

No. 4

**BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR IMPROVING THE CENTRAL WORKSHOP
IN
SOMALI DEMOCRATIC REPUBLIC**

AUGUST 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

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JAPAN INTERNATIONAL COOPERATION AGENCY

国際協力事業団		
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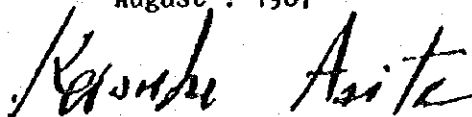
In response to the request of the Government of the Somali Democratic Republic, the Government of Japan has decided to conduct a basic design study on the Project for Improving The Central Workshop and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Somalia a study team headed by Mr. Yukio Moribe, Deputy Director, Vehicle Service, Land Transport Engineering Department, Regional Transport Bureau, Ministry of Transport from April 5 to April 30, 1987.

The team had discussions on the Project with the officials concerned of the Government of Somalia and conducted a field survey in the Mogadishu area. After the team returned to Japan, further studies were made, a draft report was prepared and a mission to explain and discuss it was dispatched to Somalia. As a result, the present report has been prepared.

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

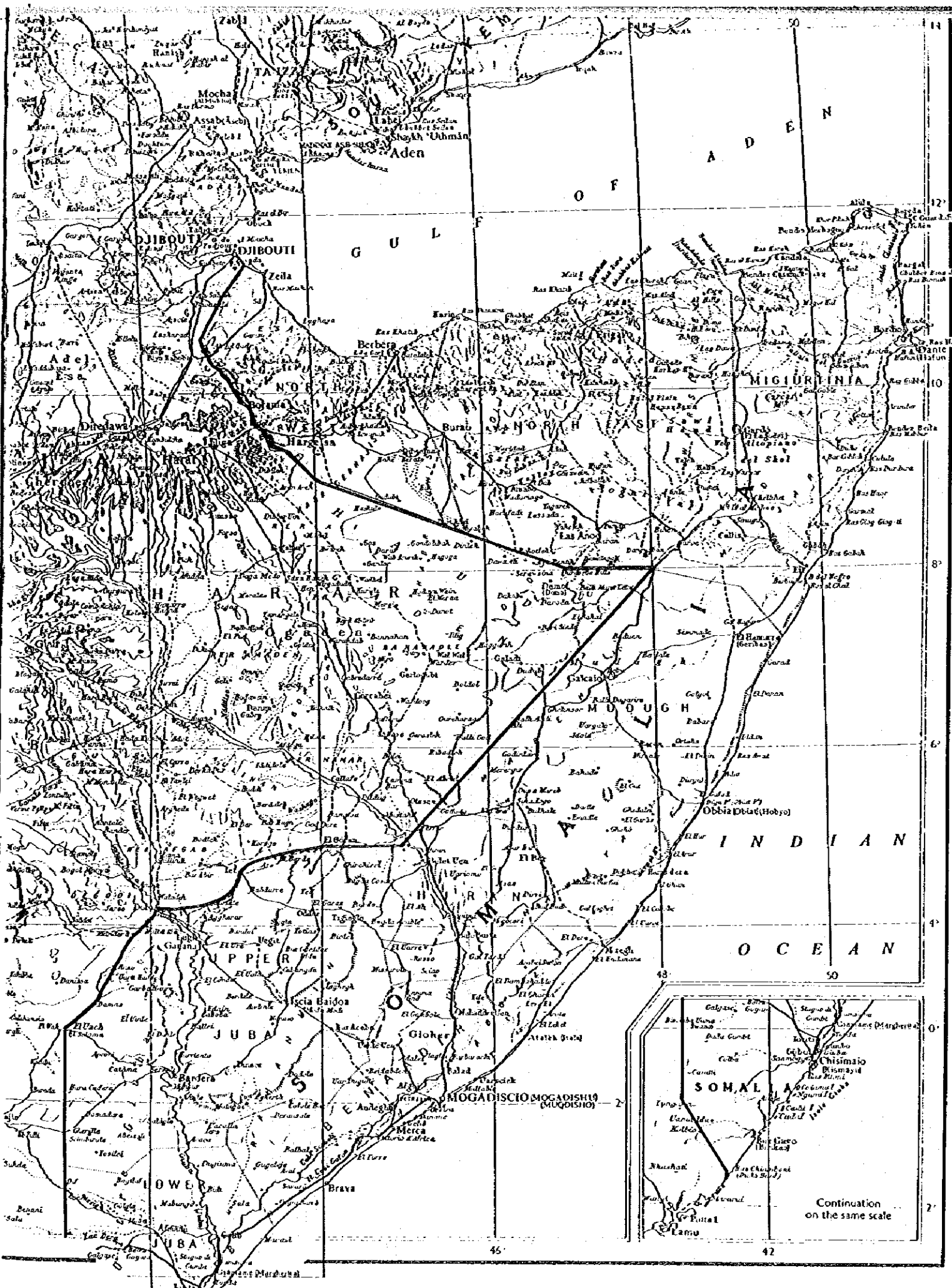
I wish to express my deep appreciation to the officials concerned of the Government of the Somali Democratic Republic for their close cooperation extended to the team.

August . 1987

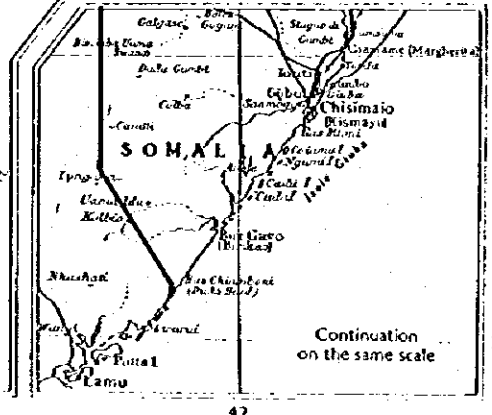


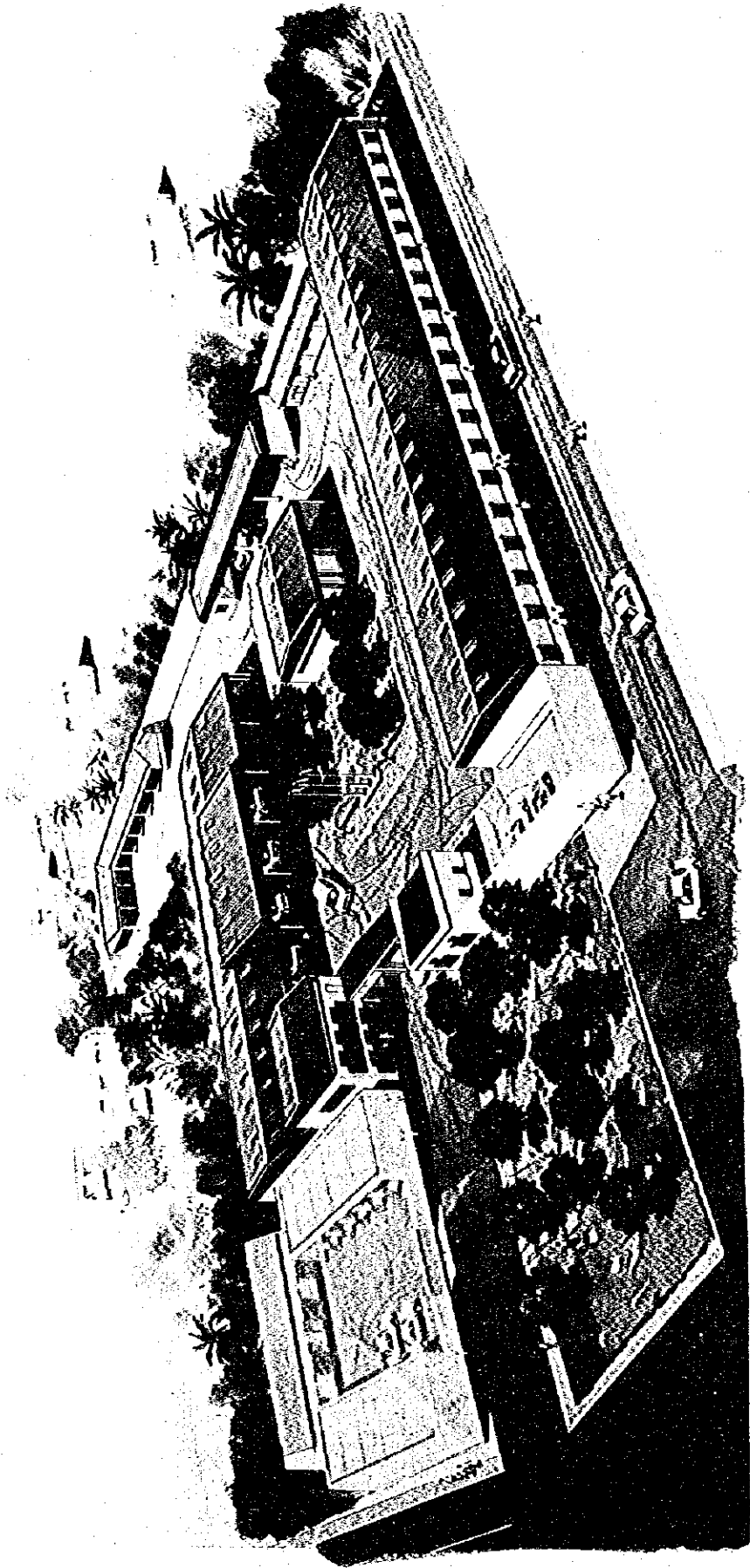
Keisuke Arita

President
Japan International Cooperation
Agency



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THE CENTRAL WORKSHOP IN SOMALI DEMOCRATIC REPUBLIC

SUMMARY

SUMMARY

Since the 1969 revolution which gave birth to the Somali Democratic Republic, the government has pursued a number of activities in order to achieve national development objectives. With the dry savanna as the dominant geographical feature, almost 50% of the nation's 8.5 million people are nomads scattered across the various regions of the country. They live under severe natural conditions with less than 500 mm of annual rainfall. Susceptible to droughts and cyclones, these regions frequently experience shortages of daily necessities such as food, drink, fuel, and medicines. A considerable gap exists between the living standard of these regions and those of urban areas. Reducing this gap is the objective of national development efforts, and the delivery of daily necessities to remote regions constitutes one of the main elements of national policy.

Vehicles represent the major means of land transport in the country, since there are no railroads in Somalia. Yet, of the total 22,000 km of road, less than 15% (about 3,200 km) is surfaced, either with asphalt or gravel. Thus, the government of Somalia is currently seeking to satisfy rising transport demand by promoting road construction and maintenance and expanding vehicle maintenance facilities. Since its establishment in 1925, the Central Workshop of the Ministry of Land and Air Transport has been responsible for the maintenance of government-owned vehicles. However, its maintenance functions have declined as the result of the deteriorating condition of building and machinery facilities and the shortage of repair parts. Consequently, it is currently incapable of satisfactorily responding to increased maintenance demands.

In order to improve these current conditions, the government of Somalia has requested assistance in the form of grant aid from the government of Japan. The objective of the grant is to upgrade the capabilities of the Central Workshop in the capital, Mogadishu, as well as the workshops located in seven other districts. In response, the government of Japan entrusted the Japan International Cooperation Agency (JICA) to conduct a basic design study on the project. A study team headed by Mr. Yukio Moribe, deputy director of the Vehicle Service Division, Land Transport Engineering Department, Regional Transport Bureau, Ministry of Transport, was dispatched to Somalia from April 5 to 30, 1987. The team confirmed the specific contents of the Somali government's requests and investigated the

appropriateness of the project and the required scope of cooperation. Field surveys were also conducted at the project site, including the current status of related infrastructures. Following the analysis of the data resulting from these surveys, the designated focus of the project is on the improvement of the maintenance functions of the Mogadishu Central Workshop for medium-sized to large vehicles. The annual maintenance capacity of the workshop for the next five years has been estimated as 2000 vehicles. The targeted monthly capacity after completion of the project includes the capability of prompt servicing for 100 vehicles, general maintenance for 50 vehicles, and heavy repair for 20 vehicles.

In order to achieve these estimated capacities, the workshop will require new buildings for inspection, overhauling, and body maintenance and repair, for a total construction floor area of 4,650 m². To more effectively utilize existing facilities, part of the existing building (437 m²) will be utilized as a garage and tire warehouse.

The type and size of required buildings and facilities are given below:

Buildings

Maintenance workshop	2,082.5 m ²
Body workshop	1,282.5 m ²
Garage	414.0 m ²
Administration building	490.0 m ²
Guard house and infirmary	81.0 m ²
Lube and inspection shop	300.0 m ²
Total	4,650.0 m ²

Use of existing building

Garage for scrap materials	310.0 m ²
Tire and air service shop	127.0 m ²
Total	437.0 m ²

The maintenance workshop, body workshop, and lube and inspection shop, will be single-story, steel-frame structures, while the administration building will be a two-story structure constructed with reinforced concrete block

structure. The guard house and infirmary will be a single-story, reinforced concrete block structure.

Machinery for vehicle inspection, maintenance, and control will include equipment for parts processing and preventive inspection/maintenance, which are seen to be specially required in Somalia. Emergency wreckers and quick-service vehicles will also be provided to cope with damaged or disabled vehicles. All machinery and equipment will feature easy handling, maintenance, and checking appropriate to the conditions in Somalia.

The project will be implemented on the existing site of the Central Workshop. The area of the site is 13,253 m² and is located at the east end of the central government office section in Mogadishu, adjacent to the facilities of the Ministry of Public Work and Housing. The site is surrounded by private and governmental agency's workshops.

Existing buildings and machinery which would hinder the project are to be removed by the Somali government before the commencement of construction work.

Of the estimated costs required to complete the project, approximately 11,415 million Somali Shilling is to be covered by Somalia.

The Somali executing agent for the project is the Ministry of Land and Air Transport. The annual maintenance/administration costs are estimated at 3,350,000 Somali shillings (approximately 5,500,000 yen). This amount can be absorbed by the ministry in view of its current financial condition.

The provision of grant aid for this project is appropriate for the following reasons: (1) The deteriorated plant facilities and maintenance capacity of the Central Workshop currently renders it incapable of satisfying the maintenance demand of government-owned vehicles; (2) The quality and reliability of vehicle maintenance not only has a significant impact on transport, but also affects every area of the society. Thus, the upgrading of its capacity will contribute to the nation's economic development and to the stabilizing of the livelihood of local inhabitants. Workshops under the jurisdiction of the Ministry of Land and Air Transport are provided with capable maintenance mechanics who are well experienced in the field of vehicle maintenance.

By establishing an official system for periodic inspection and a system for providing parts, maintenance technology will be further enhanced. Thus, the project is expected to make a significant contribution in activating social and economic activities in Somalia as well as raising the living standard of Somali citizens.

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CHAPTER 1 INTRODUCTION

CHAPTER 1 INTRODUCTION

The Somali Democratic Republic (hereafter referred to as Somalia) is located between latitudes 2°S and 12°N in the northeastern part of the African continent. It faces the Gulf of Aden to the north, the Indian Ocean to the east, and shares common borders with the Republic of Djibouti, Socialist Ethiopia, and the Republic of Kenya. The total land area is 638,000 km² (approximately 1.7 times that of Japan), most of which consists of dry savanna.

The total population of Somalia is approximately 8.5 million (1986 estimate). By industry, 46% are nomads engaged in raising livestock, 39% are involved in agriculture, and 25% participate in the manufacturing and service industries. Livestock includes sheep, goats, cattle, and camels. Along with bananas they comprise the nation's major export products, accounting for almost 90% of the total cash value of the nation's exports and thus constitute the primary source for the acquisition of foreign currencies.

Of the \$406 million public investment budget established by the nation's annual development plan for 1987, almost 90% is scheduled for the production sector including agriculture, livestock, manufacturing, transportation, and communication. Of the total public investment 40% is allocated for the transportation and communication sector. 69.4% of this is designated for road construction and maintenance. Since Somalia has no railroads, these figures show the government's recognition of the importance of land transportation.

However, the overland transportation system of the nation is strained by a lack of well maintained roads, frequent demands for travel to the dry savanna terrain of the rural regions, and unstable climate featuring high temperatures. These factors have resulted in frequent damage to vehicles. In addition, the Central Workshop of Ministry of Land and Air Transport, which is responsible for the upkeep of government-owned vehicles, is currently incapable of providing adequate vehicle maintenance due to the ongoing deterioration of workshop facilities and machinery.

Thus, the renovation and improvement of the Central Workshop is required in order to upgrade the land transportation capabilities of Somalia. Moreover, securing and stabilizing the land transportation system is

essential in promoting the nation's economic activity through industrial development. With this background, the government of Somalia has established a project for improving the Central Workshop of the Ministry of Land and Air Transport, and has requested grant aid from the government of Japan.

In response to this request, the government of Japan decided to conduct a basic design study of the project through Japan International Cooperation Agency (JICA). A team was dispatched to Somalia from April 5 to 30, 1987, headed by Mr. Yukio Moribe deputy director of the Vehicle Service Div./Land Transport Engineering Department, Regional Transport Bureau, Ministry of Transportation. During this time, the team held discussions with the various officials concerned with the project, conducted field studies on the project site, and collected other necessary data. The details of their studies can be summarized under the following headings:

- 1) current situation of vehicle transport
- 2) conditions regarding vehicle maintenance
- 3) current condition of the Central Workshop, Ministry of Land and Air Transport
- 4) confirmation of the specific requests made by the Somali government

The items of basic discussions resulting from these negotiations were compiled in a summary document, "Minutes of Discussions," which was signed by representative of both parties of April 19, 1987.

This document, entitled "Basic Design Study Report on the Project for Improving the Central Workshop of the Somali Democratic Republic," details the results of an analysis of the above-mentioned study that was conducted upon the return of the team to Japan.

CHAPTER 2. BACKGROUND OF THE PROJECT

CHAPTER 2 BACKGROUND OF THE PROJECT

2-1 Present Conditions of Automotive Transport in Somali Democratic Republic

2-1-1 Background of Automotive Transport

The territorial area of Somali Democratic Republic is 638,000 km² (approximately 1.7 times that of Japan); it is situated 2° south latitude to 12° north latitude and 41° to 51° east longitude, and is approximately 2,000 km from north to south and 200 to 900 km from east to west. It faces the Gulf of Aden to the north and the Indian Ocean to the east. In the north, the mountain ranges of 1,800 to 2,000m above sea level have an arid region similar to deserts, but other parts constitute an arid savanna region. The temperature ranges from 18° to 35° throughout the year, and the rainfall is less than 500 mm a year, constituting severe natural conditions. The population in these areas is approximately 8,500,000 (1986), and the breakdown is: 46% nomads; 29% peasants firmly settled in regions; and the remaining 25% urban residents. The administrative division is divided into 18 areas throughout the country as shown in Fig. 2-1. According to the 1975 census, the density of population is high (as shown in Fig. 2-2) in the Lower Sheberi region in the south centering around Mogadishu and in the West Garbead in the north centering around Hargelsa. Further, apart from the above figures, approximately 700,000 Ethiopian refugees are housed in camps settled in Gedo, Biran and West Garbead regions.

Fig. 2-1 Administrative division and Refugee Camps

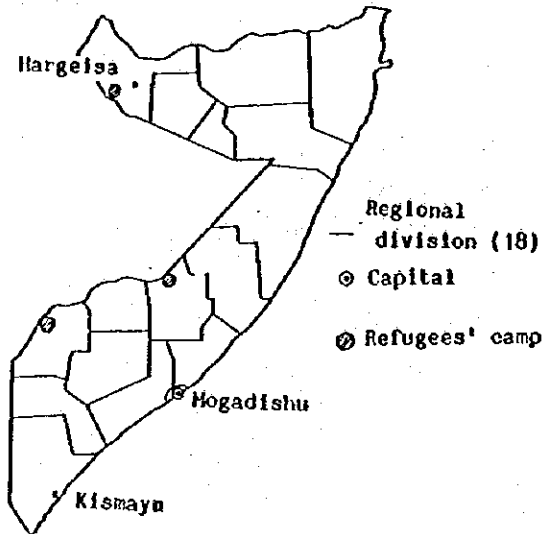
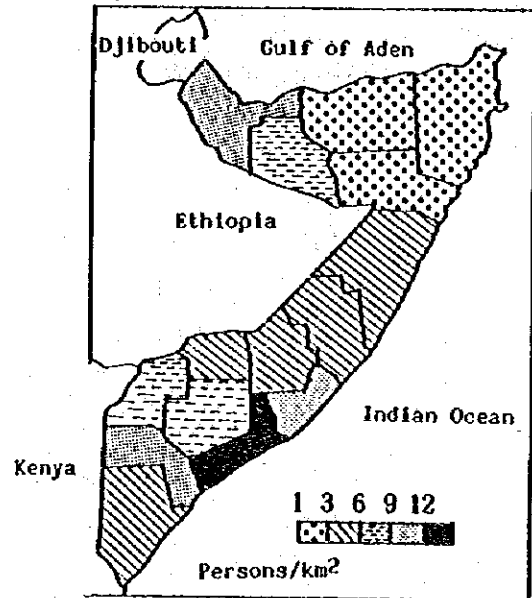


Fig.2-2 Population Density by Region



Approximately 4,000,000 nomads, over half of the total population, are dispersed in outer regions, and move with their livestock. Since these regions suffer directly by severe natural conditions like droughts, cyclones, etc., short age of living necessities such as drinking water, foodstuff, fuel, medical supplies, etc. often occurs. The regional distances from the city region is large, also. This harsh reality forms one of bases of the national plan, which is the transport of daily commodities to distant locations, embodied in the national target of "Improvement in the Living Level of all the People".

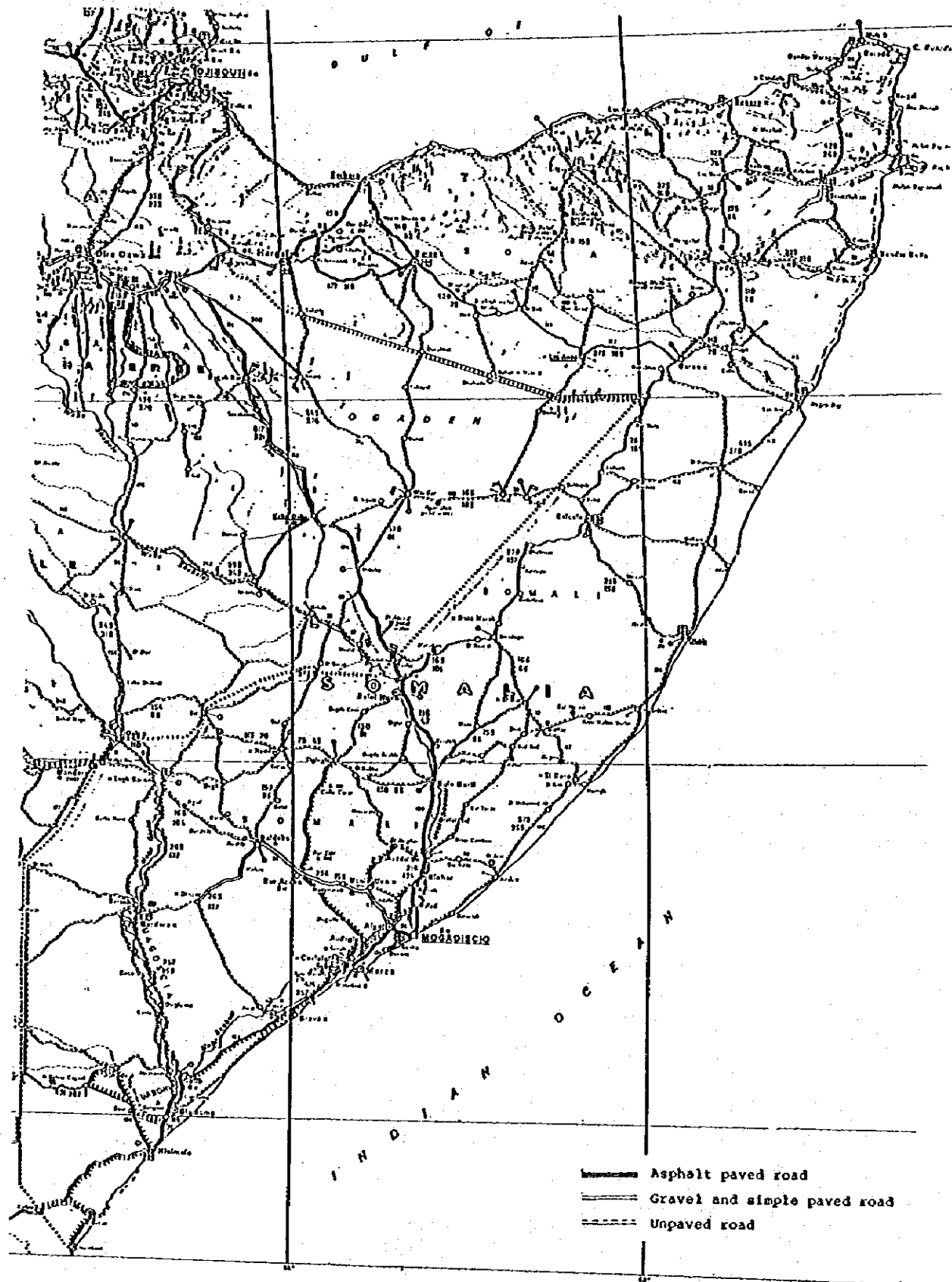
2-1-2 The Situation of Road Transport Circumstances

The means of transport in the Somali territory is divided into three types: land, coastal sea, and air. Destinations of transport are inland, with transport materials being mostly living necessities. Transportation periodically extends over a wide area and since Somalia is without railroads, land transport becomes most important. The main means of land transport are vehicles, traditional transport by animals or camels, and by

carts. Transport by donkey-driver and cattle-driver carts is seen everywhere, even in the streets of Mogadishu. Middle and long-distance transport relies mostly on vehicles.

The road network connecting the country is approximately 22,000 km as shown in Fig. 2-3. Trunk roads total 2,700 km, reaching to Kismayo, Afgoi, Mogadishu, Beltwein, Garoe, Burao, Hargeisa, Borama and Djibouti from Riboi, border of Kenya, and branching to the coast and Ethiopian border from this principal axis.

Fig. 2-3 Road Network of Somali Democratic Republic



These roads vary from good paved roads to roughly paved roads, gravel roads, etc., and their condition is not uniform.

The division by road conditions is as follows:

Asphalt paved roads (Double pavement)	2,325 km
Gravel paved roads usable throughout the year	900
Simple paved roads usable only in the dry season	6,500
Other unpaved roads	12,000
<hr/>	
Total	21,725 km

Source: Social and Economic Development of Somalia Democratic Republic, 1982/83 EC April, 1984

Seventy percent of imported foodstuff, fuel, etc. is unloaded at Mogadishu Port and transported to various other places. The transport of these materials is mainly carried out by the Land Transport Department and the National Transport Agency. NTA is the Agency under the direct control of the Ministry which carries out the transport of these materials on consignment of the Land Transport Department. Accompanied by increased industrial activity, the transport volume of raw materials, machines and parts, construction materials, etc. is also rising.

For transporting vehicles, 6 to 10-ton trucks and trailers are used, and for water supply wagons in time of drought, 6-ton tank lorries are used. Roads are often bad and driving under severe climatic conditions of Somalia causes great damage to vehicles.

2-1-3 Development Policies of the Country in the Transport Sector

Somalia has carried out the following plans as national development plans since the revolution in 1969:

1971 through 1973	Three-Year National Development Plan
1974 through 1978	Five-Year National Development Plan
1979 through 1981	Three-Year National Development Plan
1982 through 1986	Five-Year National Development Plan

At the present time, the "Five-Year National Development Plan" of 1987 through 1991 is in progress.

On the basis of this development plan the Public Investment program (PIP) has been formulated and the priority order of project determined.

Table 2-1 shows the investment and scheduled amounts by sector of past and future plans, centering around the 1987 Public Investment Program. The transport and communication sector has become very important, being markedly high in scheduled investment after 1987.

Table 2-1 Public Investment Program (Million Dollars)

	Before								After		Total	Total	
	1984	1984	1985	1986	1987	1988	1989	1990	1991	1991	Total	87-89	87-91
SECTORAL TOTALS	558.6	88.8	130.3	207.3	393.0	417.8	413.1	335.4	249.4	185.4	2979.1	1223.9	1808.7
Productive sectors													
00 Bardhere dam	5.9	0.9	1.0	0.6	3.7	4.8	97.5	99.6	77.8	166.0	457.8	106.0	283.4
01 Livestock	35.8	9.1	8.7	11.0	31.5	34.9	22.5	24.3	26.3	2.2	207.1	88.9	139.5
02 Agriculture	139.2	31.5	35.7	40.8	48.6	67.7	56.1	36.6	15.1	7.1	478.4	172.4	224.1
03 Forestry and wildlife	22.2	6.7	7.0	6.0	3.3	3.9	3.9	4.0	5.5	-	62.5	11.1	20.6
04 Fisheries	14.4	2.7	7.2	17.7	14.7	39.6	33.9	31.0	15.5	-	176.7	88.2	134.7
05 Mineral resources	-	-	-	-	2.0	2.7	1.0	-	-	-	5.7	5.7	5.7
06 Manufacturing	252.8	11.3	7.2	14.3	40.4	28.6	15.0	6.3	5.6	-	381.5	84.0	95.9
07 Energy	-	-	1.6	6.6	23.3	32.1	26.1	14.3	8.6	4.9	117.5	81.5	104.4
08 Water resources	55.7	14.6	23.1	27.8	37.7	49.3	52.5	51.6	34.5	0.7	347.5	139.5	225.6
09 Transport and communic	24.2	5.4	28.8	56.6	166.1	121.5	69.4	39.3	27.3	4.5	543.1	357.0	423.6
Social/admin sectors													
12 Education	1.9	1.6	3.2	8.3	5.0	5.5	4.9	7.4	11.8	-	49.6	15.4	34.6
13 Health	2.0	5.0	3.5	9.2	11.9	15.1	13.2	8.1	8.5	-	76.5	40.2	56.8
16 Government services	-	-	-	-	0.1	-	-	-	-	-	0.1	0.1	0.1
17 Regional/rur/urb devmt	4.5	-	3.3	7.6	4.7	12.1	17.1	12.9	12.9	-	75.1	33.9	59.7

Source: National Development Strategy and Program, 1987 through 1989

According to the 1987 Annual Development Plan, the planned growth rate of the gross domestic product (GDP) is 5%. Investment in the project makes it the nucleus of the Public Investment Program, and the total investment including technical cooperation is approximately 40,600,000,000 Somali shillings (US\$ 406,000,000), and the productive sectors of agriculture,

livestock-farming, industry, transport, communication, etc. represent approximately 90%.

The investment breakdown by each sector in the Public Investment Program in 1987 is shown in Table 2-2.

Table 2-2 Sectorial Distribution of Public Investment Program

(Thousands of So. Sh.)

	Core PIP		Technical Assistance		Total Public Investment	
<u>Productive Sectors.</u>						
01 Livestock	2,347,406	6.39%	98,436	2.52%	2,445,842	6.02%
02 Agriculture	3,799,642	10.34%	911,780	23.33%	4,711,422	11.59%
03 Forestry & Wildlife	306,404	.83%	129,000	3.30%	435,404	1.07%
04 Fisheries	2,395,000	6.52%	0	.00%	2,395,000	5.89%
05 Mineral Resources	304,000	.83%	36,500	.93%	340,500	.84%
06 Manufacturing	3,789,186	10.31%	188,450	4.82%	3,977,636	9.79%
07 Energy	1,414,556	3.85%	70,000	1.79%	1,484,556	3.65%
08 Water Resources	4,263,667	11.61%	84,320	2.16%	4,347,987	10.70%
09 Transport and Communication	15,929,300	43.36%	330,700	8.46%	16,260,000	40.00%
10 Tourism	55,000	.15%	0	.00%	55,000	.14%
<u>Social and Administrative Sectors.</u>						
12 Education	321,075	.87%	540,800	13.84%	861,875	2.12%
13 Health	981,590	2.67%	446,140	11.42%	1,427,730	3.51%
14 Manpower and Employment			365,083	9.34%	365,083	.90%
15 Planning and statistics			706,678	18.08%	706,678	1.74%
16 Government Services	167,000	.45%	0	.00%	167,000	.41%
17 Regional, Rural and Urban Development	665,962	1.81%	0	.00%	665,962	1.64%
TOTAL	36,739,788	100.00%	3,907,887	100.00%	40,647,675	100.00%

Source: Annual Development Plan, 1987

The source of investment funds are 91% from overseas and 9% from domestic sources.

According to the National Development Strategies and Programs for 1987 through 1989, the following four policies are quoted for the transport and communication sector.

- a) Investment will continue to be made in basic transport infrastructure. Social and economic benefits will be taken into account in investment decisions.
- b) Measures will be taken to ensure the expansion and improvement of transport services and communications and the maintenance or rehabilitation of existing facilities and equipment. Mechanisms for the co-ordination of transport services will be strengthened.
- c) To ensure a regular supply of fuel, spare parts and vehicles, transport services will be given a high priority in the allocation of foreign exchange.
- d) Credit arrangements will be made to stimulate private investment in transport and communications.

The proportion of investment for development of transport and communications is high, comprising 40% of the total development investment in 1987 (as shown in Table 2-2). The breakdown is shown in Table 2-3, and it can be seen that the investment on roads is increasing. In 1987, 69.4% of the total investment in transport and communications has been allocated to roads, and so it is apparent that the government is placing emphasis on land transport.

Table 2-3 Breakdown of Investment Transport and Communications Section (Million Dollars)

Division	1984	1985	1986	1987	1988
Road	8.3	2.4	18.0	113.0	73.2
Distribution ratio %	64.8	7.2	31.8	69.4	60.5
Harbor	—	15.6	24.3	31.1	6.4
Distribution ratio %	—	46.8	43.0	19.1	5.3
Aviation	0.7	0.5	—	3.4	5.9
Distribution ratio %	5.4	1.5	—	2.1	4.9
Communication	3.8	14.8	14.3	15.1	35.4
Distribution ratio %	29.8	44.5	25.2	9.4	29.3
Total	12.8	33.3	56.6	162.6	120.9
ratio %	100	100	100	100	100

Source: The National Development Strategies and Programms, 1987 to 1989; the 1987 figures related to the Annual Development Plan

2-2 The Situation of Vehicle Maintenance in Somalia

2-2-1 Vehicle Maintenance System

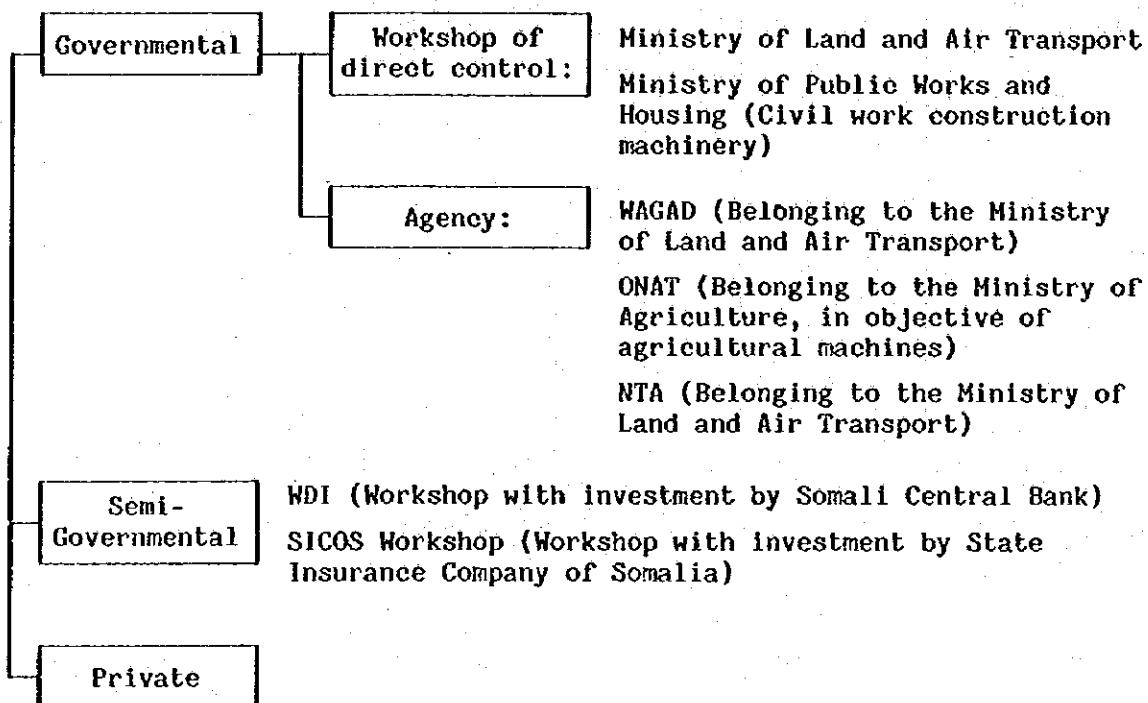
Automotive workshops in Somalia are roughly divided into three groups: governmental, semi-governmental, and private. The government is divided into two sub-groups: the Workshop Department and Agency under the direct control of the Ministry.

Workshops Departments under the direct control of the government have been established in the Ministry of Land and Air Transport and the Ministry of Public Works and Housing, and while the Ministry of Land and Air Transport maintains general vehicles owned by the government, the Ministry of Public Works and Housing is responsible for construction machinery. The Transport and Replacement Parts Import Agency (WAGAD) Workshop is under the control of the Ministry of Land and Air Transport, and the National Transport Agency Workshop (NTA) maintains general vehicles; and the Tractor

Agricultural Service Agency Workshop (ONAT) relies on the Ministry of Agriculture for agricultural machinery.

The semi-governmental workshops are funded by the Somali Central Bank (WDI) and by the State Insurance Company of Somalia (SICOS).

The system of present automotive workshops is as follows:



This project focuses on the Workshop Department of the Ministry of Land and Air Transport, one of the workshops directly controlled by the government.

The number of vehicles in the Somali territory in 1987 is 38,090. The breakdown of ownership is shown in Table 2-4.

Table 2-4 Number of Automobiles in the Somali Territory (1987)

Division of possession	Number of automobiles	Ownership Proportion
Government	3,800	10
Governmental agencies (Including semi-governmental)	2,280	6
Private	32,010	84
Total	38,090	100

Source:

Table 2-5 Breakdown of Government-Owned Vehicles

Division of model	Number of automobiles	Ratio (%)
Truck	1,145	30
Land rover and pickup	1,523	40
Passenger car	948	25
Others (Bus, crane truck and ambulance)	184	5
Total	3,800	100

(Except vehicles for civil work of road construction, etc. and for agriculture)

The workshops of the Ministry of Land and Air Transport are operated under the government budget, and maintenance is applied only to those vehicles owned by government ministries. Expenses required for the maintenance are separated according to ministry. Maintenance vehicles and spare parts, and others such as labor costs, etc., are covered by the budget of the Ministry of Land and Air Transport.

The Agencies operate under a self-supporting accounting system. Vehicles to be maintained are those owned by the government, semi-government Agencies, foreign diplomatic establishments, and private citizens, the Agencies are allowed to make profits by receiving payment for maintenance costs similar to the private workshops.

Private workshops differ according to vehicle manufacturer, kinds of business (for example, engine servicing, etc.), etc., and vary in size.

2-2-2 Workshops

(1) Ministry of Land and Air Transport, Directorate General of Workshop, Workshop Department

There are workshops in 17 regions including the Central Workshop in Mogadishu. The total number of staff members throughout the country is 380, and general vehicles are maintained not those vehicles for civil work and agriculture owned by the government.

(2) Workshops of the Ministry of Public Works and Housing

These are workshops covering public works, construction machinery related to the road work; the machinery handled include machine drills, drilling machines, bulldozers, road graders, road wreckers, pile driver, etc.

The maintenance covers casting and forging, lathe finish, mechanical service, piping, welding and electrical service. Maintenance staff members, excluding operators, number approximately 400 persons, occupying approximately 21% of the staff members of the Ministry.

(3) WAGAD workshops

This is an Agency belonging to the Ministry of Land and Air Transport that operates under a self-supporting accounting system. It owns a workshop that mainly carries out maintenance of Fiat vehicles and a workshop and parts warehouse in Mogadishu to carry out the maintenance of Mercedes Benz vehicles. It also possesses Fiat parts warehouses and workshops in the main local cities. The total number of staff members is 470 persons, comprising 230 staff members related to the maintenance, and 89 staff in the Mogadishu Fiat Workshop. This workshop has introduced new Italian maintenance equipment; the maintenance techniques are also high; and the procurement of spare parts and the control of tools and parts is also good. Originally,

maintenance of vehicles owned by the government in the periphery of Mogadishu was done by the Central Workshop; however, since its operation rate is low, the maintenance and repair of many government vehicles is carried out there.

(4) ONAT workshops

This is an Agency operating under the jurisdiction of the Ministry of Agriculture, and was established by grants provided by the Soviet Union. The workshop handles machines related to agriculture, and carries out the maintenance of tractors, bulldozers, generators, etc. Maintenance includes forging, lathe finish, mechanical service, welding, generators and electrical service, and the number of maintenance staff members is 89 persons excluding operators, occupying approximately 8% of 1,017 persons of all the staff members of ONAT.

(5) NTA workshop (In plan)

Similar to WAGAD, it is an Agency belonging to the Ministry of Land and Air Transport. It carries out the domestic transport of materials by government and private consignment. It owns 230 trucks (including trailers) and dump trucks. All models are Fiat. At the present time, the maintenance of these vehicles is performed by WAGAD and private workshops; however, the establishment of their own workshop is planned, with a site already secured in the suburbs of Mogadishu. Work is scheduled to start in 1988.

(6) WDI (Company with funding by Somali Central Bank)

This is provided with a variety of measuring equipment for the maintenance of vehicles, and equipment and materials for maintenance. Most of the tire regenerating equipment and bolt-nut manufacturing machinery are Italian. The workshop provides production service on vehicle parts, and is equipped with forging equipment and materials as well as lathes. At present, the bolt-nut manufacturing section and retreading tire section are in operation, and other sections will be started in 1988.

(7) SICOS (State Insurance Company of Somalia) workshop

This workshop is owned by the state insurance company with government funding. It is situated in the middle of Mogadishu. However, both the facilities and equipment have become outdated, and work has stopped.

(8) Private workshops

Privately owned workshops vary by their scales and types as well as the vehicle manufacturer. Those handling more than one manufacturer or those mainly carrying out the maintenance of engine section. The increase in Japanese vehicles has resulted in the parallel increase of workshops handling Japanese vehicles.

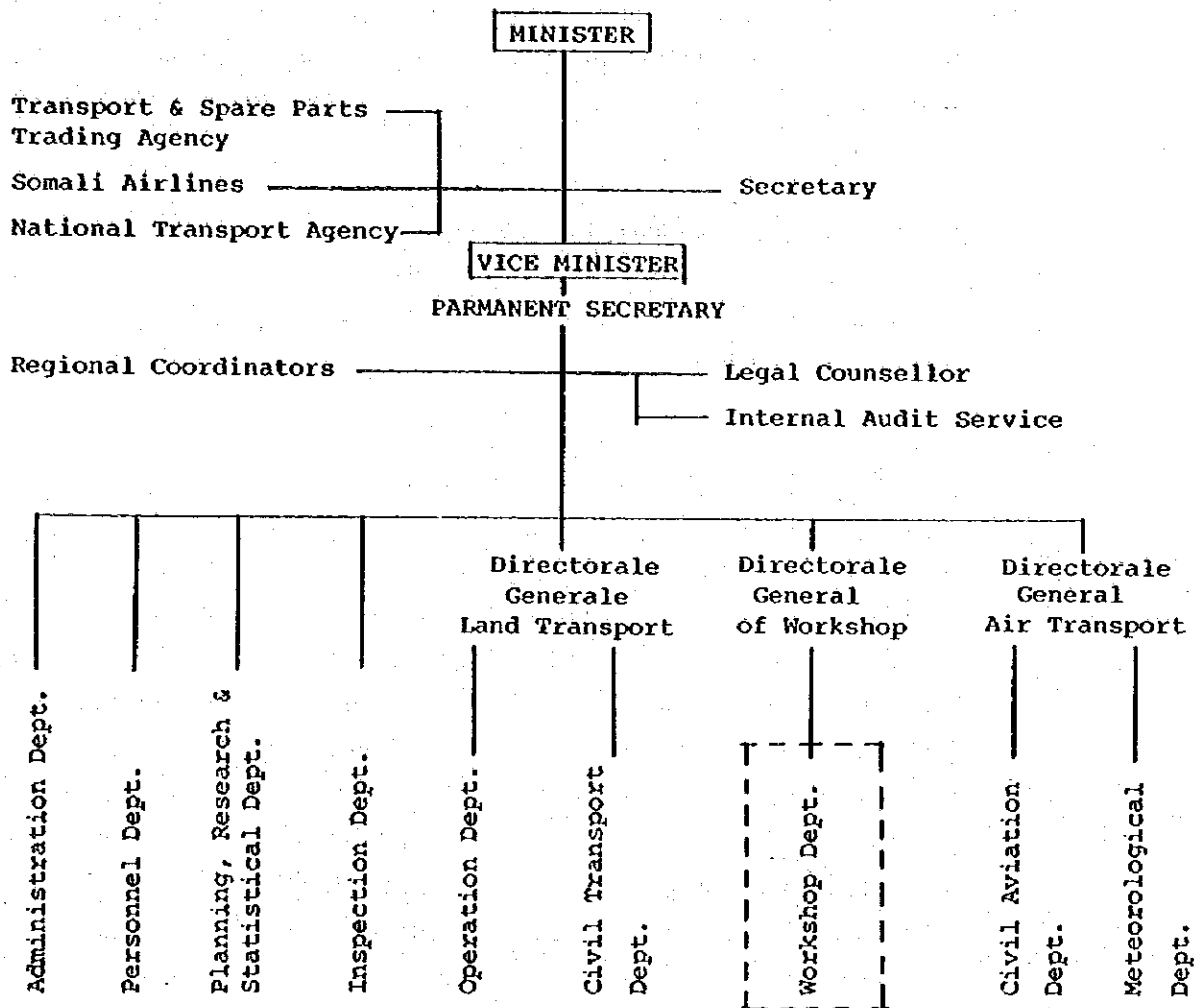
At the present time, the maintenance of general vehicles belonging to the government are carried out by the Ministry of Land and Air Transport, Workshop Department or the Agency, WAGAD. Formerly, since there were many European vehicles, there were Fiat, Mercedes Benz workshops, etc. Likewise, the Central Workshops objective was to carry out mainly the maintenance of Fiat vehicles; however, at the present time, on account of outdated facilities, equipment and materials, the heavy maintenance, like disassembly, repair, etc. of engines is now subcontracted to a private workshops, and only work such as light maintenance and general maintenance is carried out.

2-2-3 Workshops of the Ministry of Land and Air Transport

(1) Ministry of Land and Air Transport

The organization of the Ministry of Land and Air Transport which operates the Central Automotive Workshop is as shown in Fig. 2-4.

Fig. 2-4 Organizational Chart of the Ministry of Land and Air Transport



The Ministry of Land and Air Transport exercises jurisdiction over land and air transport, and the maintenance of transport vehicles related to the government falls under its jurisdiction, except those of the army and police. The number of staff members of the Ministry of Land and Air Transport is 1,273 (1987); including 380 technical staff members of the Directorate General of Workshop.

(2) Central Automotive Workshop

1) History

It was established as a workshop of the public work sector under the Italians, and has carried out the maintenance of vehicles for transfer and transport of the personnel of the Italian government. The main model is the Fiat jeep called the Campiola.

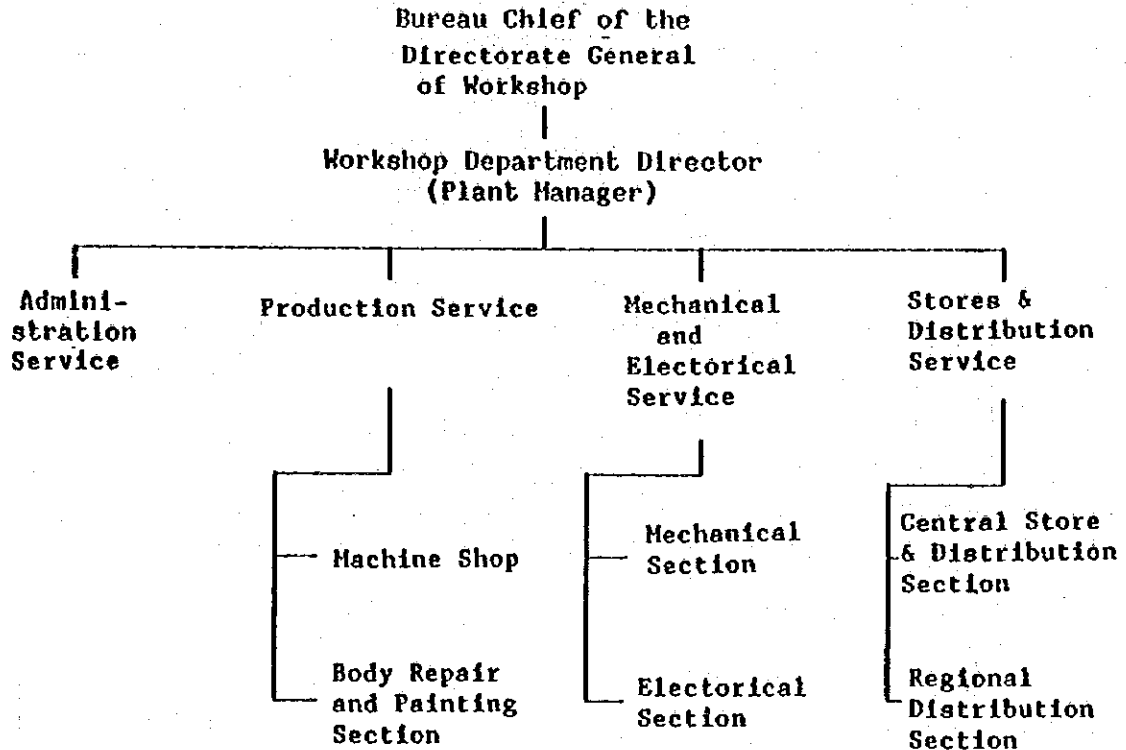
At the time of independence in 1960, Somalia was divided into 8 regions, and workshops were installed in each region. In Hargeisa, the old capital to the north, the workshop established by Britain played an important role.

Later in 1964, equipment and materials were introduced into Central Workshop aid from the Soviet Union.

In 1973, the 8 regions through the country were divided again into 16 regions, and in addition to the installation of new workshops, equipment and materials, tools, etc. were supplied from the Central Workshop. For this reason, the capacity of Central Workshop in Mogadishu was decreased, and since the availability of maintenance equipment and materials, replacement parts, etc. became difficult because of the worsening of foreign currency reserves in the same year, the deterioration of maintenance machines continued, and the majority of them became unusable. As a result, the corresponding disassembly and maintenance and thorough maintenance of machine shops etc. became more difficult. Most maintenance, today, concerns light maintenance and general maintenance as a result of this deteriorating situation.

When the regions of Odar and Sool were created by the administrative division arrangement in 1984, two regional workshops were established, bring the total number of regional workshops in the Mogadishu Central Workshop system to 17.

Table 2-5 Organizational Chart of Directorate General of Workshop

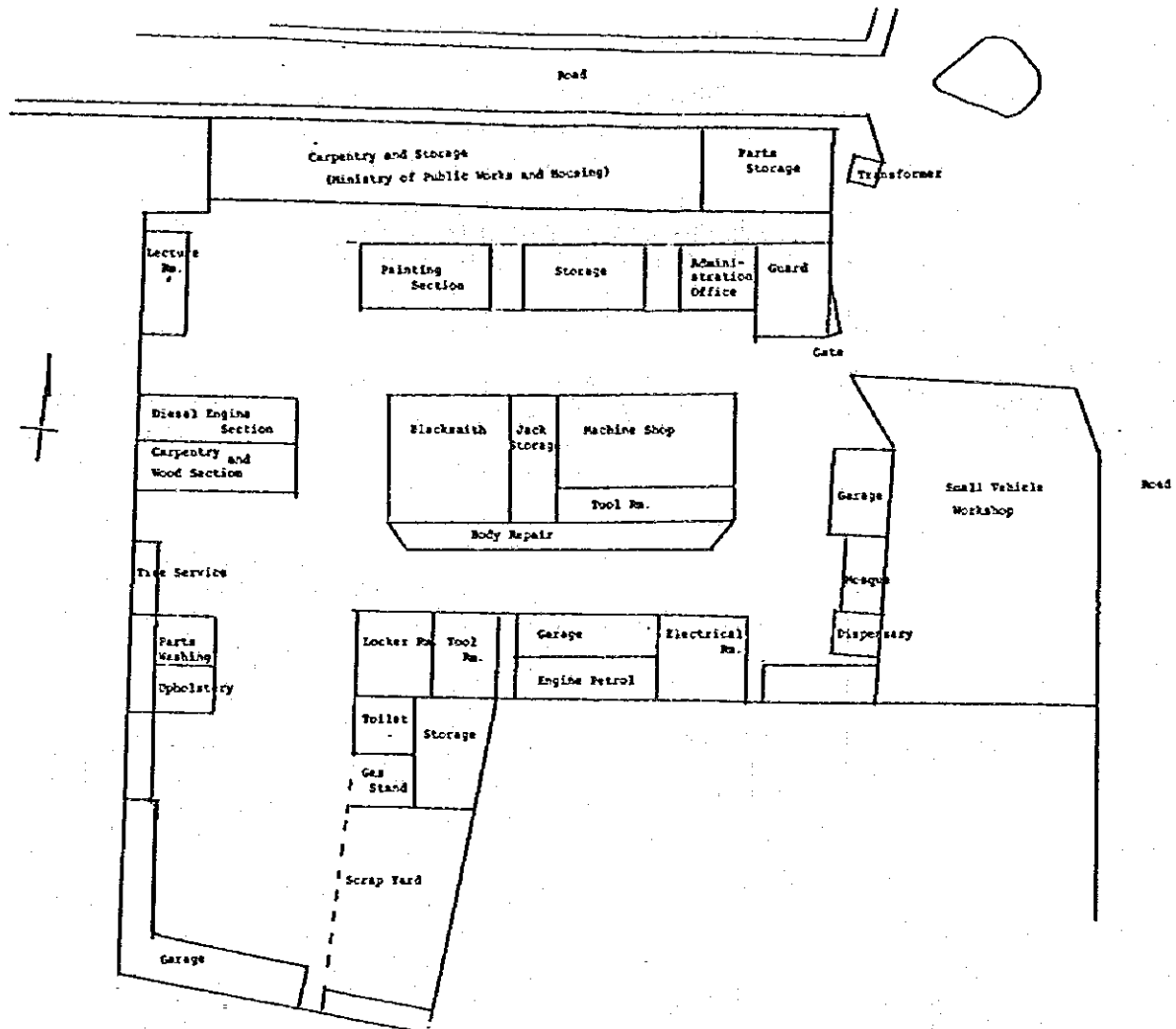


3) Present facilities

Mogadishu Central Workshop is situated near the government offices in the central part of Mogadishu, and the Ministry of Land and Air Transport concerned is located approximately 800m away. The site and layout of the existing buildings are shown in Fig. 2-6. The scale is as follows:

Site area	13,253 m ²
Floor area of existing buildings	Approx. 7,200 m ²
Building-to-land ratio	Approx. 54%

Fig. 2-6 Layout Drawing of Existing Facilities



The buildings form a square along the periphery of the site and a workshop is located at the center. The machine shop located at the center in the form of a square is one of the oldest buildings on the site, with slated-roof, wooden-truss beams covering a large space; the damage to the roof slates is worsening. The only flooring is earth. Buildings along the road are in relatively good condition, and occupied at present time by the Ministry of Public Works and Housing. However, since sea sand is used to make concrete, rust is formed on reinforced steel beams, and cracks are found in

concrete poles. The damage to structures is increasing. The external wall of the lecture room at the northwest end of the site (Fig. 2-6, Layout Drawing of Existing Facilities) serves both as a wall bordering on the adjacent ground of the Ministry of Public Works and Housing, and as the wall of the building in the adjacent ground. Further, the garage at the southwest end (Fig. 2-6) is a slate-roofed building with reinforced steel beams laid on concrete poles, and can be used as garage. Other buildings are of slated roof with wooden truss beams, and the floor is earth. The damage to the roof slates is severe as a whole, and the damage to concrete poles also has advanced. Further, since yard vehicle roads are not paved at all, the damage caused by fine sandy land to machines is large. The receiver and transformer facilities are transmitted in three phases with 3 wires, at power of 3,000V, 50 Hz; the contracted capacity is of 75 kW. City water is fed by 25 mmø conduit pipes.

4) Maintenance condition

Vehicles for maintenance are the general vehicles owned by the government, except the 2,280 vehicles owned by the Agency, so the total number is 3,800.

Since approximately 2,000 units (52%) are of Japanese make, the maintenance demands on Japanese vehicles is high. This maintenance consists of light maintenance and general maintenance described below, and it is not intended to cope with heavy maintenance.

The present maintenance activities are as follows:

- Light maintenance
Oil and filter replacement, brake check, etc.
- General repair
Brake, suspension, electric system, gearbox, etc.
- Body repairs and painting

The maintenance of approximately 50 vehicles a month is carried out. The heavy maintenance (engine overhaul, crankshaft grinding, etc.) of 20 vehicles a month cannot be coped with because of the reduced accuracy of the aged equipment and materials, malfunctioning of lathes, etc., and the adoption of an irregular system to procure parts by subcontracting, as well as repairs to private workshops in Central Workshop. The integrated maintenance plan covering both quick and extensive maintenance cannot easily be established, and the external dependency also may cause a loss of maintenance capacity.

5) Technical level of mechanics

In Somalia mechanic training programs and maintenance skills qualification systems have been established by the Ministry of Labor. The training system dispatches trainees to a workshop and carries out the training under the control of the Ministry. For the skills qualification, a qualification test is conducted in accordance with the standard skills laid down by the Ministry, and the accreditation of qualified persons is carried out. Likewise, the same maintenance technical training is carried out in the Central Workshop. The relationship between the training system and the skills qualification system is shown in Table 2-6.

Table 2-6 Vehicle Maintenance Training System and Maintenance Skill qualification System

Kind	Grade	Term of course	Qualification and accreditation	Remarks
Skill qualification	More than class 1	-	By kind of skill	
	Class 1	-	By the skills qualification test	
	Class 2	-	Same as above	
	Class 3	-	Same as above	
Training system To upper order ↑	Standard I	2 years	By the qualification test	} Qualified persons to be employed by the Central Workshop.
	Standard II	2 years	Same as above	
	Standard III	2 years	Same as above	
	Apprentice			Qualified persons to be employed by regional workshops.

When an apprentice passes the qualification test of standard III after his two-year training course, he must take the qualification test of standard II, and then advance to the upper order after passing. After passing the qualification test of standard I, passing through the skills qualification test by types of skills, he advances from the class of skill 3 of each to the upper grades 2 and 1. The range of skills is as follows:

- Mechanic Gasoline
 Diesel car
- Driver mechanic
- Body repair service
- Painting General painting
 Oxygen and acetylene welding
 Electric welding
- Electrical
- Lathe mechanic

When comparing the details of the qualification standards of maintenance skill qualification to the Japanese standards, it is judged that the class 2 of Somalia is equivalent to a class 3 Japanese mechanic.

The staff members classified according to technical grade working as maintenance technicians in the Central workshop are shown in Table 2-7.

Table 2-7 Number of Staff Members by Skill Grade in Central Workshop

Maintenance skill grade		Central Workshop
Upper order ↑	More than class 1	11 persons
	Class 1	16
	Class 2	20
	Class 3	21
	Less than class 3	21
	Apprentice	—
Total		89 persons

2-2-4 Regional Workshops

The Workshop Department of the Ministry of Land and Air Transport has workshops in 17 regions, in addition to the Mogadishu Central Workshop. The workshops and the Central Workshop are divided into the following three categories according to the maintenance capacity in terms of the needs of regional vehicle maintenance.

Category 1: Mogadishu Central Workshop and Hargaisa

Category 2: Baidoa and Kismayo

Category 3: Jowar, Sharanbod, Dousa Maleb, Budoul, Galkaio, Peletowain, Bososa, Eligabo, Burao, Las Anode, Baki, Bu Aare, Garbahalei, and Garoe

The number of staff members is 380 in both central and regional workshops: 89 in the Mogadishu Central Workshop, 48 in Hargaisa workshop, 22 in

Kismayo, 18 persons in Baidoa, and about 15 in each of the other 14 workshops.

2-3 History and Contents of Request

Since independence in 1960, the Somali Domestic Republic has progressed in the development of the country through the improvement in the living standards of the people, which it has made an important goal along with industrial development.

The government outlines the issue of continued funding for the transport infrastructure and strengthening of transport service network in the development plan. Investment in road maintenance, including bridges, is 69% of total development investment of the transport and communication sector, and the government of Somalia desires the securing of road facilities to regions for transport of essential goods, industrial development and strengthening of the domestic transport capacity to cope with the increase in exports and imports.

However, transportation under these severe natural conditions with a limited number of vehicles results in pre-mature damage to the vehicles and thereby lowers transport capacity.

The improvement of the operating rate and effective utilization of owned vehicles is essential to securing stability in transportation. The government of Somalia planned the "Maintenance Program of Automotive Workshops" to improve facilities, equipment and materials in the Central Workshop of the Ministry of Land and Air Transport (established in 1925), carry out the reorganization of maintenance technicians, as well supply equipment and materials to the seven main regional workshops under the jurisdiction of the Ministry. It therefore requested grant aid cooperation from the Japanese government for the realization of the plan. The facilities and equipment and materials requested are as follows:

(1) Facilities, equipment and materials in the Mogadishu Central Workshop

1) Facilities

- a) Machine Section
- b) Mechanical Section
- c) Electrical Section
- d) Tire Service Section
- e) Body Repair & Paint Section
- f) Lubrication Section
- g) Others

2) Equipment and materials

- a) Machine Section
Lathe, Boring Machine, Cylinder, Honing Machine, etc.
- b) Mechanical Section
Hydraulic Press, Injection Pump Tester, etc.
- c) Electric Section
Battery Charger, Circuit Tester, etc.
- d) Tire Service Section
Tire Changer, Tire Read Hammer, etc.
- e) Body Repair and Paint Section
Gas Welding Equipment, Paint Spray Equipment, etc.
- f) Lubrication Section
Grease Pump Set, Oil Pump Set, etc.
- g) Others Equipment Section
Engine Stand, Transmission Stand, etc.

(2) Equipment for Hargeisa garage (and other 6 sites)

a) Machine Section

Lathe, Boring Machine, Cylinder, Honing Machine, etc.

b) Mechanical Section

Hydraulic Press, Injection Pump Tester, etc.

c) Electric Section

Battery Charger, Circuit Tester, etc.

d) Tire Service Section

Tire Changer, Tire Read Hammer, etc.

e) Body Repair and Paint Section

Gas Welding Equipment, Paint Spray Equipment, etc.

f) Lubrication Section

Grease Pump Set, Oil Pump Set, etc.

g) Others Equipment Section

Engine Stand, Transmission Stand, etc.

CHAPTER 3 PROJECT DESCRIPTION

CHAPTER 3 PROJECT DESCRIPTION

3-1 Objective

Inferior road conditions and inadequate vehicle maintenance have severely affected the daily life of local inhabitants in Somalia by hampering the delivery of daily necessities to the rural regions. The objective of this project is to upgrade the operations of the Central Workshop by expanding the range of maintenance activities that it can perform. These expanded vehicle maintenance capabilities will serve as an indispensable component in protecting the livelihood of the nation's inhabitants, stabilizing the nation's transportation capacity and ultimately contributing to the overall development of the nation.

3-2 Study on the Details of the Request

3-2-1 The Necessity of Stabilizing Transport Capacity

The dependability of vehicles is a vital link in the domestic transportation system in Somalia. Thus a comprehensive approach for improving and stabilizing the transportation network that connects the centers of economic activity with the local regions must encompass not only the construction and maintenance of roads, but also vehicle maintenance.

Transportation to rural regions requires driving through hot savannas which inflict heavy wear and tear on vehicles. Having to contend with inferior road conditions and a harsh climate makes it extremely difficult to provide a consistent delivery of goods to regions inhabited by nomads and areas where refugee camps are located. Moreover, the need for heavy maintenance, including overhauling, is becoming even greater as an increasing number of government-owned vehicles -- the major component in this delivery network -- require repairs. With present maintenance capabilities falling far short of the rising demand, insufficiently repaired vehicles are forced back into service where they are susceptible to further damage. The result is a rapidly deteriorating transport system that brings increasing hardships on the daily lives of local inhabitants.

Thus, measures taken to stop this vicious circle, improve vehicle operability, and secure reliable transportation capabilities through an

increase in vehicle maintenance capability represent a significant contribution toward stabilizing the livelihood of Somali nationals.

3-2-2 Study of the Project for Improving the Workshop

This is intended to ensure that the grant aid will be applied in the most effective way possible. It is based upon our investigations into the problems in Somalia and our understanding of the content and background of the expressed needs of the Somali government.

Approximately 340 vehicles, of which 52% are manufactured in Japan, are being purchased each year by the Somali government. This percentage of government-owned vehicles made in Japan is expected to increase. These figures include 162 trucks provided to the Somali government under previous grant aid (1984). These vehicles will soon require extensive repairs, and in coming years, corresponding to a certain mileage after their inception and use in Somalia, they will need overhauling. Therefore, there is a clear and vital need for the construction of a maintenance facility equipped to handle Japanese-manufactured vehicles.

The projected maintenance capacity after completion of the Project for Improving the Central Workshop is given below (projections furnished by the Ministry of Air and Land Transport).

	Projected Monthly Capacity Following Completion of the Project (number of vehicles)	Current Maintenance Capacity (number of vehicles)
a) Quick maintenance	100] 50
b) General maintenance	50	
c) Heavy maintenance	20	(20)*

* Presently handled by private repair shop operations

The following three points will be reviewed in light of the above-mentioned objectives;

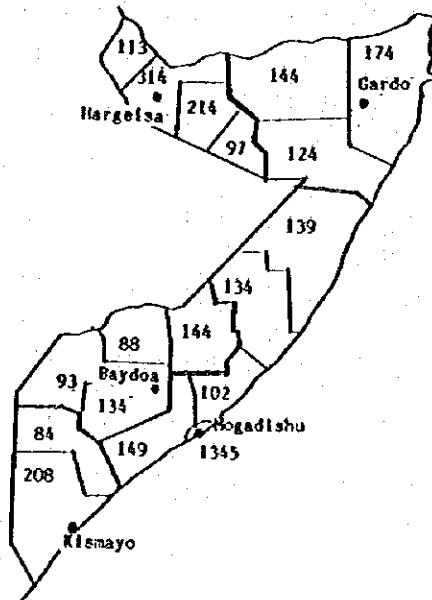
- (1) the number of vehicles to be maintained
- (2) the type of maintenance to be performed
- (3) maintenance equipment

(1) The number of vehicles to be maintained

Government-owned vehicles will be maintained by the Central Workshop and 17 regional workshops. As of 1987, there are 3,800 government-owned vehicles, which represents approximately 10% of the total number of vehicles in Somalia (38,090). (See Fig. 2-4.)

The 3,800 vehicles are currently assigned to the nation's 18 administrative districts. In the chart below, which shows the distribution of the number and type of vehicles being maintained, these districts have been organized into five blocks, each of which is centered around a major city.

Fig. 3-1 Number of Government-Owned Vehicles Assigned to Each Administrative District



(number of vehicles)

Hargeisa block	738	19.4%
Gardo block	442	11.6%
● Mogadishu block	1,869	49.2%
Baydoa block	459	12.1%
Kismayo block	292	7.7%

The distribution of vehicles by type (calculated by the composition ratio) is given below.

Table 3-1 Government-Owned Vehicles According to Type

Type of Vehicle	Composition Ratio (%)	Number of Vehicles (nationwide)	Number Maintained in the Central Workshop (Mogadishu)
Trucks	30.1	1,145	563
Landrover/Pick-up trucks	40.1	1,523	749
Others (crane, bus)	4.9	184	92

In order to calculate the required capacity of the Central Workshop, it is necessary to take into consideration a future increase in the number of vehicles to be maintained at this location. The following calculations assume that the workshop will smoothly operate for a period of five years, and are based on the import record for the most recent five-year period (data includes assistance from foreign nations).

Table 3-2 Vehicles Imported by the Government (1981-85)

VEHICLES IMPORTED BY THE GOVERNMENT
(1981-85)

	1981				1982				1983				1984				1985			
	B/V	M/V	S/V	Tot.	B/V	M/V	S/V	Tot.	B/V	M/V	S/V	Tot.	B/V	M/V	S/V	Tot.	B/V	M/V	S/V	Tot.
Japan	10	39	35	84	7	42	13	62	-	58	39	97	6	45	10	61	152	56	16	224
Fiat	159	5	87	251	12	3	55	70	30	7	27	64	21	15	38	74	17	2	7	26
Germany	41	35	9	85	24	2	8	34	11	10	12	33	2	-	14	16	3	1	3	7
England	-	81	-	81	-	29	-	29	-	80	1	81	6	192	-	198	-	8	-	8
France	-	2	-	2	5	-	3	8	-	18	-	18	-	-	-	-	-	1	-	1
China	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
America	6	-	3	9	4	-	8	12	-	18	-	18	-	-	-	-	-	-	2	2
Romania	2	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	5
USSR	2	5	3	10	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-
	222	167	137	526	52	76	88	216	41	191	79	311	35	252	62	349	177	68	28	273

Note: B/V = large-sized vehicles (trucks)

M/V = medium-sized vehicles (landrovers)

S/V = small-sized vehicles (automobiles)

As shown in Table 3-2, the number of large-sized vehicles owned by the government over the last five years increased by 527 while the number of medium-sized vehicles increase by 754. Of these, 49.2% are being maintained by the Central Workshop at Mogadishu (259 large-sized vehicles and 370 medium-sized vehicles).

Thus, based on the calculations given below, it would seem appropriate to estimate the future annual maintenance capacity of the Central Workshop at Mogadishu at approximately 2,000 vehicles.

○ Large-sized vehicles (trucks and other vehicles)	
(563 + 92) + 259	= 914
○ Medium-sized vehicles (landrovers and pick-up trucks)	
749 + 370	= 1,119
<hr/>	
Total number of vehicles	2,033
to be maintained	

(2) Review of the type of maintenance operations to be performed

The types of maintenance activities to be performed in the workshops to fulfill the objectives established by the Ministry of Air and Land Transport can be classified into the following five categories:

- 1) Inspection and preventive maintenance
- 2) Overhauling
- 3) Parts processing
- 4) Body repair
- 5) Towing damaged vehicles to the workshops for quick servicing

A more detailed examination of these activities follows.

1) Inspection and preventive maintenance

Preventive maintenance will be one of the most important activities at the Central Workshop. At present, a driver is assigned to each government-owned vehicle by the Ministry of Air and Land Transport to voluntarily perform periodic inspections. These inspections are conducted every 10,000~15,000 km and can serve as a positive context for the establishment of an

inspection/preventive maintenance system. It will be necessary to establish a vehicle control system for vehicles under government jurisdiction in which the entry of each vehicle into the workshop and subsequent inspection will be performed pursuant to a coordinated schedule.

The average annual mileage of vehicles in Somalia is 40,000~50,000 km. Although this doesn't appear to be an excessively long distance, the schedule should call for inspections every 20,000~25,000 km, or about every six months, due to the severe natural environment and poor road conditions.

2) Overhauling

Overhauling involves major repairs and renovations that are conducted at the completion of a certain mileage in order to extend the useful life of a vehicle. This includes major work on the engine, the injection pump, the transmission, the differential gear, the brakes, and the suspension systems.

In general overhauling is necessary about every 200,000 km. Therefore, in Somalia, standard procedures should require an overhaul every four years with an annual mileage calculated at 50,000 km.

The 160 vehicles provided to Somalia under Japan's 1984 grant aid will also require overhauling between 1988 and 1989. In addition, since the number of government-owned vehicles during the five-year period beginning 1981 increased at an average of about 340 vehicles per year representing an annual increase of nearly 10%, the basis for calculating the future overhauling capacity will be 10% of the total number of vehicles less the 160 vehicles provided in 1984 ($2,000 - 160 = 1,840$). Unlike the inspection/preventive maintenance activities which will be performed on all vehicles, the priority for overhauling will be on those vehicles with the strongest possibility of extended use as a result of such repairs.

3) Parts processing

Taking into consideration current conditions in Somalia in which a large number of second-hand vehicles are in use and new parts difficult to procure, it is necessary to maximize used parts by reconditioning them. Thus, an extremely important role in Somali maintenance operations will be played by the reconditioning of significant parts such as engine piston rings and crankshafts. This need is attributed to such factors as the shortage of foreign currencies required for the purchase of new parts and the great number of second-hand vehicles in use.

4) Body repair

Body repair becomes essential given the harsh natural environment and poor road facilities. Such work should coincide with overhauling.

The probability of the occurrence of car crashes or malfunctioning is estimated at 10% of the total number of vehicles.

5) Quick servicing for malfunctioning/damaged vehicles

It is often necessary to provide quick, on site repairs or servicing to malfunctioning vehicles or those which cannot be immediately towed away. Thus, the use of repair trucks for quick servicing is increasing.

(3) Review of maintenance equipment and machinery

1) Equipment for the machining section

i) The minimum necessary equipment, featuring a basic structure, will be provided to cover the needs in the engine and brake overhaul section (e.g., high-speed precision lathes). A set of the necessary electric tools will be installed for the following work: engine cylinder processing, cylinder head processing, brake drum processing/renovation/repair.

- ii) A sufficient quantity of easy-to-handle portable tools will be provided for processing, renovation, and repair work.
 - iii) A manual overhead hoist will be provided.
- 2) Equipment for the mechanical section
- i) Tools that are needed for assembling parts during overhauling (prior to processing or renovation work) and for assembling completed parts will be provided.
 - ii) Since the workshop is not equipped with lifts and pits, hydraulic jacks and a rigid rack suitable for the work space will be installed.
 - iii) Equipment necessary for overhauling injection pumps (a complete set includes an injection pump tester, a nozzle tester, nozzle tester accessories, and special purpose tools) will be provided.
 - iv) Hydraulic tools will be installed including an engine stand, a rear axle stand, a deaf jack, a transmission jack, and versatile pullers.
- 3) Equipment for the electric section
- Electric tester, including bench testers, engine testers, and battery charge testers, as well as necessary portable repair tools will be installed.
- 4) Tire service equipment
- Most of the equipment to be provided for this section will consist of manual tools with only the minimum necessary large-scale equipment to be supplied. A sufficient quantity of expendable supplies (e.g., tube repair sets) will also be provided.
- 5) Body work and paint equipment
- i) The major provision for this section will be gas welding equipment which will require acetylene generators (soluble acetylene is not available in Somalia). Electric welding

equipment of approximately 300A capacity will be selected in place of large-scale models.

ii) The priority for selection of equipment needed for body work and repair (including shearing machines, bending machines, hydraulic presses, and pullers) will be on medium-scale models that feature easy after-purchase upkeep.

iii) In consideration of economy and ease of maintenance, two sets of medium-scale air compressors, specifically designated for use in the body shop, will be installed instead of one large-scale model.

iv) Paint-related equipment will consist solely of basic tools.

v) Seat repair equipment will consist of industrial sewing machines and hand tools.

6) Lubrication equipment

For easy maintenance and administration, lubrication equipment will be independently installed instead of employing an integrated system. Basic structured models with little susceptibility to breakdown will be selected in addition to the provision of inspection and maintenance tools.

7) Emergency equipment and other equipment

i) 2 forklifts will be provided to facilitate the in-house transport of heavy parts and components.

ii) Small-scale cranes and wreckers (1.5-ton) will be sufficient since the majority of vehicles to be towed are medium-sized patrol vehicles and landrovers. Medium-scale models (5-ton) would offer the most economical option for servicing trucks, dump trucks, and water tank trucks.

iii) Administration facilities for tool parts that will be installed (including tool shelves, parts storage units, writing desks, and chairs) will feature basic structures.

- iv) Spare parts and special-purpose tools will conform to the specifications of Japanese-made vehicles, which represent over half of the vehicles to be maintained.
- v) Consideration will be given to providing spare parts for equipment which has a high frequency of use and the procurement of which is deemed difficult in Somalia.

3-3 Project Outline

3-3-1 Implementing Agency and Administration System

The Somali agency for the execution of the project is the Ministry of Land and Air Transport, while the project will be implemented in close negotiation with its General Directorate for Maintenance and Workshops. The administration of the workshop after completion of the project will be performed by the General Directorate.

Fig. 3-2 Organizational Structure of the Implementing Agency

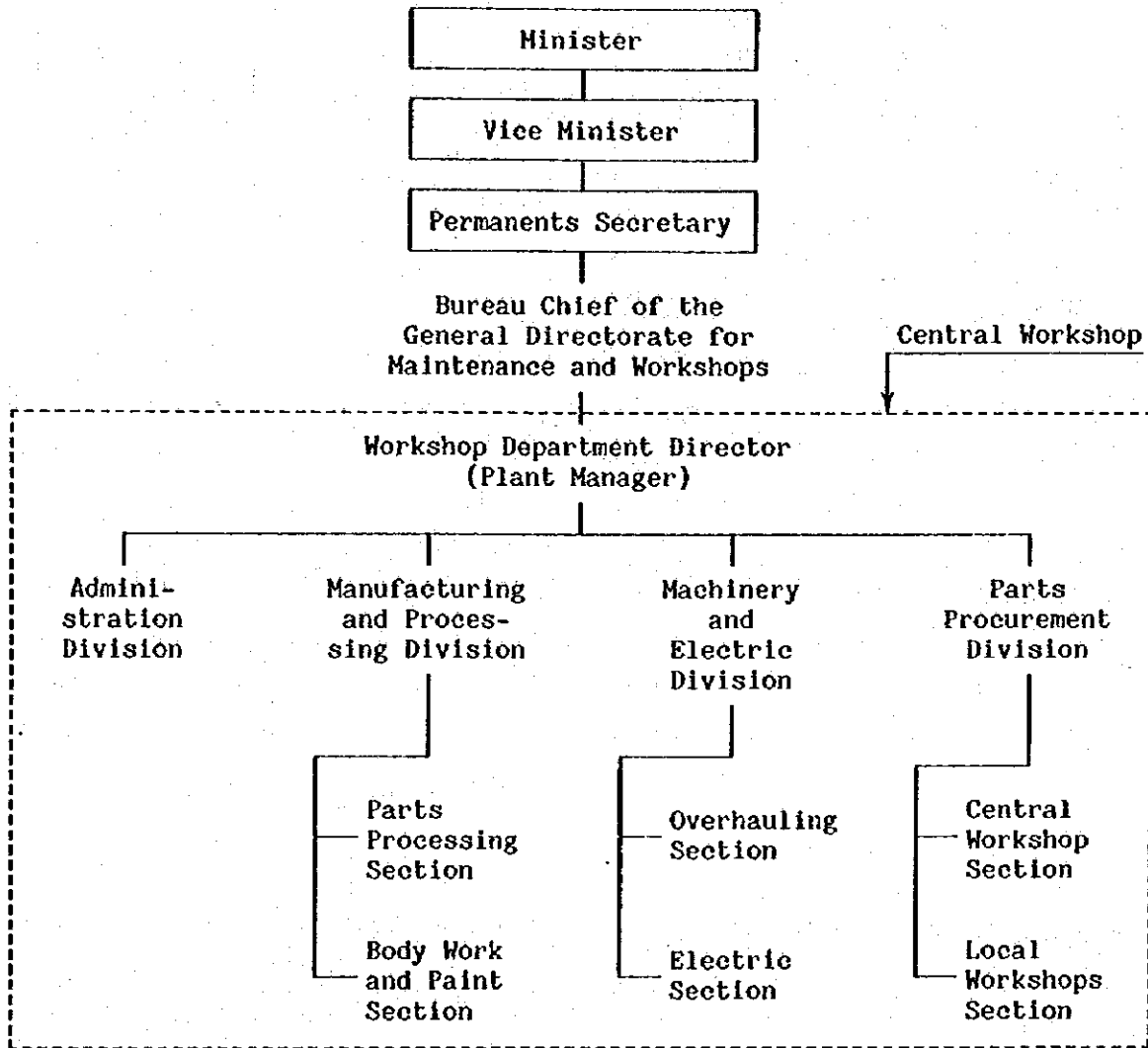


Table 3-3 serves as a reference point in estimating operating expenses by indicating the annual budget of the Ministry of Land and Air Transport along with the percentage spent on the workshop sector for the last three years.

Table 3-3 Annual Budget of the Ministry of Land and Air Transport and the Workshop Sector

Year	(A) Ministry of Land and Air Transport Budget (Somali shillings)	(B) Workshop Sector Budget (Somali shillings)	Ratio of (B) to (A) (%)
1985	76 million	41 million	53.9
1986	86 million	46.5 million	54.0
1987	113 million	66 million	58.4

In each fiscal year, the workshop budget occupies more than 50% of the ministry's budget. An examination of specific expenditures (1987) reveals that the cost of fuel and spare parts stand at the top with 32% for each of these two categories, followed by machinery costs at 9%, facilities maintenance costs, 7.5%; wages, 7.5%; and insurance and other expenses, 6%. Since the project will be implemented on the existing site and will include a reduction in the floor area of currently standing buildings, there should be little increase in the maintenance/machinery costs, while the ratio represented by wages and spare parts is expected to increase.

3-3-2 Basic Plan

The focus of this project is the capacity of the Central Workshop to handle medium- to large-scale models of government-owned vehicles which represent a variety of makes and models from different nations. During the five-year period between 1981 to 1985, the major manufacturing nations from which government-owned vehicles were imported (in order of decreasing volume) are Japan, Great Britain, Italy, and West Germany. With the number of vehicles imported from Japan expected to increase, it will be necessary to take this trend into consideration when establishing the maintenance schedule of the workshop.

In terms of the kinds of maintenance activities to be performed, the inspection and preventive systems are seen to be extremely essential. The preparation of complete records for the inspection of each vehicle at designated intervals of time or mileage will not only facilitate a systematic record of their condition and wear, but will also enable an efficient vehicle control system. Identifying the areas of vehicle breakdown at an early stage will help to reduce the labor required for

maintenance. Although vehicle inspections are currently performed every 15,000 km at the Central Workshop, including the preparation of records for each vehicle, they continue to be conducted on a voluntary basis by specialized drivers assigned to each vehicle and has yet to be established as an official system. The project intends to promote this practice into a fully developed system through the upgrading of the workshop's maintenance facilities.

In view of current conditions surrounding the procurement of parts, the processing of parts will be of great significance in Somalia. With the large number of second-hand vehicles in use, the reconditioning of used parts constitutes an important government policy enabling Somali mechanic to apply their techniques for processing parts. The installation of appropriate processing machinery will enhance their technique as well as the quality of reconditioned parts. It will also enable the manufacture of more durable parts and thereby contribute to the development of the processing technology.

3-3-3 Project Site Description

(1) Overview

The project site is defined as the existing site of the Central Workshop of the Ministry of Air and Land Transport which is located at the east end of the central government office section in Mogadishu. The site is located on a street corner with main roads on two sides of the site and facilities of the Ministry of Public Utilities and Housing adjacent to the other two sides. Diagonally opposite the site is the WAGAD Workshop. Other private workshops are scattered throughout the area. The L-shaped site has an area of 13,253 m².

(2) Infrastructure

The following paragraphs describe the infrastructure for the site, including electricity, telephone, and water supply.

1) Electricity

Administered and controlled by the Ente Nazionale Energia Elettrica (ENEE).

Although Mogadishu has a power generating capacity of 43.4 MW, electric service to the site is not presently adequate due to the ongoing renovation of power generators.

Due to the ongoing conversion of the electric supply network in the metropolitan area into 15,000V, the current supply line to the site (3,000V/50 Hz) will be upgraded in the project to 15,000/50 Hz (3-phase, 3 lines).

2) Telephone

Telephone service is under the jurisdiction of the Ministry of Posts and Telecommunications.

Prior to 1986, the switchboard capacity in Mogadishu was 6,400 lines. The completion of an 8,000-line manned telephone exchange and a 900-line unmanned telephone exchange significantly expanded this capacity.

3) Water supply and sewage

Water supply

Administered and controlled by the Mogadishu Water Agency. Mogadishu has five deep wells including those currently under construction. All water supplies are dependent on deep wells. The completion of those now under construction will resolve the current gap in water pressure between day and nighttime usage and provide a consistent pressure supply.

The roads bordering the site are provided with a four inch city water pipe (with two inch intake pipes accepted within the site). Thus, there is a sufficient daily water supply.

Sewage

Under the jurisdiction of the General Directorate for City Water, Ministry of Public Utilities

Percolation-system sewage disposal tanks are used in Mogadishu. There is no control system for the drainage of rainwater.

3-3-4 Outline of Facilities and Equipment

The following sections describe the composition of the main facilities and equipment in the project.

(1) Main facilities

The following table indicates the required buildings in the project.

Buildings	Operations
Maintenance Building	1) Overhauling 2) Parts processing and maintenance 3) Body maintenance 4) Storage of replaceable parts and work tools
Body Repair and Paint Building	5) Body repair and painting
Inspection and Maintenance Building	6) Preventive inspection
Garage in the Body Repair and Paint Building	7) Service for malfunctioning or crashed vehicles
Administration Building	8) Administrative and educational operations
Guard Building	9) Administrative operations
Pump Building	10) Water supply and vehicle washing services
An Existing Building will be Utilized	11) Tire services
Garage Building	12) Storage of vehicles under repair

(2) Major maintenance equipment

	Items	Quantity
1) Maintenance workshop		
Parts Processing	1. Work table and vise	4
	2. Parts cabinet	2
	3. Tool shelf	2
	4. Lining rivetter	1
	5. Hydraulic press	2
	6. Brake drum lathe	1
	7. Lathe	1
	8. Electric hacksaw machine	1
	9. Bench drill	1
	10. Bench grinder	1
	11. Parts washing stand	1
	12. Crankshaft grinding machine	1
	13. Cylinder boring machine	1
	14. Cylinder honing machine	1
	15. Valve sheet grinder	1
Overhauling	1. Engine overhaul stand	2
	2. Parts washing stand	2
	3. Work table and vise	5
	4. Bench grinder	1
	5. Bench drill	1
	6. Tool shelf	2
	7. Rear axle stand	1
	8. Differential stand	1
	9. Hydraulic press	1

- 10. Electric welder 1
- 11. Parts cabinet 1

**Injection Pump and
Parts Washing**

- 1. Parts washing stand 1
- 2. Work table and vise 1
- 3. Nozzle tester 1
- 4. Fuel injection tester 1
- 5. Parts cabinet 1
- 6. Hot car washing machine 1

**Battery and Electric
Maintenance**

- 1. Air compressor 2
- 2. Water purifier 1
- 3. Battery charger 3
- 4. Bench drill 1
- 5. Bench grinder 1
- 6. Work table and vise 1
- 7. Tool shelf 1
- 8. Test bench 1

2) Body workshop

Body repair

- 1. Air compressor 2
- 2. Work table and vise 4
- 3. Paint shelf 1
- 4. Dryer 2
- 5. Tire changer 1
- 6. Shearing machine 1
- 7. Bending machine 1

8.	Hydraulic press	3
9.	Bench drill	2
10.	Bench grinder	2
11.	Electric welder	4
12.	Electric spot welder	2
13.	Sewing machine	1
14.	Gas welding machine	3

3) Lube and inspection shop

Inspection and Lubrication

1.	Grease pump	3
2.	Oil pump	6
3.	Work table and vise	1
4.	Air stand	1
5.	Waste oil receiver	2

3-3-5 Spare Parts

The 1987 spare parts budget set up by the Ministry of Land and Air Transport is 21 million Somali shillings, which is a 50% increase over the previous year's budget of 14 million Somali shillings. There are two purchase routes for spare parts: direct import through foreign currencies payments and purchase through agents on the basis of domestic currency transactions. However, the purchase of parts for large-scale vehicle models is difficult due to such factors as limited allocation of foreign exchange and shortages of products in the domestic market. The Ministry of Land and Air Transport has not yet found a way to effectively counter these problems. Under these circumstances, the storage and administration of spare parts are being stringently performed at the Central Workshop.

From the perspective of vehicle maintenance, the use of inferior parts not only creates distributions in the flow of maintenance, but also causes the premature scrapping of vehicles that would otherwise operate effectively for a considerably longer period of time. The smooth and successful

administration of the Central Workshop led by raising the efficiency of vehicle maintenance will greatly depend on establishing a system ensuring the timely procurement of parts. It will be especially essential to stock spare parts for vehicles manufactured in Japan with the recent dramatic increase in the numbers of such vehicles.

3-3-6 Personnel Plans

The General Directorate for Maintenance and Workshops of the Ministry of Land and Air Transport is composed of the following four divisions which are grouped according to the type of work: the Administration Division, the Manufacturing and Processing Division, the Machinery and Electric Division, and the Parts Procurement Division. However, the project will require a reorganization of the General Directorate staff into appropriate work teams since the monthly maintenance capacity will be expanded to 170 vehicles (100 vehicles requiring quick servicing, 50 vehicles needing general maintenance, and 20 vehicles requiring heavy repair work). The following work teams will be necessary to achieve these maintenance objectives:

Composition of Work Teams

◦ Overhauling teams (for engine and chassis)		
4- to 5-man teams consisting primarily of highly skilled mechanics	4 to 5 teams	16 to 30 persons
◦ Body repair/paint teams (for body repair)		
5- to 6-man teams consisting mainly of highly skilled mechanics	4 to 5 teams	20 to 30 persons
◦ Parts processing team (for machinery processing)		
4-man team consisting mainly of expert mechanics	2 teams	8 persons
◦ Injection pump testing team		
4- to 5-man team consisting mainly of expert mechanics	1 team	4 to 5 persons
◦ Electric team (4 to 5 men)	2 teams	8 to 10 persons
◦ Parts administration team		5 to 6 persons
◦ Plant administration team (consisting mainly of foremen)		10 to 20 persons
<hr/>		
Total		71 to 109 persons

When this configuration of teams is compared with the existing number of personnel in the Central Workshop, it would appear to be possible to reorganize the 89 staff members into these teams, provided that sufficient consideration is given to the proficiency of each staff member.

3-4 Technical Cooperation

At present, 89 staff members are working for the Mogadishu Central Workshop. This number is sufficient to cover the manpower requirements after completion of the project without employing additional personnel.

However, it will be essential to introduce new maintenance technologies and to generally upgrade administrative capabilities in order to significantly improve the quality of maintenance.

The government of Somalia is requesting the technical cooperation of Japan to develop the potential skills of Somali mechanics by fully expanding the maintenance operations of the workshop. The Precise coordination of administrative functions required by this project will raise the capacity of the workshop to a satisfactory standard.

The assignment from Japan of one expert from each of the following fields is deemed as an appropriate response to this need for technical cooperations:

- Vehicle maintenance : One person
- Plant administration : One person

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4-1 Design Concept

Based on the site survey results, the following are the basic principles of the design:

- (1) Considering future plans and environments, the effective utilization of the site shall be studied in accordance with the design concept.
- (2) To adapt to the climatic conditions and living standards, and considering the level of construction techniques available for the site, local construction methods and materials shall be used as much as possible.
- (3) Buildings are to be as functional and efficient as possible and construction costs minimized.
- (4) For the operation, maintenance, and control of buildings, attention shall be given to the selection of materials, construction processes and equipment so that the maintenance and control are simplified and the running cost remains low.
- (5) The overall plan is to effectively utilize the existing buildings.
- (6) Maintenance equipment shall be chosen for its durability and easy running and operation.
- (7) In planning to implement the above-mentioned design concepts, considerations shall be made periodically to determine if the level of quality of work meets with the requirements of the grant aid program.

4-2 Study of Design Conditions

Among the above-mentioned design concepts the following items shall be studied:

(1) Natural conditions

1) Solar radiation

Rooms such as offices, etc. shall be suitably constructed to minimize influences by solar radiation through roofs and walls, and to reduce air-conditioning running costs.

2) Salt damage

Mogadishu suffers salt damage due to the wind from the Indian Ocean and for that reason, structural steel frames shall be galvanized and roof folding planks fluoridization treated.

3) Aggregates

As gravel and sand to be used at the site contain salinity, the gravel shall be washed in water, and sand with comparatively little salinity used.

(2) Local construction conditions

1) The consulting engineering agency

It carries out the planning and design of construction work and the removal of governmental facilities, and calculates costs. It calculates the cost for removal of existing facilities for this project, and supplies the data, to determine the budget, to the Ministry of Treasury and the Ministry of Land and Air Transport.

2) Application

The client (in this case, the Ministry of Land and Air Transport) submits the construction plan to the Ministry of Public Work and Housing. A construction permit is not required.

4-3 Basic Plan

4-3-1 Study of Floor Area Requirements

When the number and size of the bays of the vehicle maintenance workshop are determined, the scale of the maintenance machinery, facilities and rooms can be established.

The Central Workshop will have an annual maintenance capacity of 2,000 vehicles. The specific activities of this work can be classified into five categories: preventive inspection, parts processing, body work, and service for damage/disabled vehicles. The following paragraphs will review the hours of operation necessary for repair bays.

Given below are the hours of operation according to type of maintenance work as evaluated by means of a survey conducted in Somalia. Due to inadequate technique and an insufficient supply of parts, the number of hours required for each type of work appears to be about 1.3 times that for similar operations in Japan.

Type of Work	Number of Hours (Somalia)	Number of Hours (Japan)
i) Preventive inspection	At least 4 hours per vehicle	
ii) Overhauling		
Engine	106	81
Injection pump	20	15
Emission system	42	32
Differential gear	33	25
Other	39	30
Total	240	
iii) Body repair (Body overhauling)	156	120

The number of repair bays required has been calculated as follows based on the above-mentioned hours of operation.

Formula for calculating the number of bays=

$$\frac{\text{Standard hours of operation} \times \text{Number of vehicles handled} \times \text{Frequency of periodic maintenance}}{\text{Total hours of operation during a given period}}$$

i) Number of required bays for preventive inspection

$$\frac{4 \text{ hours} \times 2,000 \text{ units} \times 2 \text{ times/year}}{300 \text{ days/year} \times 7 \text{ hours/day}} = 7.6 \text{ bays}$$

ii) Number of required bays for overhauling

$$\frac{240 \text{ hours} \times 344 \text{ units}^{*1}}{300 \text{ days/year} \times 7 \text{ hours/day}} \times \frac{1 \text{ time}}{4 \text{ years}} = 9.8 \text{ bays}$$

$$*1 (2,000 - 160) \times 10\% + 160 = 344$$

iii) Number of required bays for body work

$$\frac{15.6 \text{ hours} \times 200 \text{ units}^{*2}}{300 \text{ days/year} \times 7 \text{ hours/day}} = 14.8 \text{ bays}$$

$$*2 10\% \text{ of traffic accidents per total number of vehicles (2,000).$$

Thus, the total number of required bays are:

Preventive inspection	7.6
Overhauling	9.8
Body repair	14.8
<hr/>	
Total	32.2 ---> 32 bays

Therefore, the basic number of required repair bays for this project is 32.

Thirty-two vehicle maintenance bays are required, which are to be provided with electricity, plumbing, compressed air and maintenance equipment and materials. However, according to the maintenance work, some bays need not have these ancillary facilities, and may be used for vehicles awaiting repair, resulting in increased efficiency. Therefore, the six vehicles awaiting repair will use bays without facilities, and 26 vehicles will use the fully equipped bays for maintenance and materials.

Bay size

The maximum size to accommodate the objectives of the maintenance in the workshop, are as follows:

	Width (m)		Length (m)
◦ Japanese manufactured dump truck (6t)	2.100	x	6.805
◦ Japanese manufactured cargo truck (6t)	2.375	x	7.855
◦ Japanese manufactured water tank truck (6t)	2.280	x	7.200
◦ Foreign manufactured cargo truck (8t)	2.480	x	9.680

Since approximately 1.5 meters is required on all four sides of the vehicle to facilitate maintenance space, the bay size shall be 5.000m in width and 11.5000m in length, and a roof overhang of 1.5m shall be added. Since work space is required for equipment and materials along the interior walls of the body workshop, the bay size in the bodyshop sector shall be 5.000m in width and 13.5000m in length.

Each building, the rooms necessary for maintenance workshop facilities, their functions and planned areas are as follows:

Table 4-1 Required buildings and rooms

a) Maintenance workshop

Room	Planned floor area	Functions
Compressor room	30 m ²	To supply compressed air for maintenance, and to prevent noise, the room will be devided.
Parts cleaning shop	40 m ²	To wash parts w/kerosene and water.
Fabrication shop	200 m ²	To work and repair crankshafts, engines, etc. to crankshaft grinders, boring machines and honing machines.
Fork lift and Jack yard	100 m ²	Parking area for fork lift trucks. Storage for garage jacks, engine jacks, transmission jacks and portable jacks.
Machine shop	200 m ²	Heavy maintenance of drive components and parts washing
Injection pump tester room	30 m ²	Washing of injection pump for Diesel engine. Division is required, to eliminate dust and high temperature.
Storage keeper	40 m ²	Storage and lending of general tools and special tools used by mechanics
Repair shop	805 m ²	Space to assemble and disassemble works (heavy maintenance) units like engines, transmissions, etc. General maintenance is carried out.
Passage	229.5 m ²	The width (approx. 3m) that forklift trucks and jacks can travel is required.
Battery service room	20 m ²	Battery charging
Electrical parts room	50 m ²	Repair and test of electrical system parts
Workshop office	78 m ²	Control of tools and replacement parts
Tool storage	50 m ²	To prevent misplacement tools must be issued by central storage for temporary use and returned.
Special tool storage	30 m ²	Tools for overhauling
Spare parts storage	180 m ²	Replacement parts storage
Sub-total	2,082.5 m ²	

Table 4-1 (Continued)

b) Body workshop

Room	Planned floor area	Functions
Paint storage	12 m ²	The storage, weighing and preparation of paints are carried out.
Compressor room	12 m ²	One (1) unit is installed for painting, and the room is partitioned for noise prevention.
Paint preparation room & paint shop	135 m ²	The room is divided, to eliminate dust, and the booth and preparation room are partitioned by a curtain.
Body shop	567 m ²	Body repairs. It shall be positioned so as not to transfer work noise to another sector.
Uphoistery shop	26 m ²	For seat repair, two (2) industrial sewing machines are installed.
Tool storage	35 m ²	Body and seat repair tools are stored.
Carpentry shop	67.5 m ²	Repair of truck beds, side boards, etc.
Garage for service vehicles	270 m ²	Wrecker trucks, mobile work trucks and crane trucks from the central maintenance workshop are housed.
Number plate shop	30 m ²	The production of license plates is done by the central repair workshop.
Jack yard	28 m ²	Storage of garage jacks and gas cylinders
Storage keeper and trouble shooter's office	32.5 m ²	Repair reception and waiting area for troubleshooters and vehicles.
Power room	67.5 m ²	Lead-in receiving and transformer facilities and generators are installed.
Sub-total	1,282.5 m ²	

c) Garage

Room	Planned floor area	Functions
Disabled vehicle garage	345 m ²	Vehicles whose components such as engine, etc. are removed at the maintenance workshop are stored during the period of repair. It serves to promote the effective operation of the maintenance workshop.
Pump room	24 m ²	To pump general living water and well water for car washing to an elevated water tank.
Washing tool storage	45 m ²	Storage for washing tools
Sub-total	414 m ²	

Table 4-1 (Continued)

d) Administration building

Room	Planned floor area	Functions
(1st floor) Corridor, staircase and toilet	62 m ²	Access to second floor is possible without disturbing first floor activities.
Pantry	21 m ²	Only tea service is provided.
Rooms related fo the lecture	130 m ²	Lecture rooms, technical assistance staff, etc.
Passage	60 m ²	Interconnecting passages to the adjacent small vehicle repair workshop
(2nd floor) Terrace, staircase and toilet	90 m ²	Rest area for trainees
Administration offices	127 m ²	Workshop administrators room, secretary rooms.
Sub-total	490 m ²	

e) Guard house and infirmary

Room	Planned floor area	Functions
Guard room	36 m ²	Night guards and daytime guards. (8 persons.
Medical room	45 m ²	When staff of 50 or more men is required.
Sub-total	81 m ²	

Table 4-1 (Continued)

f) Lube and inspection shop

Room	Planned area	Functions
Lube and inspection shop	150 m ² (2 bays)	Periodical inspection and repair space
Storage	20 m ²	The tools for the above, etc. are stored.
Locker room	48 m ²	To change into maintenance clothes.
Rest and shower room	55 m ²	Hot water supply for showers is unavailable.
Corridor	27 m ²	
Sub-total	300 m ²	

The respective floor areas are as follows:

Building designation	Floor area (m ²)
a) Maintenance workshop	2,082.5
b) Body workshop	1,282.5
c) Garage	414
d) Administration building	490
e) Guard house and infirmary	81
f) Lube and inspection shop	300
Total:	4,650 m²

However, parts of the existing buildings are utilized as a garage for scrap goods and a tire and air service shop.

Garage for scrap goods	310 m ²
Tire and air service shop	127
Total:	437 m²

The total floor area of part of the new construction and that of the existing area is 5,087 m², and the approximate building coverage is 38.0%. It is to be considered that the balance between the building and the site

area, for the construction of a maintenance workshop for large vehicles, is 13,253 m² of the site area.

4-3-2 Plot Plan

(1) Buildings and facilities

In view of the objectives and placement of this plan, and from the site survey results, the required facilities are the administration zone, repair and inspection zone, spare parts storage zone and garage zone. Considering the functions and relation of each zone, it shall be composed mainly of the following buildings and facilities:

- Administration zone: Administration building and guard house and infirmary
- Repair and inspection zone: Maintenance workshop, body workshop and lube and inspection shop.
- Spare parts storage zone: Considering its functional relation, it is attached to the repair and inspection zone.
- Garage zone: Garage

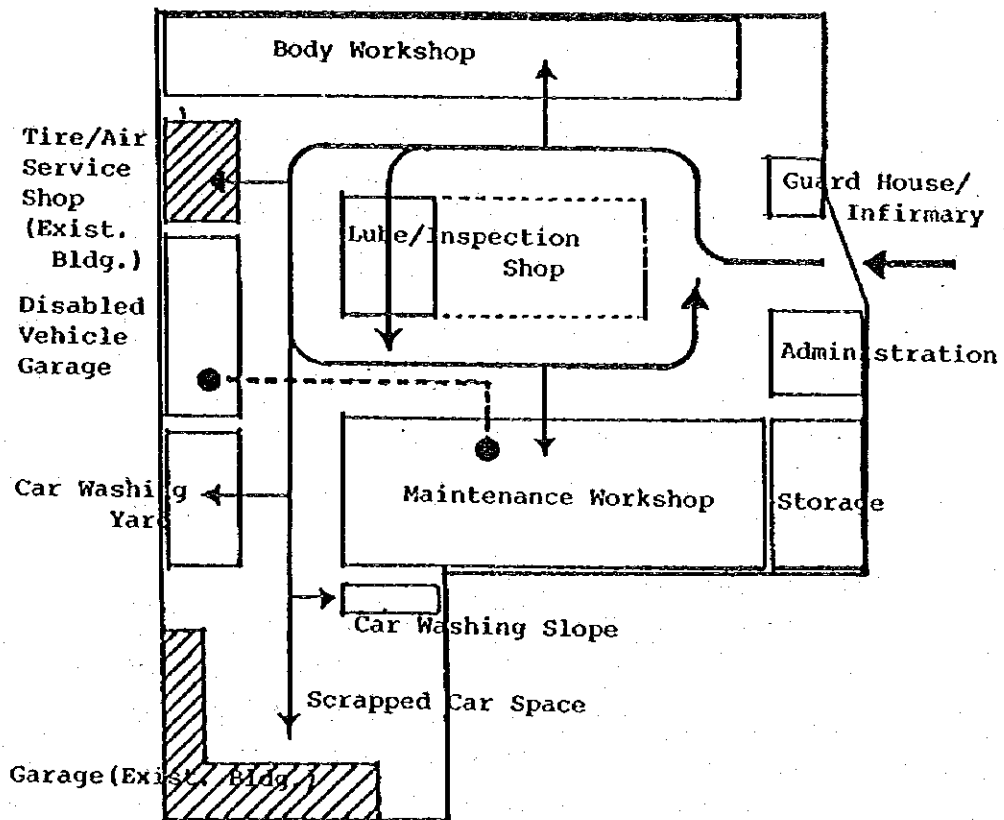
(2) Buildings layout

The above-mentioned facilities are studied along with the following basic policy:

- 1) Bearing in mind the survey reports of the existing facilities, the utilization of buildings in part is planned.
- 2) The functional layout of the workshop facilities and yard space is based on the turning circle of large trucks.
- 3) The body workshop shall be separate.

- 4) Considering the results of preventive maintenance, the lube and inspection shop is layed out in such a way that vehicles can pass through easily and quickly.
- 5) For efficient maintenance work, the repair and inspection sector is a one-story structure.
- 6) Scrapped car space and car washing station shall be layed out behind buildings out of sight.

Fig. 4-1



4-3-3 Building Plan

(1) Planning

An examination of the layout plan and building plan is as follows:.

- A clear zoning and a functional traffic line are planned.
- The inspection and maintenance shop to be constructed so that vehicles can easily pass through.
- Tools and replacement parts are adequately stored so that a centralized control can be made.
- Vehicles involved in removing maintenance equipment are housed. A garage for waiting is installed.
- The control and operation sector is arranged in a convenient position near the entrance, and a lecture room attached.
- A car washing station (raised platform type) for washing around the chassis is provided.
- Locker, toilet and shower rooms are provided between the maintenance workshop and body workshop for the convenience of maintenance staff.

(2) Structural design

1) Outline of the structure

a. Structural frame

The on-site main construction materials of cement, reinforcing bar, structural steel, etc. are imported; small diameter reinforcing bar are readily available, with the exception of large diameter reinforcing bar and heavy weight structural steel. For this reason, the use and combination of construction processes such as the reinforcing concrete block construction, steel frame concrete construction or the combination of a wooden truss roof or reinforcing steel truss roof, is common. Considering the above-mentioned, since a large span is required for the workshop, it shall be

reinforced steel construction, and for buildings of a comparatively small span, like Administration building, a reinforcing steel truss roof shall be attached to the reinforcing concrete block construction (in a partial reinforced concrete construction). Utilizing this, the required building regulations can be fully satisfied, and there is no problem in any areas for the general construction at this site. The building are indicated below:

- Maintenance workshop:
24.5m x 85m, Steel frame structure, One-story
- Body workshop:
13.5m x 95m, Steel frame structure, One-story
- Lube and inspection shop:
15m x 20m, Steel frame structure, One-story
- Administration building:
15m x 15m, Reinforced concrete block structure with steel structural roof, Two-stories
- Guard house and infirmary:
9m x 9m, Reinforced concrete block structure with steel structural roof, One-story
- Garage:
11.5m x 36m, Steel frame structure, One-story

b) Soil condition and foundation structure

A test excavation (1m of diameter and 1.7m of depth) was made at the site, and as a result, well-compacted fine sand was found to be uniformly distributed just below ground level. Further, the foundation level of the surrounding building is approximately 1m from ground level, and that neither settlement due to consolidation nor differential settlement is evident. The ground-water level is located at 20 to 25m below the ground surface, and does not exert any influence upon the ground bearing force.

Since the planned building is a partially large span one-story construction, and the roofing is light weight folding plank, the sand layer approximately 1m from the ground surface should be made as a direct foundation for the supporting layer. The design ground bearing force shall be 15.0 t/m² from the above-mentioned survey result, data from the guidance of Architectural Institute of Japan (AIJ), etc. Further, first floor slabs shall be earth floor slabs that are common at the site. However, prior to the construction, the plate loading test will be conducted at the earth floor bottom level, and the soil bearing capacity confirmed.

2) Structural design concept

The Somali Democratic Republic laws, regulations and standards on structural design have not been stipulated, and mainly American and English design laws are adopted for large-sized buildings at the site. This was due to historical and geographical reasons, whereby the majority of construction works in Somalia, have been carried out by Europeans and Americans. However, due to the fact that main structural steels are supplied from Japan, and it has been confirmed by the site survey team that there is no problem in correspondence with the Somali officials, Japanese design laws (Standard of Japan Architecture Academy, etc.) are to be adopted. Further, in the actual design, which considers fully the characteristics of the site, the wind pressure, seismic force, etc. are set, it is assured that the building will be safe, durable and economic.

3) Design load

a. Dead load

The weight of structural materials, finishing materials and equipment are calculated, and the unit weight of basic materials of the structure shall be as follows:

Concrete	2.3 tons/m ³
Reinforced concrete	2.4 tons/m ³
Mortar	2.0 tons/m ³

Steel frame	7.85 tons/m ³
Concrete block (19 cm x 19 cm x 39 cm)	300 kg/m ²

b. Live load

As the roof has no hanging load, the weight shall consist only of the materials used. First floor slabs are directly poured on earth surface. Second floor slabs used partially for offices, etc. shall be as follows:

Table 4-2 Live load (kg/m²)

Designation	For slab and beam	For column, girder and foundation
Roof	30 kg/m ²	10 kg/m ²
Offices, etc.	300 kg/m ²	180 kg/m ²

c. Wind load

Since there are no design standards in Somalia, the design wind load used for the building is determined by available data, guidance and information from various countries, etc.

In general, the strong wind safety factor for buildings varies according to the buildings construction life, and there is a recurrence interval of strong wind to use as a scale. Therefore, the AIJ gives the following guidelines according to the applications of buildings:

- (I) Extremely important buildings 150 years
- (II) General buildings other than (I) and (III) 50 years
- (III) First-aid and temporary buildings 15 years

Further, the United States, England and Australia have a recurrence interval of 50 years similar to general buildings, classification.

According to the meteorological observation data for the site, the average maximum wind speed is 8.7 m/s (January

1971). Further, when obtaining the average maximum wind velocity by the expected value for 50 years of recent data, (from January, 1981 till June, 1981) in accordance with the guidance of the AIJ, it is of approximately 9.5 m/s. However, this is the average, and differs from the maximum instantaneous wind velocity. In fact, in 1964 a cyclone hit the northeast of Somalia, and in Aura which was on the course the cyclone took the maximum instantaneous wind velocity was 200 km/h (55.5 m/s). Therefore, the design wind speed used by a European architectural consultant at the site adopted 120 km/h (33.3 m/s) in the city of Mogadishu.

Taking this information into consideration, the design wind speed shall be 33.3 m/s. From this, the velocity pressure is calculated.

$$q = 1/2 \rho v^2$$

q: Velocity pressure (kg/m²)

f: Air density (kg·sec²/m⁴) f = 0.125

v: Wind velocity (m/sec) v = 33.3

$$*q = 1/2 \times 0.125 \times 33.3^2 = 69.3 \text{ kg/m}^2$$

That is to say, 70 kg/m² is adopted as the design velocity pressure.

Although a low building has been used for this example, wind velocity distribution shall be uniform with an increase in the height.

d. Seismic load

Within the territory of Somalia, seismic activities have not been recorded, however in Uganda, 900 km west of Mogadishu, the most recent earthquake with a magnitude of 7 was recorded. Therefore, since the seismic load to a degree is smaller than the wind load in the building to be designed, the earthquake is not taken into account.

4) Main material and allowable stress

Table 4-3

Material	Standard	Long-term allowable stress (kg/cm ²)			Short-term allowable stress (kg/cm ²)		
		Com- pres- sion	Ten- sile	Shear	Com- pres- sion	Ten- sile	Shear
Concrete	F _c = 180 kg/cm ²	60	-	6	120	-	9
Reinforcing bar	SD30 (JIS)	2,000	2,000	2,000	3,000	3,000	3,000
Structural steel	SS41 (JIS)	1,600	1,600	900	2,400	2,400	1,350

Since aggregates for concrete, sea sand and crushed coral are used and the salt damage of reinforcing steel may be foreseen, washing in water shall be less than the allowable value (equivalent to JASS 5, class II). Care shall be taken also in the proportion of concrete used and in the design of concrete members. Likewise, structural steel, since severe natural conditions of sea wind, etc. are foreseen, rusting of galvanization, etc. is considered.

(3) Utilities plan

1) Water supply, sanitary and sewage plan

i) Water supply facilities

Public city water and well water are used as water source, and is supplied to various places by the gravitation type elevated water tank. Since the water supply service pipe in the existing facilities is 25 mm in diameter, it is necessary to replace it with the water supply service pipe of 50 mm.

a. Water supply requirement for living

Administration building	12 persons × 150 ℓ/person·day = 1,800 ℓ/day
Maintenance workshop and body workshop	80 persons × 150 ℓ/person·day = 12,000 ℓ/day
Lube and inspection shop	10 persons × 150 ℓ/person·day = 1,500 ℓ/day
<hr/>	
Total	= 15,300 ℓ/day

b. Water supply requirement for workshop

Used for car washing, parts washing sector, etc.

Number of car (units) washed	20 units/day
Water volume required per car wash	400 ℓ/unit
Parts washing machine	1,300 ℓ/h
Operating time	3 h/day
Faucets in 11 places	150 ℓ/h
Water supply requirement	

$$400 \text{ ℓ/unit} \times 20 \text{ units/day} + 1,300 \text{ ℓ/h} \times 3 \text{ h/day} + 150 \text{ ℓ/h} \times 7 \text{ h/day} = 12,950 \text{ ℓ/day}$$

c. Calculation of water reservoir tank capacity

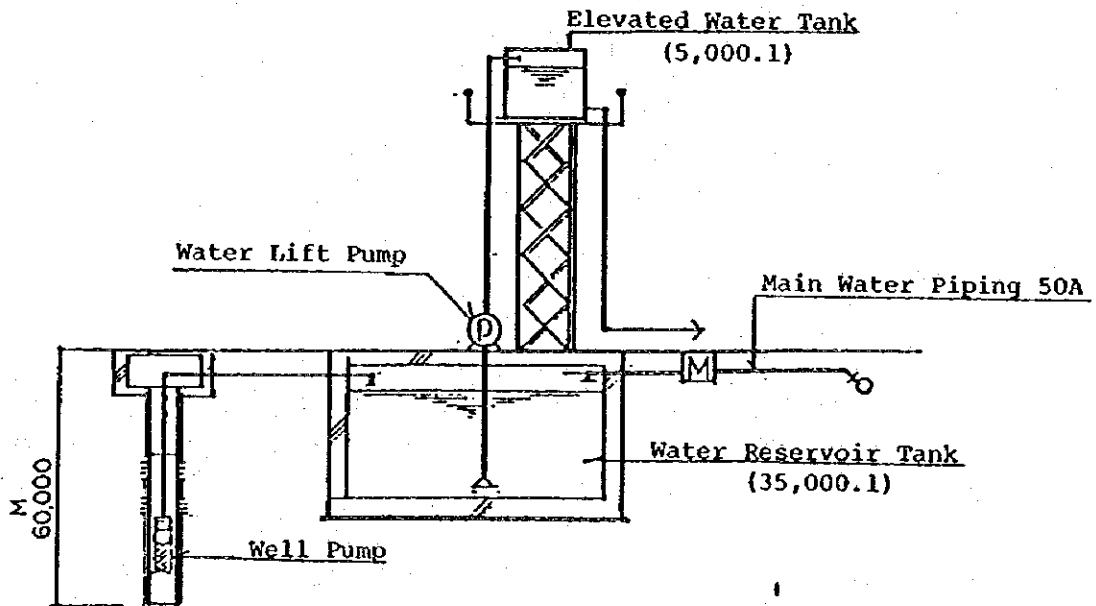
The water storage volume shall be one portion per day, and shall be the underground installation type.

$$(15,300\text{ℓ} + 12,950\text{ℓ})/\text{day} = 28,250 \text{ ℓ/day}$$

With an allowance rate of 20%, the total use per day is 35,000ℓ.

- d. Calculation of the elevated water tank capacity
With a time average, the water supply volume is stored,
with $35,000 \text{ t/day} \div 7 \text{ h/day} = 5,000 \text{ t/h}$,
the capacity of the elevated water tank is $5,000 \text{ t}$.

Fig. 4-2 Water Supply System Diagram



ii) Sewage facilities

Since public sewerage is unavailable, the following method is adopted.

Domestic and workshop sewage facilities plan

It shall be composed of two systems of domestic sewage and workshop sewage, and the waste treatment is carried out in the following flowchart.

a. Sewage system diagram

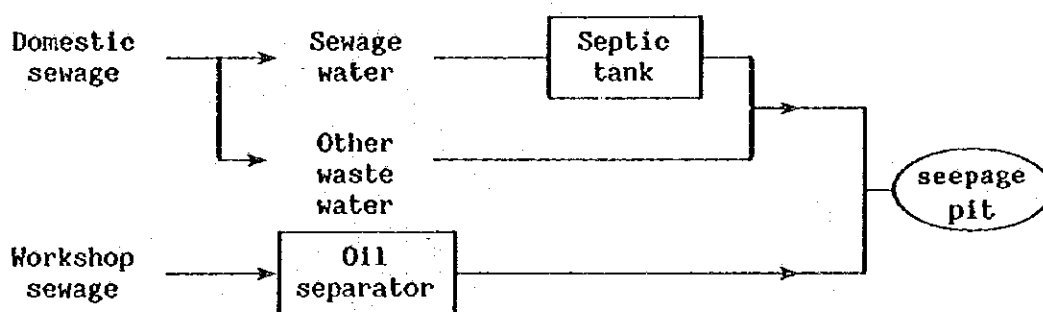


Fig. 4-3

b. Rain water drainage facilities plan

It is planned to collect water by U ditches in the site and drain water to the front road, and that some of the rain water can be drained on site.

2) Air-conditioning and ventilation facilities plan

The annual climatical conditions in Mogadishu over a 12 year period is 25°C to 29°C in temperature and 77 to 82% humidity.

As the site of the project is located at a comparatively low level of the old town, a simple ventilating facility is planned.

Air-conditioning facilities (Separate-type air-cooled package unit)

Administration offices × 5

Ventilation facilities (Ceiling fan, etc.)

Work rooms and habitable rooms except the administration offices

3) Air compressor facilities

An air compressor facilities necessary for the maintenance of vehicles is installed in the work area of workshop. Installation of a compressor is planned for the equipment and materials area as well.

4) Lubrication facility

Engine oil, gasoline and waste oil tanks are planned to be installed underground. The fuel feed method shall be manually operated and planned for the equipment and materials area.

Engine oil tank : 6,000ℓ × 1 unit

Gasoline tank : 6,000ℓ × 1 unit

Waste oil tank : 3,000ℓ × 1 unit

(4) Electrical plan

1) Receiving and distribution system

The receiving voltage shall be 15,000V on the basis of the ENEE's plan.

Due to the fact that the technical standard of the country are not determined, the receiving and transformer equipment is planned in accordance with the JIS, JEM and JEC, however, it shall be consistent with the climate of Somalia.

Receiving system:

3 phases, 3 wires, 50 Hz, 15,000V, 1 circuit

Low-voltage power distribution system

3 phases, 3 wires, 380V or 3 phases, 4 wires, 380/220V

Transformer capacity: 150 kVA

Low-voltage distribution board:

Indoor cubicle type

2) Generator facility

Since the electric power situation in the city of Mogadishu is insufficient, the installation of a non-utility generating facility is planned to maintain operations of the maintenance workshop. The capacity of the facility shall be decided by the maintenance equipment, etc. necessary for the operation.

Electric system:

3 phases, 4 wires, 380/220V, 50Hz

Engine:

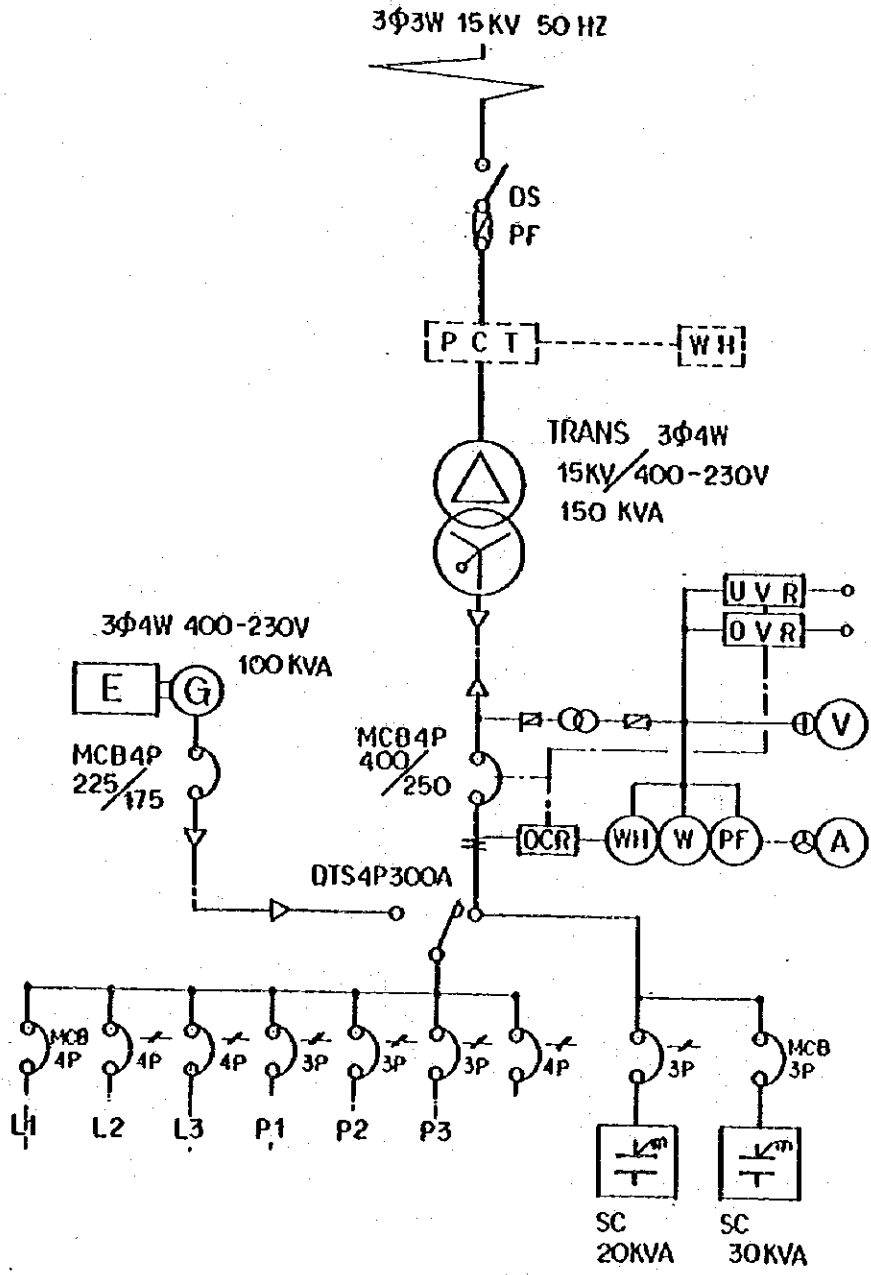
Radiator air-cooled type Diesel engine

More than 120 ps at continuous rating

Generator capacity: 100 kVA

Number of installation units 1unit

Fig. 4-4 Single Line Diagram for Substation



3) Feeders system

Piping and wiring facilities connecting to each power board and panel board from the secondary side of the power room low-voltage distribution board

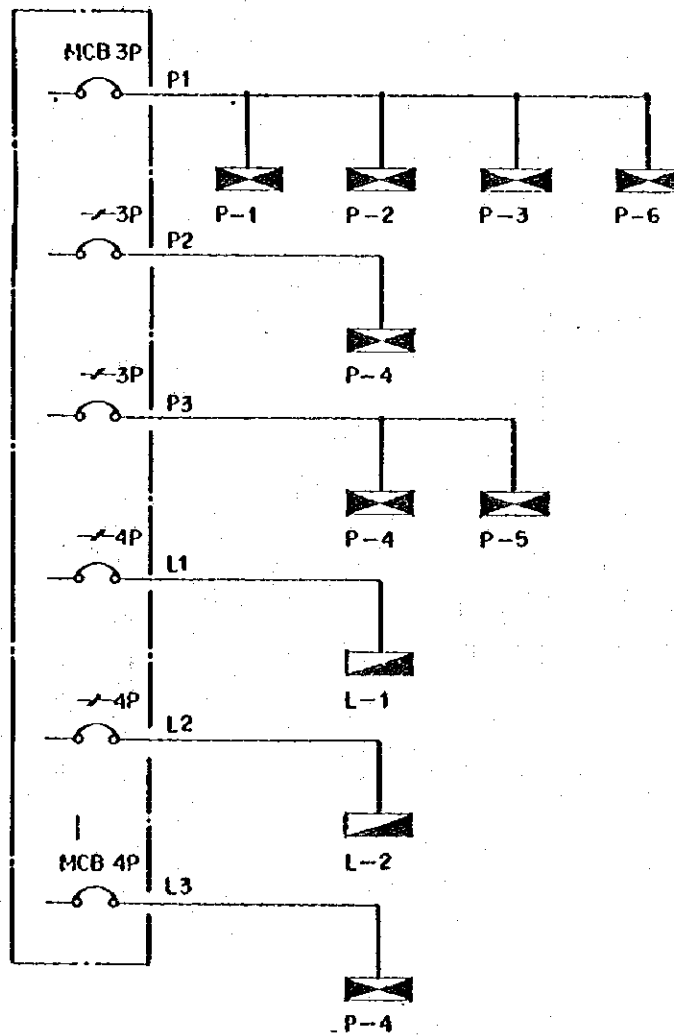
Power distribution system

For 3 phases load: 3 phases, 3 wires, 380V, 50 Hz

For single-phase load: 3 phases, 4 wires, 380/220V, 50 Hz

The feeders system shall be as follows:

Fig. 4-5 Feeders system diagram



4) Power facility

Wiring from the power board to all maintenance equipment, well pumps, etc. and installed power board. The Japanese technical standard is adopted.

Power board

It shall be either the indoor steel plate wall-mounted type or self-standing type.

The salt damage proofing shall be used to determine the paint required.

Electric system

3 phases, 3wires, 380V, 50 Hz or single-phase, 2 wires, 220V, 50 Hz

5) Lighting and receptacles system

Lighting plan

The lighting plan shall be adopted from the construction plan as to fully utilize external light. For the variation of supply voltage, long life, and high efficiency of lamps, fluorescent lamps shall be adopted.

Receptacles

Installed in an appropriate place for maintenance equipment, fan, etc.

6) Telephone system

Installed in the administration zone. Basic equipment shall be used, considering the regional peculiarity.

Installed places of telephone set

Doctor's room, six administration offices. Total 7 locations.

7) Interphone system

Communication between various places in the workshop and administration office.

Installation places

administration office, doctor's room, power room, guard

room, five administration offices, painting booth, body workshop, storage keeper and trouble shooter's office, pump room, electric parts room, fabrication shop and machine shop. Total 17 locations.

8) Public address system

Located in the workshop and for emergency calls. Amplifiers shall be installed in the administration office.

(5) Yard pavement and drainage plan

The yard pavement work is important in relation with main buildings, and maintains a large importance in terms of the construction cost.

1) Pavement plan

- Yard roads shall be of asphalt pavement.
- The car washing yard shall be of concrete pavement to prevent erosion from fuel oil.
- The cross-grade of the road section shall be of 1.5 to 2%.

2) Drainage plan

- The yard drainage cannot be done with the existing ground. (Under existing circumstances, since the pavement is unavailable, it can drain into the ground surface.)
- For this reason, preparation of a site gradient toward the direction of the entrance is made.
- Concrete drainage trenches are installed to the whole yard. Drainage trenches for vehicle crossing shall be covered with concrete covering.

4-3-4 Construction Material Plan

In Mogadishu, only limited materials are available. Therefore situation, a considerable amount shall be imported, and at the time of selection of the materials, considering the severe natural conditions of Mogadishu, maintenance is facilitated by materials of high durability, the