

Papua New Guinea  
Department of Works

**PREPARATORY SURVEY REPORT  
ON  
THE PROJECT FOR IMPROVEMENT OF  
ROAD MAINTENANCE EQUIPMENT  
IN THE  
INDEPENDENT STATE OF PAPUA NEW GUINEA**

**November 2012**

**Japan International Cooperation Agency**

**INGEROSEC Corporation**

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## PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to INGEROSEC Corporation.

The Survey team held a series of discussions with the officials concerned of the Government of the Independent State of Papua New Guinea, and conducted field investigations. As a result of further studies in Japan, 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.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Independent State of Papua New Guinea for their close cooperation extended to the survey team.

November 2012

Kazunori Miura

Director General,

Economic Infrastructure Department

Japan International Cooperation Agency

# SUMMARY

# SUMMARY

## 1. Country Profile

The Independent State of Papua New Guinea (hereinafter referred to as “Papua New Guinea”) is split by a mountain range of 3,000 to 4,000m in altitude running east to west at the center of the country and the areas except for high mountains are covered with deep tropical rain forests. Because of the steep topography, there are many portions of the trunk road network that have not been completed (hereinafter referred to as “missing links”). This not only makes it difficult for people to move between regions but also increases the transportation cost of agricultural produce, such as cacao, coffee and vanilla, forestry and fishery resources, as well as mineral resources, such as gold and copper, hindering the development of domestic industries.

## 2. Background of the Project

The implementing agency of this project on Papua New Guinean side is Department of Works (hereinafter referred to as “DOW”). The project is implemented by the Operations Division, and Plant and Transport Division (hereinafter referred to as “PTD”).

The Operations Division has DOW Provincial Offices in 19 provinces and the National Capital District, and is in charge of the maintenance, repair and restoration of the national roads with the national budget and donor budget using the equipment under the management of the PTD. The Operations Division rents equipment from the PTD to directly perform these works, but when equipment is inadequate, private contractors are asked to submit bids, based upon which orders are placed, and the Operations Division supervises the quality, progress and other details of work.

The PTD is in charge of operational management of construction equipment and vehicles, has equipment pools and repair shops within DOW Provincial Offices in 19 provinces and the National Capital District, and performs the leasing of the equipment to the Operations Division, as well as maintenance and repair. There is a large scale repair shop called the National Rebuilt Center (hereinafter referred to as “NRC”) in Lae city in Morobe Province, which is a central facility that overhauls engines and other construction equipment components used throughout the country.

As a general rule, the DOW directly performs work, but the equipment for the improvement and maintenance of gravel roads (hereinafter referred to as “grading work”) and restoration of roads after a disaster (hereinafter referred to as “restoration work”) owned by the PTD is insufficient in amount and old. Therefore, the DOW is forced to outsource work to private constructors. However, due to the limited number of private contractors and high price of work, maintenance work is currently only being carried out for about 10 percent of national gravel roads.

Furthermore, in addition to steep topography and fragile geography with many faults, each province has an annual rainfall between 2,000 mm and 4,000 mm, which results in frequent landslides and slope failures in mountain areas, and flooding caused by overflowing of rivers in downstream areas. Even during the dry season, the rainfall is higher than the rainfall of rainy season in Japan, resulting in the collapse or washing

away of roads and bridges throughout the year. However, due to the fact that the repairs made in PNG are only temporary in nature and do not address the cause of the disaster, there are many cases in which disasters occur at the same location every year. In addition, since the DOW relies on private contractors which are expensive for restoration work in the same manner as for grading work, this results in delays in the restoration of the capacity of roads.

The impact of roads in poor condition due to inadequate improvement and maintenance of national gravel roads and road closures in isolated regions without alternate routes is particularly large. These conditions prevent the transport of vegetables, fruit and other agricultural products, as well as milk, beef and other meat to the locations where these products are consumed, and also prevents access of the residents to health facilities, schools and other public facilities, causing socioeconomic losses.

The DOW has designated the grading work of national gravel roads in poor condition and restoration work to reopen roads that have been closed due to disasters as priority issues in rural areas. The objective of this project is to achieve stable transport on national gravel roads and secure transport routes. In consideration of regional distribution, the convenience of project administration such as the transfer of equipment between provinces, beneficiary population and road conditions, four provinces have been designated as priority regions. These consist of Morobe Province where Lae is located, the second largest city in PNG (Population: 120,000); Western Highlands Province where Mount Hagen is located, the third largest city (Population: 28,000); West New Britain Province which has the longest national gravel road (749 km); and East Sepik Province, where Wewak is located (Population: 25,000), which has no roads connecting any other regional cities. Road construction equipment will be provided to the DOW Provincial Offices which have jurisdiction in these provinces in order to assist them to maintain the roads and restore roads after disasters in the four provinces.

Table-1 Conditions in Four Target Provinces

Provinces	Provincial capital	Surrounding Provinces	Major Products	Population (in 10,000s)	National Road Length (km)		
					Paved	Gravel	Total
Western Highlands (Mountain region)	Mount Hagen	Southern Highlands, Enga Eastern Highlands, Simbu	Gold, natural gas, coffee, tea	44	235	93	328
Morobe (Central region)	Lae	Madang, Oro	Nickel, gold, sugar, cocoa	54	317	158	475
East Sepik (Northwestern region)	Wewak	West Sepik	Gold, wood, vanilla, coffee	34	275	186	461
West New Britain (Island region)	Kimbe	East New Britain, Manus, New Ireland, North Solomon	Wood, palm oil, cocoa	18	270	749	1019

Under such circumstances, the government of Papua New Guinea requested the government of Japan to extend grant aid for the procurement of equipment necessary for the grading work and restoration work, workshop facilities and spare parts of the equipment.

At the time of the Outline Design Study, it was confirmed that the requested equipment consists of a total of 50 units of 10 items, namely, bulldozer, excavator, motor grader, wheel loader, vibration roller, water tanker, dump truck, mobile work shop, workshop facilities and spare parts.

### 3. Outline of Study Results and Contents of the Project

Based on the decision of the government of Japan to conduct a preparatory study on the Project for the Improvement of Road Maintenance Equipment, the Japan International Cooperation Agency (hereinafter referred to as "JICA") sent a preparatory survey team to Papua New Guinea from January 21 to February 25, 2012. The survey team and Papua New Guinean government officials held discussions on the contents of the request, and conducted a field survey at the study area and collected relevant materials. After returning to Japan, the study team verified the relevance of this project based on the result of the field study, formulated the implementation plan of this grant aid assistance and prepared a draft report. From June 16 to 23, 2012, JICA dispatched the study team to Papua New Guinea and obtained an agreement of the government of Papua New Guinea with respect to the basic content of the draft report.

The scope of grant aid assistance consists of the procurement of the equipment required to perform grading work to achieve the road improvement and maintenance plans of Papua New Guinea, and the procurement of equipment required to perform restoration work promptly. The DOW, which is the agency that

implements road maintenance, plans to perform grading work on national gravel roads that are unpaved and in poor condition in addition to restoration work in areas where road disasters occur frequently as a priority project. Considering the operation and maintenance capability, the project implementation capability and the condition of existing equipment of the DOW, the types, specifications and quantity of the equipment to be procured as needed for the execution of the above-described plans were selected and determined. Then, an equipment plan was developed, while verifying the relevance of the request. The outline of the equipment plan is described in Table-2.

Table-2 Outline of Equipment Plan

Classification	Equipment type	Requested quantity	Planned quantity	Outline specifications	Application
Equipment for grading work	Motor grader	4	4	14 tons	Grading of uneven road surface
	Wheel loader	4	4	1.9 m <sup>3</sup>	Loading of gravel, minor transportation
	Vibration roller	4	4	10 tons	Compaction
	Water tanker	4	4	8,000 L	Soil moisture adjustment
	Dump truck	8	8	10 m <sup>3</sup>	Transportation of gravel
Equipment for restoration work	Motor grader	4	4	14 tons	Grading of uneven road surface
	Bulldozer	4	4	18 tons	Excavation and earthmoving
	Excavator	4	4	0.8 m <sup>3</sup>	Excavation, loading and grading
	Dump truck	8	8	10 m <sup>3</sup>	Transportation of surplus soil and gravel
Facilities for repairing construction equipment	Mobile workshop	4	4	4 x 40	On-site repair
	Workshop facilities	1 set	0	-	Maintenance and repair of equipment
	Spare parts	1 set	1 set	-	Maintenance and repair of equipment

#### 4. Project Term and Estimated Project Cost

In the event that this project is implemented under the grant aid scheme, the cost to be borne by the Papua New Guinean side is estimated to be 0.9 million yen. With respect to the implementing period, it is estimated that 4.5 months will be needed for execution design and 10 months for equipment procurement.

#### 5. Project Evaluation

As this project is relevant to the improvement and maintenance of national gravel roads and road disaster recovery work, it is consistent with the priority issues stated in the upper level plan, that is, in Papua New Guinea Development Strategic Plan, Medium-term National Development Plan, and National Transport Development Plan.

Particularly in the rural areas, most of the national gravel roads are left as bad roads that are not improved or maintained. In addition, when roads are closed due to frequent disasters, residents in rural area are obliged to be isolated as there is no alternative transportation route. This causes hindrance in the transportation of agricultural produce, such as vegetables and fruits, and livestock products, such as beef cattle and milk, to the consumption areas and affects the accessibility of residents to health care facilities, schools and other public facilities, which results in socioeconomic losses. The improvement and maintenance of national gravel roads and road disaster recovery are challenges that need to be urgently resolved for the development of Papua New Guinea.

Based on the above, it can be determined that this project, which aims to contribute to the revitalization of the circulating the products in regional society, securing the accessibility of residents to public services and improving the earnings level, has relevance.

Also, quantitative and qualitative benefits expected of the implementation of this project are as follows:

(1) Quantitative benefit

Table-3 Effectiveness of the Project (Quantitative Effects)

Verifiable indicator	Current Status (2012)	Target Value (2017) [3 Years After Project Completion]
Operation hour of equipment for grading work (Hours/Month/Each Province) *	0	84
Total monthly grading work length (km/Month/Each Province) *	0.8	8.0

\* This shows the operation hour and total maintenance work length when equipment for grading work is used only for the intended work. Not only equipment for restoration work, but also equipment for grading work has the potential to be allocated and utilized preferentially for restoration work in the event of disasters especially during the rainy season.

(2) Qualitative benefit

The provision of equipment required for restoration work at locations where disasters have occurred will enable restoration work to be more efficiently performed when a landslide or slope failure occurs.



THE PROJECT FOR IMPROVEMENT OF  
ROAD MAINTENANCE EQUIPMENT  
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INDEPENDENT STATE OF PAPUA NEW GUINEA

PREPARATORY SURVEY REPORT

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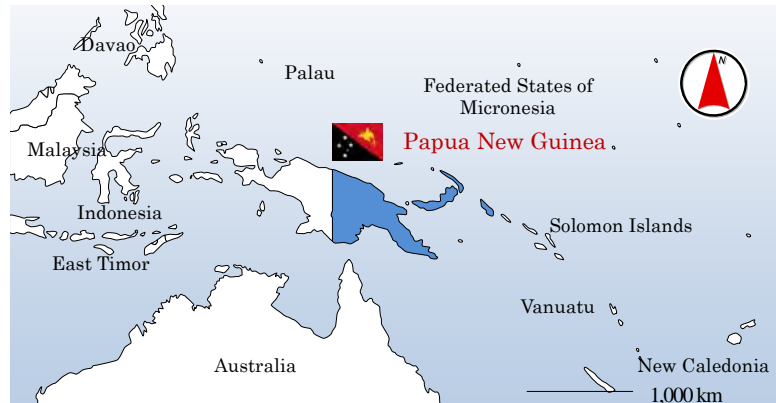
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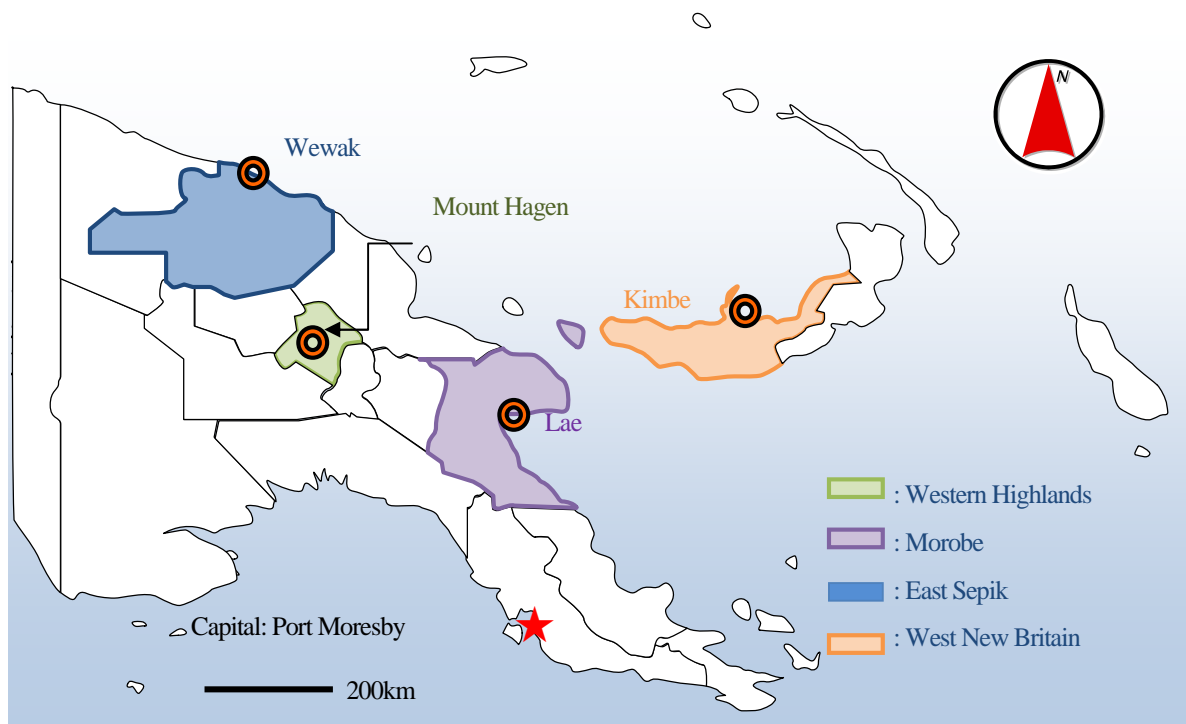
Independent State of  
Papua New Guinea



## Countries around Papua New Guinea

Area	: 462,000 km <sup>2</sup>
Population	: 7.01 million (2011, the World Bank)
Language	: Other than English (official language), Pidgin English, Motu language, etc.
Religion	: Mostly Christianity, but ancestor worship and other traditional beliefs are also strong.
GNI per capita	: USD 1,480 (2011, the World Bank)

(Source: The World Bank Website)



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## Abbreviations

ADB	Asian Development Bank
AusAID	Australian Agency for International Development
DEC	Department of Environment and Conservation
DOT	Department of Transport
DOW	Department of Works
DNPM	Department of National Planning and Monitoring
E/N	Exchange of Notes
G/A	Grant Agreement
GDP	Gross Domestic Product
GNI	Gross National Income
JICA	Japan International Cooperation Agency
MTDP	Medium Term Development Plan
NTDP	National Transport Development Plan
NRA	National Road Authority
NRC	National Rebuilt Center
PNGDSP	Papua New Guinea Development Strategic Plan
PTD	Plant and Transport Division
RMRP	Road Maintenance & Rehabilitation Project
ROPS	Roll-Over Protective Structure
TSSP	Transport Sector Support Project
WB	World Bank

# Chapter 1 Background of the Project

## **Chapter 1 Background of the Project**

### **1-1 Background and Outline of Grant Aid Assistance**

Due to the topographic conditions, the road network of Papua New Guinea has been designed to link the central cities in the provinces to the inland areas. However, since it has many missing links and detours or alternative routes are not available, road traffic is inefficient. Nevertheless, the central cities in each province and the inland areas are connected only by land, and as such, roads play a significant role in the movement of people and the circulating products. Existing roads in Papua New Guinea are of vital importance since they serve as industrial roads transporting major products, such as mineral resources, wood and coffee, from the inland areas to the cities and as access roads for residents of the inland areas to public services. However, the proportion of paved national roads is as low as 36% and national gravel roads that account for 64% are left as bad roads without being improved or maintained adequately. According to the road statistics in 2010, less than 10% of national gravel roads are improved or maintained and the remaining 90% are difficult to pass during the rainy season. Also, road closure in the event of a natural disaster, such as landslides, slope collapses and river floods makes serious impacts on the economic activities and securing of basic necessities for the life of the residents.

However, construction equipment currently retained by the PTD of the DOW to perform grading work and restoration work is old and deteriorated. For this reason, DOW is unable to carry out adequate grading work and restoration work.

Under these circumstances, the government of Papua New Guinea requested Japan to extend grant aid for the purpose of procuring equipment for grading work and restoration work, workshop facilities and spare parts for the equipment. Table 1-1 shows the list of requested equipment.

In consideration of regional distribution, the convenience of project administration such as the transfer of equipment between provinces, beneficiary population and road conditions, the target regions consist of Provincial Offices in four provinces. These provinces are Morobe Province where Lae is located, the second largest city in PNG (Population: 120,000); Western Highlands Province where Mount Hagen is located, the third largest city (Population: 28,000); West New Britain Province which has the longest national gravel road (749 km); and East Sepik Province, where Wewak is located (Population: 25,000), which has no roads connecting any other regional cities.

The target offices will provide assistance and equipment to surrounding provinces for disaster restoration work depending upon the operation status of equipment to facilitate mutual usage. The status of the four provinces that have target offices is shown in Table 1-2.

Table 1-1 List of Requested Equipment

Equipment	Outline Specifications	Unit	DOW Provincial Offices in the four target provinces				Total
			Western Highlands	Morobe	East Sepik	West New Britain	
Bulldozer	18 ton	Unit	1	1	1	1	4
Excavator	0.8 m <sup>3</sup>	Unit	1	1	1	1	4
Motor grader	14 ton	Unit	2	2	2	2	8
Wheel loader	1.9 m <sup>3</sup>	Unit	1	1	1	1	4
Vibration roller	10t on	Unit	1	1	1	1	4
Water tanker	8,000 L	Unit	1	1	1	1	4
Dump truck	10 m <sup>3</sup>	Unit	4	4	4	4	16
Mobile workshop	4×4						
Equipment for workshop facilities and spare parts		Set	1	1	1	1	4

Table 1-2 Status of Four Provinces that Have Target Offices

Provinces	Provincial capital	Surrounding Provinces	Major Products	Population (in 10,000s)	National Road Length (km)		
					Paved	Gravel	Total
Western Highlands (Mountain region)	Mount Hagen	Southern Highlands, Enga, Eastern Highlands, Simbu	Gold, natural gas, coffee, tea	44	235	93	328
Morobe (Central region)	Lae	Madang, Oro	Nickel, gold, sugar, cocoa	54	317	158	475
East Sepik (Northwestern region)	Wewak	West Sepik	Gold, wood, vanilla, coffee	34	275	186	461
West New Britain (Island region)	Kimbe	East New Britain, Manus, New Ireland, North Solomon	Wood, palm oil, cocoa	18	270	749	1019



## 1-2 Conditions of Project sites

### 1-2-1 Natural Conditions

In the middle of New Guinea Island, a spine of mountains runs from the northwest to the southeast. A gently sloping terrain spreads on both sides of the mountains and numerous rivers flow from the dividing ridges to the coastal area. During the rainy season, these rivers greatly change their channels, often causing river floods to the downstream areas.

In addition, Papua New Guinea is a major earthquake-prone country as it is located right above the area where the Pacific Plate and the Indo-Australian Plate collide with each other and the former goes under the latter. Earthquakes of magnitude 7 or higher often occur at the collision boundary between the Pacific and the Australian Plates as well as in many fault regions.

Papua New Guinea is in the tropical rainforest climate zone, except for the central highlands. The rainy season is from December to April, when the monsoon blows from the west, while the dry season is from May to November, when the easterly trade wind blows. However, even in the dry season, it rains more than in the rainy season in Japan. Yearly average rainfall is approximately 2,500 mm, and reaches 4,000 mm in regions with especially high rainfall, resulting in floods, washing out of bridges and roads, and landslides occurring frequently throughout the country.

Yearly fluctuation in the average temperature is minimal, ranging between 21 – 32°C in the coastal areas, and between 14 – 28°C in the mountain areas.

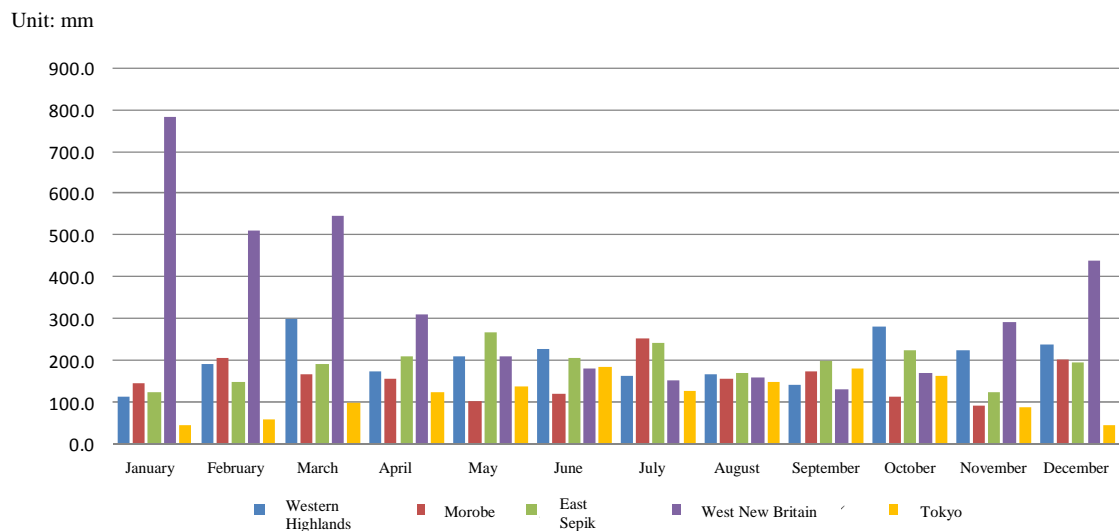


Figure 1-1 Annual Average Precipitation of the Four Priority Provinces and Tokyo (2007-2011)

### **1-2-2 Environmental and Social Considerations**

Since this grant aid assistance is an assistance for the procurement of road construction equipment to be used for the grading work and restoration work of national gravel roads administrated by the DOW, it is not relevant to sensitive sectors, characteristics and areas as described in the JICA Guidelines for Environmental and Social Considerations promulgated in April 2010 (hereinafter referred to as “JICA Environmental Guidelines”), and as such, it is determined that adverse environmental impacts resulting from this assistance would be minimal. Accordingly, it is classified as a Category C project based on the JICA Environmental Guidelines.

In Papua New Guinea, the Department of Environment and Conservation (hereinafter referred to as “DEC”) is in charge of environmental administration. As this project does not cause any impacts, the Papua New Guinean side has determined that an environmental permit is not required.

## Chapter 2 Contents of the Project

## **Chapter 2 Contents of the Project**

### **2-1 Basic Concept of the Project**

The national development plan of Papua New Guinea consists of the “Papua New Guinea Development Strategic Plan (PNGDSP) 2010-2030” and the “Medium Term Development Plan (MTDP) 2011-2015”. Both of them give priority to the maintenance and extension of the road network as part of infrastructure development. The “National Transport Development Plan (NTDP) 2006-2010”, which is an upper level plan of the transport sector, aims to adequately maintain the existing national roads that are difficult to pass due to the lack of maintenance in order to facilitate the access of residents along the roads to public services, such as schools and hospitals, and revitalize the circulation of the products in regional society, thereby enabling the economic development of Papua New Guinea.

As priority projects, the DOW planned to perform maintenance of unpaved national gravel roads of poor conditions that are common in the rural areas and shorten the period of road closure caused by frequent natural disasters. The target area for the grant aid assistance consists of DOW Provincial Offices of four provinces, namely, Morobe Province where Lae is located, the second largest city in PNG (Population: 120,000); Western Highlands Province where Mount Hagen is located, the third largest city (Population: 28,000); West New Britain Province which has the longest national gravel road (749 km); and East Sepik Province, where Wewak is located (Population: 25,000), which has no roads connecting any other regional cities, in consideration of regional distribution, the convenience of project administration such as the transfer of equipment between provinces, beneficiary population and road conditions. The status of the four provinces that have target offices is as shown in Table 1-2. It is expected that this grant aid assistance will result in improvement and maintenance of the roads in the target areas and improvement of the drivability of vehicles by inputting road construction equipment to the DOW to achieve the above-described plan.

Table 2-1 describes the content of the equipment request discussed and confirmed at the beginning of the preparatory survey.

**Table 2-1 List of Requested Equipment**

Equipment name	Outline specifications	Unit	Quantity of equipment requested by 4 DOW Provincial Offices				
			Western Highlands	Morobe	East Sepik	West New Britain	Total
For grading work							
Motor grader	14 tons	Unit	1	1	1	1	4
Wheel loader	1.9 m <sup>3</sup>	Unit	1	1	1	1	4
Vibration roller	10 tons	Unit	1	1	1	1	4
Water tanker	8,000 L	Unit	1	1	1	1	4
Dump truck	10 m <sup>3</sup>	Unit	2	2	2	2	8
For restoration work							
Motor grader	14 tons	Unit	1	1	1	1	4
Bulldozer	18 tons	Unit	1	1	1	1	4
Excavator	0.8 m <sup>3</sup>	Unit	1	1	1	1	4
Dump truck	10 m <sup>3</sup>	Unit	2	2	2	2	8
For repairing road construction equipment							
Mobile workshop	4X4	Unit	1	1	1	1	4
Spare parts for the above equipment and workshop facilities							

## **2-2 Outline Design of the Japanese Assistance**

### **2-2-1 Design policy**

#### (1) Basic policy

The grant aid assistance consists of the procurement of the equipment required by the DOW Provincial Offices in the four target provinces (Morobe Province, Western Highlands Province, West New Britain Province and East Sepik Province) to perform improvement and maintenance of national gravel roads, and restoration work. The final objective is to facilitate more stable transport in the target regions and help secure transportation routes. Based on the request from the Papua New Guinean side and the result of the preparatory survey and discussions, it was decided to design the assistance in accordance with the following policies.

With respect to the selection of equipment, equipment that has conventionally been used for the grading work and restoration work and that the implementing agency is familiar with the method to use and operate should be selected.

As the sites for grading work are scattered, for the sake of convenience in the movement and operation of the equipment, a flotilla of a motor grader, a vibration roller, dump trucks, etc. (hereinafter referred to as a “fleet”) should be organized and sent a fleet to each of four target DOW Provincial Offices upon confirming volume of work, maintenance capability of the DOW and securing of road maintenance budget.

With regard to the restoration work, the sites affected by road disasters are also scattered. To enable efficient movement and transportation of the equipment, a fleet of equipment used for restoration work, namely, a bulldozer, an excavator, a motor grader and dump trucks, etc., should be organized. Whether or not recovery budget has been secured by the four target DOW Provincial Offices should be confirmed before deploying the fleet.

All the existing equipment for grading work has been used for 10 years or longer. As such, the equipment has deteriorated and the utilization rate is low. As the low utilization rate will lower the utilization rate of the whole fleet, the existing equipment and the new equipment to be introduced should not coexist in the same fleet. Basically, the existing equipment will be gradually sold off as it becomes obsolete, having been used longer than its service life. Operable equipment may be used wherever possible as auxiliary equipment for light road maintenance work and disaster recovery, for which they can be used independently.

The NRC performs rebuilding, overhauling and major repair of equipment that cannot be handled by the provincial maintenance workshops of the PTD. Most of the workshop facilities at the NRC, except for the hand tools, were purchased more than 20 or 30 years ago and many of them cannot be operated now, having passed their service life.

The utilization rate of equipment for road improvement and maintenance that has passed the service life is low and the cost of maintenance and repair of such equipment tends to increase. Therefore, as a standard, equipment that has operated for eight years or longer is regenerated by the rebuilding work at the NRC, used for additional five years and discarded or sold off upon reaching 13 years in total.

The rebuilding work is done on the equipment retained by the DOW Provincial Office, but since the equipment is not replaced, the number of items of the retained equipment has been declining. In addition, as described above, most of the equipment is old and not suited to rebuilding in light of the rebuilding standard. However, due to the current shortage of road improvement and maintenance equipment, it may be inevitable that part of the equipment is subject to continued use by applying the rebuilding work.

However, the improvement of the utilization rate of equipment that has long passed the end of service life by the rebuilding work is limited. Furthermore, most the equipment has long passed the end of warranty period concerning the supply of spare parts by the manufacturer and the spare parts are usually out of stock. Therefore, it takes a long time to obtain the parts and even worse, such parts are unavailable in many cases. Because of this, work is often interrupted, resulting in the extension of repair period. Therefore, it is difficult to improve the utilization rate of equipment by the rebuilding work. In the case of road improvement and maintenance equipment that has long passed the end of service life, the effect of the rebuilding work will be even lower.

As the equipment for the rebuilding work, such as cylinder blocks for engines, and engine inspection equipment that have been requested are to be used for the major components of the equipment, the necessity for the replacement of such equipment is higher as compared to other equipment for the maintenance workshop. However, since the effect of the rebuilding work on the retained equipment is low, equipment shortage can be resolved by the new equipment to be procured in this grant aid assistance and there is little necessity for the rebuilding work for the time being, equipment for the rebuilding work shall be excluded from the procurement target of this grant aid assistance.

With respect to the equipment of the NRC and the PTD maintenance workshops of DOW Provincial Offices, bench presses and large special wrenches that are often used are of higher necessity for ensuring safety during work. However, since the trust account has begun to function, leading to the replacement of the equipment, it is expected that once new equipment is procured in this project, the trust account will be managed smoothly. Therefore, it can be determined that the PTD is fully capable of replacing the equipment on its own. Consequently, such equipment shall be excluded from the procurement target of this grant aid assistance.

(2) Approach to natural environmental conditions

The average temperature in Papua New Guinea is 21 – 32 °C in coastal areas and 14 – 28 °C in mountainous areas. The elevation is less than 1,500 m even in Western Highlands Province (Mount Hagen City), which is the highest of the four provinces where there are the DOW target offices. Therefore, the equipment should have the standard environmental specifications.

As the sunlight is strong in the daytime and the rainfall is relatively heavy, for the protection of the operator and the controls, a cab or a canopy should be installed over the operator’s compartment on the road maintenance equipment.

Table 2-2 Environmental Condition Specifications

Environmental specifications	Highest temperature (°C)	Lowest temperature (°C)	Elevation (m)
Standard specifications	Lower than 40	-10 or higher	Lower than 2,300
Tropical specifications	40 or higher	—	—
Cold region specifications	—	Lower than -10	—
High altitude specifications	—	—	2,300 or higher

### (3) Approach to specific conditions of the locality

As the equipment is often used in mountainous areas, to provide for the risk of rollover and falling, the bulldozer, motor grader and wheel loader should be equipped with a Roll-Over Protective Structure (hereinafter referred to as “ROPS”) and seat belts.

Also, since the equipment is often parked at the worksite, the equipment shall be specially equipped with a theft prevention device for fuel and oil.

As the work is carried out on the roads, the equipment should be equipped with a yellow rotating lamp in accordance with the standard specifications of the DOW and the body should be painted yellow, which is the standard color designated by the DOW.

### (4) Approach to operation and maintenance

The equipment maintenance and management technology of the DOW is determined to be of an adequate level from the following perspectives:

- It has a training system for the mechanics engaged in equipment maintenance and the training is regularly carried out.
- When the quantity of equipment decreased due to suspension of replacement, they were temporarily assigned to the maintenance of vehicles. Accordingly, most of the mechanics with over 10 to 20 years of experience continue to work for the PTD without being dismissed.

In addition, although maintenance and repair of construction equipment are also carried out at the work site, since current vehicles for on-site repair are pickups loaded only with simple tools, maintenance and repair performed at the work site are limited only to simple work. As equipment that cannot be easily repaired at the work site is sent to the maintenance workshop, it takes time to repair such equipment. Also, because it is difficult to arrange replacement while equipment is being repaired, the operation rate decreases at the work site, which greatly affects the work progress.

If the equipment is under repair, the equipment rental fee, which is a major source of revenue for the trust account, cannot be charged, which means that the revenue of the trust account decreases. Therefore, the capacity for repairing the equipment at the site should be enhanced in order to improve the utilization rate.

### (5) Approach to setting the specifications of the equipment

The equipment should be of standard specifications because no special work is involved in grading work or restoration work. Equipment of standard specifications can be procured in



a short period of time. Also, the spare parts that are essential for maintenance and repair are readily available and as such, extension of the repair period due to the unavailability of parts can be prevented.

(6) Approach to procurement method and period

In principle, the equipment should be procured in Japan or from a domestic supplier in Papua New Guinea. However, when equipment cannot be procured at a competitive price due to a lack of suppliers in Japan and Papua New Guinea, procurement from a third country may be considered.

The equipment should be delivered to the PTD maintenance workshop of the DOW Provincial Office in each of the four target provinces. At the PTD maintenance workshop of the Morobe Office in Lae City, Morobe Province, where the unloading port is located, the equipment for the Morobe Office should be adjusted and put to trial operation. Then, initial operation training and maintenance and repair training should be carried out for all four provinces. After that, the equipment should be delivered to the PTD maintenance workshop of each of the three Provincial Offices for adjustment, trial operation and acceptance inspection. With respect to the equipment for the Morobe Office, only the acceptance inspection should be carried out at this point, since the adjustment and trial operation have been completed.

## **2-2-2 Basic Plan (Equipment Plan)**

### **2-2-2-1 Overall Planning**

The equipment to be procured in this grant aid assistance will be used for the grading work and restoration work in the four provinces which have the target DOW Provincial Offices.

Following the procedures described in the flow chart in Figure 2-1, the type, specifications and quantity of equipment to be procured are determined and the relevance of the request is examined to be an optimal plan that covers the minimum necessary equipment.

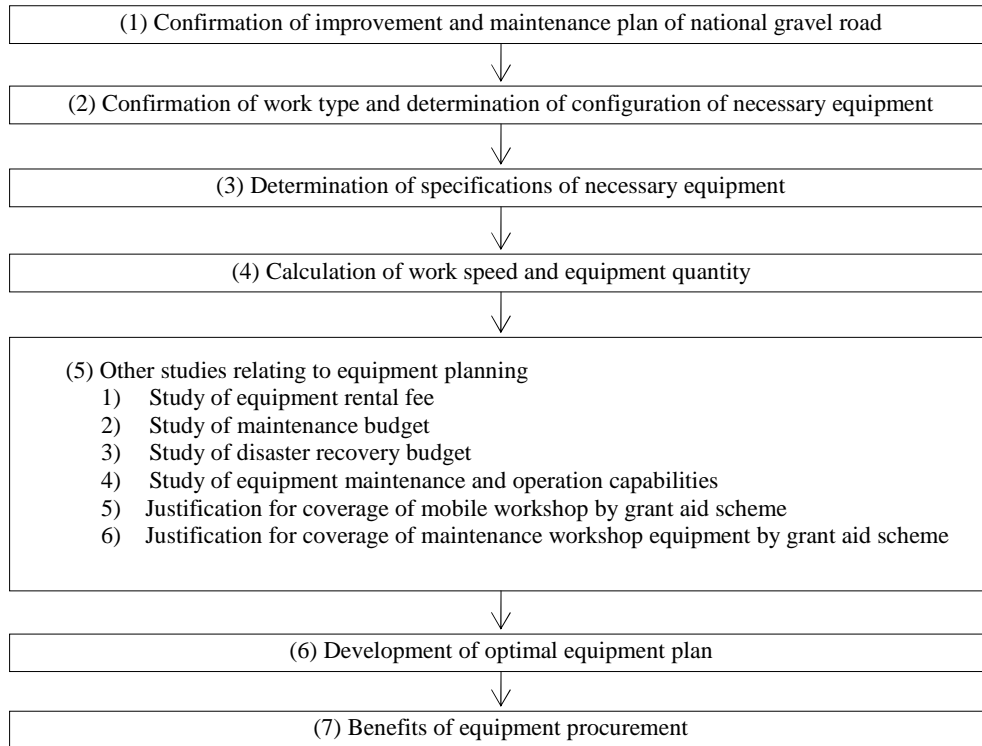


Figure 2-1 Flow Chart for Determination of Type, Specifications and Quantity of Equipment to be Procured

(1) Confirmation of improvement and maintenance plan of the national gravel road

The classification of national gravel roads in Papua New Guinea is described in Table 2-3 and the road surface evaluation standard for gravel roads in Table 2-4.

Table 2-3 National road categories

• NR (National Route) roads	Trunk roads that link major cities, running through several provinces
• NM (National Main) roads	Roads that link major cities with NR roads or major facilities, such as ports and airports
• ND (National District) roads	Roads that link villages with towns, ports, airports, markets, hospitals and other facilities within the same district
• NI (National Institutional) roads	Roads within national facilities (military roads, roads within university campuses, etc.)

Source: DOW

Table 2-4 DOW's national gravel road surface rating criteria

• Good	Well-maintained national gravel roads passable by all types of vehicles in all weathers
• Fair	Rough national gravel roads passable by all types of vehicles except in rainy weather. Passable only by 4WD vehicles in rainy weather.
• Poor	Rough national gravel roads passable only by 4WD vehicles except in rainy weather. Almost impassable by vehicles in rainy weather.

Source: DOW

Considering the budgetary limitation, capacity of private contractors and equipment capacity, of the national gravel roads that require improvement and maintenance, DOW defines roads of the following categories as roads for priority improvement/maintenance.

- National Route (NR) roads, National Main (NM) roads and National District (ND) roads
- Road that have been judged as fair or good as a result of road evaluation

National Institutional (NI) roads, which are another category of national roads, are roads within national facilities, such as military roads, and they are excluded from the priority maintenance road categories designated by the DOW. Roads that are rated poor are also excluded from the priority road categories, as it is deemed necessary to carry out large-scale construction work, such as rehabilitation, for such roads.

Table 2-5 shows the length of the priority maintenance national gravel roads as of 2011.

Table 2-5 Priority Maintenance National Gravel Roads (2011)

DOW Provincial Office	Length of national gravel roads by category				Road condition (NR roads+NM roads+ND roads)			Length of priority maintenance roads (Good+Fair)
	NR roads	NM roads	ND roads	Total	Good	Fair	Poor	
Western Highlands	0.00	51.98	30.00	81.98	0.00	69.47	12.71	69.47
Morobe	24.73	85.93	28.35	139.01	1.04	58.65	79.31	59.69
East Sepik	142.58	0.00	43.28	185.86	16.59	70.63	98.62	87.22
West New Britain	67.59	6.00	150.29	223.88	0.00	73.59	150.29	73.59
PNG total	1324.32	1632.94	1859.29	4816.55	514.57	2117.12	2255.89	2631.69

Source: DOW

- (2) Confirmation of the work type and determination of the configuration of the necessary equipment

Table 2-6 shows the equipment that should comprise one fleet for grading work and restoration work. This equipment configuration is the basic configuration set by the DOW and covers all types of necessary work.

Table 2-6 Necessary Equipment by Work Type

Grading work

No.	Equipment name	Quantity in fleet (unit)	Applicable work type
1	Motor grader	1	Grading of uneven road surface
2	Wheel loader	1	Loading of gravel, minor transportation
3	Vibration roller	1	Compaction
4	Water tanker	1	Soil moisture adjustment
5	Dump truck	2	Transportation of gravel

Restoration work

No.	Equipment name	Quantity in fleet (unit)	Applicable work type
1	Bulldozer	1	Excavation and earthmoving
2	Excavator	1	Excavation, loading and grading
3	Motor grader	1	Grading of uneven road surface
4	Dump truck	2	Transportation of surplus soil and gravel

- (3) Determination of the specifications of the necessary equipment

The specifications of the necessary equipment should be determined as described in Table 2-7, considering the details and scale of the work as well as the fact that the project aims to replace the current equipment. As common specifications, all the equipment should be fitted with vandalism protection to prevent the theft of fuel and oil and a yellow rotating lamp, and the body color should be yellow in accordance with the DOW standards.

Table 2-7 Specifications of Necessary Equipment

No.	Equipment name	Details (Specifications, Dimensions, etc.), Application	Justification for Specifications
1	Bulldozer	18 ton, 135kw class, excavation and earth moving	The bulldozers should be medium size, easily transported with a general trailer and capable of rapidly clearing soil. Such bulldozers are commonly used for road construction.
2	Excavator	20 ton, 105kw class, 0.8m <sup>3</sup> , excavation, loading and correction	The excavators should be medium size, easily transported with a general trailer and capable of rapid excavation and loading of soil on a dump truck. Such excavators are most commonly used for road construction.
3	Motor grader	14 ton, 116kw class, blade width: 3.7m, unevenness correction, spreading	The motor graders should be equipped with rear rippers, as they may be used for the removal of large gravel 20cm or larger. Since the road width is about 7m, 3.7 m blades should be used.
4	Wheel loader	100kw, 1.9m <sup>3</sup> class, loading and minor transportation of gravel	The wheel loaders should be medium size to facilitate movement on general roads. (The vehicle body width should be no more than 2.5 m)
5	Vibration roller	10 ton, 90kw class, vibration rolling	The vibration rollers should be of 10 ton class, medium and standard size, capable of laying and grading gravel and compacting the roadbed. The rear wheels should be tires that excel in driving force and maneuverability.
6	Water tanker	147kw class, 8,000L tank, 4X2, soil and sand moisture conditioning	Although large water tankers are preferable for the purpose of reducing the travel time for replenishing water as the water source is often located far away, considering the status of the work site and the condition of the road surface for traveling, medium size water tankers with a capacity of 8,000 L should be selected.
7	Dump truck	10 m <sup>3</sup> load, 170kw class 6X4, transportation of gravel	As most work sites consist of uneven ground and slopes, 6x4 dump trucks that can be easily maneuvered should be selected. The loading capacity should be 10 m <sup>3</sup> to expedite the transportation of surplus soil.
8	Mobile workshop	147kw class, loaded with maintenance equipment, onboard crane, 4X4, on-site repair <u>on-board equipment</u> <ul style="list-style-type: none"> <li>• Generator</li> <li>• Welding machine</li> <li>• Air compressor</li> <li>• Electric facilities</li> <li>• Small crane within van</li> <li>• On-board tools, etc.</li> </ul>	Sending broken equipment to a maintenance workshop for repair and maintenance is ineffective for raising the utilization rate of the equipment. Therefore, the mobile workshop should be equipped with a generator, air compressor, welding machine, etc. to enable efficient repair and maintenance at the site. The vehicles should also be fitted with an on-board crane to ensure safe and efficient lifting for disassembly and assembly. 4x4 vehicles should be selected to ensure maneuverability on rough roads.
9	Spare parts	Early replacement parts to ensure smooth operation in the initial period	To ensure smooth initial operation, replacements should be prepared for short-term consumables, such as bits, bit holders, ripper teeth and cutting edges and parts subject to periodic replacement, such as elements and filters, as early replacement parts.

(4) Calculation of work speed and equipment quantity

Grading work

According to the DOW, grading work is classified into the following two works.

- 1) Patrol grading: Grading of uneven road surfaces carried out by a motor grader two to four times a year. The work speed is about 1.0km/day (according to an interview from the DOW).
- 2) Team grading: Grading of uneven road surfaces, compaction by spraying water as well as laying gravel and roller compaction in some areas as needed for the purpose of repairing roadbeds and road surfaces. This is carried out by one fleet consisting of a motor grader, a wheel loader, a vibration roller and other equipment once or twice a year. The work time per day is 6 hours, with a work efficiency of 0.7 and work speed of approximately 0.3 – 0.5 km/day (according to an interview from the DOW).

The quantity of equipment required for team grading, which is heavy work, should be calculated.

The number of annual operating days is assumed to be 240, as the DOW sets the number of monthly operating days at 20.

The annual operating hours is assumed to be 1,008 (= 240 days x 6 hours x work efficiency of 0.7).

The average annual road length maintained per fleet is assumed to be 96 km/year (= 0.4 km/day x 240 days).

Table 2-8 shows the frequency of team grading per year.

Table 2-8 Frequency of Team Grading Per Year

DOW Provincial Offices in the four target provinces	Length of priority maintenance roads (km)	The road length maintained per fleet per year (km)	Frequency of team grading per year	Number of necessary fleets
Western Highlands	69.47	96	1.4	1
Morobe	59.69	96	1.6	1
East Sepik	87.22	96	1.1	1
West New Britain	73.59	96	1.3	1

One fleet is capable of team grading once or more per year to ensure passage of traffic during the rainy season. The minimum grading capacity needed can be ensured by procuring one equipment fleet for each of the target DOW Provincial Offices.

### Restoration work

The restoration work that is currently carried out is emergency work primarily for opening roads that have been closed. It is difficult to estimate the severity of the disasters or to determine the definition of the restoration work, but the average period required for disaster recovery was determined based on the information collected through interviews during the field study. The number of necessary fleets is calculated based on the recovery period and the incidence of disasters.

Disaster recovery period: As 8 to 12 days are required for recovery from a disaster according to an interview from the DOW, the period is assumed as 10 days for the sake of calculation.

With respect to the number of operating days per year, as is the case for grading work, it is assumed to be 240 as the number of monthly operating days set by the DOW is 20. On the basis of the number of disasters occurring between 2009 and 2011, the number of necessary fleets has been calculated as described in Table 2-9.

Table 2-9 Numbers of Necessary Fleets

DOW Provincial Offices in the four target provinces	Incidence of disaster				Period required for disaster recovery (days)	Number of necessary fleets	Note
	2009	2010	2011	Annual average in three years			
Western Highlands	16	15	16	16	160	1 (0.67)	0.67=160 days/ 240 days
Morobe	15	14	16	15	150	1 (0.63)	0.63=150 days/ 240 days
East Sepik	14	17	16	16	160	1 (0.67)	0.67=160 days/ 240 days
West New Britain	15	17	14	16	160	1 (0.67)	0.67=160 days/ 240 days

In view of the work volume, each of the four target DOW Provincial Offices requires 0.6 to 0.7 fleets. It is considered reasonable for each of them to retain one fleet because extra equipment capacity is needed to provide for urgent and unexpected fleet deployment for restoration work.

### Calculation of the number of dump trucks

As it is difficult to calculate the quantity of gravel to be replenished and the quantity of transported soil in the event of a disaster, considering the efficiency of the combination of dump trucks and loading equipment, such as wheel loaders and excavators, the number of dump trucks required for one loading machine should be calculated.

Calculation conditions

### Grading work

Average travel speed of dump truck : 30 km/hour

Standard transportation distance: 3 km (from the gravel pit to the work site)  $\rightarrow 3/30 = 6$  minutes

Wheel loader loading time: 9 minutes per dump truck  
( $\cong 10\text{m}^3 / (1.9\text{m}^3 \times 0.8 \times 0.7) \times 1$  minute)

(Dump truck vessel capacity:  $10\text{m}^3$ , bucket capacity:  $1.9\text{m}^3$ , Loading time per load: 1 minute, Bucket efficiency: 0.8, Loading work efficiency: 0.7)

Time required for soil discharge: 1 minute

Time required for one dump truck traveling cycle: 22 minutes (= 9+6+1+6)

Based on the above,

Number of dump trucks necessary for one wheel loader: 2.4

(= 1 wheel loader + (22 minutes - 9 minutes)/9 minutes)

### Restoration work

Average travel speed of dump truck: 20 km/hour (The speed is assumed to be lower because the dump truck will travel on rough roads.)

Standard transportation distance: 3 km (from the work site to the soil disposal yard)  $\rightarrow 3/20 = 9$  minutes

Excavator loading time: 18 minutes per dump truck  
( $\cong 10\text{m}^3 / (0.8 \text{ m}^3 \times 0.8 \times 0.7) \times 0.83$  minute)

(Dump truck vessel capacity:  $10\text{m}^3$ , bucket capacity:  $0.8\text{m}^3$ , Loading time per load: 0.83 minute, Bucket efficiency: 0.8, Loading work efficiency: 0.7)

Time required for soil discharge: 1 minute

Time required for one dump truck traveling cycle: 37 minutes (= 18+9+1+9)

Based on the above,

Number of dump trucks necessary for one excavator: 2.1

(= 1 excavator + (37 minutes - 18 minutes)/18 minutes)

Thus, it is determined that two dump trucks are needed per fleet for grading work and two dump trucks are needed per fleet for restoration work.

### (5) Other studies relating to equipment planning

1) Study of equipment rental fee that is the source of funds to cover the cost of equipment operation and maintenance

Maintenance of national roads is carried out by the Operations Division with equipment rented from the PTD. The Operations Division pays the equipment rental



fee to the PTD out of its maintenance budget and the fee is collected by the trust account. The rental fee, which includes the equipment maintenance cost, equipment depreciation, fuel/oil and other expenses, is the primary source of revenue of the trust account and it is the source of funds to cover expenses for the maintenance, repair and replacement of equipment. Table 2-10 shows the equipment rental fee.

1. While the current rental fees are set to be low due to the deterioration of the equipment, the PTD set new rental fees for newly purchased equipment. Table 2-10 shows the rental fees of new and current equipment. As a reference, the rental fees per operating hour for the same class model as the equipment to be procured based on the Table of Construction Machinery Rental Fee issued by the Japan Construction Machinery and Construction Association in 2011 shown in this table. The rental fees for newly procured equipment are higher than this, but these fees are the main source of income, and are required in order to ensure the cost of maintenance, repairs, fuel, oil and renewal of equipment can be covered, and thought to be appropriate as shown in “2-5-2 Operation and Maintenance Cost”.
2. The rental fee is incurred only for the operating hours of the equipment. If the equipment is not operating even though it is retained, for example, while the equipment is waiting due to the scheduling at the construction site, no payment is required. The operating hours are managed by the daily work report.

Table 2-10 Equipment Rental Fee

For grading work

1 kina=35.13 yen

No.	Equipment name	Quantity in fleet (unit)	New rental fee kina/hour	Current rental fee kina/hour	New rental fee in yen Yen/hour	Reference* Rental Fee Table 2011 Yen/hour
1	Motor grader	1	311	119 – 256	10,925	5,770
2	Wheel loader	1	274	166 – 219	9,626	5,320
3	Vibration roller	1	199	172	6,991	4,320
4	Water tanker	1	150	102	5,270	3,090
5	Dump truck	2	300	*67 – 72	10,539	3,360
		Total (for one fleet)	1,234	-	43,350	21,860
		Total (for four provinces)	5,248	-	173,402	87,440

\* The current rental fee is a reference amount since the dump truck is a small model (6 ton class).

For restoration work

1 kina=35.13 yen

No.	Equipment name	Quantity in fleet (unit)	New rental fee kina/hour	Current rental fee kina/hour	New rental fee in yen Yen/hour	Reference* Rental Fee Table 2011 Yen/hour
1	Bulldozer	1	373	160 – 175	13,103	5,470
2	Excavator	1	286	204	10,047	4,850
3	Motor grader	1	311	119 – 166	10,925	5,770
4	Dump truck	2	300	67 – 72	10,539	3,360
		Total (for one fleet)	1,270	-	44,615	19,450
		Total (for four provinces)	5,080	-	178,460	77,800

\* Japan Construction Machinery and Construction Association “Table of Construction Machinery Rental Fees 2011”

Source: DOW

2) Study of national gravel road maintenance budget

The expenses required for operation of the equipment fleet are calculated for comparison with the current budget.

Annual cost required for the operation of one fleet of grading work equipment

Calculation conditions

1. The actual operating hours per fleet per year will be 1,008 hours. (= 240 days x 6 hours x work efficiency 0.7)
2. Labor costs for the construction work, such as the wages of the foremen of the Operations Division of the DOW Provincial Office, are provided under a separate budget, which is not included in the road maintenance budget. As inexpensive river gravel available near the site is the main material used during the grading work, most of the expenses for the road maintenance work are the equipment rental fee paid by the Operations Division to the PTD.
3. The rental fee is paid for the actual operating hours. It is not paid for waiting time, etc.

Annual operating cost: Hourly rental fee 1,234 kina x 1,008 hours = 1,243,872 kina/year

Table 2-11 shows the national gravel road maintenance budget and Table 2-12 shows a comparison of the national gravel road maintenance budget and the equipment fleet operating cost.

Table 2-11 Annual Budgets for National Gravel Road Maintenance

Unit: kina

DOW Provincial Offices in the four target provinces	2009	2010	2011	2009-2011 Average
Western Highlands	1,842,593	181,906	1,627,823	1,217,440
Morobe	4,931,465	714,030	1,118,584	2,254,693
East Sepik	2,807,547	851,177	1,094,434	1,584,386
West New Britain	6,743,440	1,631,588	1,006,279	3,127,102

Table 2-12 Comparison of National Gravel Road Maintenance Budget and Equipment Fleet Operating Cost

DOW Provincial Offices in the four target provinces	2009-2011 average budget (kina/year)	Annual operating cost per fleet (kina/year)	Improvement and maintenance budget /Annual operating cost	Length of road improvable/maintainable by one fleet (km/year)
Western Highlands	1,217,440	1,243,872	0.98	94
Morobe	2,254,693	1,243,872	1.81	96
East Sepik	1,584,386	1,243,872	1.27	96
West New Britain	3,127,102	1,243,872	2.51	96

The budget of the DOW Western Highlands Office is slightly insufficient for operating the equipment at full capacity. Since the equipment is capable of carrying out the grading work 1.4 times a year, team grading work can be performed 1.3 times ( $\#1.4 \times 0.98$ ) a year with the current budget. However, it is desired that the budget of the DOW Western Highlands Office will increase so that the maintenance for national gravel roads can be carried out in a stable manner.

On the other hand, due to the aging and deterioration of the equipment for grading work, most of the grading work is outsourced to private contractors. The number of such private contractors is limited and the outsourcing cost is high. The outsourcing cost greatly varies, but it ranges between 130,000 and 200,000 kina/km, according to an interview from the DOW. Table 2-13 shows the length of road maintainable per year through outsourcing to private contractors.

Table 2-13 Length of National Gravel Road Maintainable Per Year through Outsourcing to Private Contractors

DOW Provincial Offices in the four target provinces	Length of priority maintenance national gravel road (km)	2009-2011 average budget (kina/year)	Cost of outsourcing to private contractors (kina/km)	Length of national gravel road maintainable per year (km/year)
Western Highlands	69.47	1,217,440	165,000	7.4
Morobe	59.69	2,254,693	165,000	13.7
East Sepik	87.22	1,584,386	165,000	9.6
West New Britain	73.59	3,127,102	165,000	19.0
			Average of four Provincial Offices	10.1

Table 2-12 and Table 2-13 show that the provision of one fleet of equipment to each of the provinces will increase the annual capability of improvement and maintenance for national gravel roads, which was about 10km, to about 96km.

### 3) Study of disaster recovery budget

The expenses required for operation of the equipment fleet should be calculated for comparison with the current budget.

#### Annual cost required for the operation of one fleet of restoration work equipment

##### Calculation conditions

- The actual operating hours per fleet per day will be 2.4 hours (= 6 hours x work efficiency 0.4).  
The work efficiency is assumed to be 0.4, because restoration work will include a lot of difficult work, as it is not routine task.
- Labor costs for the construction work, such as the wages of the foremen of the Operations Division of the DOW Provincial Office, are provided under a separate budget, which is not included in the restoration budget. Most of the expenses for restoration work are the equipment rental fee paid by the Operations Division to the PTD.
- The rental fee is paid on the basis of the actual operating hours. No payment is required for waiting time, etc.

Table 2-14 shows the annual cost required for the operation of one fleet.

Table 2-14 Annual Cost Required for the Operation of One Fleet

DOW Provincial Offices in the four target provinces	Annual operating days	Annual operating hours	Rental fee (kina/hour)	Annual operating cost (kina/year)
Western Highlands	160	384	1,270	487,680
Morobe	150	360	1,270	457,200
East Sepik	160	384	1,270	487,680
West New Britain	160	384	1,270	487,680

Table 2-15 shows the disaster recovery budget and Table 2-16 shows a comparison of the disaster recovery budget and the operating cost of the equipment fleet.

Table 2-15 Disaster Recovery Budget

DOW Provincial Offices in the four target provinces	Unit: kina			
	2009	2010	2011	2009-2011 Average
Western Highlands	703,096	632,787	782,918	706,267
Morobe	747,815	807,640	589,632	715,029
East Sepik	624,456	655,679	559,647	613,261
West New Britain	899,135	809,221	429,851	712,736

Table 2-16 Comparison of Disaster Recovery Budget and Operating Cost of Equipment Fleet

DOW Provincial Offices in the four target provinces	2009-2011 average budget (kina/year)	Annual operating cost per fleet (kina/year)	Disaster recovery budget /Annual operating cost
Western Highlands	706,267	487,680	1.4
Morobe	715,029	457,200	1.6
East Sepik	613,261	487,680	1.3
West New Britain	712,736	487,680	1.5

As shown in Table 2-9, the annual utilization rate of the equipment fleet for restoration work required for disaster recovery is 0.6 to 0.7. Considering this utilization rate, the current budget is sufficient for the equipment operating expenses. Also, it is possible to respond to the need for large-scale restoration work, which is implemented with a separate budget and support to other provinces.

#### 4) Study of equipment maintenance and operation capabilities

##### Equipment maintenance

10 to 12 mechanics skilled in the maintenance of construction equipment are allocated to PTD maintenance workshops at the Provincial Offices in the four target provinces. Table 2-17 shows the number of mechanics belonging to the PTD of each DOW Provincial Office. Table 2-18 shows the quantity of equipment deployed and the number of mechanics needed when a construction equipment manufacturer's agent plans to build a maintenance workshop in Japan.

The maintenance for 8 construction equipment to be procured for each DOW Provincial Office (excluding four dump trucks) can be sufficiently done by the current number of mechanics at the PTD of each DOW Provincial Office, since they have over 10 years of experience in maintenance of the same type of equipment.

Table 2-17 Numbers of Mechanics by DOW Provincial Office in the four target provinces

Unit: Person

DOW Provincial Offices in the four target provinces	construction equipment	General vehicles	Total
Western Highlands	8	4	12
Morobe	7	3	10
East Sepik	7	3	10
West New Britain	7	3	10

Source: DOW

Table 2-18 Quantity of construction Equipment Deployed and Number of Mechanics Required

Size of maintenance workshop	Quantity of equipment deployed	Quantity of repaired equipment (unit/month)	Number of mechanics	Work details
Small	100	18	10 or less	Mostly replacement of parts
Medium	100-500	30	20	Overhaul of some of the components
Large	500-2000	40	35	Overhaul of all the components, repair and replacement of parts
Ultra large	2000-	60	50 or more	Regeneration of parts and quality (performance) confirmation after repair

Source: Agent for Japanese construction equipment manufacturer

For the maintenance of equipment, each workshop has the spare parts that are regularly replaced and consumables that require frequently replacement in stock. Spare parts that are required for repairs are procured by the manufacturer's agent, indicating there is not a problem in particular regarding the procurement of parts.

### Operation

The road maintenance equipment is operated by 8 to 10 foremen belonging to the Operations Division of each DOW Provincial Office, who also work as operators. With over 10 years of experience in the operation of such equipment, they can adequately operate the equipment. If there is a shortage of operators, retired people with experience in operation are hired and operate the equipment under the management of an experienced foreman. Therefore, the equipment can be operated appropriately.

#### 5) Justification for the coverage of mobile workshops by the grant aid scheme

As the work (construction) sites are mostly located in remote areas, it is inefficient to send broken equipment to a maintenance workshop for repair and maintenance. To improve the utilization rate of the equipment by ensuring safe, quality on-site repairs, mobile workshops are procured in this project covered by the grant aid scheme.

Equipment and tools often used for maintenance work should be mounted on the mobile workshops. A crane, which is essential for safe and efficient operations, should also be installed. The main on-board equipment is as follows:

#### Main on-board equipment

- On-board crane
- Generator
- Welding machine

- Air compressor
- Electric facilities
- Small crane within van
- On-board tools

6) Justification for coverage of maintenance workshop facilities by the grant aid scheme

The facilities used for rebuilding work at the NRC are excluded from the scope of this grant aid scheme, because it is considered that very little equipment will require rebuilding for the time being as the equipment of the DOW will be mostly comprised of the equipment to be procured in this grant aid assistance, that is, new equipment.

The facilities and tools at the PTD maintenance workshops of the DOW Provincial Offices should also be excluded because facilities and tools may be replaced, if necessary, with the trust account funds.

(6) Development of optimal equipment plan

Based on the above, the types and quantity of necessary equipment are determined as shown in Table 2-19.

Table 2-19 Type and Quantity of Necessary Equipment

No.	Equipment name	Western Highlands Office	Morobe Office	East Sepik Office	West New Britain Office	Total
1	Bulldozer	1	1	1	1	4
2	Excavator	1	1	1	1	4
3	Motor grader	2	2	2	2	8
4	Wheel loader	1	1	1	1	4
5	Vibration roller	1	1	1	1	4
6	Water tanker	1	1	1	1	4
7	Dump truck	4	4	4	4	16
8	Mobile workshop	1	1	1	1	4
Road maintenance equipment and vehicle total		12	12	12	12	48
9	Spare parts	1 set	1 set	1 set	1 set	1 set

(7) Benefits of equipment procurement

Benefits of procurement of grading work equipment



If the equipment is not procured, road improvement and maintenance cannot be adequately carried out and accordingly, it is highly possible that roads in good condition (G) will deteriorate into fair roads (F) or fair roads (F) will deteriorate into poor roads (P). However, if the equipment is procured, it is expected that road conditions can be maintained by performing grading work once a year and improved by performing grading work twice a year on national gravel roads. Therefore, as shown in the calculation Table 2-20 below, equipment procurement will make it possible to improve roads condition.

Table 2-20 Changes in Road Conditions Resulting from Grading Work

						Unit: km
		Western Highlands Office	Morobe Office	East Sepik Office	West New Britain Office	Total
Current (2011)	Good	0.00	1.04	16.59	0.00	17.63
	Fair	69.47	58.65	70.63	73.59	272.34
	Poor	12.71	79.31	98.62	150.29	340.93
	Good (G)+Fair (F)	69.47	59.69	87.22	73.59	289.97
Grading capacity		96km				384km
First year	G→G (once)	0.00	1.04	16.59	0.00	17.63
	F→G (twice)	26.53	36.31	8.78	22.41	94.03
	G Total	26.53	37.35	25.37	22.41	111.66
	F→F (once)	42.94	22.34	61.85	51.18	178.31
Second year	G→G (once)	26.53	37.35	25.37	22.41	111.66
	F→G (twice)	26.53	22.34	8.78	22.41	80.06
	G Total	53.06	59.69	34.15	44.82	191.72
	F→F (once)	16.41	0.00	53.07	28.77	98.25
Third year	G→G (once)	53.06	59.69	34.15	44.82	191.72
	F→G (twice)	16.41	0.00	8.78	22.41	47.60
	G Total	69.47	59.69	42.93	67.23	239.32
	F→F (once)	0.00	0.00	44.29	6.36	50.65

Note: G→G (once): Roads in good condition whose condition remained good after grading once a year  
 F→G (once): Roads in good condition whose condition improved after grading twice a year  
 G Total: Length of roads in good condition after implementation of the grading work above  
 F→F (once): Roads in fair condition whose condition remained fair after grading once a year

Table 2-21 compares the condition three years after the start of the project and the current condition.

Table 2-21 Comparison of Condition Three Years after Start of Project and Current Condition

Unit: Km

		Western Highlands Office	Morobe Office	East Sepik Office	West New Britain Office	Total
Current (2011)	Good	0.00	1.04	16.59	0.00	17.63
	Fair	69.47	58.65	70.63	73.59	272.34
Third year	Good	69.47	59.69	42.93	67.23	239.32
	Fair	0.00	0.00	44.29	6.36	50.65

Benefits of procurement of restoration work equipment

Although the period required for recovery varies greatly depending on the details and severity of the disaster, the average disaster recovery period was determined based on the information collected by interviews during the field study. As a result, it was found that due to the lead time required at tendering or contract signing stages, etc. to work with private contractors, approximately 30 days were spent on preparations before starting the work.

Procurement of the restoration work equipment will significantly reduce the period of road closure: this enables the work to be started in about 5 days in total (3 days for preparation and 2 days for transportation of equipment) except for large-scale disasters.

**2-2-2-2 Equipment plan**

The equipment plan created based on the request from the DOW and the results of the above-described planning is shown in Table 2-22.

**Table 2-22 Equipment Plan**

No.	Equipment name	Quantity (unit)		Main specifications
		Request	Planned quantity	
1	Bulldozer	4	4	18 ton class, 135 kW class, straight tile dozer, multi-shank ripper
2	Excavator	4	4	20 ton class, 105 kW class, 0.8 m <sup>3</sup> bucket
3	Motor grader	8	8	14 ton class, 116 kW class, 3.7 m blade, rear ripper, ROPS cab
4	Wheel loader	4	4	1.9 m <sup>3</sup> class, 100 kW class, ROPS cab
5	Vibration roller	4	4	10 ton class, 90 kW class, front wheel: smooth steel wheel, rear wheel: tire, ROPS canopy
6	Water tanker	4	4	8,000 L class, 147 kW class, 4×2
7	Dump truck	16	16	170 kW class, 10 m <sup>3</sup> loading class, 6×4
8	Mobile workshop	4	4	147 kW class, on-board crane, 4×4
Road maintenance equipment and vehicle total		48	48	
9	Facilities for maintenance workshop	1 set	0	Excluded from the scope of this grant aid assistance, because such facilities have been purchased for replacement with funds from the trust account and are not greatly needed for maintenance of the new equipment.
	Spare parts	1 set	1 set	Early replacement parts to ensure smooth initial operation

### **2-2-3 Implementation Plan**

#### **2-2-3-1 Implementation Policy**

##### (1) Implementing agency

The principal implementing agency in charge of this grant aid assistance on the Papua New Guinean side is the DOW. In accordance with the system of grant aid, a Japanese consulting firm takes charge of execution design and procurement supervision and a Japanese supplier is the main contractor for the procurement of the equipment in this grant aid assistance.

##### (2) Consultant

After the conclusion of the exchange of notes (hereinafter referred to as “E/N”) and the grant agreement (hereinafter referred to as “G/A”), the DOW enters into a consultancy contract with the Japanese consultant regarding the provision of the grant aid assistance.

The consultant that has contracted with the DOW provides consulting services including preparation of the execution design of the equipment in this grant aid assistance, preparation of the tender documents and procurement supervision, and assumes overall responsibility for the project until completion of the equipment delivery.

### (3) Equipment supplier

The equipment supplier is selected by competitive tender with qualification for tender participation. The successful bidder, having passed examination with respect to the quality requirements and specifications, enters into a contract with the DOW to supply the equipment in this grant aid assistance. The supplier should carry out delivery and adjustment and trial operation of the equipment requested by the DOW and conducts initial operation and maintenance and repair operation training within the period specified in the contract.

#### **2-2-3-2 Implementation Issues**

The DOW has experience in equipment procurement and bridge construction under the Japanese grant aid scheme and is familiar with the system of grant aid. However, in order to ensure that all the necessary steps are taken at each stage of procurement and to avoid any delay or failure, explanations should be given to and discussions held with the DOW once again.

Equipment procured from Japan and third countries will be transported by sea to Lae Port in Papua New Guinea and transported inland to the offices in the target provinces, namely, Western Highlands, Morobe, East Sepik and West New Britain, after unloading. On the other hand, initial operation and maintenance and repair training will be conducted at the Provincial Office in Morobe Province, where Lae Port is located, by assembling the engineers, mechanics and operators from the other Provincial Offices. The acceptance inspection and delivery of the equipment should be carried out in each province. The equipment supplier should take care not to cause any problems for the Papua New Guinean side with respect to the warranty for deficiencies resulting from damage and/or theft that may occur during marine transportation, unloading and inland transportation of the equipment.

#### **2-2-3-3 Scope of Works**

The work and expenses up to the point of equipment delivery, namely, the offices in the four provinces, should be carried out or borne by the Japanese side. The expenses for completing the formalities for tax exemption on imported equipment should be borne by the Papua New

Guinean side. Table 2-23 shows the share of work and expenses of the Japanese and Papua New Guinean sides.

Table 2-23 Shares of Work and Expenses

Work and expenses to be shared	Japan's share	PNG's share	Remark
1. Equipment procurement			
Equipment procurement cost	●		Procurement source - Lae Port
Marine transportation cost	●		
Inland transportation cost	●		Lae Port – Offices in the four provinces
Unpacking, delivery and assembly of equipment	●	●	The Japanese side should give instructions.
Adjustment and trial operation	●		The Japanese side should provide training. The participants' costs should be borne by the Papua New Guinean side.
Initial operation training	●	●	
Maintenance and repair training	●	●	The Japanese side should provide training. The participants' costs should be borne by the Papua New Guinean side.
2. Tax exemption		●	

#### 2-2-3-4 Procurement Supervision

##### (1) Basic policy of procurement supervision

With respect to the execution design and procurement supervision, an implementation structure should be set up by assigning personnel with ample experience in execution design and procurement supervision, with a special focus on the following matters.

- Content of preparatory survey report
- Structure of grant aid assistance
- E/N concluded between the two countries
- G/A concluded between the Japan International Cooperation Agency and the government of Papua New Guinea

In view of the above, an outline of the content of the execution design and procurement supervision, personnel and matters to be noted is given.

##### (2) Content of the work

After the conclusion of the E/N and G/A, the consulting firm enters into a consulting contract with the DOW with respect to the scope of work prescribed in the E/N and G/A. The content of the work is as follows:

### 1) Execution design

- Final confirmation of the project details, preparation of the tender documents and discussions
- Acquisition of approval by the Papua New Guinean side for the tender documents
- Tender announcement and distribution of tender documents
- Assistance in tender implementation, evaluation and report of the tender result
- Expediting the contract with the suppliers

### 2) Equipment procurement supervision

- Confirmation of manufacturer specifications of the equipment
- Confirmation of procurement progress
- Witnessing of pre-delivery factory inspection/Confirmation of pre-shipment collation and inspection
- Confirmation of equipment adjustment and trial operation
- Confirmation of initial equipment operation training
- Confirmation of equipment maintenance and repair training
- On-site confirmation of acceptance inspection and delivery

### (3) Assignment of supervisory personnel

- 1) With respect to manufacturing of the equipment to be procured, an inspection engineer should be dispatched for confirmation of the manufacturing specifications, pre-delivery factory inspection and pre-shipment inspection to make sure that the equipment specifications and quantity have not changed from those specified at the stage of the preparatory survey.
- 2) After the arrival of the equipment at the site, a procurement supervision engineer should be stationed at the site for supervision of the work process, including assembly, equipment adjustment, confirmation of trial operation, initial training, maintenance and repair training, acceptance inspection and delivery.
- 3) Similarly, at an appropriate point after the arrival of the equipment at the site, a procurement supervision engineer should be dispatched to the site for overall supervision relating to procurement, such as preliminary arrangements, acceptance inspection and delivery.
- 4) Personnel with ample experience, appropriate technical decision-making ability and coordination ability should be selected for these assignments.

### **2-2-3-5 Quality Control Plan**

The following inspections should be carried out at each stage of equipment procurement to confirm that the equipment conforms to the technical specifications specified in the contract.

- Pre-fabrication inspection  
Confirmation and collation of the equipment drawings to make sure that it conforms to the details in the technical specifications  
(Implemented by the supplier and confirmed by the consultant)
- Pre-delivery factory inspection  
Conformance of the fabricated equipment to the details in the technical specifications in terms of specifications, performance and quantity  
(Implemented by the supplier and confirmed by the consultant)
- Pre-shipment inspection  
Collation of the technical specifications with the shipment documents and collation of the shipping documents with the equipment  
(Implemented by a specialist inspector, witnessed by the supplier and confirmed by the consultant)
- Acceptance inspection  
Confirmation of the shipped equipment to make sure that it conforms to the details of the technical specifications  
(Implemented by the supplier and confirmed by the consultant)

### **2-2-3-6 Procurement Plan**

#### (1) Procurement source

In principle, the equipment to be procured should be made in Japan for the following reasons:

- The products to be procured are not manufactured in Papua New Guinea.
- As most of the equipment to be procured is manufactured by plural manufacturer in Japan, competitiveness can be ensured even if the tender is limited to Japanese companies. Procurement from a third country may be considered for equipment whose competitiveness cannot be ensured.
- Since most of the current equipment of the PTD is made in Japan and the staff is familiar with the operation and maintenance method of such equipment, the PTD wishes that the equipment will be procured from Japan.

With respect to the equipment whose competitiveness cannot be fully ensured among Japanese products alone for lack of manufacturers in Japan, such as the motor grader, which is manufactured in Brazil, and the vibration roller, which is manufactured in Germany, Brazilian products and German products should also be included in the products qualified for procurement. Many products made in these countries have been used in Papua New Guinea and they are considered technically reliable. Also, they do not have any problem with the system of after-delivery services. Table 2-24 shows potential procurement sources for each type of equipment.

Table 2-24 Potential Procurement Sources for Each Type of Equipment

Equipment name	Procurement source				Reasons
	Japan	Brazil	Germany	Papua New Guinea	
Bulldozer	●				
Excavator	●				
Motor grader	●	●			The number of Japanese manufacturers is limited.
Wheel loader	●				
Vibration roller	●		●		The number of Japanese manufacturers is limited.
Water tanker	●				
Dump truck	●				
Mobile workshop	●				

## (2) Spare parts

To ensure smooth initial operation, parts for periodic maintenance which need to be replaced within a year after the start of operation and short-term consumables as described below, should be procured as spare parts at the same time to improve the utilization rate of the equipment.

- Parts for periodic maintenance : Fuel filter, engine oil filter, air cleaner element, power line filter, hydraulic system filter, etc.
- Short-term consumables : Bit, bit holder, end bit, blade cutting edge, ripper point, bucket teeth, etc.

## (3) Transportation route

Japanese products to be procured are transported by sea from a shipping port in Japan and products from third countries (Brazilian and German products) are transported by sea from



a major shipping port in the country. They arrive at Lae Port in Papua New Guinea. After unloading, products for Western Highlands and Morobe are transported by low-bed trailer, while products for East Sepik and West New Britain are first sent by domestic vessel to Wewak Port and Kimbe Port and then transported inland by low-bed trailer before being handed over to the Papua New Guinean side.

### 2-2-3-7 Operational Guidance Plan

The equipment to be procured in this grant aid assistance will be transported to the four DOW Provincial Offices. After the arrival of the equipment to be deployed at the Morobe Provincial Office, initial operation training and routine operation training will be provided by the manufacturer’s engineers at the Office. The consultant will supervise the training by the manufacturer’s engineers.

Table 2-25 Number of Days Required for Operational Guidance

Training details	Target	Number of days required
Initial operation training	Equipment operators	1) 1.0 day/item of road maintenance equipment × 5 items = 5.0 days (for 5 items of road maintenance equipment) 2) 0.5 day/vehicle (dump truck, water tanker) x 2 items = 1.0 day (2 vehicles) 3) 1.0 day/ vehicle (Mobile workshop) x 1 item = 1.0 day (1 vehicle) All the training above should be carried out at the office in Morobe Province. Seven days are required.
Maintenance and repair training	Engineers, mechanics	1) 1.0 day/ item of road maintenance equipment x 5 items =5.0 days (for 5 items of road maintenance equipment) 2) 0.5 day/vehicle (dump truck, water tanker) x 2 items =1.0 day (2 vehicles) 3) 1.0 day/vehicle (mobile workshop) x 1 item = 1.0 day (1 vehicle) All the training above should be carried out at the office in Morobe Province. Seven days are required.

### 2-2-3-8 Soft Component (Technical Assistance) Plan

The equipment to be introduced in this grant aid assistance will be maintained and operated by the PTD. The current engineers at PTD have the basic skills and knowledge required for maintenance and operation because the equipment is equivalent to the current equipment at the PTD. Therefore, there is no need to provide a soft component except for the initial operation and maintenance and repair training.

### 2-2-3-9 Implementation Schedule

This grant aid assistance should be implemented in accordance with the schedule as described in Figure 2-2.

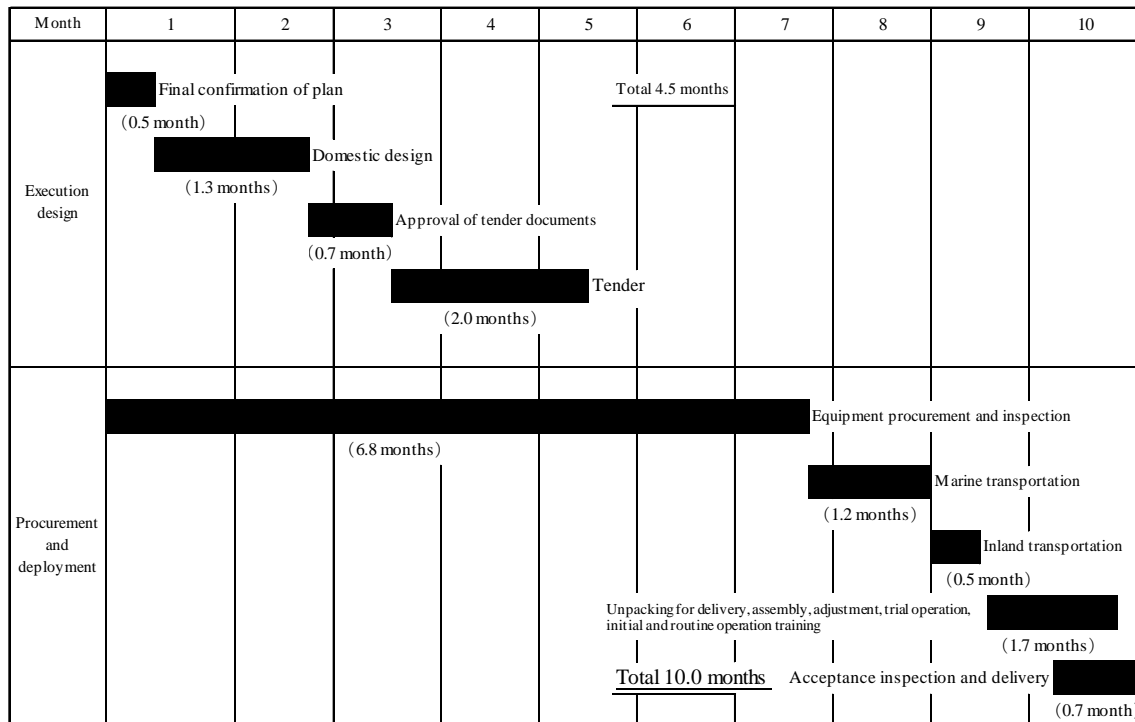


Figure 2-2 Implementation Schedule

### 2-3 Obligations of Recipient Country

The Papua New Guinean side shall be in charge of the following matters when this grant aid assistance is implemented.

- (1) Payment of commission to Japanese banks based on the banking arrangement (hereinafter referred to as “B/A”)
- (2) To take the necessary measures to exempt tariffs and import taxes on the equipment to be procured in this grant aid assistance
- (3) Provision of benefits to Japanese citizens involved in this grant aid assistance when entering and staying in Papua New Guinea for the purpose of executing their tasks
- (4) Formalities for the exemption of tariffs, domestic taxes and other surcharges on Japanese citizens with respect to the supplies and tasks relating to this grant aid assistance
- (5) Appropriate and effective operation and maintenance of the equipment to be procured in this grant aid assistance
- (6) Securing of the budget necessary for implementation of the road improvement plan

- (7) Securing of a budget for the replacement of equipment necessary for sustainable road improvement
- (8) Payment of all expenses relating to this project other than those covered by the grant aid scheme of Japan
- (9) Payment of all the following expenses relating to initial operation and maintenance and repair training, acquisition of necessary approvals and permits and arrangement of schedule
  - Securing of work yard and stock yard necessary for the implementation of training
  - Procurement and securing of materials, equipment and personnel (engineers, operators, instructors, etc.) necessary for the training
  - Preparation of indoor lecture space and equipment necessary for the implementation of indoor lectures and assembling of participants (engineers)
  - Acquisition of approvals and permits from agencies and facilities relating to the training

## **2-4 Project Operation Plan**

### (1) Equipment maintenance structure

The PTD is in charge of equipment maintenance and has established the following maintenance structure.

#### 1) Each construction site: Daily inspection, periodic maintenance, minor breakdown repairs

Daily inspection is carried out by the operators. Following a check sheet, the operators check the equipment and enter the operating hours and fuel and oil consumption as well as signs of abnormality, if any, in the daily inspection record.

Periodic maintenance is carried out by the mechanics that patrol each construction site. Referring to the check sheet created by the operators, the mechanics grasp the condition of each item of equipment and place an order for the parts necessary for periodic maintenance.

Minor breakdown repairs are carried out by the mechanics at the construction site. The mechanics investigate the cause of the breakdown and repair the equipment. At the same time, they enter the details of the cause of the breakdown and repairs, the required man-hours and replacement parts in the vehicle history. It is expected that the procurement of the mobile workshop will result in expansion of the scope of repairs and improvement of the quality of repairs, which will lead to an increase in the utilization rate of the equipment.

## 2) Provincial maintenance workshop: Breakdown repairs

If the cause of breakdown cannot be identified at the construction site or if it is determined that the equipment cannot be repaired at the site, the equipment is sent to the PTD maintenance workshop of DOW Provincial Office to be repaired. The maintenance workshop keeps a stock of parts for periodic replacement. Other parts necessary for the repair work are ordered to an agency of the manufacturer.

## 3) NRC: Major breakdown repairs, overhaul

If the breakdown cannot be repaired or restored by the PTD maintenance workshop of DOW Provincial Office, the equipment or the broken component is transferred to the NRC, which is the central maintenance workshop of the PTD, in Lae City, Morobe Province, to be repaired or rebuilt.

## (2) Personnel allocation

A total of 10 to 12 mechanics relating to road maintenance equipment have been assigned to work at the PTD maintenance workshop of the four DOW Provincial Offices. Table 2-26 shows the number of mechanics belonging to the PTD of each Provincial Office.

Eight to ten foremen work for the Operations Division of each Provincial Office. They also work as operators of road maintenance equipment. With over 10 years of experience in operation, they can adequately operate the equipment. In addition, since the road improvement and maintenance equipment to be procured in this project is of the same models as the equipment retained by the DOW, they can surely master the maintenance method through the initial operation and routine operation training to be implemented when the equipment is delivered. If there is a shortage of operators, retired people with experience in operation will be hired to operate the equipment under the management of an experienced foreman. Therefore, the equipment can be operated appropriately without a problem.

Table 2-26 Numbers of Mechanics in Each DOW Provincial Office

Unit: Person

DOW Provincial Offices in the four target provinces	Construction equipment	General vehicles	Total
Western Highlands	8	4	12
Morobe	7	3	10
East Sepik	7	3	10
West New Britain	7	3	10

Source: DOW

## 2-5 Project Cost Estimation

### 2-5-1 Initial Cost Estimation

(1) Estimated expenses to be borne by Papua New Guinea

Approximately 25,100 PGK (About 882 thousand yen)

Bank commission                      Approximately 25,100 PGK (About 882 thousand yen)

These amounts are to be paid from the trust account of the DOW which is the implementing agency. The Papua New Guinean side should be able to bear this amount, because it is equivalent to about 0.21% of 12,147,000 kina, which is the trust account revenue of DOW, the implementing agency, in 2011.

(2) Conditions of estimation

- 1) Point of estimation    : February 2012
- 2) Exchange rate        : 1 US\$ = 78.23 yen, 1PGK = 35.13 yen
- 3) Procurement period   : The period of execution design and equipment procurement is approximately 14.5 months as shown in Figure 2-2 “Implementation Schedule.”
- 4) Others                 : This project shall be implemented in accordance with the grant aid scheme of the Japanese government.

### 2-5-2 Operation and Maintenance Cost

The annual fuel/oil cost and maintenance and repair cost required for operation and maintenance of the newly procured equipment for the grading work and restoration work are estimated at approximately 57.1 million yen and 14.8 million yen, respectively.

The estimation results of fuel/oil cost and maintenance and repair cost are shown in Tables 2-27, 2-28, 2-29 and 2-30.

Table 2-27 Estimation of Fuel /Oil Cost for Grading Work

No.	Equipment name	Specifications (kW)	Fuel consumption rate per operating hour (ltr/kW-h)	Average annual operating hours in 4 provinces (hr/year)	Number of equipment	Annual fuel consumption (ltr)
1	Motor grader	115	0.108	1,008	4	50,077
2	Wheel loader	91	0.153		4	56,138
3	Vibration roller	103	0.152		4	63,125
4	Water tanker	199	0.040		4	21,289
5	Dump truck	246	0.050		8	99,187
					Total	289,816

Table 2-28 Estimation of Fuel /Oil Cost for Restoration Work

No.	Equipment name	Specifications (kW)	Fuel consumption rate per operating hour (ltr/kW-h)	Average annual operating hours in 4 provinces (hr/year)	Number of equipment	Annual fuel consumption (ltr)
1	Bulldozer	136	0.175	378	4	35,986
2	Excavator	104	0.175		4	27,518
3	Motor grader	115	0.108		4	18,779
4	Dump truck	246	0.050		8	37,195
					Total	119,478

#### Conditions of estimation

##### a. Annual operating hours:

The average actual annual operating hours of the equipment for grading work at the four target DOW Provincial Offices is 1,008 hours.

$$(\text{= } 240 \text{ days} \times 6 \text{ hours} \times \text{work efficiency } 0.7)$$

The average actual annual operating hours of the equipment for restoration work at the four target DOW Provincial Offices is 378 hours.

$$(\text{= } 157.5 \text{ days} \times 6 \text{ hours} \times \text{work efficiency } 0.4)$$

##### b. Fuel consumption rate per operating hour (ltr/kW-h):

Estimated in accordance with the standards prescribed in the Table of Construction Machinery Rental Fees issued by the Japan Construction Machinery and Construction Association in 2011. Oil consumption is assumed to be 1% of fuel consumption.

c. Diesel fuel price : 3.85 kina = 135.25 yen/ltr (1 kina=35.13 yen)

Oil price : 12.66 kina = 444.75 yen/ltr

Based on the above,

Annual fuel cost :  $(289,816 \text{ ltr} + 119,478 \text{ ltr}) \times 3.85 \text{ kina} \# 1,575,783 \text{ kina}$   
 (= 55.3 million yen)

Annual oil cost :  $(289,816 \text{ ltr} + 119,478 \text{ ltr}) \times 0.01 \times 12.66 \text{ kina} \# 51,817$   
 kina (= 1.8 million yen)

Total annual fuel/oil cost  $55.3 + 1.8 = 57.1 \text{ million yen (1.63 million kina)}$

Table 2-29 Estimation of Maintenance and Repair Cost for Grading Work

No.	Equipment name	Specifications (Kw)	Number of equipment	Ratio of maintenance and repair cost (/unit)	Service life	Ratio of maintenance and repair cost (/unit/ year)	Ratio of parts cost	Equipment price (CIP thousand yen/unit)	Annual maintenance and repair cost per unit (thousand yen/unit/year)	Annual maintenance and repair cost (thousand yen/total number of equipment/year)
1	Motor grader	115	4	0.35	14	0.025	0.5	19,531	244	976
2	Wheel loader	91	4	0.65	12	0.054	0.5	17,439	471	1,884
3	Vibration roller	103	4	0.45	13	0.035	0.5	13,201	231	924
4	Water tanker	199	4	0.40	11	0.036	0.5	8,106	146	584
5	Dump truck	246	8	0.55	11	0.050	0.5	12,932	323	2,584
									Total	6,952

Table 2-30 Estimation of Maintenance and Repair Cost for Restoration Work

No.	Equipment name	Specifications (Kw)	Number of equipment	Ratio of maintenance and repair cost (/unit)	Service life	Ratio of maintenance and repair cost (/unit/year)	Ratio of parts cost	Equipment price (CIP thousand yen/unit)	Annual maintenance and repair cost per unit (thousand yen/unit/year)	Annual maintenance and repair cost (thousand yen/total number of equipment/year)
1	Bulldozer	136	4	0.55	11	0.050	0.5	24,537	613	2,452
2	Excavator	104	4	0.45	9	0.050	0.5	17,883	447	1,788
3	Motor grader	115	4	0.35	14	0.025	0.5	19,531	244	976
4	Dump truck	246	8	0.55	11	0.050	0.5	12,932	323	2,584
									Total	7,800

Conditions of estimation:

- Ratio of equipment maintenance and repair cost, and service life: Estimated in accordance with the standards prescribed in the Table of Construction Machinery Rental Fees issued by the Japan Construction Machinery and Construction Association in 2011.
- Annual maintenance and repair cost per unit: Estimated equipment price (CIP price/unit) x Ratio of maintenance and repair cost x Ratio of parts cost
- Although the ratio of parts cost and labor cost in the maintenance and repair cost is 50:50, only the parts cost is included in the estimation since maintenance work will be carried out during the PTD workshop. (Ratio of parts cost: 0.5)
- Annual maintenance and repair cost: Annual maintenance and repair cost per unit x number of equipment

Total cost of annual equipment maintenance and repair: 7.0 + 7.8 = 14.8 million yen (0.421 million kina)

The sum of annual fuel/oil cost and maintenance and repair cost required for operation and maintenance of the newly procured equipment is 71.9 million yen. (2.05 million kina)



On the other hand, the trust account, which provides funds to cover the operation and maintenance expenses of the equipment, earns revenue from the equipment rental fees as shown in Table 2-7.

Annual rental fee for grading work equipment for the four target Province Offices in total: 174.8 million yen (173,402 yen x 1,008 hours)

Annual rental fee for restoration work equipment for the four target Province Offices in total: 67.5 million yen (178,460 yen x 378 hours)

The annual equipment rental fee for the four target DOW Provincial Offices in total is 242.3 million yen (6.90 million kina), which is greater than the annual operation and maintenance cost. Therefore, utilization of the equipment can also be justified from this point of view.

## Chapter 3 Project Evaluation

## **Chapter 3 Project Evaluation**

### **3-1 Preconditions**

The Papua New Guinean side shall ensure that their obligations (payment of bank commissions, preparations for the exemption of tariffs and import taxes, securing of work yard, etc.) will be promptly fulfilled.

The equipment to be procured in this project shall be appropriately operated and maintained.

### **3-2 Necessary Inputs by Recipient Country**

The recipient country shall secure a budget for the grading work and restoration work with the equipment to be procured.

The recipient country shall properly manage the trust account, which is the source of funds for the maintenance of the equipment to be procured. Management of the trust account will secure the funds for purchasing new equipment, which will lead to sustainable development, enabling the distribution of equipment to provinces other than the four target DOW Provincial Offices and the operation of increased road maintenance work.

### **3-3 Important Assumptions**

- No change (outsourcing to private sector, etc.) shall occur in the framework of road maintenance.
- The policy with a focus on the maintenance and improvement of the road network shall continue.

### **3-4 Project Evaluation**

#### **3-4-1 Relevance**

It is highly relevant to implement this grant aid assistance because adequate road maintenance and prompt disaster recovery have not been carried out due to the aging, deterioration and lack of road repair equipment managed by the PTD. The grant aid assistance also conforms to the development plan of the Papua New Guinea as well as the ODA policy of the Japanese government and JICA. In consideration of the project content, degree of its effectiveness and capabilities for the operation and maintenance of the target equipment, it is judged to be relevant to implement this project under the grant aid scheme of the Japanese government for the following reasons:

- (1) Beneficiaries of the project are general residents including the poor and the number of such people is fairly large.

- (2) The residents along the national gravel roads will have an easy access to markets, schools and health facilities, which will result in the reduction of economic and social losses and the improvement of living standards.
- (3) The equipment can be operated and maintained with Papua New Guinea's own funds, human resources and technology. Excessively advanced technology is not required.
- (4) The project will contribute to the maintenance and improvement of the road network, which is a goal of the medium- and long-term development plans of Papua New Guinea.
- (5) No negative impact will be made on the environment or society.
- (6) The aid policy of Japan for PNG designates cooperation in transportation as an important field to help strengthen the infrastructure for economic growth, and this grant aid scheme matches this policy.

### 3-4-2 Effectiveness

- (1) Quantitative benefit

Table 3-1 Effectiveness of the Project (Quantitative Benefit)

Verifiable indicator	Current Status (2012)	Target Value (2017) [3 Years After Project Completion]
Operation hour of equipment for grading work (Hours/Month/Each Province) *	0	84
Total monthly grading work length (km/Month/Each Province) *	0.8	8.0

\* This shows the operation hour and total maintenance work length when equipment for grading work is used only for the intended work. Not only equipment for restoration work, but also equipment for grading work has the potential to be allocated and utilized preferentially for restoration work in the event of disasters especially during the rainy season.

- (2) Qualitative benefit

The provision of equipment required for restoration work at locations where disasters have occurred will enable restoration work to be more efficiently performed when a landslide or slope failure occurs.

Judging from the above, it is determined that this project is highly relevant and expected to be beneficial.

## Appendices

## Appendix1 Member List of the Survey Team

### (1) Preparatory survey

Name	Responsibility	Affiliation
Takashi TSUJI	Overall management/Mission leader	Representative, JICA Papua New Guinea Office
Denichiro YAMADA	Planning and management	Planning Coordination Section, Economic Infrastructure Department, JICA
Haruo FUKUCHI	Project Manager/Road planning	INGEROSEC Corporation
Yukio KOHSAKA	Equipment planning/Maintenance planning	INGEROSEC Corporation
Nobuyuki KAMIHASHI	Procurement planning/ Estimation	INGEROSEC Corporation

### (2) Study for Explanation of the Project Formulation Study Outline

Name	Responsibility	Affiliation
Shigeru SUGIYAMA	Overall management/Mission leader	Manager, No. 1 Implementation Supervision Section, Financing Facilitation and Procurement Supervision Department
Denichiro YAMADA	Planning and management	Planning Coordination Section, Economic Infrastructure Department, JICA Head Quarter
Haruo FUKUCHI	Project Manager/Road planning	INGEROSEC Corporation
Yukio KOHSAKA	Equipment planning/Maintenance planning	INGEROSEC Corporation

## Appendix 2 Survey Schedule

### (1) Preparatory Survey Schedule

Schedule			JICA officer	Consultant (INGEROSEC)			
Day No.	Date	Day	1. Overall management/Leader Takashi TSUJI 2. Planning and management Denkihiro YAMADA	3 Project manager/Road planning  Haruo FUKUCHI	4 Equipment planning/Maintenance planning  Yukio KOHSAKA	5 Procurement planning/Estimation  Nobuyuki KAMIHASHI	
1	2012/1/21	Sat	Travel (by air) Departure from Narita (21:05) PX055→				
2	2012/1/22	Sun	Arrival at Port Moresby (04:40) , Meeting within mission				
3	2012/1/23	Mon	Courtesy visit to Japanese Embassy and JICA (9:30), Department of National Planning and Monitoring (11:00) and DOW (Department of Works) (13:30)/Explanation on Inception Report and Questionnaire, Discussion on schedule				
4	2012/1/24	Tue	Travel (by air) Departure from Port Moresby (12:00)→Arrival at Lae (12:45) PX102 Survey of NRC (National Rebuild Center)				
5	2012/1/25	Wed	Visit to PTD Lae Provincial Office, survey of repair shop, survey of roads managed by PTD Lae Provincial Office Travel (by air) Departure from Lae (13:15)→Arrival at Port Moresby (14:00) PX103	Visit to PTD (Plant and Transport Department) Lae Provincial Office, survey of NRC workshop, survey of roads managed by PTD Lae Provincial Office (on-site survey of flood damage)			
6	2012/1/26	Thu	Discussion with DOW (discussion on M/D)			Visit to PTD Lae Provincial Office (8:30-10:00), visit to DOW Morobe Provincial Office Civil Engineering Branch (10:00-11:30), survey of customs clearance at Lae Port (13:00-14:30), survey of roads managed by Lae Provincial Office (on-site survey of gravel and flood damage)	
7	2012/1/27	Fri	Discussion with DOW (signature on MD)(11:00), report to Embassy and JICA (15:00)			Hearing at NRC and DOW Morobe Provincial Office Civil Engineering Branch	
8	2012/1/28	Sat	Travel (by air) Port Moresby (14:20) PX054→Narita (19:55)	Preparation of materials	Survey of distributors and after-sale service,		
9	2012/1/29	Sun	[Blank]	Preparation of materials, meeting within mission	Survey of distributors and after-sale service, Travel (by air) Departure from Lae (13:15)→Arrival at Port Moresby (14:00) PX103, Preparation of materials, meeting within mission		
10	2012/1/30	Mon		Travel (by air) Departure from Port Moresby (9:00)→Arrival at Mount Hagen (10:00) PX184 Visit to PTD Mount Hagen Provincial Office, survey of maintenance workshop			
11	2012/1/31	Tue		Visit to DOW Mount Hagen Provincial Office Civil Engineering Branch (8:30-12:00), survey of roads managed by Mount Hagen Provincial Office (on-site survey of flood damage) (13:00-16:00)			
12	2012/2/1	Wed		Survey of roads managed by PTD Mount Hagen Provincial Office			
13	2012/2/2	Thu		Visit to PTD Mount Hagen Provincial Office Travel (by air) Departure from Mount Hagen (15:00)→Arrival at Port Moresby (16:00) PX185			
14	2012/2/3	Fri		Meeting with DOW Assistant Secretary, PTD and MCS (Maintenance Coordination Service Branch)			
15	2012/2/4	Sat		Survey of maintenance by private contractor and spare parts (Komatsu and Caterpillar distributor), preparation of materials, meeting within mission			
16	2012/2/5	Sun		Preparation of materials, meeting within mission			
17	2012/2/6	Mon		Travel (by air) Departure from Port Moresby (15:00)→Arrival at Kimbe (16:30) PX844			
18	2012/2/7	Tue		Visit to PTD West New Britain Provincial Office Kimbe, survey of repair shop			
19	2012/2/8	Wed		Survey of roads managed by DOW and PTD West New Britain Provincial Office Kimbe			
20	2012/2/9	Thu		Visit to PTD West New Britain Provincial Office Kimbe			
21	2012/2/10	Fri		Travel (by air) Departure from Kimbe (12:05)→Arrival at Port Moresby (13:35) PX4989			
22	2012/2/11	Sat		National Foundation Day Preparation of materials, meeting within mission			
23	2012/2/12	Sun		Preparation of materials, meeting within mission			
24	2012/2/13	Mon		Discussion on specifications with DOW and PTD, collection of materials			
25	2012/2/14	Tue		Discussion on specifications with DOW and PTD, collection of materials			
26	2012/2/15	Wed		Travel (by air) Departure from Port Moresby (12:40)→Arrival at Wewak (14:10) PX0944 Preliminary visit to PTD			
27	2012/2/16	Thu		Visit to PTD Wewak Provincial Office, survey of repair shop, survey of roads managed by PTD Wewak Provincial Office			
28	2012/2/17	Fri		Visit to PTD Wewak Provincial Office, DOW Wewak Provincial Office and Civil Engineering Branch			
29	2012/2/18	Sat		Survey of roads managed by PTD Wewak Provincial Office			
30	2012/2/19	Sun		Travel (by air) Departure from Wewak (06:10)→Arrival at Port Moresby (08:20) PX125 Preparation of materials, meeting within mission			
31	2012/2/20	Mon		Morning: Discussion with DOW (data collection, discussion of technical memo) Afternoon: Visit to ADB			
32	2012/2/21	Tue		Discussion with DOW (data collection, discussion on technical memo), visit to AusAID, survey of transport conditions (transport company)			
33	2012/2/22	Wed		Discussion with DOW (data collection, discussion on technical memo)			
34	2012/2/23	Thu		Discussion with DOW (data collection, discussion and signature on technical memo), survey of transport conditions (transport company)			
35	2012/2/24	Fri		Survey of transport conditions (transport company) , report to Embassy and JICA (16:00-)			
36	2012/2/25	Sat		Travel (by air) Port Moresby (14:20) PX054→Narita (19:55)			

## (2) Study for Explanation of the Project Formulation Study Outline

Schedule			JICA officer	Consultant (INGEROSEC)	
Day No.	Date	Day	1. Overall management/Leader Shigeru SUGIYAMA 2. Planning and management Denichiro YAMADA	3. Project manager/Road planning  Haruo FUKUCHI	4. Equipment planning/Maintenance planning  Yukio KOHSAKA
1	2012/6/16	Sat	Travel (by air) Departure from Narita (21:05) PX055→		
2	2012/6/17	Sun	Arrival at Port Moresby (04:40), Departure from Port Moresby (11:30)(travel)→Lae		Preparation of materials
3	2012/6/18	Mon	On-site survey of large-scale repair shop (NRC) and discussion, discussion with DOW Morobe Provincial Office, on-site survey (landslide restoration work)		Discussion with PTD on technical memo
4	2012/6/19	Tue	Departure from Lae (13:00) (travel)→Port Moresby, Discussion with Department of National Planning and Monitoring (DoNPM), courtesy visit to JICA Office and Japanese Embassy in Papua New Guinea		Discussion with PTD on technical memo, Discussion with Department of National Planning and Monitoring (DoNPM), courtesy visit to JICA Office and Japanese Embassy in Papua New Guinea
5	2012/6/20	Wed	Discussion on project formulation study report with DOW Plant and Transport Division (PTD), discussion on M/D with Department of Works (DOW), discussion on technical memo		
6	2012/6/21	Thu	Discussion on M/D with PTD, discussion of technical memo, meeting with NRA, discussion with DOW (Civil, PTD)		
7	2012/6/22	Fri	Signature on M/D, signature on technical memo, report to JICA Office and Japanese Embassy in Papua New Guinea		
8	2012/6/23	Sat	Travel (by air) Port Moresby (14:20) PX054→Narita (19:55)		



## Appendix3 List of Parties Concerned in the Recipient Country

(1) Japanese Embassy in Papua New Guinea

Yoshiki TAKAHAMA First Secretary

Kou SHISHIDO Second Secretary

(2) JICA Papua New Guinea Office

Takashi TSUJI Representative

Yoshikazu TANIGUCHI Staff

Hikari MIYAHARA Volunteer Coordinator

(3) The Government of Papua New Guinea

1) Department of Works (DOW) Headquarters

Name	Designation	Affiliation
Joel Luma	Secretary	DOW
David Wereh	Deputy Secretary Technical	DOW, Plant & Transport Division Headquarters
Andrew Ralpa Buna	Manager Operation	DOW, Plant & Transport Division Headquarters
Joe Asinimbu	First Assistant Secretary-Operations	DOW, Operations Division
Bernard Kull	First Assistant Secretary-PTD	DOW, Plant & Transport Division Headquarters
Eddy Sangrador	DOW, Assistant Secretary	DOW, Assistant Secretary

2) Department of Transport

Name	Designation	Affiliation
Gabi Haoda	First Assistant Secretary Policy & Research Division	Department of Transport Policy, Planning and Corporate & Support Services Wing
Koni Pombo	First Assistant Secretary Planning and Coordination Division	Department of Transport Policy Planning Wing
Manfred Ruzsicska	Policy Development Adviser	Department of Transport Transport Sector Support Program (TSSP) Supported by the Government of Australia

3) Department of National Planning and Monitoring (DNPM)

Name	Designation	Affiliation
Reichert Thanda	Acting First Assistant Secretary	Foreign Aid Division (FAD), Department of National Planning & Monitoring (DNPM)
Floyd Lala	Acting Assistant Secretary	Bilateral Branch, FAD, DNPM
Kazumi OGAWA	Development Planning Advisor (JICA Expert)	Bilateral Branch, FAD, DNPM
Loise Kuarughin	Program Officer (Transport)	Infrastructure Branch, Infrastructure & Economic Division, DNPM

4) National Rebuild Center (NRC)

Name	Designation	Affiliation
Alphonse Powe	Provincial Technical Officer Auxil Lae	NRC
Sam Odik Towal	Regional Mechanical Engineer	NRC
Naime Dai	Senior Training Officer	NRC

5) DOW Western Highlands Provincial Office Mt. Hagen

Name	Designation	Affiliation
Edoward Maniat	Provincial Works Manager Western Highlands	DOW PTD Western Highlands Provincial Office Mt. Hagen
Allan Mandui	Provincial Plant Manager Western Highlands	DOW PTD Western Highlands Provincial Office Mt. Hagen
Thomas Dei	Provincial Civil Engineer	DOW Western Highlands Provincial Office Civil Engineering Branch
Paul Waine	Project Engineer	DOW Western Highlands Provincial Office Civil Engineering Branch

6) DOW Morobe Provincial Office Lae

Name	Designation	Affiliation
Andrew A. Thavung	Provincial Works Manager-Morobe	DOW, Morobe Provincial Office Civil Engineering Branch
Waraf Omad	Provincial Transport Supervisor	DOW PTD Morobe Provincial Office Lae
Steven W.Kafang	Provincial Plant Manager Lae	DOW PTD Morobe Provincial Office Lae
Kingsford E Kassen	a/PROVINCIAL CIVIL ENGINEER	DOW, Morobe Provincial Office Civil Engineering Branch

7) DOW East Sepik Provincial Office Wewak

Name	Designation	Affiliation
Paul Nindivi	Provincial Works Manager East Sepik	DOW, East Sepik Province
Savenat Butinga	Acting PTD Manager	DOW, PTD East Sepik Provincial Office Wewak
Jonathan Jones	Acting Supervisor	DOW, PTD East Sepik Provincial Office Wewak
Emmanuel Karo	Provincial Transport Supervisor	DOW, PTD East Sepik Provincial Office Wewak
Samson Sirimo	Human Resources Officer	DOW, East Sepik Provincial Office Wewak
Paul Pitaro	Provincial Civil Engineer	DOW, East Sepik Provincial Office, Civil Engineering Branch

8) DOW PTD West New Britain Provincial Office Kimbe

Name	Designation	Affiliation
Penias Paison	Provincial Works Manager West New Britain	DOW Operations Division
Peter Pilon	a/Provincial Plant Manager	DOW PTD West New Britain Provincial Office Kimbe
Paul Balen	Provincial Plant Manager	DOW PTD West New Britain Provincial Office Kimbe

9) National Road Authority (NRA)

Name	Designation	Affiliation
Roy Harry Mumu	Executive Officer	NRA

(4) Others

1) Other Donors

Name	Designation	Affiliation
Allen Lee	Deputy Head PNG Resident Mission	ADB
Steven Pup	Project Director	ADB
Glenn De Castro	Project Director	Ausaid

2) Private Companies

Name	Designation	Affiliation
Francis Liku	Branch Manager-Port Moresby	UMW Niugini Limited. (Construction machinery distributor)
Sinakling Sele	Parts Manager	UMW Niugini Limited. (Construction machinery distributor)
Peter Reva	Service Manager	UMW Niugini Limited. (Construction machinery distributor)
Jon Vutliu	Sales Representative	Hastings Deering (PNG) Limited. (Construction machinery distributor)
Francis Wagaia	Managing Director	LD Logistics Ltd (Transport company)

## Appendix 4 Minutes of Discussions (M/D)

### \*Preparatory Survey

MINUTES OF DISCUSSIONS  
ON  
THE PREPARATORY SURVEY  
ON  
THE PROJECT FOR IMPROVEMENT OF ROAD CONSTRUCTION AND MAINTENANCE  
EQUIPMENT AND WORKSHOP FACILITIES  
IN THE INDEPENDENT STATE OF PAPUA NEW GUINEA


In response to a request from the Government of the Independent State of Papua New Guinea (hereinafter referred to as "PNG"), the Government of Japan decided to conduct a Preparatory Survey on the Project for Improvement of Road Construction and Maintenance Equipment and Workshop Facilities (hereinafter referred to as "the Project") in PNG and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").


JICA sent to PNG the Preparatory Survey Team (hereinafter referred to as "the Team"), which is headed by Mr. Takashi TSUJI, Chief Representative, JICA Papua New Guinea Office, and is scheduled to stay in the country from January 22<sup>nd</sup> to February 25<sup>th</sup>, 2012.

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

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

Port Moresby, January 27<sup>th</sup>, 2012.

  
\_\_\_\_\_  
Takashi TSUJI  
Leader  
Preparatory Survey Team  
Japan International Cooperation Agency

  
\_\_\_\_\_  
JOEL LUMA  
Secretary  
Department of Works  
Independent State of Papua New Guinea

## ATTACHMENT

### 1. Objective of the Project

The objective of the Project is to contribute to development in the infrastructures in PNG with providing road maintenance equipment and workshop facilities for four provincial offices of the Plant and Transport Division (hereinafter referred to as "PTD") of Department of Works (hereinafter referred to as "DOW").

### 2. Project site

The site of the Project is shown in Annex-1

### 3. Responsible and Implementing Agency

3-1. The Responsible Agency for executing the Project is the Department of Works (DOW).

3-2. The Implementing Agency is the Plant and Transport Division (PTD) of DOW.

3-3. The organization charts of DOW and PTD are shown in Annex-2-1 and Annex-2-2.

### 4. Items Requested by the PNG Side

After discussions with the Team, the items as described below were requested by PNG side. JICA will assess the appropriateness of the request and the necessity of technical cooperation for the efficient operation and maintenance of the requested equipment, and will report the findings to the Government of Japan.

#### a) Road Maintenance Equipment

Equipment	Number of Requested Items				
	Lae	Mt.Hagen	Wewak	Kimbe	TOTAL
Bulldozer	1	1	1	1	4
Excavator	1	1	1	1	4
Motor Grader	2	2	2	2	8
Wheel Loader	1	1	1	1	4
Vibratory Roller	1	1	1	1	4
Water Tank Truck	1	1	1	1	4
Dump Truck	4	4	4	4	16
Mobile Workshop	1	1	1	1	4

#### b) Spare Parts for above-mentioned equipment

#### c) Workshop Facilities for four provincial offices (Lae, Mt.Hagen, Wewak, Kimbe)

#### d) Soft Component or Technical Cooperation (e.g. Training for maintenance of above-mentioned equipment) (if necessary)

### 5. Japan's Grant Aid Scheme

5-1. PNG side understood the Japan's Grant Aid scheme explained by the Team, as described in

2.2.

Annex-3.

5-2. PNG side will take the necessary measures, as described in Annex-4, for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

6. Schedule of the Study

6-1. The consultant members of the Team will proceed with further studies in PNG until February 25<sup>th</sup>, 2012.

6-2. JICA will prepare the draft preparatory survey report in English and dispatch a mission in order to explain its contents in May 2012.

6-3. In case that the contents of the report are accepted in principle by the Government of PNG, JICA will complete the final report and send it to the Government of PNG by August 2012.

6-4. The above schedule is tentative and subject to change.

7. Other Relevant Issues

7-1. PNG side shall submit answers in English to the Questionnaire with relevant documents, which the Team handed to the PNG side by February 3<sup>rd</sup>, 2012.

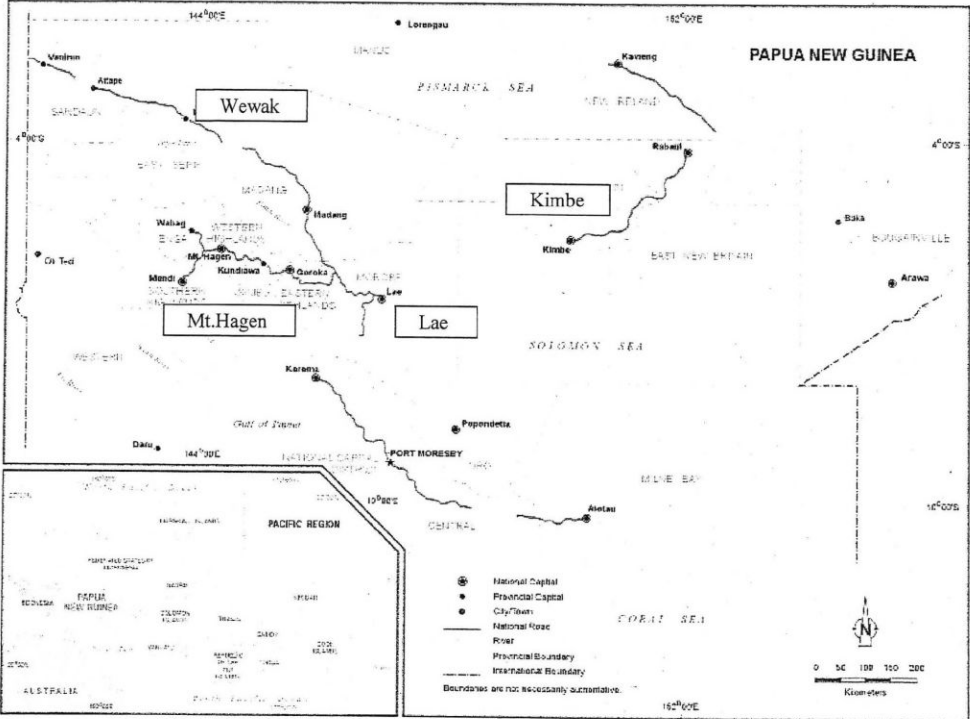
7-2. PNG side shall provide necessary number(s) of counterpart personnel to the Team during the period of the study in PNG.

7-3. PNG side shall secure enough budget and personnel necessary for maintenance of the equipment and facilities procured by the Project.

(end)

7.7.

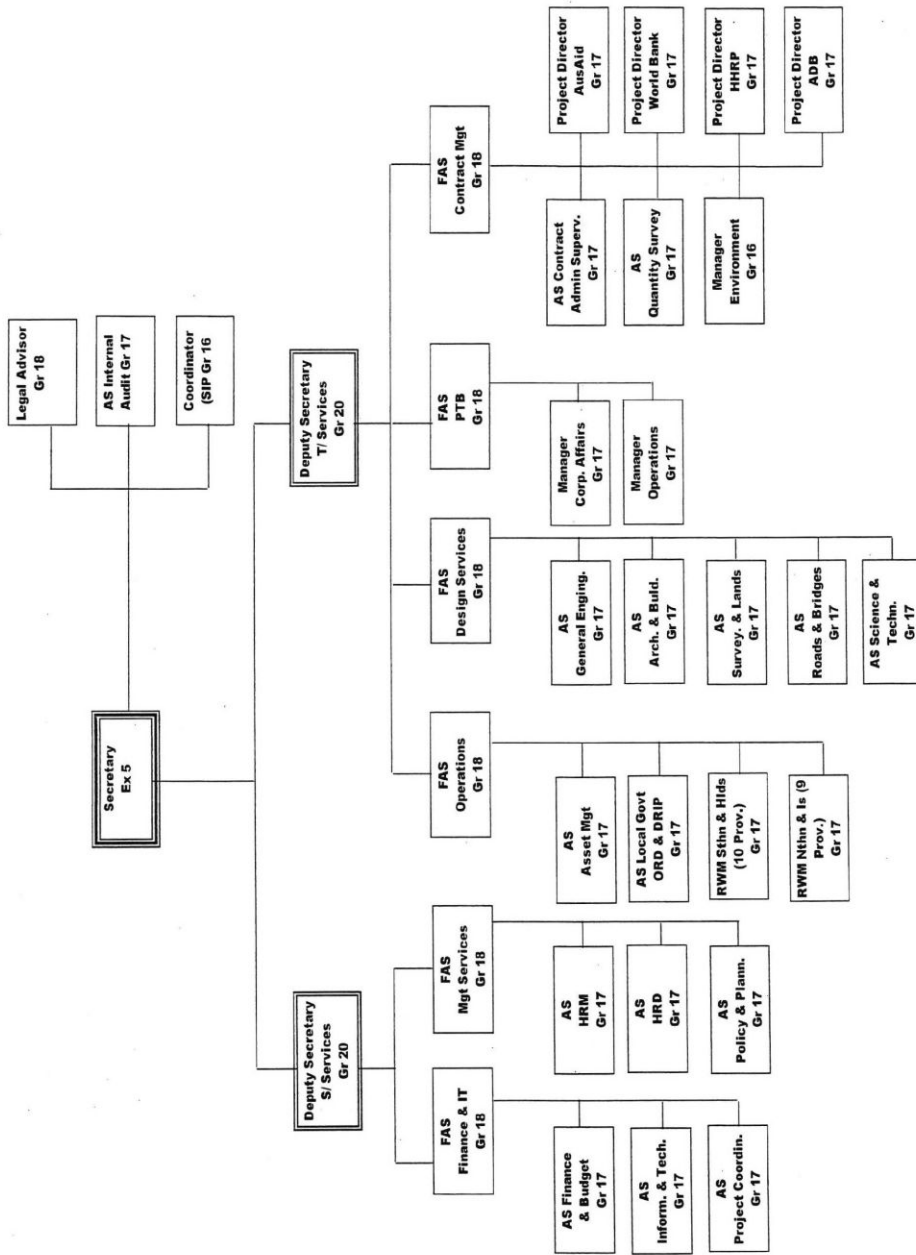
The Project Site



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Organization Chart of Department of Works (DOW)

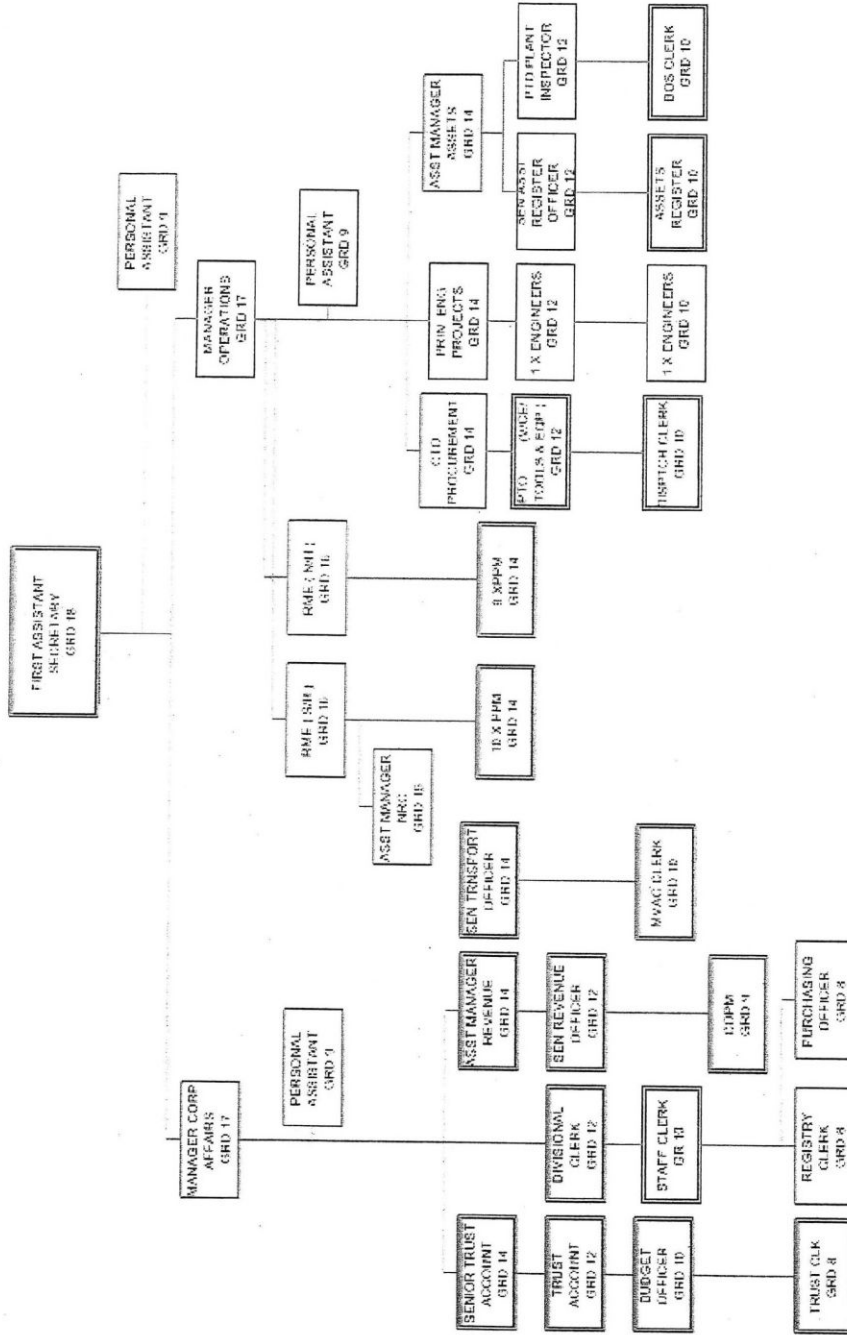


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Organization Chart of Plant and Transportation Division (PTD)



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