management tasks of the implementing organization

(i) Currently, mechanics, who also hold a post of operators, carry out maintenance activities according to knowledge on structures and maintenance/management, which was acquired during the Soviet Union period and is based on machineries and equipment of the old type. It is necessary, therefore, to obtain knowledge and information on the latest machineries and equipment in order to effectively maintain them.

(ii) Currently, maintenance activities are carried out according to individual experiences because of insufficient maintenance/management facilities. Therefore, appropriate techniques of solving problems and maintaining each machinery and equipment are required.

(iii) Currently, parts are procured each time when there is a breakdown. It is necessary to keep/hold spare parts and to establish an appropriate operation/management system that can deal with regular and irregular (in case of breakdown) parts exchange.

(iv) Since the surface of SBST, that covers almost the entire road, is thin, bitumen emulsion is degraded and surface layer is coming off. In carrying out re-pavement, it is essential to make a technical assistance for effective construction planning by combining various machineries and equipment.

(v) Rutting, surface distortion and potholes have often taken place because of insufficient strength of pavement structure and improper construction. Therefore, technical assistance for pavement design, quality control of aggregate and asphalt as well as for construction management.

Implementing organization lacks know-how of effective construction planning by combining various machineries and equipment as well as knowledge on the latest machineries and equipment, and therefore, it desires to receive technical assistance in order to effectively utilize diverse machineries and equipment procured by the Project. In order to smoothly promoting the Project purpose, “appropriate repair of main roads”, it is necessary to make a technical assistance for effectiveness and technology improvement in terms of operation/maintenance/management of

machineries and equipment as well as of detailed design of road repair and construction management.

(2) Objectives of Soft Components

Insufficient knowledge regarding the operation of the latest machineries and equipment, which is mentioned above, can be improved by instructions on the initial operation conducted by deliverer. In addition to instructions on the initial operation, the soft components will provide technical assistance for effective and efficient road maintenance and repair with limited financial resources, by building up the capacity, properly allocating and comprehensively operating combined machineries and equipment.

(3) Expected Outcomes of Implementation of Soft Component

Outcomes achieved by the soft components are as follows.

○ Securing of necessary technologies regarding effective construction plan and management by using road maintenance/management machineries and equipment

- Appropriate repair works according to the road damage can be carried out as planned by obtaining the techniques of selecting the most proper method of pavement degradation and repair.
- It will be possible to understand the appropriate combination of machineries and equipment, construction process, important notices, timing and quantity of necessary machineries/equipment and work force for construction, according to each repair condition. It will be possible, therefore, to carry out the road maintenance/management plan as well as tasks by effective use of machineries and equipment.
- Repair technologies will be improved by obtaining appropriate construction management method, and as a consequence, repair/construction of better quality can be achieved in shorter period.

Outcomes achieved by the soft components will be confirmed from the following viewpoints.

○ Securing of necessary technologies regarding planning, designing, and construction management of road maintenance/management (rehabilitation)

- Preparation of construction plan documents
- Increase of construction record(number of constructions, quality of construction, etc.)
- Increase of operational effectiveness of equipment
- Quality management (grain size, composition, temperature, etc)of asphalt mixture

The implementation agency will confirm the above points independently.

(4) Soft Component Works (Input Plan)

When repair work is carried out by the implementing organization, activities of the soft components include technical assistance for planning, designing, and construction management by using procured machineries and equipment,. This site repair work is based on a concept when a road is repaired by using the procured machineries and equipment and it is accompanied by the start-up activities of initial operation and operational instructions. It aims to make a comprehensive improvement in terms of road repair technologies by carrying out effectively and as planned a series of tasks such as repair plan, designing, procurement of machineries and equipment, construction management, recording and feedback. Fixing of technologies will be intended by the program consisting of theoretical training such as lectures and construction planning, and practical training in designing and site surveys.

Concrete activities are shown as follows.

- Technical assistance for preparation of an inventory book regarding maintenance and management of machineries and equipment
- Technical assistance for surface examination method
- Technical assistance for examination method of pavement degradation
- Preparation of road repair/construction plan
- Preparation of a gist of road repair/construction management
- Technical assistance for preparatory arrangement, actual preparation and post-Project –evaluation of road repair/construction
- Technical assistance for appropriate construction management in relevant road maintenance/repair sites

The details of the above-mentioned components are as follows.

1) Technical assistance for preparation of an inventory book regarding operation and management of machineries and equipment

In order to improve the above-mentioned problem, “possession and keeping of spare parts”, technical assistance for the preparation of an inventory book, that will be a basis for keeping and stock management of spare parts, will be conducted. Consultants will advise in the process of preparing the form of an inventory book by examining necessary items and layout and they also instruct a method to actually manage machineries and equipment by using the prepared inventory book.

① Major items for technical assistance and instruction

(i) Use and management of an inventory book of machineries and equipment（repair records, dairy operation report, inspection at the beginning of work, regular inspection, etc.）

(ii) Use and management of an inventory book regarding possession, keeping,

procurement and stock of spare parts (record of stock management, stocktaking, procured parts management, location of parts, etc.)

② Timing and duration of implementation

Five days before and after the delivery of machineries and equipment

(Contents)

- Explanation on the necessity and utilization of inventory book management(1day)
- Instruction on inventory book preparation by the Kyrgyz side(3days)
- Practical management training by using an inventory book (1day)

③ Place of implementation

Maintenance and Management Office of the 955th road

④ Target

Personnel of the implementing organization responsible for sites, chief of works, and other personnel involved in works, 15 personnel in total

⑤ Instructor/Trainer

One consultant/road engineer

2) Road repair plan/technical assistance by practical training in designing(lectures and practical training)

Technical capability of the Kyrgyz construction engineers is to be improved by carrying out theoretical lectures concerning road repair. In addition to the lectures, based on “Road repair/construction plan” and “Gist of road repair/construction management” to be prepared by the Kyrgyz side, a series of practical training in road maintenance/management is to be carried out in relevant sites. While aiming to fix techniques by the practical training, construction method suitable to the Kyrgyz Republic is to be established by exchanging views with site engineers.

① Major items for technical assistance and instruction

(i) Study on road surface and analytical method
(ii) Technique of selecting optimal repair method
(iii) Pavement design method
(iv) Technique of establishing construction preparatory plan (forwarding of machineries and equipment, combination of necessary machineries and equipment)
(v) Technique of establishing removal plan (e.g. smashing of the surface layer)
(vi) Technique of setting the thickness of pavement surface
(vii) Technique of quality control (improvement of roadbed, surface pavement)

(viii) Evaluation technique of pavement construction

(ix) valuation after technical instruction

② Timing and duration of implementation

17 days after the instruction of the initial operation of machineries and equipment

(Contents)

- Lectures on item (i)~(iii)(3days)
- Practical training in item (iii)(4days)
- Instruction on construction implementation preparatory plan(1day)
- Practical training in (v)~(vii)(7days)
- Instruction on pavement/construction evaluation(1day)
- Evaluation after technical instruction(1day)

③ Place of implementation

Maintenance and Management Office of the 955th road, potholes and re-pavement sites

④ Target

Personnel of the implementing organization responsible for sites, chief of works, and other personnel involved in works, 25 personnel in total

⑤ Instructor/Trainer

One consultant/road engineer

3) Preparation of a road repair/construction plan

Under technical assistance by consultants, this plan will be formulated by road engineers of the implementing organization according to the needs of the Kyrgyz Republic, in order to repair potholes and roads by re-pavement method, using machineries and equipment provided by the Project. Consultants will prepare a construction plan manual in Japan. The manual will reflect the procurement composition of machineries and equipment as well as the current demands of the Kyrgyz Republic (e.g. technical capability of the implementing organization, situations in target areas, etc.) and consists of the following components.

(i) Implementation process, (ii) Implementation structure, (iii) Machineries and equipment to be used (combination), (iv) Materials to be used (procurement of materials), (v) Materials to be used (procurement of materials), (vi) Construction methods (process), (iiv) Safety measures, and (iiiv) Environmental protection

① Major items for technical assistance and instruction

(i) Study on the current road situations

(ii) Preparation of a road repair/construction plan

② Timing and duration of implementation

Six days after the instruction of initial operation of machineries and equipment

(Contents)

・Practical training in road monitoring and in analysis of the current situations(3days)

・Instruction on the preparation of a road repair/construction plan(3days)

③ Place of implementation

Maintenance and Management Office of the 955th road

④ Target

Road engineers and relevant personnel of the implementing organization, approximately five personnel in total

⑤ Instructor/Trainer

One consultant/road engineer

4) Preparation of a gist of road repair/construction management

Based on the road repair/construction management manual prepared by consultants in Japan, this gist will be formulated by road engineers of the implementing organization according to the needs of the Kyrgyz Republic, in order to standardize the quality, quantity and progress/process under technical assistance by consultants. In concrete, check lists and management chart will be prepared. The contents of road repair/construction management manual prepared by consultants will reflect the current demands of the Kyrgyz Republic.

① Major items for technical assistance and instruction

(i) Preparation of a gist of the road repair/construction management

② Timing and duration of implementation

Two days after the instruction of initial operation of machineries and equipment

③ Place of implementation

Maintenance and Management Office of the 955th road

④ Target

Road engineers and relevant personnel of the implementing organization, approximately five personnel in total

⑤ Instructor/Trainer

One consultant/road engineer

Chapter 3　Study on Relevancy of the Project

3-1　Effects of the Project

Current situations and problems	Measures taken in the Plan（Projects to be conducted by the cooperation）	Effects of Plan and degree of improvement	
		Direct effects	Indirect effects
1．Machineries and equipment for road maintenance/management • There are not many operating machineries and equipment and it is difficult to deal with various road maintenance/management. • Currently operating machineries and equipment have become obsolete and repeated to be out of order as well as to be maintained. • Currently operating machineries and equipment are limited and also frequently develop trouble, which are the major causes of low effectiveness of road maintenance/management as well as low quality of construction.	• Procurement of machineries and equipment for repair of potholes, clearing snow, restoration from calamities, and re-pavement of asphalt • Instruction for operation • Implementation of soft component tasks for road maintenance/management	• Road of 362 km between Bishkek and Bishkek-Torugart is to be paved. • Machineries and equipment for road maintenance/management are prepared.	• Promotion of employment and improvement of living standards of residents of Naryn Rayon • It is expected that logistics expenses be lower by shortening transport time. • Time for clearing away snow during winter is reduced and positive living environment are secured for residents. • Damage to running vehicles as well as vehicle maintenance/management costs iare reduced.
2．Asphalt plant • Asphalt can not constantly be provided because of overage roads and frequent breakdown. • Living capability is low and sufficient shipping quantity can not be provided. • Quality of asphalt is not assured because of lower functions by overage. • Management of grain combination (mixture) can not be carried out because of the lack of stock based on grain size.	• Procurement of asphalt plant • Installation in the sites • Trial implementation and adjustment • Instruction for operation		
3．Aggregate plant • Aggregate can not constantly be produced because of overage and frequent breakdown. • There are only two kinds of aggregate that can be produced and grains necessary for asphalt mixture can not be secured. • There are no specific machineries to carry ores and aggregates and therefore, efficiency is quite low.	• Procurement of aggregate plant • Installation in the sites • Trial implementation and adjustment • Instruction for operation		

4. Maintenance and management of machineries and equipment • There is no knowledge on systematic maintenance and necessary facilities do not exist. • Although experiences to deal with breakdown are sufficient, knowledge on breakdown prevention is not enough. • It takes time to complete repair, since no spare parts are in stock.	• Procurement of mobile vehicles for maintenance • Implementation of soft components regarding maintenance/management of machineries and equipment		

3-2 Issues to be solved and recommendations

It is essential to solve the following issues in order to more reliably generate and mainatain positive effects of this Project plan.

(i) In this Project, in order for the executing agency to perform road maintenance effectively and efficiently under the limited budget, a soft component will be introduced so that comprehensive road maintenance technique, including equipment operation, can be acquired. This soft component needs to be completed by October, before suspending the works during the winter time due to heavy snowfall in the region. Therefore, it is necessary to have a thorough discussion with parties involved so that the delivery of equipment procured to the field and installation works are performed according to the Project operation process, and the budgetary steps are taken by the Kyrgyz Republic side for the portion to be borne.

(ii) In order to secure a budget needed for road maintenance, it is necessary to develop a concrete road rehabilitation work plan on the Project road section, and to try to obtain cooperation from agencies involved so that the plan is executed steadily.

(iii) It is desirable to promote the introduction of computer system to ensure efficient management of maintenance history, as well as the records of stock, usage, order and delivery of parts and components.

(iv) Recently, in the road section covered by this Project, the traffic of heavy vehicles is increasing. In order to maintain good road conditions which are expected to be realized by this plan for a long period of time, it is necessary to promote installation of vehicle weighing equipment, and to enhance regulations on the passage of heavy vehicles.

[Appendices]

1. Member List of the Study Team
2. Study Schedule
3. List of the Study Team
4. Minutes of Discussions (M/D)
5. Cost Estimation Borne by the Recipient Country
6. Other Relevant Data
7. References

Appendix 1：Member List of the Study Team

Appendix 1：Member List of the Study Team

（1） Basic Design Study

Name	Title	Affiliation
Mr. NAKANO Satoshi	Leader	Resident Representative JICA Kyrgyz Office
Mr. SUGITA Shigehiko	Project Coordinator	Officer of Transportation and Electric Power Team, Project Management Group I, Grant Aid Management Department, JICA
Mr. SATO Tadashi	Chief Consultant/ Road Planner	Katahira & Engineers International
Mr. KOGAWA Satoshi	Equipment Planner/ Management & Maintenance Planner	Katahira & Engineers International
Mr. MURAKAMI Keiichi	Procurement Planner/ Cost Estimator	Katahira & Engineers International
Ms. MURAKAMI Masayo	Interperter (Russian – Japanese)	Katahira & Engineers International

（2） Explanation of the Draft Final Report

Name	Title	Affiliation
Mr. NAKANO Satoshi	Leader	Officer of Transportation and Electric Power Team, Project Management Group I, Grant Aid Management Department, JICA
Mr. SATO Tadashi	Chief Consultant/ Road Planner	Katahira & Engineers International
Mr. KOGAWA Satoshi	Equipment Planner/ Management & Maintenance Planner	Katahira & Engineers International
Ms. MURAKAMI Masayo	Interperter (Russian – Japanese)	Katahira & Engineers International

Appendix 2：Study Schedule

Appendix2：Study Schedule

（1） Basic Design Study Field Survey

No.	Date (2005)	JICA		Consultant
		Mr. NAKANO Satoshi	Mr. SUGITA Shigehiko	Mr. SATO Tadashi, Mr. KOGAWA Satoshi, Mr. MURAKAMI Keiichi, Ms. MURAKAMI Masayo
1	9 ／ 27 （Tue）	—	—	Kansai International Airport～Bishkek
2	9／28 (Wed)	JICA Office Meeting	Narita ～ Tashkent	JICA Office Meeting
3	9／29 (Thu)		Tashkent ～ Bishkek	
		Courtesy Call（Japanese Embassy in Kyrgyz、Ministry of Transportation and Communication）		
4	9／30 (Fri)	Courtesy Call（Finance Ministry、ADB）、Conference（MOTC）		
5	10／01 (Sat)	Site Ivestigation（Around Bishkek～Naryn）		
6	10／02 (Sun)	Site Ivestigation（Naryn～Dolon Pass～Bishkek）		
7	10／03 (Mon)	Conference（MOTC）		
8	10／04 (Tue)	Conference（MOTC）、Attendance at Seminar Hosted by Project Formulation Study		
9	10／05 (Wed)	Execution of Minutes、Interim Report（Japanese Embassy in Kyrgyz）		
10	10／06 (Thu)	—	MOTC Laboratory Investigation	
11	10／07 (Fri)	—	Bishkek ～ Tashkent ～Narita	Conference（Discussion for Implementation of Transportation Investigation : Motor Road Line Control Division No 1）
12	10／08 (Sat)	—		Site Ivestigation（Bishkek～Naryn、MRLCD No. 3 Meeting）
13	10／09 (Sun)	—	—	Site Ivestigation（Between Naryn～Torugart : Site Ivestigation）
14	10／10 (Mon)	—	—	Site Ivestigation（Between Naryn～Torugart : Site Ivestigation）
15	10／11 (Tue)	—	—	Site Ivestigation（Around Naryn、Mr. SATO for Bishkek）
16	10／12 (Wed)	—	—	Site Ivestigation（Travel to Naryn～Balykchy）
17	10／13 (Thu)	—	—	Site Ivestigation（Around Kachkor：Site Ivestigation） Mr. SATO：JICA Recent Report、Information-Sharing with Project Formulation Study
18	10／14 (Fri)	—	—	Site Ivestigation（Balykchy～Naryn：Site Ivestigation、Mr. SATO join the team）
19	10／15 (Sat)	—	—	Site Ivestigation（MRLCD No. 3、RMC No. 41）
20	10／16 (Sun)	—	—	Site Ivestigation（Naryn～Bishkek）
21	10／17 (Mon)	—	—	Conference（MOTC）、Summary of Field Survey
22	10／18 (Tue)	—	—	Conference（Institute of Design）、Summary of Site Investigation
23	10／19 (Wed)	—	—	Summary of Site Investigation
24	10／20 (Thu)	Conference on Target Area	—	Final Report（Conference on Target Area, etc. : JICA Office）
25	10／21 (Fri)	—	—	Summary of Site Investigation

26	10／22 (Sat)	—	—	Conference（MOTC：Target Area, etc、Execution of Technical Minutes）
27	10／23 (Sun)	—	—	Summary of Site Investigation
28	10／24 (Mon)	—	—	Final Report（Japanese Embassy in Kyrgyz）、Bishkek～Tashkent ～Seoul～Narita
29	10／25 (Tue)	—	—	

（２） Explanation of the Draft Final Report

No	Date (2006)	JICA	Consultant
		Mr. NAKANO Satoshi	Mr. SATO Tadashi, Mr. KOGAWA Satoshi, Mr MURAKAMI Masayo
1	3／16 (Thu)	—	Narita～Xian～Urumqi
2	3／17(Fri)		Urumqi～Bishkek JICA Meeting、Cortesy Call and Explanation of Draft: Japanese Embassy in Kyrgyz、Ministry of Transportation and Communication, Finance Ministry, Ministry of Transportation and Communication
3	3／18(Sat)	—	Site Investigation（RMC No. 955：Comfirmation of Asphalt Plant Planned Site and Items to be Shared, Cortesy Call: State Vice-Governor in Naryn）
4	3／19(Sun)	—	Site Investigation（Naryn～Torugart Area Survey）
5	3／20(Mon)	—	Site Investigation（Between Naryn～Bishkek）、Site Investigation Report to MOTC Vice Minister
6	3／21（Tue）	—	Explanation of the Draft Final Report to MOTC Vice Minister
7	3／22(Wed)	Site Investigation Report and Meeting on Minutes Writing at JICA Explanation of the Draft Final Report to MOTC Road Department Officials and Conference Explanation of the Draft Final Report and Dialogue at ADB	
8	3／23(Thu)	Execution of Minutes	
9	3／24(Fri)	—	Site Investigation（JICA Lake Issyk-Kul Circumferential Road Investigation）
10	3／25(Sat)	—	
11	3／26(Sun)	—	Summary of Investigation/Report Writing
12	3／27(Mon)	—	Fial Report（Japanese Embassy in Kyrgyz）、Bishkek～Tashkent ～Seoul～Narita
13	3／28（Tue）	—	

Appendix 3：List of Parties Concerned in the Recipient Country

Appendix 3：List of Parties Concerned in the Recipient Country

Organization	Title	Name
Ministry of Transport and Communication	Minister	Sulaimanov. Nurlan Galionbaevich
	Vice Minister	Mamaev A. Kubanichbek
	Road Department Director General	Aidarov Z.K.
	Road Department Assistant General Manager	Kaiynbaev. N.
	Vice Director	Aibek Berdibekov
	Principal Expert ／ Institute of Kyrgyz Road Design Vice Director	Rakhmatulim R.U.
Bishkek ～ Naryn ～ Torugart Motor Road Line Control Division	Director	Subanbenov Ausun
Motor Road Line Control Division No. 3	Director	Kubaev Abdysator
	Contract/Production Control Chief	Toktoliev Sasherbek
	Chief Mechanic	Abdypbekov Tynych
	Senior Expert	Beituogenov Nurbek
Road Maintenance Companies No. 8	Director	Abitaliev Zhumagul
Road Maintenance Companies No. 14	Director	Aliev Mairombek Matkazievich
Road Maintenance Companies No. 41	Director	Omuraliev Kubanychbek
Road Maintenance Companies No.955	Director	Aliev Alibert Soparovich
Road Maintenance Companies No.957	Director	Kudaibergenov Motsoldor
Ministry of Economy and Finance	Division of External Economic Coorporation, Vice Director	Kongurbaev N.A.
	Division of External Economic Coorporation, Chief Expert	Sharanov T.Z.
	Division of Investment Attraction, Director	Kanynbaev. N.
“Aerodromdorctroi” Public Corporation	Quality Control Engineer	Prokuronov Georgii Anatolievich
	Laboratory Engineer	Khafizova Nina Stepanovna
Japanese Embassy in Kyrgyz	Acting Ambassador	Tatsuhiko Kasai
	Third Secretary	Tsutomu Shibata
Japan International Coorperation Agency Kyrgyz Republic Office	Resident Representative	Satoshi Nakano
	Assistant Resident Represetative	Kotaro Nishigata