JAPAN INTERNATIONAL COOPERATION AGENCY

MINISTRY OF LOCAL GOVERNMENT
THE PUBLIC OF UGANDA

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR REHABILITATION
OF
THE BUGEMBE WORKSHOP
IN
THE REPUBLIC OF UGANDA

DECEMBER 1994

CONSTRUCTION PROJECT CONSULTANTS, INC.

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Preface

In response to a request from the Government of the Republic of Uganda, the Government of Japan decided to conduct a basic design study on the Project for Rehabilitation of the Bugembe Workshop and entrusted the study to the Japanese International Cooperation Agency (JICA).

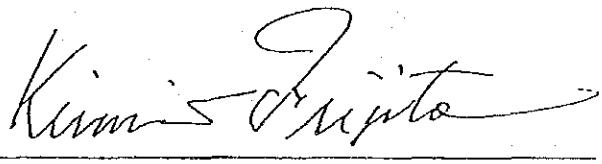
JICA sent to Uganda a study team, which is headed by Mr. Takao Yoshimura, Advisor to Manager, Facilities Sec., Construction Dept. I, Nagoya Construction Bureau, Japan Highway Public Corporation and constituted by members of Construction Project Consultants, Inc., from June 7 to July 2, 1994.

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

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

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

December, 1994



Kimio Fujita
President
Japan International Cooperation Agency

December, 1994

Mr. Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Rehabilitation of the Bugembe Workshop in the Republic of Uganda.

This study was conducted by Construction Project Consultants, Inc., under a contract to JICA, during the period from June 7, 1994 to July 2, 1994. In conducting the study, we have examined the feasibility and rationale of the project with due considertaion to the present situation of Uganda and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

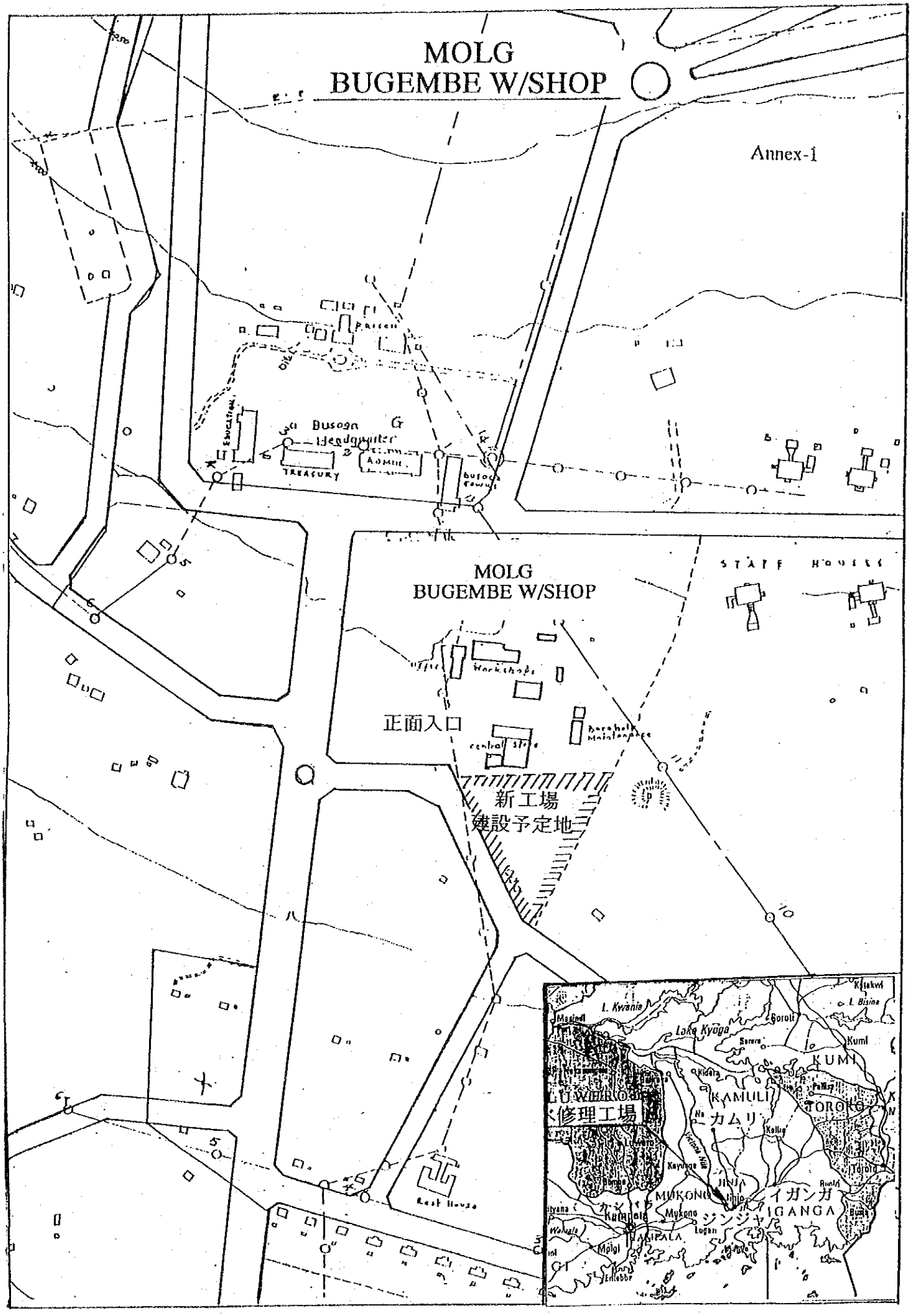
We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA and the Ministry of Foreign Affairs. We would also like to express our gratitude to the officials concerned of the Ministry of Local Government, the JICA Kenya office, the Embassy of Japan in Kenya for their cooperation and assistance throughout our field survey.

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

Very truly yours,

Akira SHIMA
Project Manager,
Basic Design Study Team on
the Project for Rehabilitation of
the Bugembe Workshop,
Construction Project Consultants, Inc.


SUDAN
ZAIRE
RWANDA
TANZANIA
KENYA
N
ARUA
MOYO
KITGUM
KOTIDO
GULU
NEBBI
APAC
LIRA
MASINDI
SOROTI
MOROTO
KUMI
KAPCHORWA
LUWERO
KAMULI
TORORO
MBALE
HOIMA
MUBENDE
FORT PORTAL
KABAROLE
KASESE
MPIGI
MASAKA
BUSHENYI
MBARARA
RUKUNGIRI
KABALE
IGANGA
JINJA
MUKONO
KAMPALA
Lake Victoria
Lake Albert
Lake Edward
L. George
L. Kwania
Lake Kyoga
L. Bisina
International boundary
District boundary
County boundary
Capital city
District headquarters
Other town
Note: the boundaries shown on this map relate to the 1980 census
1:3 250 000
0 20 40 60 80 100 kilometres
KEY MAP
AFRICA
UGANDA
LOCATION MAP


MOLG
BUGEMBE W/SHOP
Annex-i
Busoga G
Headquarter
TREASURY
MOLG
BUGEMBE W/SHOP
STAFF HOUSES
正面入口
新工場
建設予定地
修理工場
カムリ
KAMULI
TORORO
KUMI
IGANGA
イガンガ
JINJA
ジンジャ
MUKONO
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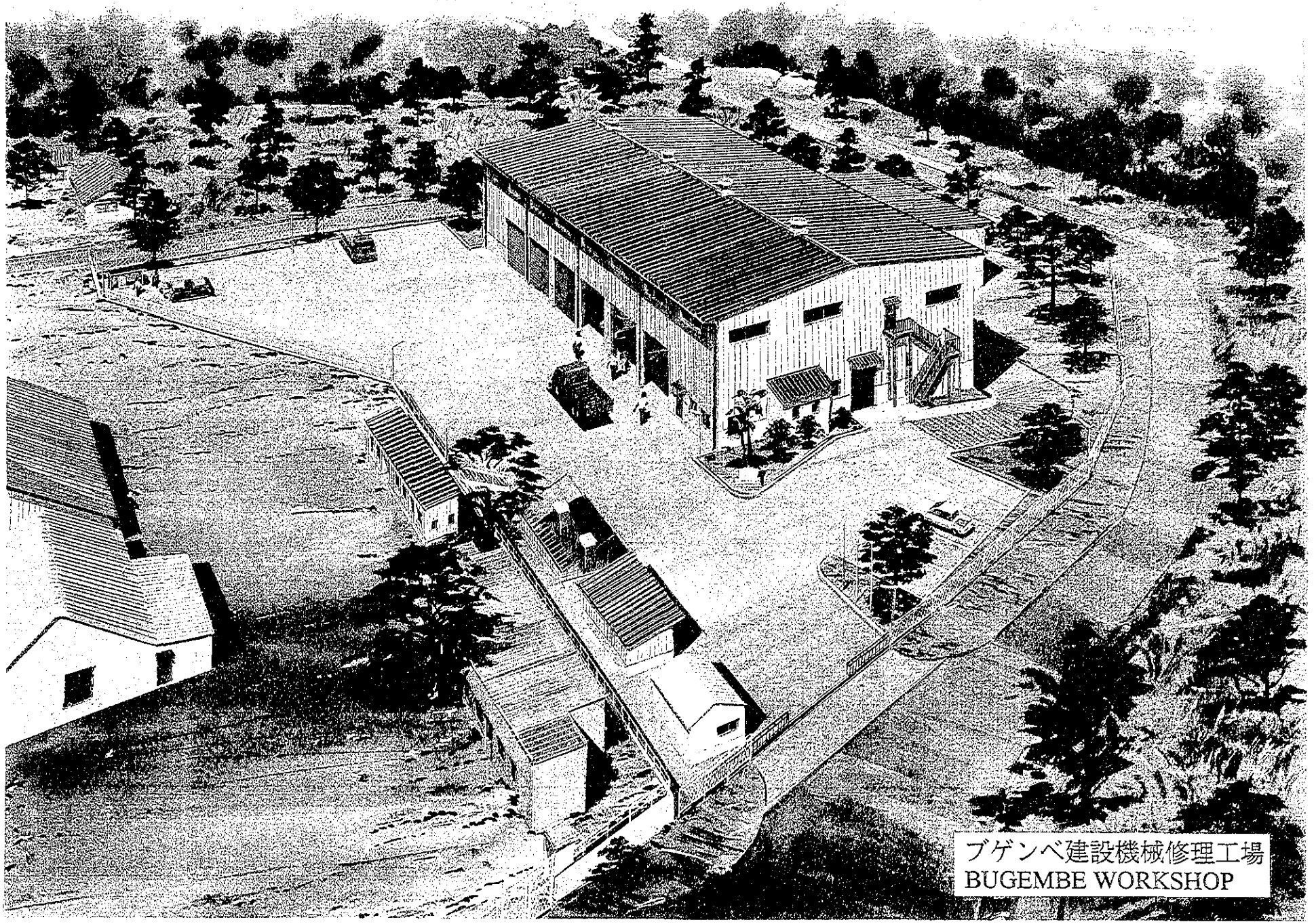
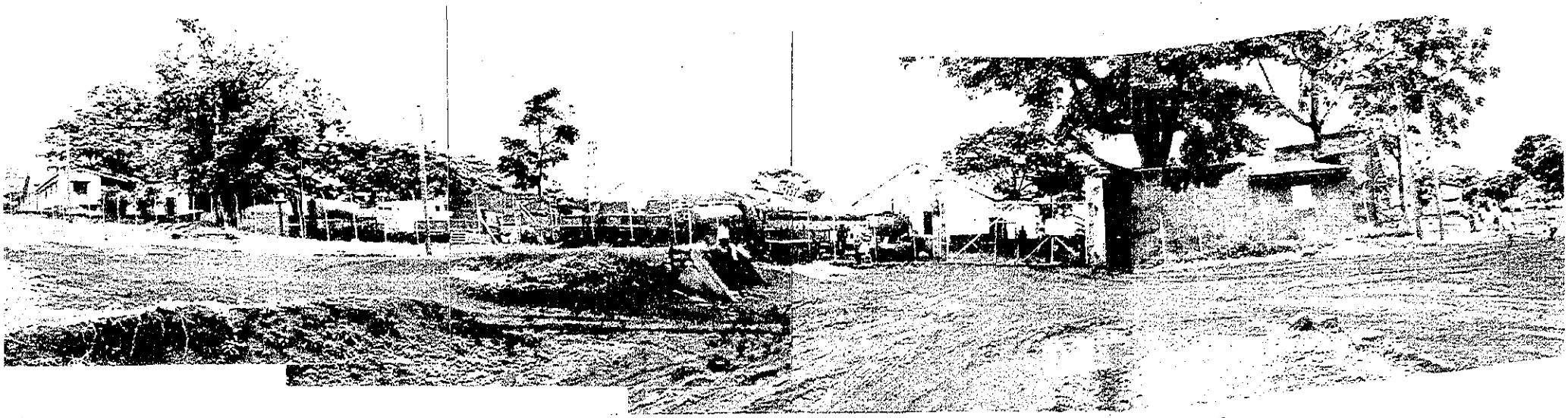

ブゲンベ建設機械修理工場
BUGEMBE WORKSHOP

PHOTOS



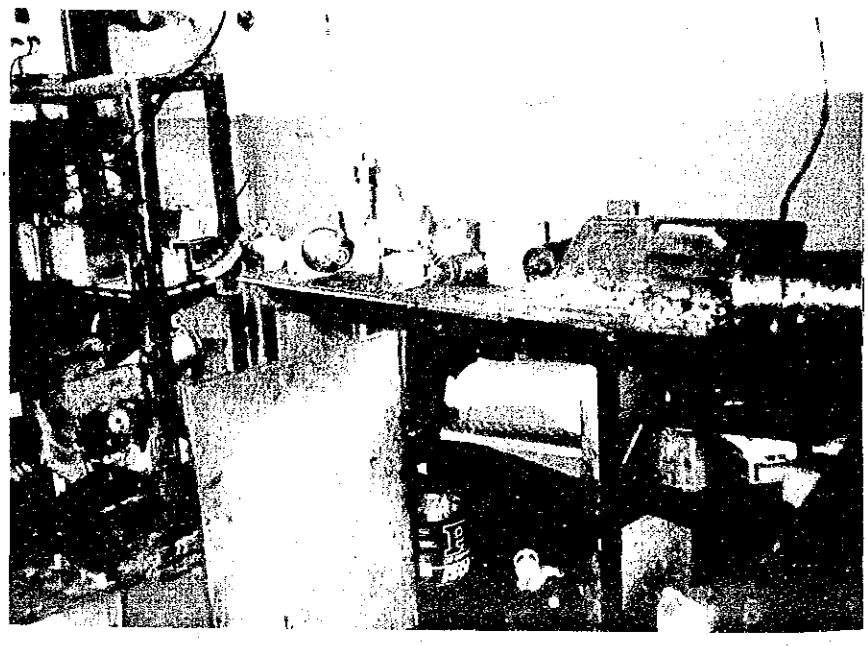
BUGEMBE WORKSHOP

NEW WORKSHOP AREA

BUGEMBE WORKSHOP PRESENT CONDITION

BUGEMBE WORKSHOP

BUGEMBE WORKSHOP
PRESENT CONDITION

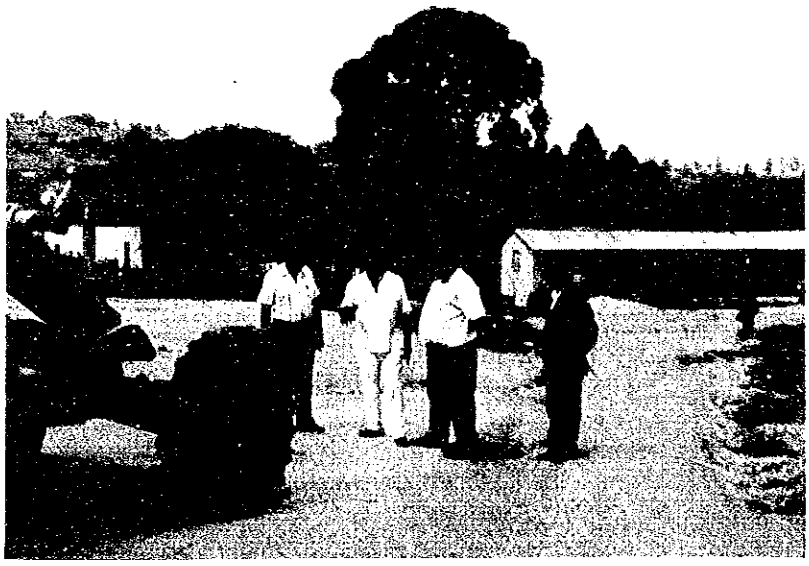


BUGEMBE WORKSHOP
Electric Component Repair Shop

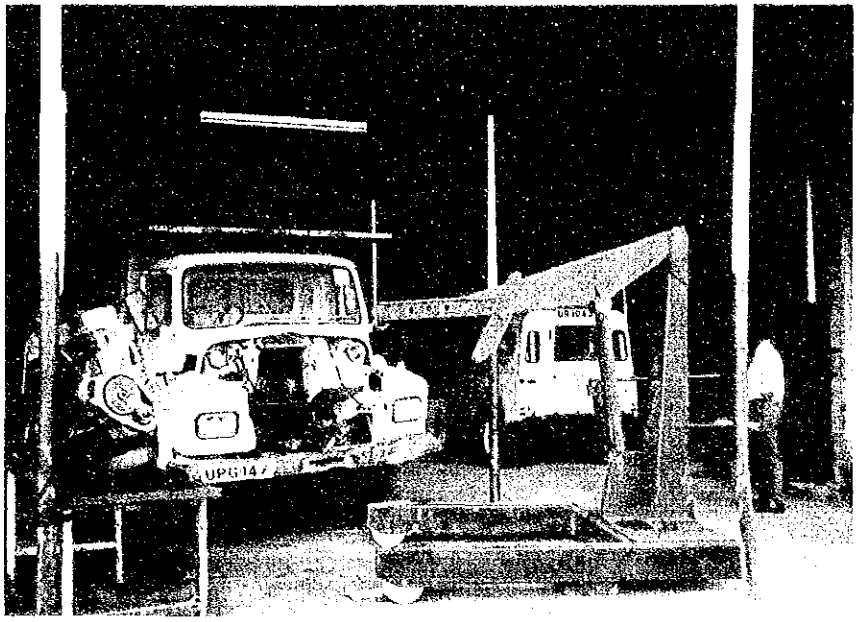
DISTRICT WORKSHOPS

MPIGI WORKSHOP

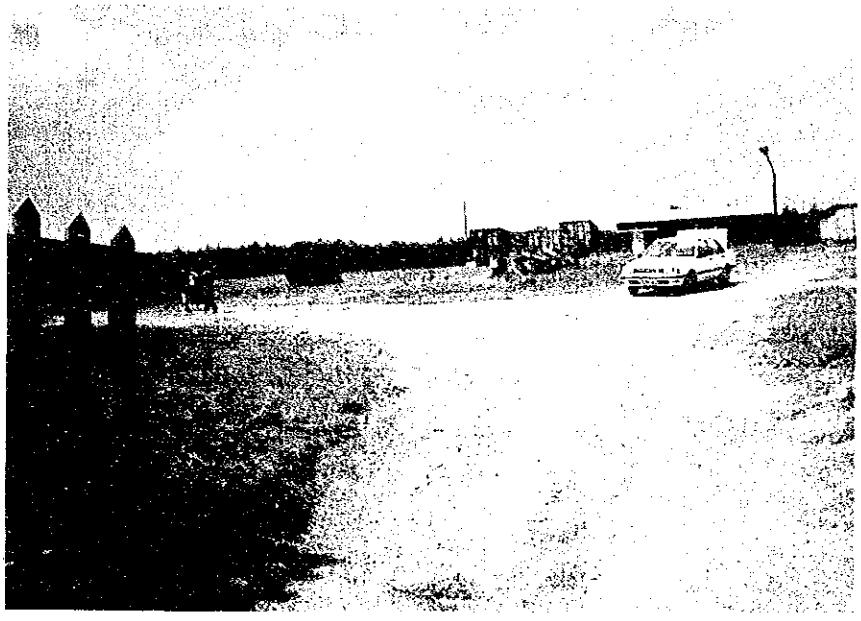
MASAKA WORKSHOP



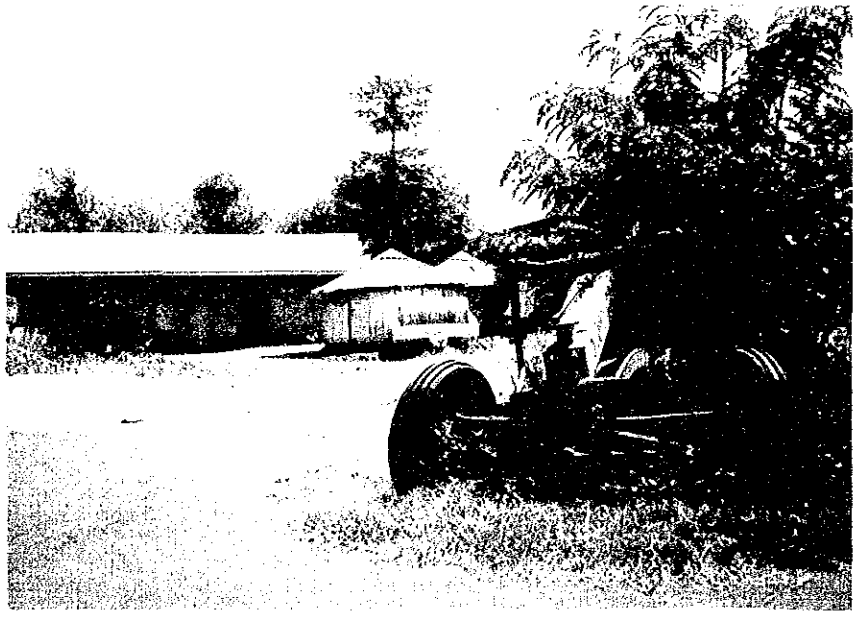
RAKAI WORKSHOP



MBARARA WORKSHOP



BUSMENYI WORKSHOP



KASESE WORKSHOP

KABAROLE WORKSHOP

LOCAL FEEDER ROAD

Grading Work

Construction of Culvert

Summary

Summary

Uganda is a relatively small landlocked country located in the heart of the great African high plateau that rolls from Ethiopian highlands towards southern Africa. It is bordered by Kenya in the east, Tanzania in the south, Rwanda in the south west, Zaire in the west, and Sudan in the north.

The political turmoil and economic decline in the country during the last twenty years have resulted in a severe decline in the living standard of the vast majority of Ugandans. Transport and communication have deteriorated severely due to inadequate managerial and technical expertise and the allocation of low level of resources for repair, maintenance and development.

In 1987 the Government introduced the Economic Recovery Programme (ERP), which included policy reform and rehabilitation of investments. In the ERP emphasis had been placed on the rehabilitation and maintenance of dilapidated infrastructure.

Uganda has a reasonably well distributed network of classified and feeder roads totaling approximately 29,000 km exclusive of village paths, of which about 8,000 km is under control of MOWTC. About 21,000 km feeder road is under control of MOLG (Ministry of Local Government).

The feeder road maintenance condition is not sufficient, so road maintenance was made only for 600 km in 1990. During 1991 and 1992, 620 km additional road was rehabilitated, 555 km was repaired and 500 km was graded. However, about 30 percent of the farm products were unable to reach markets in towns because almost all feeder roads are still not properly maintenanced.

Now, the various international funding agencies-World Bank, Japan, UNDP, Arab Fund, Germany, etc. have provided assistance for road maintenance work for a total of 20,000 km in the entire country.

In 1989 and 1990, Japanese Government donated 114 units of construction equipment for road maintenance purpose of 1,800 km's in the Jinja, Kamuli and Iganga districts. This equipment is being used properly and is well maintained.

But the Bugembe Workshop which is Central Workshop under the control of MOLG cannot function adequately because of lack of repair facilities.

Therefore, the Uganda government has planned and requested the donation of a new workshop for construction equipment at the site of the Bugembe workshop from the Japanese Government.

Receiving such request, the Government of Japan decided to carry out a basic design study, and JICA sent a basic study team to the site for the period from June 5 to July 4, 1994. The team held meetings on details of the request with the officials concerned of the Government of Uganda, and carried out a study of the present conditions of the workshop for construction equipment, field survey of feeder roads and a fact-finding of construction matters, and collected related information.

After returning to Japan, the team verified the soundness of this project based on the results of the site survey, determined the outline of facility design and equipment specifications, planned an execution schedule for the project, and prepared this draft Basic Design Study Report.

The project, whose objectives are the rehabilitation and promotion of the maintenance of roads under the control of MOLG, includes the following work items.

1) Construction of a new workshop for the maintenance of construction equipment and heavy vehicles, and provision of equipment for the workshop.

2) Partial repair of the existing workshop.

3) Supply of spare parts for the formerly donated equipment (construction equipment and heavy and light vehicles).

By carrying out the above items of work, the operation ratios of road construction equipment will increase, and more efficient, valuable and larger projects will be achievable.

Shown below is a summary of this project:

(1) Facilities to be newly constructed and repaired

No.	Name of Facility	Planned Floor Area (m2)	Remarks
1	Construction equipment workshop	1,757.0	New, 1-storied (partial mezzanine), reinforced structure construction
2	Shower and lavatory house for workers	53.3	New, 1-storied, concrete block construction
3	Lubricant storehouse	21.0	New, 1-storied, concrete block construction
4	Shed for washing vehicles	6.0	New, light-weight reinforced construction
5	Diesel oil station		New, reinforced concrete wall, H=2.5 m
6	Water supply facility		New
7	Power distribution facility		New
8	Drainage facility		New (including oil/ water separation tank)
9	Pavement road and apron within premises		New, reinforced concrete (partial gravel)
10	Retaining wall		New, reinforced concrete construction
11	Mechanical shop	257.4	Repair roof, and repair and set up more lighting fixtures
12	Repair workshed	117.5	Repair roof and columns, repair and set up more lighting fixtures
13	Painting workshed	455.5	Newly construct roof and columns, repair floor, and set up lighting fixtures

(2) Repairing equipment and tools

No	Type of Equipment
1	Chassis disassembling, repairing equipment and tools
2	Engine repairing equipment and tools
3	Fuel system repairing and testing equipment and tools
4	Electrical component repairing and testing equipment and tools
5	Battery charging equipment and tools
6	Engine power testing equipment and tools
7	Machine tools
8	Welding and fabrication equipment and tools
9	Light vehicle repairing equipment
10	Air compressor
11	Tyre repairing equipment and tools
12	Equipment machine washing and tools
13	General tools, special tools and measuring instruments
14	Parts shelves
15	Training materials

The execution agency of this project is MOLG, and the buildings and repair equipment items to be provided under the project will be used for their daily maintenance and repair work after completion. All buildings, repairing equipment and spare parts to be provided will be delivered at the Bugembe workshop.

The estimated project period is four months (4 months) for the detail design, and twelve (12) months for the construction and, repair of the workshops and procurement of equipment.

The workshop to be constructed under this project is planned to be controlled and run as a department of MOLG by sixty-two (62) employees including the department director. Thirteen (13) of the above personnel are planned to be moved from the existing workshop upon the opening of the workshop and the remainder are planned to be newly employed.

Further, the existing workshop will be used as a light vehicle workshop and forty-five (45) of the present personnel will remain there. The labor cost of these employees is planned to be budgeted within MOLG's annual operating cost.

Once this project is achieved with the grant aid from Japan, it will lead the feeder road maintenance project to an efficient and effective development, and the mutual access thus secured between agricultural producing areas and metropolitan areas will greatly contribute to the economic recovery of Uganda, where 90% of the movement of people and products depends on road transportation.

It is also expected to greatly contribute to the enhancement of the technical ability of the personnel, increase employment opportunities and provide a degree of stability to the people's livelihood at the project area. Besides such direct effects, the promotion of the road rehabilitation project will also bring about the following effects.

- It will reduce transportation costs, and enable the smooth transportation of products and produced materials between farming areas and urban areas, and, as a result, economic activities will be activated. It will also bring about the stability of various price indexes.

- It will enable easy access by the local people to social benefits, such as medical services, educational services, and so on.

Considering such advantages, it is highly significant to execute this project under Japan's grant aid programme, and also it is desirable to start this project as early as possible.

Preface
Letter of Transmittal
Location Map and Perspective
Summary

Chapter 1 Background of the Project

Chapter 1 Background of the Project

1-1 Background of the Project

In the Republic of Uganda, during the period of serious economic decline from the '70s to the first half of the '80s, the maintenance of roads was not properly carried out, and, as a result, the road network collapsed. Therefore, under the Economic Recovery Programme of 1987, the maintenance and control of the transportation system and the rehabilitation of the transportation-related organization became one of the most important policies in terms of priority.

Especially, MOLG (Ministry of Local Government) constructed feeder roads totalling about 21,000 km out of the entire road network in Uganda totalling 29,000 km, but their maintenance condition is so bad that maintenance work for 600 km, repair work for 555 km and grading work for 500 km only were carried out during the period from 1991 to 1992. Therefore, rehabilitation has not yet been done on most of the feeder roads and about 30 percent of the farm products were still unable to reach markets in towns.

To aid the country under such circumstances, the Government of Japan donated to MOLG, in 1989 and 1990, 114 units of construction equipment, in total, for the "road maintenance project" of 1,800 km of roads in total in the Jinja, Kamuli, Iganga districts. These items of equipment have been properly operated and maintained, and most of them are still in a satisfactory operating condition at present.

On the other hand, the existing Begembe Central Repair workshop under the control of MOLG cannot function adequately because of the lack of repair facilities.

Considering the above, the Government of Uganda planned the construction of a new repair workshop for construction equipment next to the existing Begembe workshop and requested grant aid therefore from the Government of Japan.

The Foreign Ministry of Japan, which understood the urgent necessity to construct the repair workshop concerned and to equip it with the repair equipment required, judged that the objectives of the project fulfilled the conditions of Japan's grant aid system. It therefore decided to carry out a basic study and entrusted the study to the Japan International Cooperation Agency (JICA). Receiving such instructions, JICA, the organization in charge of international cooperation, sent a basic study team headed by Mr. Takao Yoshimura, Advisor to Manager, Facilities Sec.,

Construction Dept. 1, Nagoya Construction Bureau, Japan Highway Public Corporation, to Uganda for the period from June 5 to July 4, 1994.

Its objectives, details and results are as follows:

(1) Objectives

1) Clarification of the nature of the project requested by the Government of Uganda.
2) Study and evaluation of the technical and economic effects of the project.
3) Preparation of a general plan and design.
4) Estimation of project costs and planning of project schedule.

(2) Details of study

In order to achieve the above objectives, the study team confirmed the nature and background of the project requested, and carried out the following at the site with the assistance of the Government of Uganda.

1) Explanation of the scope of study.
2) Confirmation of the position, necessity, level of priority of the project concerned within the scope of the development plan of Uganda (and that of the sector).
3) Study of the present conditions of the road sector.
4) Confirmation of the present conditions of aid from foreign countries.
5) Confirmation of the implementation organization and its scope with regard to cost and work for the project (management plan, operational plan, maintenance and control system, budgetary plan, training plan, and so on.)
6) Confirmation and clarification of the project, namely, clarification of the nature, function, completion time, maintenance and control system, and so on.

(3) Results of study

1) Present conditions of the existing repair workshop.

The Bugembe repair workshop is located about 4km east of Jinja (Jinja is the second biggest city in Uganda, located about 80km east of the capital, Kampala, and is called the industrial city of Uganda. There is a group of plants manufacturing sugar and there are steel works utilizing the abundant supply of electricity generated by the copious waters of the Nile River.). The workshop was initially constructed as a car maintenance shop of the district, but as the "Road Maintenance Project" commenced, it started playing the present roles, serving as the head office of the project and as central maintenance shop for construction equipment.

Most of the buildings were constructed in 1947 or 1952 and are therefore already about 40 years old. A part of the buildings (warehouse) has been constructed for dedicated parts storage under the JICA I and II projects. The building is constructed with concrete block walls and galvanized iron ceiling. Inside the building, lighting is insufficient, the wall paint has pealed off and the building is narrow and dark. The roof of corrugated galvanized iron sheets is rusted and perforated. Such conditions can be seen in the attached photographs.

A summary of the existing facilities and equipment, and the main work items of the repair workshop is as follows:

Size of the facility

1)	Surface area	:	About 18,000m^2
2)	Building area	:	About 11,000m^2
3)	Number of mechanical workers	:	46 persons
4)	Area of parts warehouse	:	1,000m^2
5)	Parts stock	:	11,902 items (Of which about 60% are parts for light vehicles such as pick-ups motorcycles.)

Repair equipment

1)	AC welder	:	1
2)	Battery tester	:	1
3)	Drilling machine	:	1
4)	Mechanical vehicles	:	2
5)	Crane	:	1
6)	Grease car	:	1
7)	Hand tools	:	Small quantity

Main repair and maintenance work

1) Routine maintenance
   500-hour maintenance and
   1,000-hour maintenance
2) Component replacement
   Engines, hydraulic pumps and motors,
   hydraulic cylinders, electrical parts
3) Overhaul
4) Reconditioning
   Engine and other components

2) Points at issue

The points at issue concerning each item of repair work are as follows:

- The maintenance facilities and tools are designed only for the maintenance of vehicles and, furthermore, they are becoming old.

- Replacement of hydraulic pumps, alternators, cylinder motors, hydraulic valves, and so on: Repair work after such replacement is not possible because parts are not readily available in Uganda.

- Engine overhaul: this is difficult because of the shortage of proper parts required for repair work, test equipment, repair tool and repair manuals.

- Parts reproduction: Parts reproduction which requires high level surface finish is not possible because there is only a welder as far as mechanical facilities for parts reproduction are concerned.

- Tools: Repair and maintenance work is badly affected because basic tools, such as standard wrenches, etc. are in shortage or are lacking.

- Spare parts: Consummables such as oil filters, fuel fillers, air cleaners, etc., are readily available, but their purchase is not possible because of the insufficient budget.

As can be seen from the above, the problem does not consist only in the insufficiency of repair facilities and equipment, but in the shortage of both general and special tools, and the work is being adversely affected. Under such circumstances, repair work is barely being carried out, by utilizing the equipment and tools attached to mobile repair mechanical vehicles.

Further, the member list and activity of the study team, a list of persons concerned with this project on Ugandan side, and minutes of meetings are given in the appendix.

1-2 Outline of the Request and Main Components

The objectives of the current request from the Government of Uganda are the construction of a new construction equipment workshop, including a set of facilities and equipment to support the maintenance and repair work to be done therein. Their purpose is to enhance the operating ratios of the Japan made construction equipment and vehicles provided under the grant aid programs of the Government of Japan and provided by the World Bank or other donor in order to promote the rehabilitation of feeder roads, to increase the physical distribution of farm products, to activate movements, and to enhance the quality of life.

According to MOLG's schedule on development after the completion of the new workshops, the existing workshop (lack of repairing facilities) will be dedicated to light vehicles and the new workshop will be dedicated to construction equipment and heavy vehicles, playing the role of a central workshop for major repair work for the entire country. Listed below is a summary of facilities and equipment which are being requested by the Government of Uganda.

1) Chassis maintenance and service shop
2) Engine maintenance and service shop
3) Engine dynamometre test and control room
4) Fuel injection pump test room
5) Electrical components service and test room
6) Hydraulic components service and test room
7) Battery service shop
8) Power transmission gear service shop
9) Tire service shop
10) Machining shop
11) Welding and fabrication shop
12) Compressor room
13) Cleaning workshed
14) Painting shop
15) Tool room
16) Parts room
17) Special tool room

Each of these service shops/rooms includes its own maintenance and repair facilities and machinery.

1-3 Project and/or Program of Other Donors

With the increasing stability of the political situation, aid to the Government of Uganda from various countries is now rapidly increasing. Also, various aid groups are offering aid to MOLG in its construction and repairing of feeder roads.

Especially, as to aid in MOLG's programme, perfect allotment per area was achieved under MOLG's coordination, as shown in Table 1-1, and there is no overlapping between different aid organizations.

Also, as to this workshop construction project, it has been confirmed, through the site survey, that there is no overlapping with other aid organizations.

Table 1-1 Feeder Roads Rehabilitation and Maintenance Plan

Project Name	Funds (million US$) Aiding Organization or Countries	The Government of Uganda	Objective Districts	Objective Road Length	Nature of Project	
GTZ	9.4	1.34	Kasese, Kabarole, Bundibugyo, Hoima, Kabale	1,958km	Road constru ction equipment, tools, pipe culvert, technical assistance, training, repairing work of workshop	Direct work, Under the control of GTZ and MOLG Started in 1988
UNDP/UNCDF	13.9	1.5	Masaka, Rakai, Mbarara, Bushenyi, Rukungiri, Kabale	2,000km	Construction materials, tools, technical assistance	Direct work, Started in 1989
IFAD/IDA	13.3	2.7	Mbarara, Sushenyi, Rukungiri, Kabale, Kisoro	2,000km	Construction equipment	Direct work, partly sub-contracted. Started in 1992
IDA 4th High-way Project	0.8	0.2	Mbale, Kapchorwa, Tororo, Palisa		Road construction eauipment, tools, materials, construction of site camp	Direct work
JICA I / II	2.5	1) 1.2	Jinja, Kamuli, Iganga	1,800km	Road construction equipment	Local consultant. Started in 1992
BADEA	8.2	5.6	Mukono, Mubende, Kiboya, Mpigi		Equipment and equipment consultant procurement	Subcontracted. Sttarted scheduled in 1992
ERC II	9.0	1) 2.0	(Nothern, north-eastern, north-, western parts)	45 ~ 60km	Eauipment and materials,	Reinforcement of capability of the District Road Main-tenance Control Division
ADB	24.3	16.1	(Western, south-western, eastern parts)			Establishment of the District Road Main-tenance Control Division
DANIDA	2) 3.3 10.5	3) NY NY	Rakai, Gulu, Kitgum, Lira, Apac, Kumi, Soroti, Palisa		Organisation and reinforcement of district road maintenance control department	Started scheduled in 1993
IDA	9.2	NY	Tororo, Mbale, Luwero, Kapchorwa	150km	Trraining of road rehabilitation and maintenance control training	Started scheduled in 1993
USAID	8.0		Mpigi, Rakai, Luwero, Masindi, Mukuno, Mubende, Kiboga		Support of local currency to road rehabilitation and maintenance control	

Remarks: 1) Annual cost 2) Draft 3) Schedule

Chapter 2 Outline of the Project

Chapter 2 Outline of the Project

2-1 Objectives of the Project

The feeder roads under the control of MOLG are, as mentioned above, very important for economic and social activities in farming and mountain villages. They are also the only access means for the transportation of farm products to the market, physical distribution of agricultural chemicals to producing districts, and the provision of administrative services and social benefits to the inhabitants.

The major part of the existing feeder road network has been left as it is since its deterioration during the time of political turmoil and, in the rainy season, communication is cut on 25% of the total network due to the deterioration of road surfaces or road body, weed growth, deterioration of drainage systems and flooding of bridges.

The rehabilitation and maintenance of national roads have been one of the most important policies in terms of priority. However, the rehabilitation and maintenance of feeder roads totaling about 21,000 km is still lagging behind other projects, mainly due to financial restrictions.

Under such circumstances, the Government of Japan has donated, twice in the past, road construction equipment and vehicles to three districts: Jinja, Kamuli and Iganga. Utilizing these equipment, MOLG is carrying out the rehabilitation and widening of roads within these districts.

The people of the districts concerned use these roads thus rehabilitated and widened, calling them "JICA roads" in expression of their gratitude.

We have actually traveled on these feeder roads in these districts for about 500 km and found quite a difference between the roads rehabilitated or widened and those not rehabilitated or widened. The people are looking forward to having the rehabilitation work carried out as soon as possible.

On the other hand, as reported in Chapter 2, because it is already close to the time limit for the execution of medium and heavy maintenance sevice of construction equipment and vehicles, and so on, troubles involving various parts are gradually increasing and the operability of the equipment, vehicles, etc.is declining.

However, there is a great shortage of facilities and service equipment necessary for the maintenance and repairing thereof.

With a view to resolving such problems, the new construction of a construction equipment workshop to play the role of a central workshop for all workshops under the control of MOLG, as well as to train personnel in the work involved is the objective of this project.

2-2 Study and Examination on the Request

The construction of roads and maintenance control are the first priority for Ugandan districts which rely solely on roads for the land transportation, and much road construction and maintenance work are being carried out with financial aid from the World Bank and various other aid organizations. For the implementation of such road maintenance projects, large numbers of construction equipment and vehicles are required and, further, their repair and maintenance are indispensable. The existing repair workshops under the control of MOLG, including the Bugembe repair workshop of the current project, are found to be insufficient for taking up their roles.

The Bugembe workshop of MOLG that was set up in 1947 now functions as the central repair workshop for road construction equipment and supporting vehicles. However, since the existing buildings and facilities have deteriorated with the lapse of nearly fifty years, its functions have become obsolete. The building, which is mainly divided into three sections : engine service shop, car service shop, and parts storage and painting shed and all of them have problems with roofing, flooring, supporting columns, windows, lightings, etc. is not adequate and requires rebuilding. Further, the size of the facility is small and is not suitable for heavy vehicles.

Therefore, it is a must for the road rehabilitation project of Uganda to promote the efficiency of the repair, maintenance and control of construction equipment for the road rehabilitation project of Uganda and to prolong the life of such equipment by implementing this project.

Also, in the implementation of this project, considering that many light vehicles were provided by the last two grant aids from Japan, the supplies of minimum repair equipment for light vehicles as well as spare parts for both heavy and light vehicles are included in the project objectives.

As a result of examination, following facility will be considered / omitted to this project.

Table 2-1 Requested facilities and result

Requested Items	Adopted or not	Remarks
1.Chassis repair shop	adopted	
2.Engine repair shop	ditto	
3.Engine dynamometre room	ditto	
4.Fuel system repair and test room	ditto	
5.Electric component repair and test room	ditto	
6.Hyd. component repair and test room	not adopted	infrequent use
7.Battery service room	adopted	included in the electric component repair shop
8.Power train repair room	ditto	included in the engine repair shop
9.Tyre service room	ditto	
10.Machine room	ditto	
11.Welding and fabrication shop	ditto	
12.Undercarriage rebuilding shop	not adopted	infrequent use
1.Compressor room	adopted	
2.Cleaning area	ditto	
3.Loading/ unloading deck	ditto	
4.Lubrication storehouse	ditto	
5.Painting room	not adopted	to be used in common with the existing paintshop to be repaired under the project
6.Tool room	adopted	
7.Parts warehouse	ditto	
8.Special tool room	ditto	included in the tool room
9.Shower room for workers	ditto	newly adopted and used in common with workers in the existing workshop
10.Lavatory for works	ditto	
1. Reception room	adopted	
2.Small kitchen in office	ditto	
3.Lavatory for office personnel	ditto	
1.Rehabilitation of light vehicle repair shop	adopted	
2.Inspaction facility (wheel alignment, etc.)	ditto	
3.Repair Instruction Manual (Video, etc.)	ditto	
4.Office goods (copy machine etc.)	ditto	
5.Fuel supply station (6,000L.tank & stand)	ditto	
6.Computer for parts control	ditto	
7.Spare parts	ditto	
8.Electric wiring for emergency power plant	ditto	

2-3 Project Description

2-3-1 Execution Agency and Operational Structure

The rehabilitation and maintenance of roads under the control of MOLG is generally carried out under the control of the Engineering Department of MOLG. The Engineering Department, which will be the execution agency of this project, consists of the road sector, mechanical sector and architectural sector and 102 employees in total, as shown in Table 2-2.

The organization of MOLG and the Engineering Department are shown respectively in Figures 2-2 and 2-3 .

Table 2-2 Number of Personnel in Engineering Department of MOLG

Position	No. of Person
Engineering Department of MOLG	
1) Manager of Engineering Section	1
2) Engineering Adviser (foreigner)	2
3) Chief Engineer	6
4) Senior Engineer	6
5) Junior engineer	4
6) Assistant engineer/draftsman/land surveyor	12
Total	31
District Administration/Public Work Department	
1) District Engineer/Construction engineer	1
2) Assistant construction engineer	5
3) Construction supervisor	15
4) Skilled worker	50
Total	71
Total	102

With the construction of a new maintenance shop, employment of some new workers will be required. It is understood that there will be no difficulty at all in securing the necessary personnel.

As to the qualifications of such personnel, graduates from technical high schools and those who have finished training at the Professional Training Center can be considered.

The securing of employees appears to be easy, because there are not so many work opportunity suitable for those who have finished the training course at the Professional Training Center under the present conditions in Uganda.

We have visited the Professional Training Center and confirmed that employment is possible under the circumstances thereof. Also, we have received confirmation from an official of MOLG that there will be no problem in securing the budget for the employment of new personnel.

Budget

About 1.5 billion out of MOLG's ordinary budget for 1993/1994 totaling 13 billion Ugandan Shilling is allocated to the Engineering Department. The breakdown is as follows: (See Annex 9)

Table 2-3 Budget for Engineering Department MOLG

(Unit: 1,000 Ushi.)

Employment cost of persons	
Traveling and transport	31,891
Administration cost	
Office expenses	3,998
Advertisement and public relations	1,500
Supplies and services	
Hiring of transport for stores	15,978
Computer charges, etc.	5,000
Materials supply and manufactured goods	59,439
Books and periodicals	997,015
Transport and plant costs	
Operation and maintenance of vehicles (operational)	395,487
Properties cost	
Maintenance of Buildings (grounds and equipment)	5,000
Total	1,515,307

Further, the development budgets for 1992/93 and 1993/94 of MOLG are shown in Table 2-4. However, as most of the annual budget relies on aid from other countries, their amounts are not constant. Recently, the amount of such aid money from other countries has tended to increase because efforts toward economic recovery are beginning to bear fruit, owing to political stability.

Table 2-4 Budget for Development Programme of MOLG

	1992/93 1000 USh	1992/94 1000 USh
Recovery and Development Programmes (RDP) related		
- Aid from other countries	46,125,000	50,301,200
- The Government of Uganda	5,954,900	4,784,300
- Commodity Aid		3,388,800
Sub-total	52,079,900	58,474,300
Other than RDP	376,000	276,400
Total	52,455,900	58,750,700

Accordingly, there seems to be no problem concerning the financial ability of the Government of Uganda to bear the necessary expenses after the startup of the project.

Figure 2-1 Set-up of Ministry of Local Government

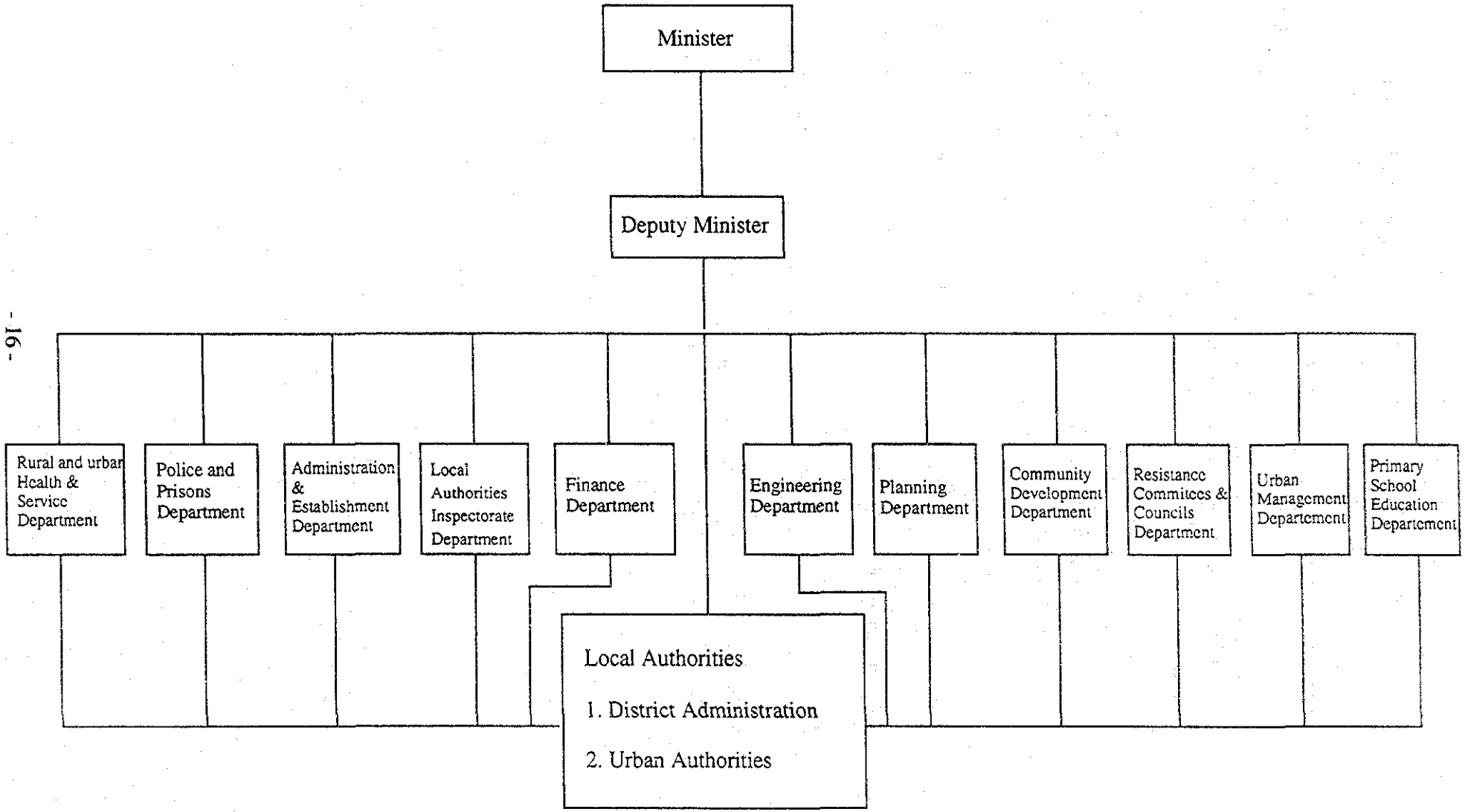
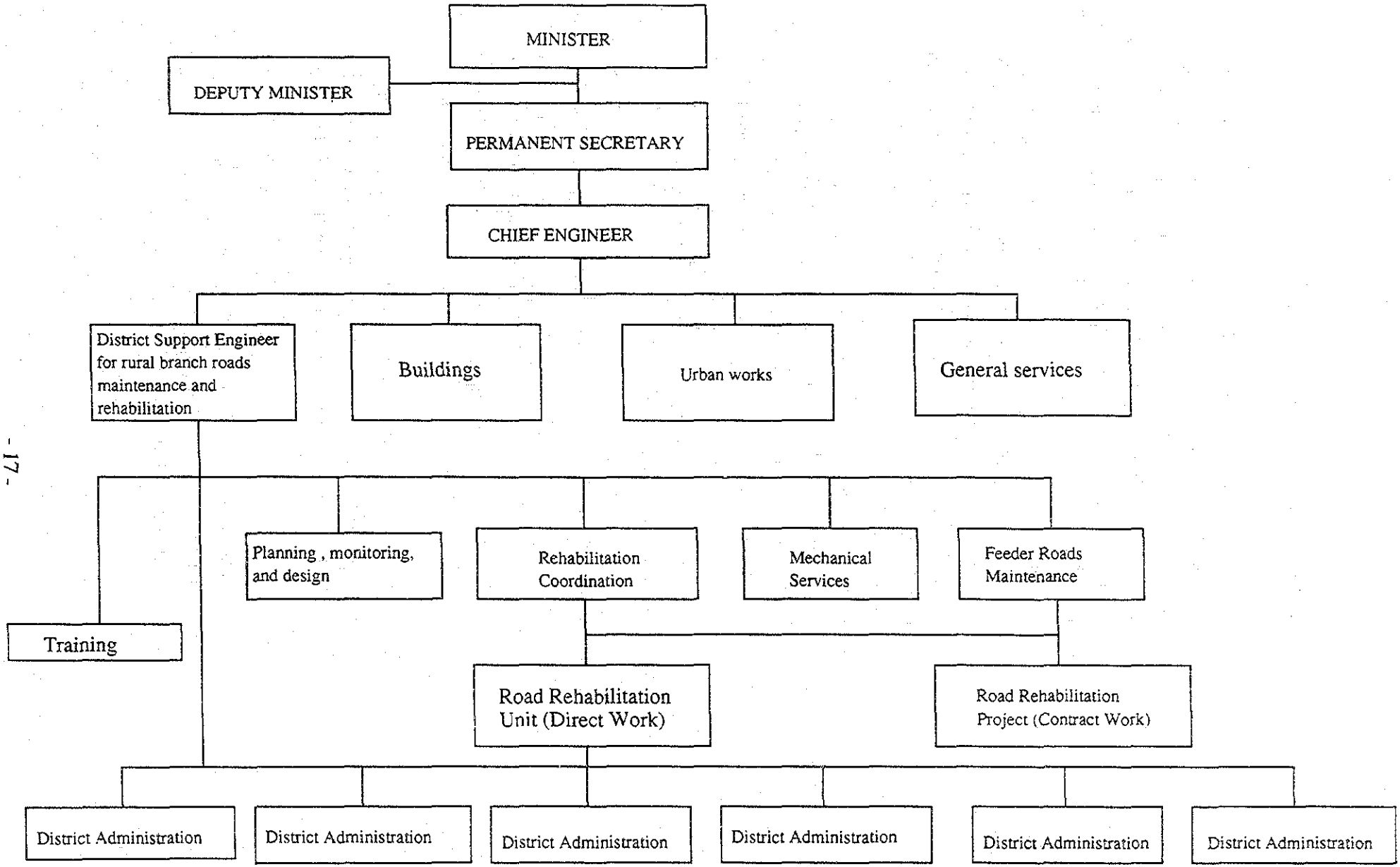


FIG. 2-2 ENGINEERING DEPARTMENT, MINISTRY OF LOCAL GOVERNMENT



2-3-2 Plan of Operation (Activity)

In Uganda, under the present economic circumstances, the demand for construction equipment in the private sector is low, and there is not enough worthy of note in the maintenance facilities of manufacturers' agents and parts stock conditions. However, the MOLG, which is one of the biggest users in Uganda, owns many items of equipment for road maintenance and repair work, as shown in Table 2-5

As these construction equipment items are not sufficiently maintained (this is a general tendency which can be seen in every developing country), there are many vehicles waiting for repairs or striping down and the machinery operating ratio is decreasing.

Under the present circumstances, the maintenance and repair work of all construction equipment, including both heavy and light vehicles are carried out in the same workshop. However, to resolve such confusing conditions, it would be more reasonable to construct a new workshop dedicated entirely to construction equipment and heavy vehicles in the vacant land next to the existing workshop, and to use the existing workshop exclusively for light vehicles.

In such case, it is natural to provide various types of equipment for heavy equipment repair workshop but it is also necessary to provide to the existing workshop the minimum required facilities and maintenance equipment for the repairing of light vehicles such as pick-ups, station wagons, etc. which were previously supplied by the Government of Japan.

Further, it is necessary to establish the repair workshop of the current project so as, to be consistent with other workshops distributed throughout all Uganda under the control of the MOLG, and to play the role of a central workshop.

Also, it is necessary to provide the facilities where by the training courses can be given with a view to enhancing the technical abilities of repair workers and operators, and for standardizing the work.

Table 2-5 Present Number of vehicles owned and those to be repaired

1. Construction equipment

	Made in Japan				Made in Other Countires			
	In operation B	Waiting for repair	Abandoned	Total A	In operation B	Waiting for repair	Abandoned	Total A
Bulldozer	5	3	1	9			2	2
Motor grader	15	15	4	34	6	7	12	25
Tractor shovel	1	2		3	1	2	1	4
Wheel loader	10	9		19	8	4		12
Back-hoe loader					10	11		21
Dump truck	60	40	16	116	27	21	9	57
Truck crane	3			3				
Mechanical car for repair	3			3				
Road roller	4		1	5	10	9		19
Total	101	69	22	192	62	54	24	140

Operating ratio $\frac{B}{A}$ = 52.6% = 44.3%

2. Heavy vehicles

	In operation B	Waiting for repair	Abandoned	Total A	In operation B	Waiting for repair	Abandoned	Total A
Tanker	2	2	1	6	1			1
Concrete mixer	4	2	1	7				
Trailer truck	2			2	4			4
Trailer	2			2	4			4
Truck	5		1	6	10	2	2	14
Minibus	4	1		5	2		1	3
Total	20	5	3	28	21	2	3	26

Operating ratio = 71.4% = 80.8%

3. Light vehicles

	In operation B	Waiting for repair	Abandoned	Total A	In operation B	Waiting for repair	Abandoned	Total A
Pick-up	108	77	15	200	12	8	1	21
Station wagon	51	25	11	87	17	11	19	47
Passsenger car	7	3	3	13	1	4	8	13
Agricultural tractor trailer	7		0	7	51	21	1	73
Motorcycle	178	96	15	289	16	4	1	21
Total	351	201	44	596	97	48	30	175

Operating ratio = 58.9% = 55.4%

1,157 items in total (of which, 816 items are made in Japan and 341 items are made in foreign countries.)

Remarks:

1. The number of vehicles made in Japan includes vehicles provided by UNDP, UNCDF, ILO, IDA, etc.

2. Of these vehicles in use, some items of certain categories need to be repaired.

3. The above data is based on documents of the Project Promotion Design Section of the MOLG (issued in June 22, 1994).

(1) Study on the number of items to be serviced

As a design basis for the size of the construction equipment repair workshop, the number of construction equipment and heavy vehicles to be serviced in the workshop must be determined. The determination of the number of items to be serviced is important for determining the number of bays (unit of space required for the maintenance of each item of construction equipment), depending on which the size of the facility will be greatly vary.

Although the operating conditions of vehicles now maintain a very high operating ratio as already mentioned, every item is close to the designated time for its medium and heavy maintenance. Therefore, considering the future 5 years from now, urgent maintenance must be carried out in order to avoid as much scraping as possible.

Table 2-6 Estimated Number of Items which will be in Operation after Five Years from Now

	Present	'94	'95	'96	'97	'98	'99	Total
Construction equipment								
To be newly provided (+)		22	20	20	20	20	20	+122
To be scrapped (-)		8	9	7	8	9	10	- 51
Sub-total	170	184	195	208	220	231	241	+71
Heavy vehicles								
To be newly provided (+)		6	8	8	8	8	8	+46
To be scrapped (-)		4	5	5	5	6	7	-32
Sub-total	25	27	30	33	36	38	39	+14
Total	195	211	225	241	256	269	280	+ 85

Remarks:

1. The number in the "present" column does not include items to be scrapped.
2. As construction equipment and heavy vehicles are the only objectives of the new workshop, the number of light vehicles is not included.

As shown in Table 2-6, considering a period of five years from now,the vehicles in use at present and those not in use (waiting for repairs) will become increasingly worn and scrapped. Also, the number of vehicles to be newly provided in the five years is estimated. These will not need large-scale maintenance for a period of five years from now, and those which will need medium-scale maintenance in three or four years from now can be dealt with the new repair workshop.

The foreign-made construction equipment and heavy vehicles in the possession of the MOLG can be maintenanced and repaired in the new workshop. However, as they will need various special tools, such as gaskets, filters, etc. and repair parts, they are excluded from the basis of estimation. As already mentioned, since political power was transferred to the present government, the reformation of the country has advanced and aid from foreign aid organizations such as the World Bank is increasing and so it can be assumed that the tendency of increase in the number of new road maintenance and transportation-related equipment will continue.

As regards this year (1994), the number of items shown in Table 2-6 is foreseen to be implemented in the latter half of this year, and referring to such numbers, the variation in the number of items in the future is estimated here.

(2) Details of maintenance

1) With regard to the medium and heavy maintenance of construction equipment and heavy vehicles, some part of the parts will be manufactured and welding will be conducted. The details are as follows:

i. Heavy maintenance : Overhaul of each vehicle.
ii. Medium maintenance : Repair and maintenance of each component (disassembling/assembling and repair, etc. of engine, transmission, Undercarriage, driving clutch, differential gear, and so on)
iii. Maintenance and performance check - engine horsepower and fuel injection pump tests
iv. Manufacturing of small parts, and welding and sheet metal processing

2) All maintenance of support vehicles such as pick-up trucks, station wagons, farming tractors, small size trucks, etc.

All maintenance work ranging from small repair and overhaul work to wheel balance adjustment will be carried out here.

2-3-3 Location and Condition of Project Site

1) Jinja district

MOLG has set up their central workshop for road construction equipment in the Jinja district. Jinja district has developed as the heartland of Uganda. Until today, the district has filled the role of the oldest industrial and agricultural centre of Uganda. Two hundred and eighty-four thousand and nine hundred people live in the district. Of this, 208,400 people (73%) live in rural areas and 76,500 people (27%) live in urban areas, in particular, 61,000 people (80% of the urban population) live in Jinja town. The population of Jinja town is second only to that of Kampala which has 773,000 people. Historically this development took place because the location of the town is most convenient as a transport hub and warehousing centre serving all the districts of Uganda.

The district has four major towns: Jinja, Bugembe, Buwenge and Kakira. It borders the districts of Iganga on the east, Mukono on the southwest, Kamuli on the north and Lake Victoria on the south located. Near the source of the Nile river which is fed by Lake Victoria, the Owen Falls Dam was constructed in 1952 by the British in the southwest area of Jinja district. The dam supplies power to the whole of Uganda, and, moreover, to Kenya, and Bukoba in northwestern Tanzania. That is the reason why Jinja, geopolitically and historically, is more important than other areas. At present however, Uganda faces an acute shortage of power failing to meet the increasing domestic demand. The Government of Uganda is now implementing work to increase the generating capacity of the Owen Falls Project.

2) Geography, climate and vegetation

A large part of Uganda is constituted by the central plateaus between the east Kenya rift valley and the west rift valley running along the border between Zaire and Uganda. The land is hilly and rolling. Most of the Jinja district is in an equatorial climatic belt that extends 30-40 km from Lake Victoria at an approximate altitude of 1143-1376 metres above sea level. This area receives a plentiful rainfall (average 1,300 mm per year) compared to neighbouring counties, and has high temperatures (14-33°C), high humidity (34-100%), and frequent thunder storms (average 16 days per month) throughout the year. Because of the absence of a marked dry season, vegetation is predominantly tropical rain forest. The wind blows mainly from south to north and the

maximum velocity recorded is 47 knots (25 m per second). Earthquakes affect western Uganda twice in March 1966 and in February this year (1994) but did not affect this area.

3) Existing condition of workshop

Currently, Bugembe workshop is composed of three buildings including parts office & storage, vehicle repair shop with simple roof and engine & other component repair shop. However, all of these three buildings are constructed about 40 years ago to repair mainly light vehicles. For these reasons, this workshop is not so effective and dilapidated condition in terms of facilities and equipment compared to that of modern workshops. Here, some problems are addressed in detail as follwos.

a) Parts office & storage

The management and system is relatively well-organized. Nevertheless, partial damages on wooden parts racks and poor working condition in a dim light with only few bulbs are observed.

b) Painting shop

The shop does not have roof facility and the shop floor with mortar pavement is partially worn out. Moreover, the working condition is so poor due to the rains and absence of lighting facility.

c) Vehicle repair shop

Although there is temporary roof on the pit, the working condition is still poor due to the rain blow into shop in rainy days and lack of lighting facility.

d) Mechanical shop

The engine and other components repair is carried out in this shop. Nevertheless, the dilapidated pipe columns, roof and windows are observed. Particularly, the pipe pillars with 60mm diameter are twisted and the tin roof leads to serious rain blow into the shop in rainy days. Also, windows with dust seems to be not used for a long time and partially cracked and broken.

4) Outline of the site

The Jinja town is 80 km east of Kampala and Bugembe central repair workshop is 7 km east of the town. About 86 km of the 87 km is national road (asphalt-paved road) and the remaining 1 km local road that is a bumpy broken asphalt road. A signboard that says Jinja district administration headquarters joints to the local road is at the corner of the intersection. The buildings of the district headquarters are located in front of a rising road and Bugembe workshop is on the right hand side. In front of the workshop gate the road turns to the right and a laterite paved road goes down with an earthen ditch on the side.

MOLG has managed the central repair workshop for road construction equipment in Bugembe since 1989. This workshop area is on a hill side inclined towards the south and the configuration of the land looks like a triangular area The site is made up of three terraces which gently decline to the south. The vertical distance riser at the border between the upper terrace and the middle is more than 2 metres, and between the middle and the lower, more than 1 metre. The difference from the highest point to the lowest point in each terrace is more than 3 metres. A supervising office and carpentry shop area is located in the upper terrace. The existing workshop area for road construction equipment and support vehicles is located on the middle level, and the lower level is reserved for the proposed project area. The total site area is approximately 19,210 m^2, of which approximately 4,400 m^2 (23%) is the proposed project area.

5) Geography, soil and supporting layer

The report of soil investigation and geotechnical study gives the following: The top layer of 0.5 m is fill followed by a layer of red clay from 0.5 to 4.0 m depth. The 3rd layer is composed of lateritic gravel from 4.0 to 8.0 m. The 4th layer is composed of silts with kaolin and mica from 8 to 20 m. The layer from 20.0 to 25.0 m is composed of clay-silt soil. The stratigraphy shows the mineralogical change during weathering leading to the formation of laterite. The weathered zone extends at least up to 25.0 m depth. The lateritic zone is from 0.5 to 8.0 m.

The standard penetration test shows that the N value averages 12 from 5.0 to 10.0 m and 22 from 10.0 to 20.0 m depth. The triaxial test of the subsoil clay indicates that undrained cohesive strength is 66 kN/ m^2. Moreover ground water is not confirmed. Piles are not used in Uganda because of good soil conditions for multistorey buildings. At this site, the subsoil layer of clay was selected for the foundation of project structures.

6) Infrastructure of the site

a) Power supply

The present electric power supplies 11 KVA to a substation at workshop from a 100 KVA transformer installed on an electric pole about 100 m away from the site towards the top of the hill.

b) Water supply

Two public water pipelines presently provide water to the site. One main pipe of 3 inches in diameter leads to the site and serves the office outlets by 2-inch offtake pipe. The other, a 4-inch pipe running outside workshop supplies tap water by 3/4" pipe.

c) Drainage

No sewerage facilities are in this area. Soil water is led to septic tanks from which it is discharged into the ground. Storm water flows into earthen ditches and then runs into an underground pipe at the boundary point at the lowest part of the site. The earthen ditch excavated along the upper property line connects with the east side ditch going down and across the project area. Storm water from the uphill area and the site flows over the surface of the ground into the ditch, so that both the sides and the bottom of the ditch have been eroded to about 1.0 m width and 0.7 m depth.

d) Telephone line

A telephone line that has 8 cables leads to the site.

e) Others

Wire fence with an electric wire have been erected around the periphery of the site.

2-3-4 Outline of Facilities and Equipment

Listed below are the objectives of this project.

(1) Facilities for major maintenance

A. Maintenance Department

1) Chassis maintenance and servicing room
2) Engine maintenance and servicing room
3) Engine dynamometer test and control room
4) Fuel injection pump test room
5) Electrical components servicing and test room
6) Hydraulic components servicing and test room
7) Battery servicing room
8) Power transmission gear maintenance and servicing room
9) Tyre servicing room
10) Machining room
11) Welding and fabrication room
12) Undercarriage rebuilding room

B. Maintenance Support Department

1) Compressor room
2) Vehicle cleaning workshed
3) Vehicle loading/unloading platform
4) Grease storage room
5) Painting room
6) Tool room
7) Parts room
8) Special tool room
9) Staff shower room
10) Staff lavatory

C. Administration Department

1) Reception office
2) Hot-water supply room
3) Lavatory

D. Others

1) Maintenance manual(video set, etc.)
2) Repair workshop office supplies (copy machines, etc.)
3) Fuel stands (6.000 liter tank + stand)
4) Personal computer for parts inventory control (hardware only)
5) Spare parts
6) Wiring of emergency power generating system

(2) Minor maintenance

A. Buildings

1) Mechanical shop
2) Repair shop
3) Painting shop
4) Spare parts warehouse
5) Drainage system

B. Equipment

1) Repair equipment
2) Inspection facilities

2-3-5 Operation and Maintenance Plan

After the completion of the project, the maintenance and control work will be carried out under the system as mentioned in Fig 2-3. The especially important issue here is the smooth utilization and maintenance control of newly implemented repair equipment. In this regard, for the technology transfer at and subsequent to the time of start-up, the following steps can be considered.

(1) Installation and implementation of the equipment

Together with the learning of the modes of operation, maintenance and checking from manufacturers or their agents, training in the disassembling, assembling and repair of vehicles using educational videos and plastic materials which will be provided at the same time must be carried out for effective maintenance and control.

(2) Securing of spare parts

The spare parts owned at present by the MOLG for the equipment provided by the Government of Japan are shown in Table 2-7. Spare parts for light vehicles and motorcycles as well as construction equipment are included. They are well controlled under the care of the workshop manager and parts manager, using cardex, but 40% of them are already consumed and their replenishment is urgently required.

Table 2-7 Stock rate of Spare Parts for Japanese Equipment

(in Japanese yen)

Existing number of items in stock	Total Price Amount of Initial Stock	Total Price Amount of Present Stock
35,591 items	190,595,744 yen (100%)	71,972,981 yen (37.7%)

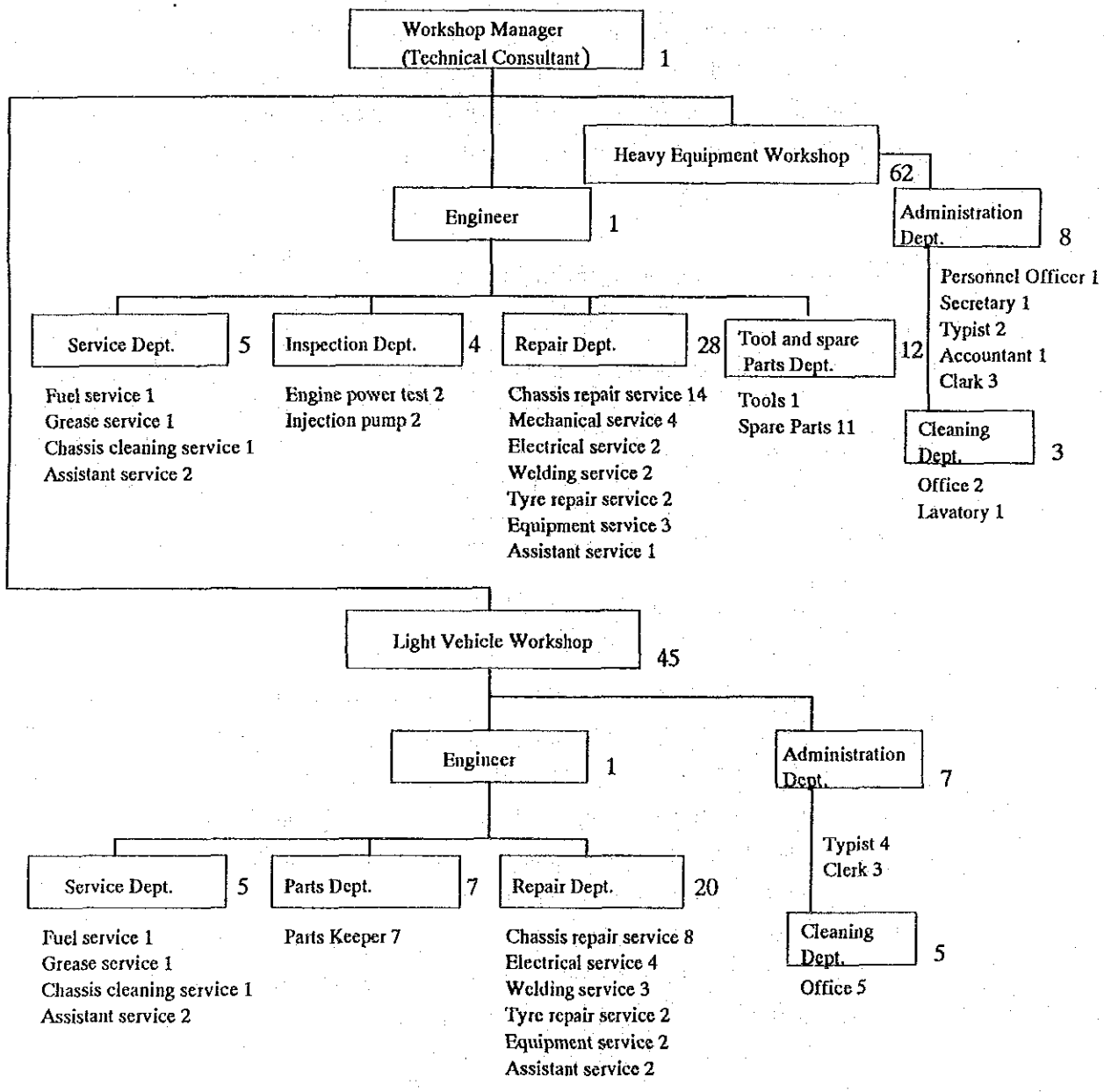
(3) Maintenance Control and its System

1) It is preferable to carry out the maintenance control of repair equipment to be procured within the scope of this project, under the control of workshop managers and engineers, determining the scope of responsibility per department. Namely, daily and periodical inspection, checking of lubricating oil, greasing up of moving parts, cleaning of small parts, adjustment of mechanical system, etc. will be carried out. To this end it will be better to prepare an "Equipment Inspection Control Table" to refer to during the work. Besides, it is also necessary to establish, in the future, a repair equipment maintenance department to do the equipment maintenance control service.

2) Maintenance control system

The result of discussion with the officials of the Technical Section of MOLG on organization and number of personnel to be assigned for the new construction equpiment maintenance and repair workshop after the completion with an assistance of the Government of Japan is shown in Fig 2-3 and Table 2-8 below:

Fig. 2-3 Organization for Bugembe Maintenance and Repair Workshop



(Number: Number of personnel)

Table 2-8 List of Personnel for Bugembe Workshop

(number of persons)

Department	Category of Position	Present personnel	New personnel		Newly employed
			Light vehicles	Construction equipment	
Administration	Workshop Manager (Technical Consultant)	1	-	1	
	Personnel Officer			1	1
	Secretary	1	-	1	
	Typist	4	4	2	2
	Clerk	6	3	3	
	Accountant	1	-	1	
Spare Parts	Supervisor			1	
	Assistant	14	7	1	
	Clerk			9	4
Tools	Person in charge	-	-	1	1
Repair	Chassis repair skilled worker	-	-	6	6
	Chassis repair worker	8	8	8	8
	Mechanician	-	-	4	4
	Welder	4	4	2	2
	Type service worker	3	3	2	2
	Equipment service worker	2	2	2	2
	Assistant	2	2	3	3
		1	1	1	1
Injection	Engine horsepower tests	-	-	2	2
	Injection pump tests	-	-	2	2
Service	Fuel service	1	1	1	1
	Grease service	1	1	1	1
	Chassis cleaning	1	1	1	1
	Assistant	2	2	2	2
Cleaning	Office	5	5	2	2
	Lavatory			1	1
Technical	Engineer	1	1	1	1
Total		58	45	62	49

(4) Maintenance and control costs

1) Equipment

As the maintenance and repair equipment normally lasts for 10 years or longer except the consumable parts, if it is regularly checked and services, no renewal cost is considered at this stage.

2) Buildings

In this project, the operational funds include the six items as follows: i) labor costs, ii) equipment operation costs, iii) heat and light expenses, iv) water charges, v) fuel and consumable costs, vi) building maintenance costs.

i) Labor costs

The facilities will run by 62 persons, consisting of a (1) manager, three (3) officers, five (5) clerks, one (1) engineer, fourteen (14) assistant engineers, thirty-five (35) engineer trainees and three (3) handy men.

Based on MOLG'S related documents including both direct and indirect costs, average numbers of staff of each category are estimated as follows:

Manager	x 1 person	x 750,000Ush/man.month	=Ush	750,000
Secretary	x 2 persons	x 150,000Ush/man.month	=Ush	300,000
Personnel Officer	x 1 person	x 250,000Ush/man.month	=Ush	250,000
Clerk	x 5 persons	x 100,000Ush/man.month	=Ush	500,000
Officer	x 1 person	x 250,000Ush/man.month	=Ush	250,000
Engineer	x 1 person	x 450,000Ush/man.month	=Ush	450,000
Asst. engineer	x 14 persons	x 250,000Ush/man.month	=Ush	3,500,000
Engineer trainee	x 35 persons	x 100,000Ush/man.month	=Ush	3,500,000
Handy men	x 3 persons	x 70,000Ush/man.month	=Ush	210,000
	Total			9,460,000

As a result, estimated annual labor cost is 9,460,000Ush x 12 months = 113,520,000Ush

ii) Electricity (the total of Items ii and iii above)

	KW	Power supply (KVA)	x	Required Rate	=	Required Power (KVA)
Equipment operation	20,152	251.9	x	0.6	=	151.1
Heat and Light		136.0	x	0.35	=	47.6
Total						198.7

Based on the actual working hours (=8 hours), weekly holidays (=2 days) and annual working days (=300 days), estimated annually required power supply is 198.7KVA x 8 hours/ day x 300 days = 476,880 KWh /year.

Based on the electricity cost of 115Ush/ KWh and the 15% CTL to be levied, estimated annual electricity cost is 476,880 KWh /year x 115Ush x 1.15 = 63,067,380Ush /year.

iii) Water charges

The planned volume of water to be daily used in the project land is 13 tonnes. If the demand rate is assumed to be 70%, the volume of water to be used will be 13.0 x 0.7 = 9.1 tonnes /day, and 9.1 x 300 = 2,730 tonnes /year. Accordingly, the annual water charges will be 2,730m3 x 475Ush/m3 = Ush 1,296,750.

iv) Fuel and Consumables costs

Although the present function will be divided into two, the number of units to be repaired will increase instead. Therefore, the estimation is done here on the assumption that the same cost is required for this project. The existing facility is now consuming 3,800 liters of gasoline and 45,000 liters of diesel, which totally costs 40,000,000,000Ush. The consumables costs which amount to 50,000,000,000Ush and the above fuel cost make the total estimated annual cost, which is 40,000,000 + 50,000,000 = Ush 90,000,000.

v) Annual maintenance and control costs

As a result of the above, the approximate costs and expenses to be required for the annual maintenance and control will be as shown in Table 4-8 following page.

Table 4-8

(Unit : Ush 1,000)

Items	Cost Amount
Labor costs	113,520
Heat and light costs	63,067
Water charges	1,297
Materials and consumables costs	90,000
Miscellaneous expenses	2,116
Total	270,000

This is about 18% of the MOLG'S annual budget and is considered to be practicable.

Based on the above studies, it is considered to be adequate to implement this project with the grant aid system of Japan, from the reasons that its advantages, actually, and Uganda's ability to implement the project have been confirmed, and that effects of the implementation of the project meet requirements of grant aid system of Japan. Accordingly, it was decided to review the summary of this project and carried out basic design work assuming that the project is to be carried out with the grant aid of Japan. However, as regards details of the project, it is adequate to modify part of the components of the request, as mentioned in the detailed studies on constitutive elements, and requested facilities and equipment in the project.

Chapter 3 Basic Design

Chapter 3 Basic Design

3-1. Design Policy

The following conditions affect the design of the building; Configuration and topography of the proposed project site, both location and difference in elevation between the site and access road, weather condition and natural hazards in the area, infrastructure on the site, relations between the surrounding environment and use of buildings. After examination of these conditions the following design policy was decided:

i) Sit on the slope of a hill, storm water from upper levels flows over the site, which only has a system of earthen ditches. To remedy this, over the whole site of the project, a site drainage system is envisaged, consisting of open type concrete gutters and catchment pits.

ii) The design envisages leading rainwater into the ground as far as possible and to guide storm water on the apron into concrete ditches along the retaining wall, moreover to use a part of the rainwater as supplementary water for the tank for the engine horsepower test.

iii) The temperature in the morning and evening is low compared to that during the daytime, but the humidity is high and the wind is gentle. To take account of this condition, the design incorporate high ceiling height, ventilation openings and roof fans.

iv) Although the site does not suffer from earthquake, the design considers 0.1 seismic intensity coefficient in the structural calculation.

v) The office design has a manager's room and two large rooms for other staff.

vi) Building materials and equipment use durable materials and reliable equipment so as to save maintenance and repair cost. In addition to this, the project considers procurement and repair cost, availability and quantity, and prompt response of after service with respect to the building materials and equipment. From this point of view, the project will decide the procurement country of both materials and equipment.

vii) The project will adopt Japanese construction methods and workmanship because local constructions are unfamiliar with structural steel work. Concrete work and other incidental works may be done using local methods according to the custum of local constructors.

As regards construction methods, Ugandan methods will be adopted for those work, such as concrete work, brick work, which are generally carried out in Uganda. However, Japanese methods will be adopted for those work, such as steel structure, wiring within distribution panel, and piping work, and so on, which are not generally carried out in Uganda.

viii) The project will also include repairs on a machine shop, vehicle repair and repaint shops and parts warehouses.

ix) Most construction materials and equipment are imported from the Middle and Near East, Kenya and India. The cost, quality and quantities fluctuate. Materials and equipment for steel structures are in short supply due to limited demand. In addition to this, the Japanese grant system requires completion of the construction work within one year, including the period from the procurement of both materials and equipment to delivery at the site, and from handover inspection, by the consultants and by the owner. Construction work itself will affect the construction period as well. The project therefore envisages the adoption of prefabricated materials.

3-2 Study and Examination on Design Criteria

The building standard of AIJ (Architectural Institute of Japan) governs the determination of the dimensions of lavatory and office rooms. The location and layout of furniture and equipment cover the minimum dimension of a room. The widths of respective passageways in the room are 60 cm between desks, 80 cm between desk and wall or partition, and 150 cm between cabinets and wall or from the edge of a desk to the wall. The distance between rows of desks is 80 cm. The construction equipment repair handbooks of Japan Construction Mechanisation Association covers the design of every repair shop and facility.

The following summarizes design criteria:

(1) Standards and requirements

Scale of drawings	1: 200
Drawings	Plan, elevation and section
Law & Regulations	Building code & regulations of Japan & Uganda
Design standard	AIJ design standard
Specifications	Japanese specifications
Requirements:	
(1): heavy vehicles and equipment	MOLG's Japan made heavy vehicles and equipment.
(2): personnel	62 persons in project workshop including 8 persons in office, and 45 persons in the existing workshop
(3): work demarcation	New workshop repairs road construction equipment and heavy vehicles, and the existing workshop repairs light vehicles of MOLG.
(4): common work	Both workshops will make use of the existing repaint shop after rehabilitation
(5): security measures	Steel grilles will be provided for outside windows & door of the new workshop
Additional consideration	How to discharge storm water out of the whole site including the proposed project site

(2) Design Standard

In terms of the setting up the are and heigth of each repair shop, the additional examiniatior was made in consideration of the incoming vehicles and component.

1) Design condition

Based on the shapes, the maximum module of retaining vehicles are as follows:

	L	x	W	x	H(m)
Bulldozer	6.6	x	2.4	x	3.0
Motor Grader	9.5	x	2.4	x	3.5
Dump Truck	7.0	x	2.5	x	3.0
(Dumping Height)			5.6		

From the numerical values above, the maximum value of vehicles are shown below;

L x W x H = 9.5. x 2.5 x 5.6 (m)

The modules are decided in consideration of following factors.

- Sufficient space for working operation
- Length in case of spreadinf out bulldozer track (about 15m)
- Space in case of disassembling parts

Based on the above factors, the modules are set up per one span as follows;

L : 9.5 -- 12 (m)
W : 2.5 -- 6 (m)
H : 5.6 -- 6.5 (m) (under crane hook)

2) Design condition

Table 3-1

a) Administration room	Minimum dimension and distance
Desk	80 x 160 x 72 cm (general)
	80 x 180 x 72 cm (manager)
Cabinet	40 x 90 x 120-150 cm
Distance	between rows of desks: 80 cm
	between columns of desks: 60 cm
	between row of desks and wall or partition: 150 cm
	between side line of desks and wall or partition: 80 cm
	between row of desks and cabinets: 160 cm
	between side line of desks and wall or partition or cabinets: 150 cm
Water supply (1)	For house water
Condition	Elevated tank provides the capacity for peak demand.
Formula	A = qf x F x p, Q = A/t x 1.5*
	A = (7 x 1.2 + 11 x 0.4 + 12 x 0.9) x 0.4 = 9.4 ton/day
	Q = 9.4/8 x 1.5 = 1.77 ton/h
Design capacity	elevated tank: 2 ton
	water collection tank: 10 ton
(2)	For dynamometre room
Used water	5,000 litre. for one time of engine test
Cooling system	Circulation and natural evaporation
Room to cooling	100 % of used water
Design capacity	5.0 x 2 = 10 ton
Remark	Evaporation volume is supplemented with rain water.
	Reservoir tank for rain water: 5 ton
(3)	For washing of road construction machines
Water capacity	1,600 litre per hour
Washing time	50 minutes per one machine (50/60= 0.83)
Numbers of machines	2 machines per day
Water demand	1.600 x 0.83 x 2 = 2.6 ton/day
Design capacity	3 ton

*Note: where, A: Used water volume per day (litre per day)
qf: Used water per unit (litre per day)
F : Numbers of units (closet: 7 (tank type), urine: 11, wash basin: 12)
p: Use rate at once (this case 40%)
Q: Maximum capacity of used water (litre per hour)
t : Water-consuming time (hours)

3) Estimation of required number of bays

The number of bays to serve as a basis for the determination of facility size of the repair workshop in the project is studied here.

(a) Basis for estimation of number of bays

1) Number of working days per year :

Number of working days per year at Bugembe workshop :
300 days

2) Classification and definition of maintenance work on construction equipment and vehicles

- Small-scale maintenance - daily, routine maintenance
- Medium-scale maintenance - maintenance per unit (engine, transmission, clutch, hydraulic device, etc.)
- Large-scale maintenance - General overhaul

Small-scale maintenance is generally carried out using a mechanical service car and maintenance mechanics in-situ, and the medium and large-scale maintenances are mainly carried out in the workshop. However, the medium-scale maintenance comprises more unit maintenance, and about 50% of them are estimated to be carried out in local repair workshops, at construction sites and outside of the repair workshop.

3) Targeted number of working days required for repair work

As a result of the site survey, it is found that the present number of days required for maintenance is far greater than that of the Japanese standard because of the following reasons:

1. Operators are not sufficiently trained.
2. Routine maintenance is not sufficiently carried out.
3. Maintenance workshop, facilities and tools are poor.
4. Training is not well systematized.

5. As there are so many varieties of equipment involved, standardization of the maintenance work is difficult.
6. Spare parts are not readily available because of stock and budget deficits.

Further, as the quality of maintenance is poor, the rate of repeat breakdown is high.

The targeted number of working days after the completion of new workshop is assumed (excluding waiting time) as follows :

Table 3-2 Targeted Number of Working Days

	Standard number of working days in Japan	Present number of working days	Targeted number of working days
Medium-scale maintenance	10 days	30 days	13 days
Large-scale maintenance	30 days	60 days	40 days

Actually, the targeted number of working day is estimated based on the following.

i) Construction equipment :
If the equipment is maintained in a workshop provided with proper facilities, it is reasonable to consider that the number of working days will be about 1.3 times more than that of Japanese, taking into account the diligent character and educational level of Ugandans.

ii) Vehicles :
As for the maintenance of vehicles, if they have sufficient repair facilities and tools, the work efficiency will not be much different from that of Japanese because Ugandans are familiar with repair and maintenance work since their former suzerain time. Therefore, the present difference can be considered to be

caused by the control and administrative information system of the country.

d) Number of items to be maintained

Of the Japanese construction equipment and vehicles which were provided by the Government of Japan within the scope of JICA I and II, and by other aid organizations, the following number of items require maintenance.

Construction equipment : 170 items
Heavy Vehicles : 25 items

e) Amount of maintenance work to be carried out

(a) The work being done by MOLG's construction equipment to be repaired and serviced mainly consists of the maintenance and repair of existing roads, and the work load is relatively light for the construction equipment.

(b) i. Average annual operating time of MOLG's construction equipment is 1,200 hours.

- Medium-scale maintenance :
  Every 3,000 hours (About once every three years, considering the nature of the work). Of these, 50% is assumed to be carried out at the construction site or outside the new workshop.

- Large-scale maintenance :
  Every 7,000 hours (about once every six years)

ii. Average annual travelling distance of heavy vehicles is 18,000 km.

- Medium-scale maintenance :
  Every 30,000 km (Once every two years)
- Large-scale maintenance :
  Every 100,000 km (Once every seven years)

2) Estimation of number of bay

The number of bay is estimated by the "formula for the calculation of number of bays in construction equipment and vehicle maintenance workshops" which is commonly used in Japan.

$$\text{Number of bays} = \frac{\text{Average no. of working days (C)} \times \text{No. of objectives to be serviced (B)} \times \text{No of items to be actually maintenance (D)}}{\text{Total Working Days per year}}$$

(1) Bays for construction equipment

Number of bays for medium - scale maintenance

$$= \frac{13 \text{ days} \times 170 \text{ units} \times 50\% \times 1/3 \text{ times /year}}{300 \text{ days}} = 1.2$$

Number of bays for large - scale maintenance

$$= \frac{40 \text{ days} \times 170 \text{ units} \times 1/6 \text{ times /year}}{300 \text{ days}} = 3.7$$

(2) Bays for vehicles

Number of bays for medium - scale maintenance

$$= \frac{10 \text{ days} \times 25 \text{ units} \times 1/2 \text{ times /year}}{300 \text{ days}} = 0.4$$

Number of bays for large - scale maintenance

$$= \frac{25 \text{ days} \times 25 \text{ units} \times 1/7 \text{ times /year}}{300 \text{ days}} = 0.3$$

As a result, the total is 4.9+0.7= 5.6, which is about 5 or 6. However, considering the room for the future, it should be 6.

3-3 Basic Plan

The plan is examined in consideration of the following factors such as shape of site, topography, access roads, correlation of surrounding roads with site, management and safety measures of the site, direction and strength of wind, direction of rainfall blow, earthquake occurrence and its strength, location of electric supply and water supply, drainage method, type of buildings and surrounding environment, etc. based on the design method. According to the above design criteria, the location, direction, plan, elevation, section, details, materials, equipment and drainage treatment method of the buildings are determined.

3-3-1 Site and Layout Plan for New Workshop

The site consists of three terraces; upper terrace, middle terrace and lower terrace. Each of terraces is facing south on a slant. This slant includes 3.0m height difference in each terrace. The gate of the site is designed near the lower level of middle terrace in the west and it is considered as a desirable one to access through this gate. Nevertheless, some problems are observed due to the location of this gate which includes the height differences more than 1.0m between middle & lower terrace , and lack of space for trailer turning. Also, this makes it difficult to secure the loading & unloading space of vehicles and vehicle washing space. Therefore, new gate in the project site is designed in consideration of size of the site and topographical constraints.
In addition, considering the number and movement plan of workshop annex, management of existing repair shop operation, and safety problems, the location of entrance gate and site apron is designed at the next the border of middle terrace in the shape of facing the middle terrace borderline which is adjacent to the apron. The location of the annex is also designed inside the apron. Moreover, the project site is to have a new retaining wall between the middle and lower terrace in order to effectively use the proposed project site. The apron is constructed with steel concrete pavement by the load-resistant method. The slope to retaining wall from the repair shop is made and this enables the effective flow of rainfall through a drainage and ditch along the retaining wall.

The road construction equipment is used crawler type including tyre vehicles. As the damage can be occurred on the surface of the road during the operation of crawler type equipment, it is desirable to locate the construction equipment bay near the equipment loading & unloading deck, vehicle washing station. The location of heavy vehicle repair

bay is to be near the entrance gate. Also, motor pool is designed to be located near the respective bay. The movement of vehicles is illustrated as shown Figure 4-4.

The toilet, shower room and washing area for workers is common use with the workers of existing repair workshop. Considering the effectiveness of the use, the facilities is to be arranged next to the existing multi-purpose building. The water supply tank is used the existing one. The location of water supply facility is to be located on the northeast of site upper level in consideration of utilization of water pressure by height differences and the relation with operation and other facilities.

3-3-2 Architectural Designs

1) Floor Plan

The floor plan is carried out based on the zoning concept after examining required room size and utilization. The room size examined by the design condition and " The design condition study " is determined based on the final allocation of buildings and pillars.

2) Section Plan

Wind mainly blows from south-north. Every room of the workshop utilizes the wind to ventilate while temperature, humidity and ventilation, and the height of an overhead traveling crane decide the height of the room. This workshop is equipped with two 3-ton overhead traveling cranes, a 2-ton hoist and two 1.5-ton hoists. The rail top of the crane is 7.0 m high, and the hook centre of the hoist is not less than 3.0 m; and the lowest height of the bottom of a structural girder is therefore 9.0 m in the main workshop and 5.0 m in the part room; and the ceiling height of office rooms is more than 3.0 m from floor level. The height of the ground floor considers the decline of the site economically.

3) Structural Design

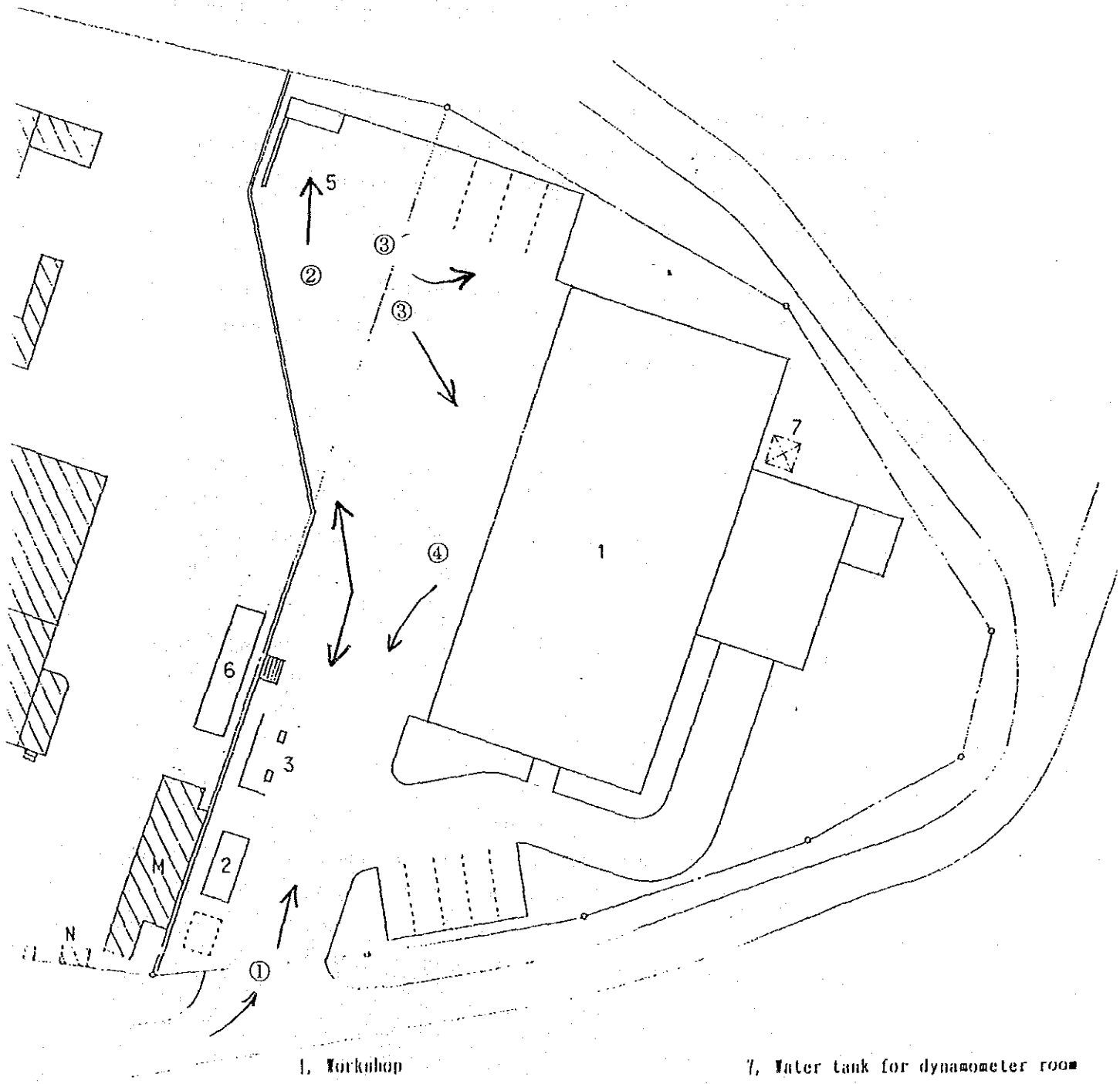
As the limited bearing capacity of foundation is low (5.0t /m2) and cranes are running, it is desirable to minimize the self-weight of buildings. For this, steel structure method is applied to the building construction. Although there is bare possibility of earthquake, the building is designed in consideration of the intensity 0.1 of an earthquake. Also, as entrance and exit of the building are located in the apron side, facing the north, the rainwater flows east-west direction, which is at right angles with the entrance and exit direction. Regarding piles, Uganda-made piles are not used due to the lack of machine

and technology in case of driving in a pile. This can create the cost increase in case of pile conveyance from foreign countries. Therefore, light self-load of the buildings can be introduced in terms of strength aspect. On the building foundation, it is designed to bear only self-load, and to bear floor load directly to earth.

SITE PLAN S:1/600

Figure 4-4 Movement of Vehicle

① Arrive to Workshop
② To Cleaning
③ To Workshop
③´ To Waiting area
④ To Loading deck



1. Workshop
2. Lubrication warehouse
3. Diesel station

5. Washing place for construction equipment
6. Shower room & lavatory

7. Water tank for dynamometer room (9.0-ton water volume)
8. Water tank for living and washer

4) Building Facility Plan

i) Electric power

Considering the high cost of electricity, the electrical installation is designed for a cost-saving. In addition to this, the project is equipped with an automatic voltage regulator (AVR) for stabilizing the voltage and with a stand-by generator against power failure. Furthermore, the project provides lighting rods to protect the facilities from damage from thunderstorms.

The project workshop has their own generator for emergency use. From here 400/440 voltage three-phase line leads to installed machines in the workshop, and 240 voltage single-phase line leads to the lighting and communication system. The frequency is 50 Hz.

Heavy electric lines lead to duplex or triplex round-locked type socket outlets at the point nominated in every bay and room. The socket outlets installed at the outside of the building and facilities are waterproof types.

ii) Water supply

Basically an elevated water tank gets water by water pressure in a public pipe line. In spite of the 4-inch diametre of the pipe, however the project consumes a plenty of water for Building and facilities, washing heavy vehicles and construction equipment and engine horsepower test. Therefore, an additional tank with a reserve capacity for a day's use is envisaged.

In addition to this, the tank for horsepower test adopts a water recirculation system so as to save water consumption and to cool naturally the water. The project however provides a water pump to cope with the drop of water pressure.

iii) Drainage

Drain water is classified four types : polluted water, mixed waste water, rainwater and vehicle washed-down water. In this project, the toilet treatment is carried out by water-washing system. The polluted water is treated through septic tank and penetrates into ground from seepage box. The mixed waste water treatment is also conducted by penetrating into ground from seepage box. The rainwater is discharged out of the site by underground pipe of the site through ditches. As the vehicle washed-down water includes oil dirt, the water is to be discharged after sediment of the water.

iv) Ventilation

Ventilation system is carried out by natural ventilation and, natural & compulsory emission. The natural ventilation is conducted through doors and windows.

v) Telephone and others

The existing and projected repair workshop plays a role of a central repair workshop of the MOLG, which covers the operation of nationwide MOLG substation and construction equipment repair. As postal communication and transportation system are inefficient condition in this country, telephone and facsimile communication method is indispensable one. Since 8 cable leads to the site, the project provides an automatic telephone switchboard involved the existings. An intercommunication system also uses the telephone system. Appropriate points equipped with speakers for paging in the premises.

3-3-3 Main Building Material Plan

Outside finish	Specification	Reasons for the Selection
Roof	Troughed steel long sheet *1	Durability & reliability To be procured in Japan
Outside wall	Extruded asbestos cement board *1	Durability & reliability To be procured in Japan
Wainscot	Acrylic paint on mortar	Foundation : concrete block To be procured in Uganda
Window	Steel screen finished with paint (with Insect-steel grill screen)	Assembly after the import in Uganda To be procured in Uganda
Door	Steel door finished with paint (with steel grill)	Grill to be manufactured in Uganda
	Steel shutter finished with paint *2	Durability & reliability To be procured in Japan

*1 This material is not yet available in Uganda. Although there are more tight and reliable materials than this, it has been judged to be most easily available and reasonable material, considering that the diffusion of steel structures in the near future in Uganda will make it more readily available in the market.

*2 The selection will be made from among Japanese products with good records, considering convenience in the maintenance control of motor parts.

Inside finish	Floor	Wainscot	Ceiling	Reason for the Selection
Main Work-shop	Surface hard-ened concrete	Mortar paint with vinyle resin enamel	Exposed steel structure	High durability for floor. Facility of cleaning for wall
Office	Mortar paint with Vinyle-tile	Double plaster board (15mm x 2)	Double plaster board (9 + 12mm)	Standard material

3-3-4 Equipment Plan

As a result of the review on the requested facilities, as per Table 2-1, the selection of main items of equipment to meet the requirements of the repair work to be carried out on road construction machinery and heavy vehicles is based on the following criteria.

(1) Criteria of Selection

1) The repair workshop will be positioned as the Central Repair workshop.

2) Accordingly, medium-scale maintenance work (dismantling and assembling of engine, transmission and undercarriage, injection pump testing, engine power testing, etc.), which local repair workshops are unable to do, and major maintenance work (overhaul of chassis, etc.) will be carried out in this Central Repair workshop.

3) Expensive special machinery, such as undercarriage truck link press, honing machine, and so on, will not be provided, and the work will be sublet.
Such selection was made, on the assumption that if such special machinery, which will not be frequently used, are installed, the handling techniques cannot be expected to be mastered, kept up or enhanced, and they would not be efficiently used under conditions where an organized repair workshop cannot be anticipated.

Items of equipment to be provided for the repair workshop have been selected based on the above criteria.

(2) Technical Level

The people seem to have sufficient capability to master handling techniques of those machinery which are not provided at present in the existing repair workshop, if they are frequently used and sufficient training is provided at the time of introduction.

Based on this, the following items of equipment have been selected:

1) Chassis disassembly and assembling work

a) Dismantling and removal and moving of dismantled heavy components (engine, power shift transmission, driving clutch, braking devices, undercarriage, etc.): 3-ton overhead traveling crane, 10-ton, 30-ton and 50-ton hydraulic jacks, Tractor front and back parts supporting frame, 300-kg hand-truck, 2-ton palette truck, parts shelves, parts cleaner, table grinder

b) Maintenance equipment required after repairing and assembling : Lubricating machine, drum porter

2) Engine repairing work

a) Hoisting and moving: 2-ton overhead hoist crane, 300kg hand truck

b) Parts repairing : 55-ton hydraulic press, parts shelves, valve sheet grinding machine, valve refacer, valve spring testing machine, working table, cleaning table, tool box, etc.

c) Total performance testing : A set of engine bench testing equipment, 2-ton monorail, working table

3) Fuel system maintenance work

a) Fuel injection pump performance testing : Injection tester, working table, spare shelves

b) Injection valve performance testing : Nozzle tester

4) Electric components repair work

a) Total performance testing : Starter/generator testing device, working table, hand truck
Parts testing : Armature tester, regular tester, insulation tester

5) Battery repair work

a) Charging : Silicon quick charger, parts shelves

b) Battery liquid make-up : Distilled water maker

6) Tyre repair work

a) Tyre removal and mounting work : Hydraulic tyre remover, tyre service tool set, tubeless tyre, constrictor, tool box, air compressor

b) Parts inspection : Wheel balancer (1 each for passenger car and large truck)

7) Parts manufacturing and processing work

a) Machine tool work : lathe, drill, shaping machine, milling machine, table-top lathe, belt saw, table-top grinder, 1.5-t overhead hoist crane

8) Sheet metal and welding work

a) Welding : Acetylene and arc welding

b) Sheet metal work : 100-t hydraulic press, high-speed cutter, table-top grinder

9) Compressed air supply facility

a) 37 kw air compressor

10) Car washing area

a) Mud removal : High pressure hot water car washer

b) Cleaning : Steam cleaner

11) Light vehicle plant

a) 4-column lift, wheel balancer, 10-ton hydraulic jack