STUDY REPORT ON THE PROJECT FOR IMPROVEMENT OF THE EQUIPMENT FOR ROAD CONSTRUCTION AND MAINTENANCE IN THE REPUBLIC OF HAITI

February 1996

Japan International Cooperation Agency (JICA)

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ON
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Contents

PREFACE

In response to a request from the Government of the Republic of Haiti, the Government of Japan decided to conduct a basic design study on the Project for Improvement of the Equipment for Road Construction and Maintenance and entrusted the Japan International Cooperation Agency (JICA) to conduct the study with the assistance of the Japan International Cooperation System (JICS).

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

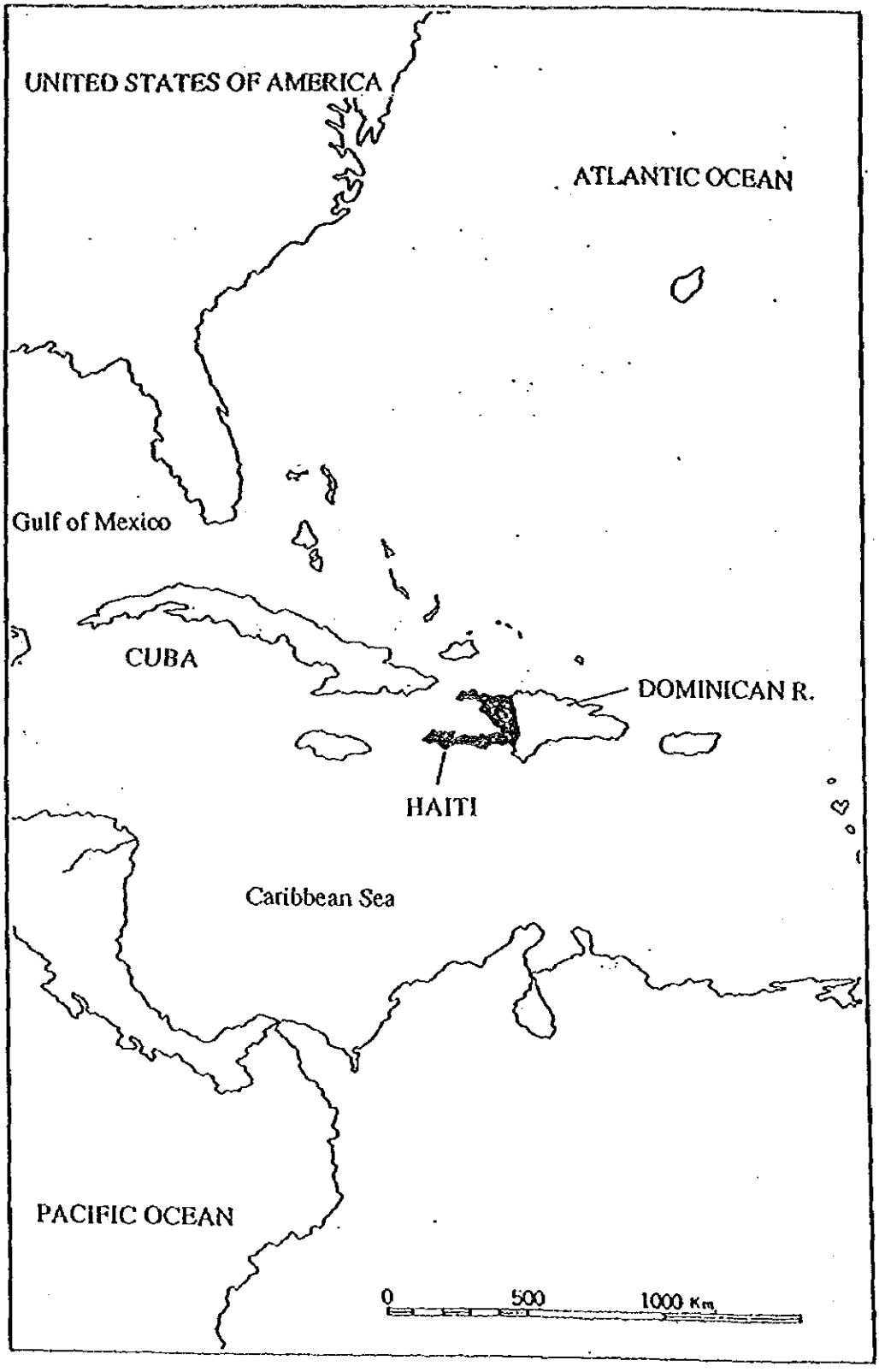
I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Haiti for their close cooperation extended to the study.

February 1996

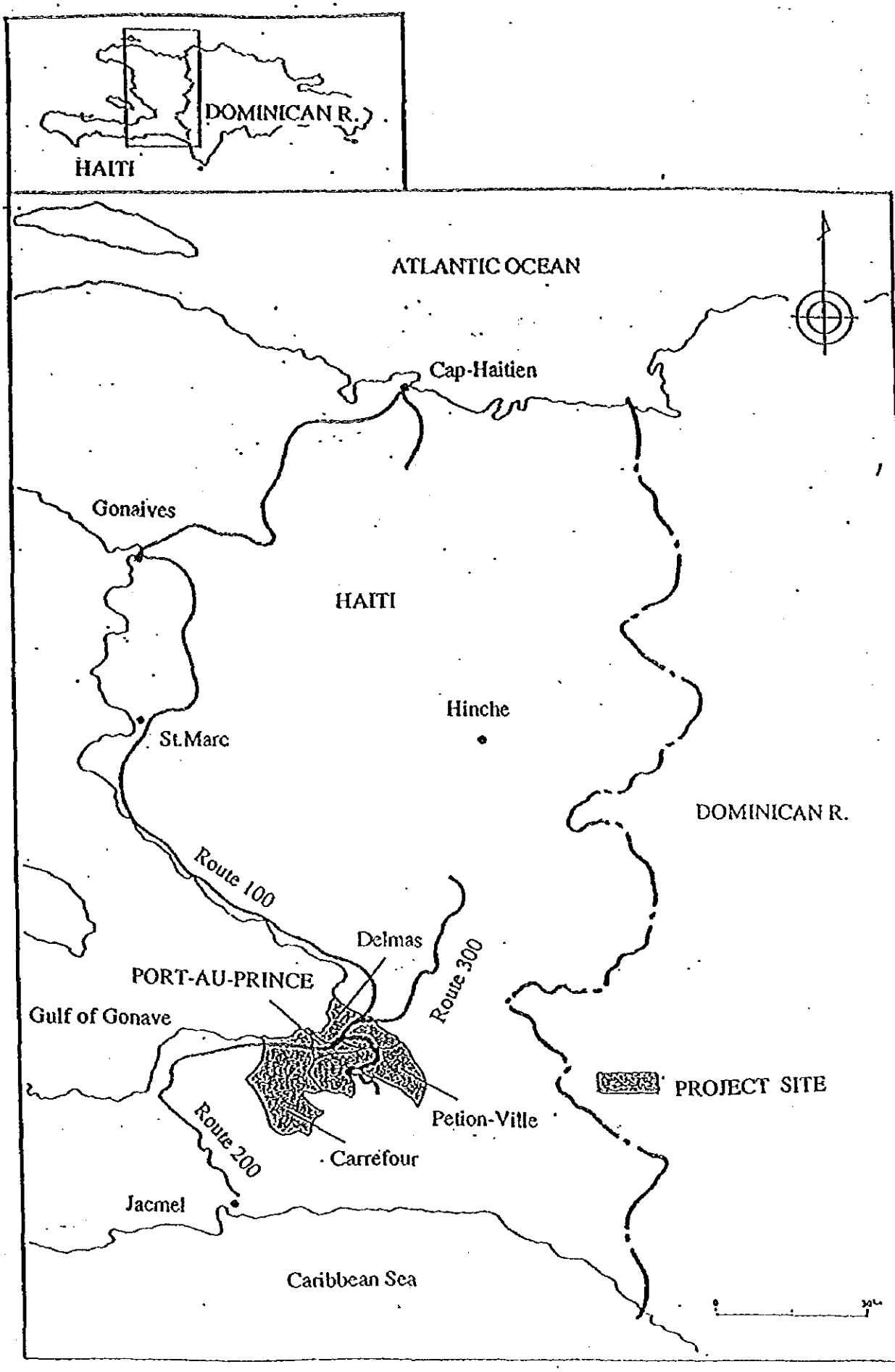
Kimio Fujita
President
Japan International Cooperation Agency

Abbreviations

BID	: =IDB (Inter-American Development Bank)
DTP	: Direction des Travaux Publics
MTPTC	: Ministère des Travaux Publics, Transports et Communications
SEEUR	: Service d'Entretien des Equipements Urbains et Ruraux
SEPRRN	: Service d'Entretien Permanent du Reseau Routier National



Location Map of HAITI (Part-1)



Location Map of HAITI (Part-2)

Chapter 1 Background of the Project

Haiti experienced a military coup and continued instability even following the downfall of the Duvalier dictatorship in February 1986, but in December 1990, the country's first democratic elections were held and Father Aristide, receiving the strong support of the impoverished classes, was elected president. The Aristide administration was formally inaugurated in February 1991, however, as a result of a further military coup that occurred in September the same year, President Aristide was driven into exile and the country once again fell under the rule of the military. International society including Japan refused to acknowledge rule by the military and, as a result of efforts centering primarily around the Organization of American States (OAS) and the United Nations, agreement was reached on a process for the restoration of democracy. Following that, President Aristide returned to the country in October 1994 and democracy was once again realized.

The sole plan for overall development in Haiti is the Emergency Economic Recovery Plan (implementation period unknown), which primarily targets medium-term development and includes preparation of the infrastructure as one of its top priority issues.

The urbanized area of Port-au-Prince and its environs (the target area of the Project) increased by approximately 75% from 3,825 Ha to 6,694 Ha in the eight years between 1980 and 1988. In line with this urbanization, there has been a rapid increase in car ownership among the local residents, and this has brought about problems in transportation capacity and the transport system in the metropolitan region. A survey of the paved road network in the metropolitan area conducted by the Government of Haiti in 1991 brought to light the following problem points.

- Damage to the Port-au-Prince metropolitan region road network (estimated at 1,000 km) is severe.
- The large proportion of vehicular traffic is concentrated on the main arterial roads.

- Because many parts of small and medium roads are unpaved and receive no maintenance, they are not used frequently.
- Because there are insufficient footpath and crossing facilities, pedestrians face much difficulty and danger.

The urban road infrastructure in the metropolitan region has received no maintenance or repair following the aforementioned survey, and this has combined with accelerated urban expansion to result in the continued deterioration of road conditions. Consequently, the immediate maintenance and repair of roads in the region is required in order to normalize transportation of people and goods in the capital and thus stabilize citizens' daily lifestyles and aid economic recovery. In order to remedy the present situation, the MTPTC (Ministry of Public Works, Transportation and Communications) has compiled and has been implementing road restoration plans that include the National Road Restoration Three Year Plan (planned for between 1991-1993, but yet to be completed), however, due to an absolute inefficiency in its equipment and the fact that existing equipment is in a deteriorated state, the ministry is unable to conduct proper road works, and plans are hardly advancing at all.

It was in these circumstances, with the aim of improving the current appalling road situation, that the Government of Haiti requested the Government of Japan to provide grant aid for the procurement of equipment needed for the construction, repair and maintenance of roads.

Chapter 2 Contents of the Project

2-1 Objectives of the Project

The objective of the Project is to improve the currently appalling state of the road network (approximately 1,000 km) in the metropolitan region of Haiti (Port-au-Prince, Delmas, Petion-ville, Carrefour) by procuring road construction, repair and maintenance equipment.

2-2 Basic Concept of the Project

In Haiti, construction and maintenance of the road infrastructure (currently in a very poor state) is one of the top priority issues that needs to be tackled in order to aid economic recovery and stabilize the everyday activities of citizens. As was indicated earlier, the only existing equipment that can be used is 26 vehicles including dump trucks, and there is almost no equipment that can be used for earnest road repair and maintenance work.

Thus, in order to raise the work implementation capability of the SEEUR and make a contribution to the immediate realization of road preparation in the metropolitan region, road construction equipment (bulldozers, hydraulic shovels, motor graders, vibrating rollers, etc.) and support equipment shall be procured.

2-3 Basic Design

2-3-1 Design Concept

(1) Concept with Regard to Natural Conditions

① The crumbly limestone geological makeup throughout all Haiti means that damage is frequently caused by sand and stone avalanches, and equipment will often be put to use on such occasions.

② The rugged nature of the terrain means that equipment needs to be fitted with protective measures in cases of overturning.

③ There are many sloping and bending roads.

④ Because even the main and arterial roads have steep gradients which make the haulage of equipment on trailers difficult, self-

running equipment fitted with tires shall be introduced as much as possible.

⑤ Measures shall be taken to counter roads in bad condition. The paved surfaces of almost all roads are extremely deteriorated or practically non-existent and there are many areas with large holes, gullies and humps. During the rainy season, areas where the paving has peeled away are further opened up and turn in to deep puddles. Therefore, care shall be taken to strengthen the undercarriages, raise ground clearances and protect the overhanging parts of the vehicles.

(2) Concept with Regard to Local Contractors and Equipment

① Pickup trucks and ordinary trucks that are made in Japan possess more superior performance and also account for an overwhelmingly higher market share in Haiti. Furthermore, because the local dealer and service setup for Japanese trucks is well established and there are no problems concerning the supply of spare parts and the provision of maintenance service and guidance on usage, etc., there is no need to introduce vehicles from third countries.

② Regarding bed aggregate and asphalt raw materials, because there is a private plant in the suburbs and this presents no problems in terms of quality or supply capability, local materials shall be used.

(3) Concept with Regard to the Operation and Maintenance Capacity of the Implementing Agency

① Because the Government of Japan has provided grant aid for the procurement of road construction equipment on three occasions in the past, the staff of the SEEUR (the implementing agency) are well used to Japanese road construction equipment. Moreover, because the construction and maintenance setup, work tools and training system of the said agency are all geared to Japanese products, it is strongly desired that Japanese products be procured. Even assuming that cheaper North American or South American equipment was

introduced, there is a strong possibility that this would hinder the smooth operation of the Project in that it would be slow getting off the ground and the implementation setup and staffing plan described later would be affected. Incidentally, regarding the particulars of third country items, please refer to the preliminary survey appendices.

② Concerning the capacity of the implementing agency to operate and maintain the procured equipment, it cannot be denied that, compared to the previous three occasions when grant aid was carried out, the technical capacity level has declined as a result of an outflow of engineers to the private sector and overseas countries during the past six years of turmoil. However, the core engineers and operators are still on the staff and it should be possible to overcome any problems through carrying out training programs to once again develop highly skilled staff members. Having said that, it is desirable that special work areas such as hydraulic system repairs and parts replacements, etc. be consigned out to private garages.

③ The SEEUR garage is only able to conduct daily maintenance inspections, and major breakdowns are taken to the central garage of the MTPTC, Management Division, Equipment Department. However, because many of the tools in this garage are made in America and are not compatible with Japanese equipment, it will be necessary to provide sufficient technical guidance to staff on the maintenance tool sets and the methods of daily inspections and routine maintenance when the equipment is delivered. Moreover, in cases of major breakdowns, the equipment should be taken to local dealers for repair.

(4) Concept with Regard to Setting the Equipment Range and Grade

① The equipment selection shall primarily revolve around items that are required for conducting daily operation and maintenance affairs and minor repairs. (The construction of new roads and major road repairs are ordered out to private companies).

② Light oil, which is the easiest fuel to procure locally, shall be

used as the fuel for the equipment.

③ Because the target work sites lie within the metropolitan region and are relatively nearby, rather than crawler-type construction machinery that has to be hauled to work sites, the ratio of self-running machinery with tires shall be increased, and many haulage vehicles capable of carrying lots of smaller items of equipment shall be introduced.

④ Regarding spare parts for vehicles, many undercarriage parts shall be introduced in view of the fact that such parts are most prone to damage caused by the poor state of roads.

(5) Concept with Regard to Implementation Period

① The Project shall be implemented over a single fiscal year. The SEEUR is hoping for the early arrival of the equipment. As will be described later, the equipment scheduled for introduction will be divided for use between set work teams and put to work in restoring and repairing roads that are more or less devoid of any paving. Therefore, all the Project equipment shall be delivered simultaneously and at an early stage of the implementation process.

2-3-2 Basic Design

(1) Overall Plan

The Project is intended to procure equipment that is necessary in order to restore the existing road network and construct new roads in the metropolitan region of Haiti. In selecting the specific items of equipment, the main emphasis was placed on equipment needed for daily operation and maintenance and construction, and consideration was also given to site characteristics and the future implementation setup of the SEEUR, etc. Moreover, because the meager existing equipment will go beyond its useful service life by the time the Project equipment is procured in fiscal 1997, it has been decided not to include existing items of equipment within the description of equipment composition.

The SEEUR plans to carry out road maintenance and repairs by

dividing staff and equipment into set teams. There will be six teams in all; four maintenance teams will be responsible for the maintenance of damaged paving (potholes, etc.), one paving replacement team will be responsible for the complete replacement of paving, and one equipment management team will be responsible for the storage and maintenance of equipment.
The composition of the equipment was determined to fit with the future implementation setup of the SEEUR and to include items necessary for carrying out the planned work. The specific equipment makeup for each team is indicated below. Refer to Table 2-1 for the overall equipment composition.

1) Maintenance Teams (4 teams)
It is planned to form four teams responsible for the maintenance of damaged paving (potholes, etc.), and each team will possess the equipment shown below. Each team will be responsible for maintaining the equivalent of 250 km of road per year and will conduct daily maintenance on approximately 1,000 m of road each day.

		(Q'ty)
Roadbed rolling	Human power	
Rolling	Tandem roller (1)	
	Rammer (1)	
Asphalt rolling	Tandem roller (1)	
	Vibrating plate (1)	
Coating	Bitumen heating kettle (1)	

Communication, light transportation, equipment haulage Open-top truck (1)
The rammer, vibrating plate and bitumen heating kettle shall be used for standby purposes in cases of breakdown or maintenance. As for the tandem roller, standby will not be necessary in view of usage efficiency.

2) Paving Replacement Team (1 team)
In areas where pot holes have grown large and damage has become serious, the total replacement of paving is required, and it is efficient to consign such work to private companies. However, in

order to handle damage caused by disasters and other emergency situations, and also to maintain guidance and supervision over work that has been consigned to private companies and keep up to date with new technologies and methods, it is necessary to have a paving replacement team. This team will also possess the capacity to construct new roads, and it is planned in the medium-to-long run to eventually transform the team into a new road construction team.

Digging up	Motor grader (1)
Rolling	Motor grader (1)
Watering	Water truck (1)
Rolling	Tire rollers (2)
Coating	Asphalt distributor (1)
Asphalt rolling	Asphalt finisher (1)
Asphalt rolling	Vibrating rollers (2)

Communication, light transportation, equipment haulage Open-top truck (1)

3) Equipment Management Team (1 team)

Regarding general use construction equipment and items for which the numbers used vary greatly depending on work conditions, it is usual to store and manage the equipment in one place and lend it out to sites according to necessity. Therefore, in order to raise the efficiency of equipment usage and preparation, the formation of one equipment management team (garage) has been planned.

Wheel loaders	Earth and waste products loading	(2)
Crawler-type hydraulic shovels	Excavation and loading	(2)
Tire-type hydraulic shovels	Excavation and loading	(2)
Bulldozers	Earth cutting and planing	(2)
Bulldozers	Rolling and shaping	(2)
Dump trucks	Haulage of materials, etc.	(10)
Ordinary trucks fitted with repair tools	Equipment repair	(2)
Ordinary trucks fitted with cranes	Equipment haulage	(2)
Low-floor truck trailer	Heavy machinery haulage	(1)
Water truck	Watering for dust prevention.	(1)

(2) Equipment Plan

The main specifications and purposes of use of the equipment to be provided to the SEEUR under the Project are as indicated in Table 2-1.

Table 2-1 Specifications and Purposes of Use of Project Equipment

No.	Equipment	Specification	Purpose of use	Q'ty
1	Wheel loaders	Bucket capacity 2.1 m^3	Loading of materials and waste products	2
2	Bulldozers	Weight 12 tons	Rolling and shaping	2
3	Bulldozers	Weight 20 tons	Earth cutting and planing	2
4	Motor grader	Blade width 3.5-4.0 m, 150 HP	Digging up of old paving	1
5	Motor grader	Blade width 3.5-4.0 m, 125 HP	Roadbed rolling	1
6	Vibrating rollers	Weight 7-10 tons	Rolling	2
7	Trucks with repair tools	Loadage 8-10 tons, tools onboard	Site equipment repairs	2
8	Trucks with cranes	Loadage 8-10 tons, crane onboard	Heavy machinery haulage	2
9	Tractor trailer	Loadage 30 tons, low-floor	Heavy machinery haulage	1
10	Water trucks	Loadage 10,000 ℓ, sprinkler onboard	Road watering	2
11	Refueling truck	Loadage 6,000 ℓ	Refueling	1
12	Dump trucks	Loadage 8-10 tons	Materials haulage	10
13	Light transportation pickup trucks	Double cabin, 4 × 4, 2,000 cc min	Communication and light transportation	2

No.	Equipment	Specification	Purpose of use	Q'ty
14	Pickup trucks for light equipment haulage	Double cabin, 4 × 4, 2,000 min.	Communication and light transportation	3
15	Crawler-type hydraulic shovels	Bucket capacity 0.5-1.0 m^3	Earth excavation and loading	2
16	Tire-type hydraulic shovels	Bucket capacity 0.5-1.0 m^3	Earth excavation and loading	2
17	Asphalt finisher	Laying width 2.5-5.0 m	Asphalt rolling	1
18	Asphalt distributor	Tank capacity 6,000 ℓ, 2 burners	Coating	1
19	Tire rollers	15 tons, water ballast	Bed rolling	2
20	Tandem-type rollers	1-2.5 tons	Rolling	4
21	Vibrating plates	70 kg	Rolling	5
22	Rammers	70 kg	Rolling	5
23	Bitumen heating kettles	Tank capacity 500 ℓ, kerosene heater	Coating	5
24	Welder	Current range 30-300 A, with power supply	Equipment repair	1
25	Generator	3-phase, 10 KVA, 50 Hz, towing type	Lighting	1
26	Compressor	Output 2-5 m^3, towing type	High pressure air supply	1

Chapter 3 Implementation Plan

3-1 Implementation Plan

Following the Cabinet decision by the Government of Japan, the two countries will conclude the exchange of notes (E/N) and the Project will enter into the implementation stage.

3-1-1 Obligations of Recipient Country

The items to be borne by the Haiti side during the implementation of the grant aid are as follows.

1) To carry out the prompt unloading and customs clearance of the procured equipment.
2) To take measures for the exemption of tariffs and domestic taxes which may otherwise be applied to the procured items and procurement work.
3) To provide all conveniences necessary for the entry to and stay in Haiti of Japanese nationals involved with the Project.
4) To bear all costs not covered within the bounds of the grant aid.
5) To assign a full-time counterpart.
6) To ensure the proper maintenance and utilization of the procured equipment.
7) To make all necessary banking arrangements.
8) To secure operating funds and staff.
9) To bear all costs arising from customs and bonded warehouse.

3-2 Operation and Maintenance Plan

Assuming implementation of the Project to be a precondition, the operation and maintenance costs of the road construction and maintenance equipment for which budget measures need to be taken are as shown below. The main expenditure items of fuel cost, maintenance cost (including parts and expendable items) and personnel cost were trial calculated. Because there are no similar figures from past projects in Haiti, calculations were made by applying standards used in Japan.

(1) Fuel Cost

Upon trial calculating the annual fuel and oil cost based on future operating plans, a figure of 1,860,000 gourdes (grd) (including oil) was arrived at. This amounts to three times the fuel cost contained in budgets up until now, however, because the maintenance budget will be increased in line with the scale of equipment following Project implementation, and the fuel cost, etc. is to be included in the Project investment budget, it should be possible to secure the necessary budget.

It is estimated that the combined horse power of the Project equipment will be 4,000 HP.

Crawler equipment	900 HP
Wheel and roller equipment	1,000 HP
Dump trucks	1,200 HP
General vehicles	900 HP

Furthermore, it is assumed that the average equipment operating time is 1,000 hours per year and that the hourly fuel consumption per horse power (according to standards of the Ministry of Construction of Japan) is as follows.

Crawler equipment	0.138 liter/HP per hour
Wheel and roller equipment	0.115 liter/HP per hour
Dump trucks	0.138 liter/HP per hour
General vehicles	0.040 liter/HP per hour

Thus, the estimated annual fuel consumption volume is as follows.

Crawler equipment 900 HP × 0.138 l/HP per hour × 1,000 hours = 124,200 liters

Wheel and roller equipment 1,000 HP × 0.115 l/HP per hour × 1,000 hours = 115,000 liters

Dump trucks 1,200 HP × 0.063 l/HP per hour × 1,000 hours = 75,600 liters

General vehicles 900 HP × 0.040 l/HP per hour × 1,000 hours = 36,000 liters

Total 350,800 liters ≒ 93,000 gallons

Thus, the annual fuel cost will be as follows.

93,000 gallons × 20 grd = 1,860,000 grd (light oil is 4 H$/gallon = 20 grd)

(2) Maintenance Cost

After the spare parts which are supplied together with the equipment are all used up, assuming that there is approximately 30% depreciation over 10 years, the annual cost of necessary expendable items and parts will be approximately 3% of the initial cost (equipment cost). This amounts to approximately 1,800,000 gourdes. This is equivalent to six times the current equipment purchase budget of the SEEUR and, although the SEEUR believes it will be possible to cover this cost through carefully planning its future budgets, a major effort will be required.

(3) Personnel Cost

Regarding equipment maintenance staff, because it will not be necessary to secure new staff to handle the new equipment, there will be no increase in the personnel cost. It is planned to raise the technical levels of the engineers currently employed.

Chapter 4 Project Evaluation and Recommendation

4-1 Project Effect

1) Validation of Appropriateness

The MTPTC is planning to form four teams responsible for the maintenance and management of damaged paved roads. The overall target area will be divided up into four zones, and each team will be in charge of 250 km of road per year. Each team will conduct routine maintenance and management of approximately 1,000 m of road per day and, assuming that there are a maximum of 200 working days per year, it will be possible to maintain and manage a total of 800 km of road annually.

Regarding road repair by the paving replacement team, assuming that it can repair 1 km of road per month and that work can be carried out for 10 months per year, it will be possible to repave 10 km of road in the metropolitan area annually.

The calculations assume a total number of annual working days that does not include holidays and a work suspension period during the rainy season. Although work efficiency will initially be low due to unfamiliarity of the staff with the equipment, if it is assumed that the efficiency level rises 10% per year, faster progress can be anticipated in the execution of work.

In reality, because it is thought that the annual working days will fall short of 200 due to the natural conditions, social conditions and other external factors, it is estimated that the level of work achievement will be 20% lower than given. Even so, the maintenance teams will still be able to look after some 600 km of road per year, meaning that all major roads will be comfortably covered. Also, the paving replacement team will be able to repave 8 km of roads per year.

2) Beneficial Effect

It is forecast that implementation of the Project will bring about the following kinds of effects.

[Benefiting Area and Population]

1) The direct beneficiaries of Project implementation will be

approximately 1,580,000 citizens living in the metropolitan area (8,200 ha) and people from the regions residing in the capital. In indirect terms, the whole national population of Haiti will benefit from the Project.

2) The MTPTC is planning to form four teams responsible for the maintenance and management of damaged paved roads, and each team will be in charge of 250 km of road per year. Each team will conduct routine maintenance and management of approximately 1,000 m of road per day and, assuming that there are a maximum of 200 working days per year, it will be possible to maintain and manage 800 km of road annually. Thus, it will be possible to maintain almost all of the road network within the metropolitan region.

3) It will be possible to conduct paving replacement and other major repair of 1 km of road per month, or 10 km of road per year within the metropolitan region.

4) It will be possible to immediately respond to landslides during the rainy season and other disasters, and thus minimize the resulting damage to roads.

[Indirect Effect]

1) Implementation of the Project will result in the constant maintenance and improved quality of roads. As a result, it is forecast that the average daytime traveling speed on roads will increase from approximately 10 km per hour to around 20-30 km per hour. This in turn will contribute to an improvement in the efficiency of economic activities due to the mitigation of traffic congestion and shorter traveling and transportation times, a reduction in transportation costs due to less vehicle breakdowns and damage, a stabilization in distribution activities through the increased supply of daily necessities, and mitigation of social and economic losses as a result of fewer traffic accidents, and so on.

2) Improvement to the sanitary environment, which has deteriorated due to litter, waste products and polluted puddles on roads, can be anticipated.

3) In the long term, the movement of people and goods on the national level will become easier and public works will come to be

actively implemented. In this way, the Project will have a ripple effect on the economy and will contribute to the creation of jobs.

4-2 Recommendation

When implementing the Project, it will be necessary to pay attention to the following points.

1) Because the numbers of core engineers and equipment operators are not sufficient, it is necessary to conduct training programs in order to raise the level of inexperienced staff and so establish a satisfactory staff setup.

2) Equipment control methods (preparation of maintenance histories and repair histories, etc. for each item of equipment) need to be established.

3) The planned securing of equipment purchase and maintenance budgets that incorporate equipment depreciation is required.

4) The compilation of construction plans for roads that have yet to be commenced is required.

5) It is essentially desirable to build a setup whereby all equipment repairs, parts replacements and overhauls, etc. can be carried out at the MTPTC central garage. However, because such a setup is not currently in place, it will be necessary for the immediate future to establish a setup where private dealers' garages are used to conduct appropriate parts replacements and repairs.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