2.2 General Conditions of Project-Related Facilities

2.2.1 Roads in Yemen

(1) Conditions

Road construction in Yemen has been mainly conducted based on financial and economic assistance provided by donor countries and aid organizations. This foreign assistance has imprinted its own technical features on the completed roads with British and US influences mainly observed in the former South Yemen and former North Yemen respectively. It is also true that the cooperation of various countries in the building of Yemen's road network has fostered domestic road construction skills.

The People's Republic of China constructed the Sana'a-Hodeidah Road in the mid-1950's while the UK constructed the Aden-Taiz Road. In addition, the Hodeidah-Al Mukha Road was constructed by the Soviet Union. The Sana'a-Taiz-Al Mukha Road was constructed in the 1960's by the USAID which was subsequently paved in the late 1980's with the assistance of West Germany and other countries.

At present, the trunk road network linking Yemen's main cities is fairly well established except in the eastern and northern areas and passenger and cargo transportation is smooth in the central, western and southern areas. The main trunk roads are the Sana'a-Hodeidah Road which links the capital with an important port on the Red Sea, the Sana'a-Taiz Road and the Hodeidah-Taiz Road. In addition, roads running north from Sana'a to Sa'ada and east to Mareb and the Taiz-Aden Road are also important, indicating the central importance of Sana'a in terms of the road transport network. While airports are located in Sana'a, Hodeidah, Taiz and Aden, etc., there is no airport in the eastern part of the country, necessitating the urgent construction of new roads. Recognising the importance of the road network as an essential component of the economic infrastructure, the Government of Yemen has been actively constructing and improving roads. This commitment of the government appears to have become even stronger since unification.

The total length of roads under government management is 6,585.5km as of 1989, of which 4,475.5km is paved. The road network in Yemen has been rapidly expanding under the strong commitment of the government with an improved ratio of paved roads. Nevertheless, any boost to economic and industrial activities in Yemen requires the further construction of new buildings, the expansion of existing roads (from 2 lanes to 4 lanes), paving (from dirt roads to asphalt paved roads) and appropriate

maintenance work. Although trunk roads linking major cities (towns) have only two lanes, the road shoulders are very firm with sections accompanied by stone side ditches. Asphalt is usually used as the paving material. Table 2-3 shows the development of the road network between 1962 and 1990, while Table 2-4 gives the length of each major trunk road in Yemen. The total road length for each governorate is given in Table 2-5.

Table 2-3 Development of Road Network in Yemen (1962-1990)

(Unit: km)

Year	Asphalt Roads	Gravel Roads	Dirt Roads	Total
1962	231	—	—	231
1972	553	585	1,800	2,938
1982	2,848.2	1,004	31,505	35,357.2
1990	4,475.91	2,110	44,306	50,891.91

(Source: GCRB)

Table 2-4 Major Trunk Roads in Yemen (1991)

Road Name	Length (km)
Sana'a - Hodeidah	226
Sana'a - Taiz	256
Sana'a - Sa'ada	243
Sana'a - Mareb	173
Sana'a - Dhamar - Al-Bayda	100 - 168
Sana-a - Bayt Miran	35
Sana'a - Shibam - Thula	34 - 13
Sana'a - Jahana	31
Sana'a - Amran - Hajjah	50 - 77
Taiz - Hodeidah	256
Taiz - Al-Turba	65
Taiz - Al-Rahida - Al-Shoraija	57
Taiz - Al-Mafraq - Al-Mukha	63 - 44
Hodeidah - Jizan	204
Hodeidah - Al-Kathib	14
Sa'ada - Al-Dhahran	80
(Levelled Dirt Roads)	
Hays - Al-Khawkha	28
Mareb - Harib	99
Maydi - Harad	32
Ibb - Jibia	6

(Source: GCRB)

Table 2-5 Road Network by Governorate (1990)

(Unit: km)

Governorate	Paved Roads	Gravel (Dirt) Roads	Total
Sana'a	685.5	400	1,085.5
Aden	21	—	21
Taiz	324	319	643
Lahj	279.4	—	279.4
Al-Hodeidah	469	192	661
Ibyan	466	—	466
Ibb	220.5	241	461.5
Shabwah	420.6	—	420.6
Dhamar	184	145	329
Hajjah	86	170	256
Sa'ada	120.5	81	201.5
Al-Mahwit	31	86	117
Al-Baida	117	99	216
Mareb	267	120	387
Hadramawt	652.5	179	831.5
Al-Mahra	117.5	—	117.5
Al-Jauf	14	78	92
Total	4,475.5	2,110	6,585.5

(Source: GCRB)

MINISTRY OF CONSTRUCTION
HIGHWAY AUTHORITY

خريطة شبكة الطرق في الجمهورية اليمنية
MAP OF ROAD NETWORK IN THE REPUBLIC OF YEMEN

وزارة الانشاءات والتعمير
الهيئة العامة للطرق والجسور

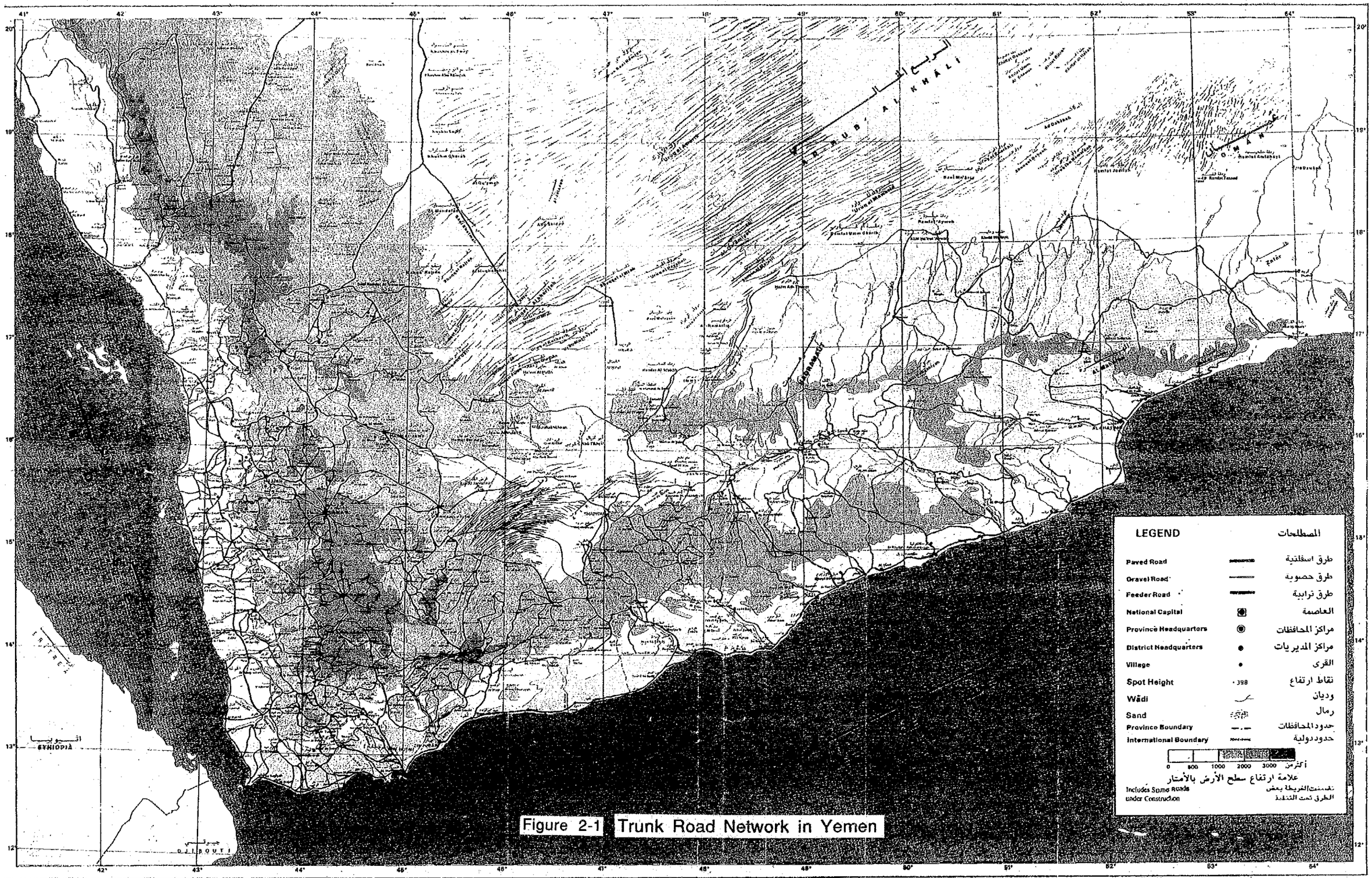

Figure 2-1 Trunk Road Network in Yemen

Scale 1:1500 000

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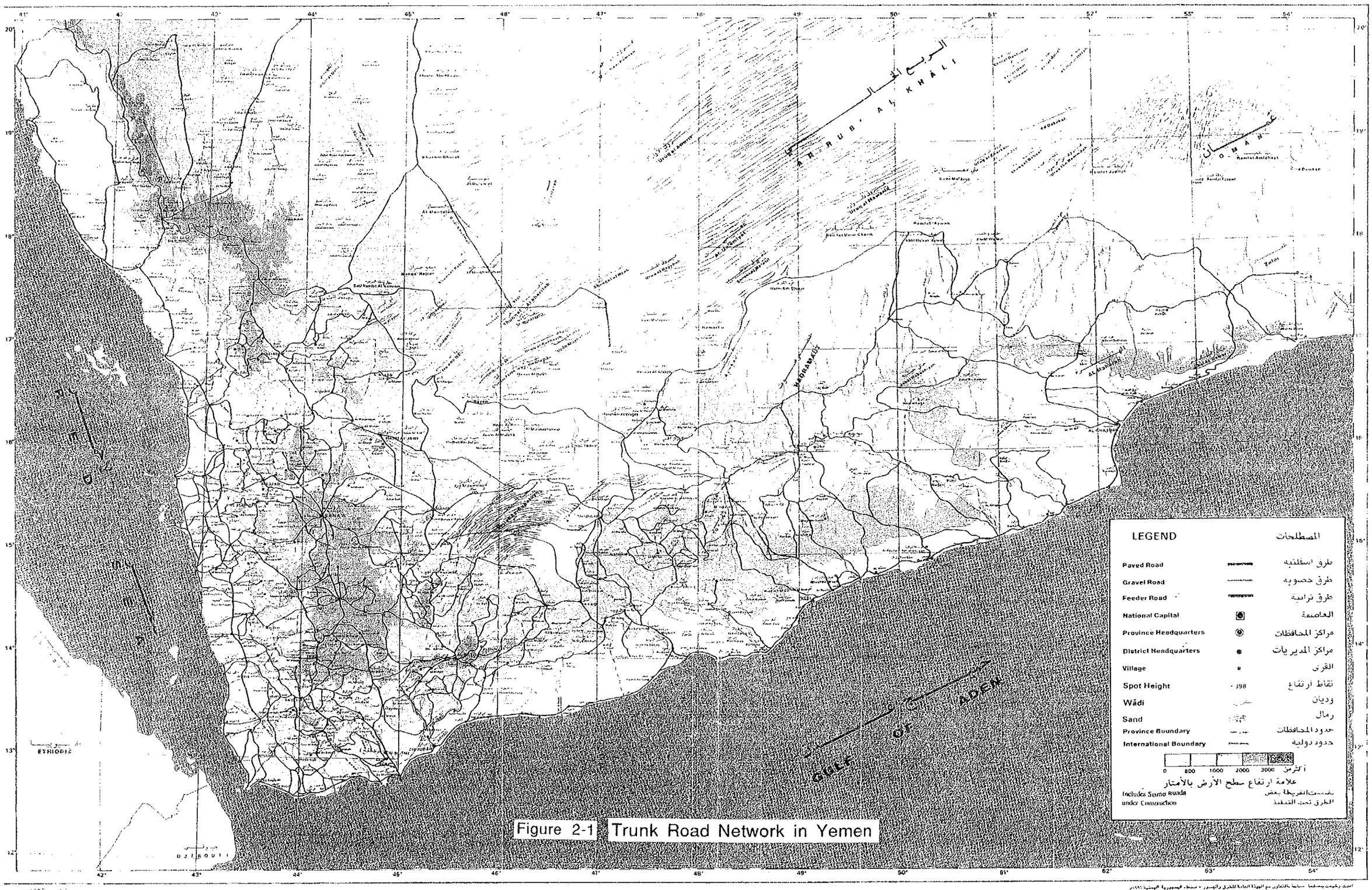


Figure 2-1 Trunk Road Network in Yemen

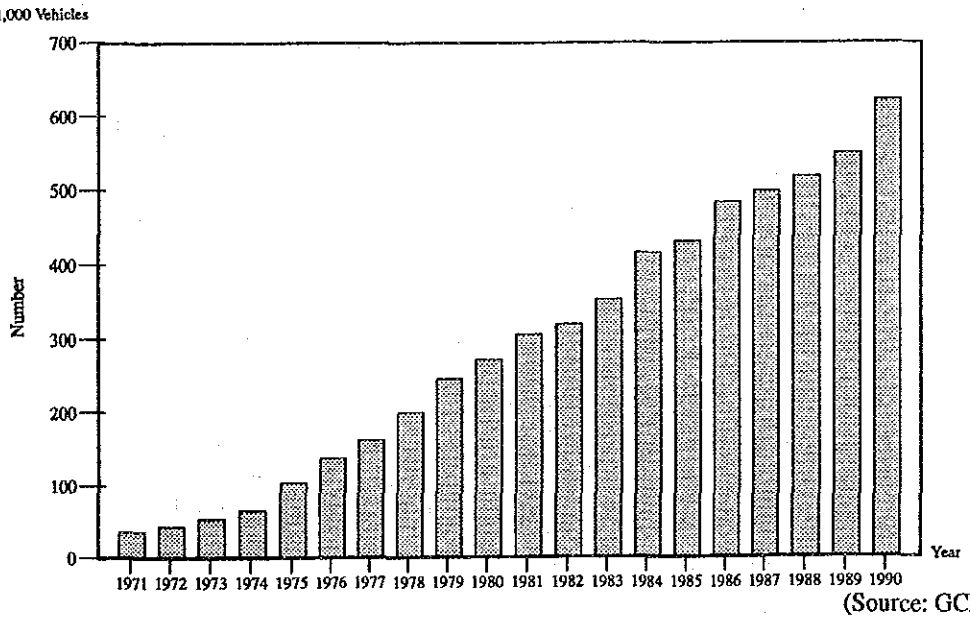
(2) Automobile Ownership

Automobile ownership in Yemen has been rapidly growing in recent years, totalling some 640,000 vehicles at the time of unification in 1990. This increase in the number of registered automobiles has resulted in traffic congestion, particularly in city centres. The number of junctions with traffic signals is as low as 10, even in Sana'a, the capital, and it is currently standard practice for traffic at a major junction to be directed by a policeman.

Many Yemeni workers returned from Saudi Arabia and Kuwait at the end of the Gulf War to Yemen with their own cars, further increasing the number of vehicles in use in Yemen although the actual number has not yet been established. The serious consequences on domestic traffic, however, have been witnessed in terms of steep rises in the number of traffic accidents and casualties following the intensified congestion in cities.

Table 2-6 and Table 2-7 show the changes in automobile ownership in Yemen between 1962 and 1992 and the number of traffic accident casualties between 1980 and 1990 respectively.

Since the automobiles in use in Yemen are mainly Japanese, there are dealers for Japanese manufacturers. With the increase of registered cars, the volume of repair work is expected to increase, necessitating the establishment of a reliable maintenance and repair system. Drivers in Yemen are required to drive on the right-hand side of the road.



(Source: GCRB)

Fig. 2-2 Increase of Registered Automobiles in Yemen

Table 2-6 Increase of Registered Automobiles in Yemen (1962-1990)

Year	Number
1962	300
1963	468
1964	731
1965	1,142
1966	1,783
1967	2,785
1968	4,348
1969	6,790
1970	10,242
1971	15,449
1972	23,303
1973	35,149
1974	53,018
1975	79,972
1976	120,628
1977	148,273
1978	182,255
1979	230,229
1980	257,405
1981	288,728
1982	329,680
1983	388,444
1984	417,926
1985	464,977
1986	479,384
1987	491,212
1988	518,393
1989	549,193
1990*	644,443

* Figure for 1990 is for newly unified Yemen. All other figures are for North Yemen only.
(Source: GCRB)

Table 2-7 Casualties of Domestic Traffic Accidents in Yemen (1980-1990)

Year	Killed	Injured
1980	591	2,226
1981	623	2,243
1982	687	2,845
1983	780	4,035
1984	814	4,374
1985	718	4,249
1986	768	4,792
1987	723	4,404
1988	917	5,443
1989	980	5,773
1990	1,655	7,195

Source: GCRB

2.2.2 Organizations Responsible for Road Construction and Improvement

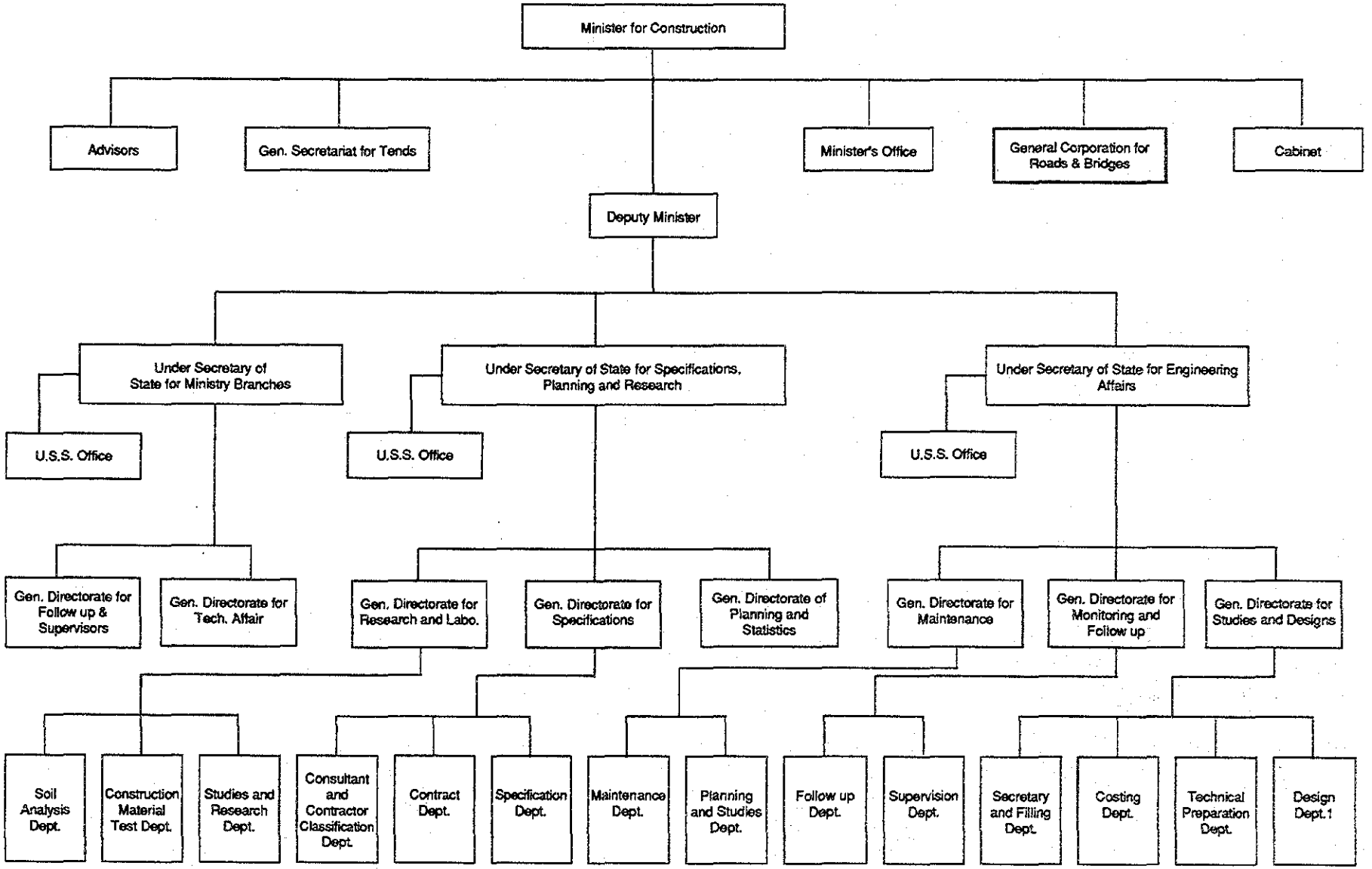
There are two organizations in Yemen which are responsible for the construction and improvement of roads, i.e., the General Corporation for Roads and Bridges (GCRB: former Highway Authority) which is under the jurisdiction of the Ministry of Construction, and which is responsible for the construction and maintenance of trunk roads linking major cities; and the Services Activities Department of the Local Council which is under the jurisdiction of the Ministry of Local Administration, and which acts as the central organization for the construction and maintenance of local road networks. The organization and functions of the GCRB and Ministry of Local Administration are described below.

(1) Ministry of Construction and GCRB

Fig. 2-3 and Fig. 2-4 show the organization of the Ministry of Construction and GCRB respectively.

The GCRB is under the direct control of the Minister of Construction who is also the Chairman of the GCRB. The construction and maintenance of trunk roads is under the control of nine departments (plus three departments, i.e., Workshop Department and two other related departments) which are in turn under the control of the Deputy Chairman for Construction and Maintenance. The training of technicians and engineers is provided by the Training Department which is directly controlled by the Chairman. The GCRB has six regional divisions and 13 local offices, employing a total of 3,800 people as described below.

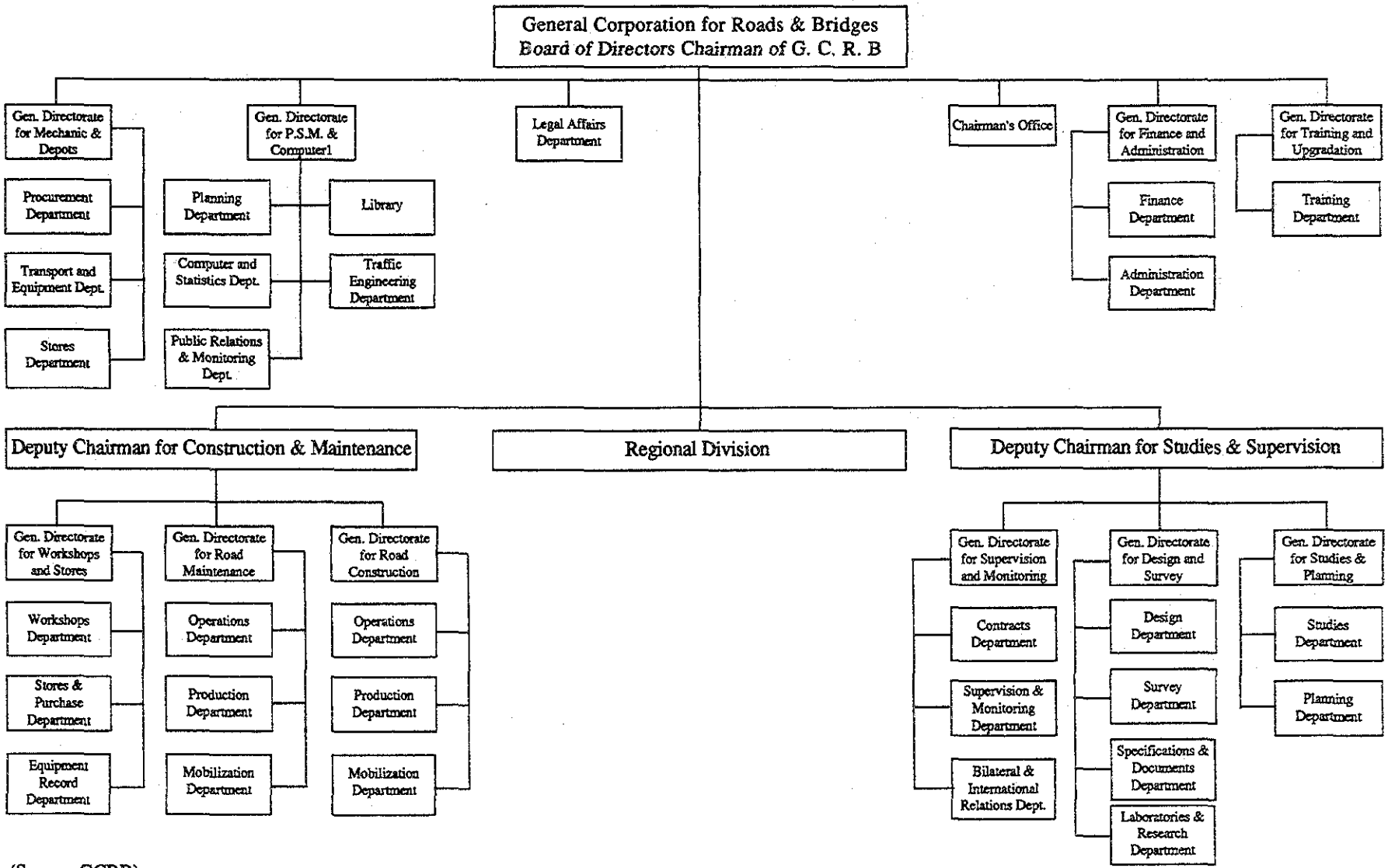
Senior Staff	80
Clerical Staff	300
Engineers	250
Technicians	2,000
Assistants	1,170



(Source: GCRB)

Fig. 2-3 Organizational Structure of Ministry of Construction

Organizational Structure for the General Corporation for Roads & Bridges



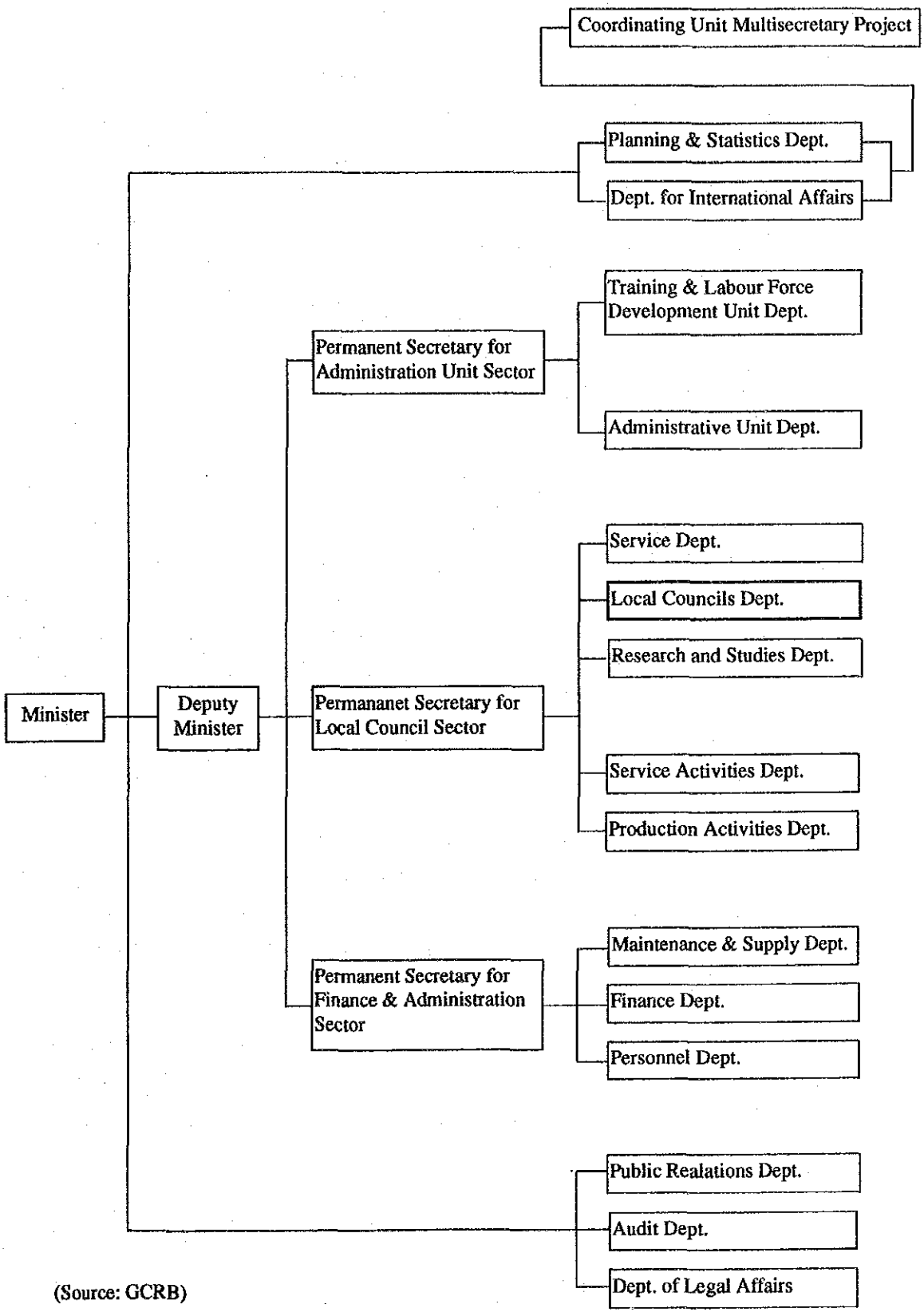
(Source: GCRB)

Fig. 2-4 Organizational Structure of GCRB

(2) Ministry of Local Administration

Local affairs in Yemen are largely administered by local councils which are formed at every local administrative level from sub-district to governorate. Local councils are based on the traditional spirit of mutual help, which is the backbone of Yemeni society, and consist of elected representatives who represent 500 inhabitants each. Local councils are involved in all local development projects in cooperation with other project-related organizations and, therefore, act as the central body for the construction and maintenance of roads other than trunk roads.

In contrast, the Ministry of Local Administration is responsible for the provision of various services, including project planning, supervision, inspection, coordination with other organizations and fund raising, etc. The organizational structure of the Ministry of Local Administration is shown in Fig. 2-5. Work relating to the construction and maintenance of local roads, including the rental of construction machinery, is conducted by the Services Activities Department of the Local Council Sector.



(Source: GCRB)

Fig. 2-5 Organizational Structure of Ministry of Local Administration

2.2.3 Road Projects

(1) Current Conditions of Road Construction Machinery

In principle, the construction of trunk roads in Yemen is the responsibility of the GCRB and all related work, such as surveying, planning, design, construction, supervision and the operation of construction machinery, is carried out by GCRB employees. Since the construction of major trunk roads depends on the availability of foreign assistance, most road construction work is conducted by foreign companies, leaving the GCRB mainly responsible for the maintenance of roads.

The actual management and maintenance of roads are conducted by the GCRB's Head Office, as well as by the regional divisions which operate the maintenance centres responsible for the management and operation of construction machinery, various materials and equipment.

One of the special features of road construction/improvement work in Yemen is the country's topography which is classified into lowland (upto 200m EL) along the Red Sea and Arabian Sea, hill areas (200m-1,500m EL) at the piedmonts of mountains, mountainous areas (over 1,500m EL) and highland (around 1,000m EL) dominating the eastern part of the country. Sana'a, the capital of Yemen, is located at 2,300m above sea-level. In general, the most prominent feature is mountainous areas with many undulations. Therefore, road construction work often involves the opening of a route through mountains, necessitating the use of heavy construction machinery. Bulldozers and graders, etc., play a crucial role in the progress of such work.

The GCRB currently owns an asphalt plant and some 1,550 pieces of large and small construction machinery and vehicles, etc. More than 80 percent of these are distributed for road construction, improvement or maintenance work in the northern part of the country, centering on Sana'a. Table 2-8 lists the construction machinery and vehicles, etc., owned by the GCRB.

This machinery is currently distributed to actual construction sites across the country. Fig. 2-6 provides a rough idea of the geographical distribution with machinery in the north, including the Hodeidah area, accounting for more than 80 percent.

The state of this machinery is shown in Table 2-9. Machines out of order include unrepairable machines as well as repairable machines, indicating the inaccurate state of maintenance. The following causes appear to have contributed to the high rate of machines which are out of order.

Table 2-8 Road Construction Machinery Owned by GCRB and Ministry of Local Administration

(May, 1992)

Type of Equipment	No.	No. Out of Order	Type of Equipment	No.	No. Out of Order
< GCRB >			Tyre Inflation Compressors	17	7
Bulldozers	143	23	Tyre Numbering Machines	3	-
Motor Graders	80	16	Fuel Supply Pumps	13	4
Wheel Loaders	52	7	Electric Generators	73	21
Excavators	17	8	Chain Hoists	2	-
Asphalt Plants	2	-	Welding Sets	18	8
Crushing Plants	5	-	Transformers	1	-
Concrete Plants	10	4	Water Supply Pumps	32	12
Dump Trucks	115	21	Trucks with Winch	3	1
Road Rollers	72	18	Water Tanker Trucks	49	13
Fork Lifts	7	3	Fuel Tanker Trucks	24	2
Crane (Lift) Trucks	7	1	Shop Trucks	7	-
Air Compressors	76	23	Lorry/Grease Unit Service	8	2
Wagon Drills	11	6	Trucks		
Jack Hammers	82	25	Truck Tractors	16	6
Screening Plants	3	-	Asphalt Carrier Trucks	8	2
Soil Mixing Plants	1	-	Small Vehicles	216	54
Road Sweepers	7	1	Buses	14	3
Asphalt Plants (Mixer)	8	-	Trailers	9	-
Asphalt Cutting Machines	8	2	Lorries	11	-
Asphalt Pavers	7	2			
Asphalt Spreaders	4	1			
Asphalt Heaters	15	4	**< Ministry of Local Administration >**		
Road Marking Machines	8	-			
Preheaters (Paint)	3	-	Bulldozers	214	124
Hand Millers	1	-	Motor Graders	14	6
Spray Painting	3	-	Wheel Loaders	24	10
Steam Cleaners	4	-	Compressors	48	20
Blasting Machines	15	5			
Battery Chargers	14	5			

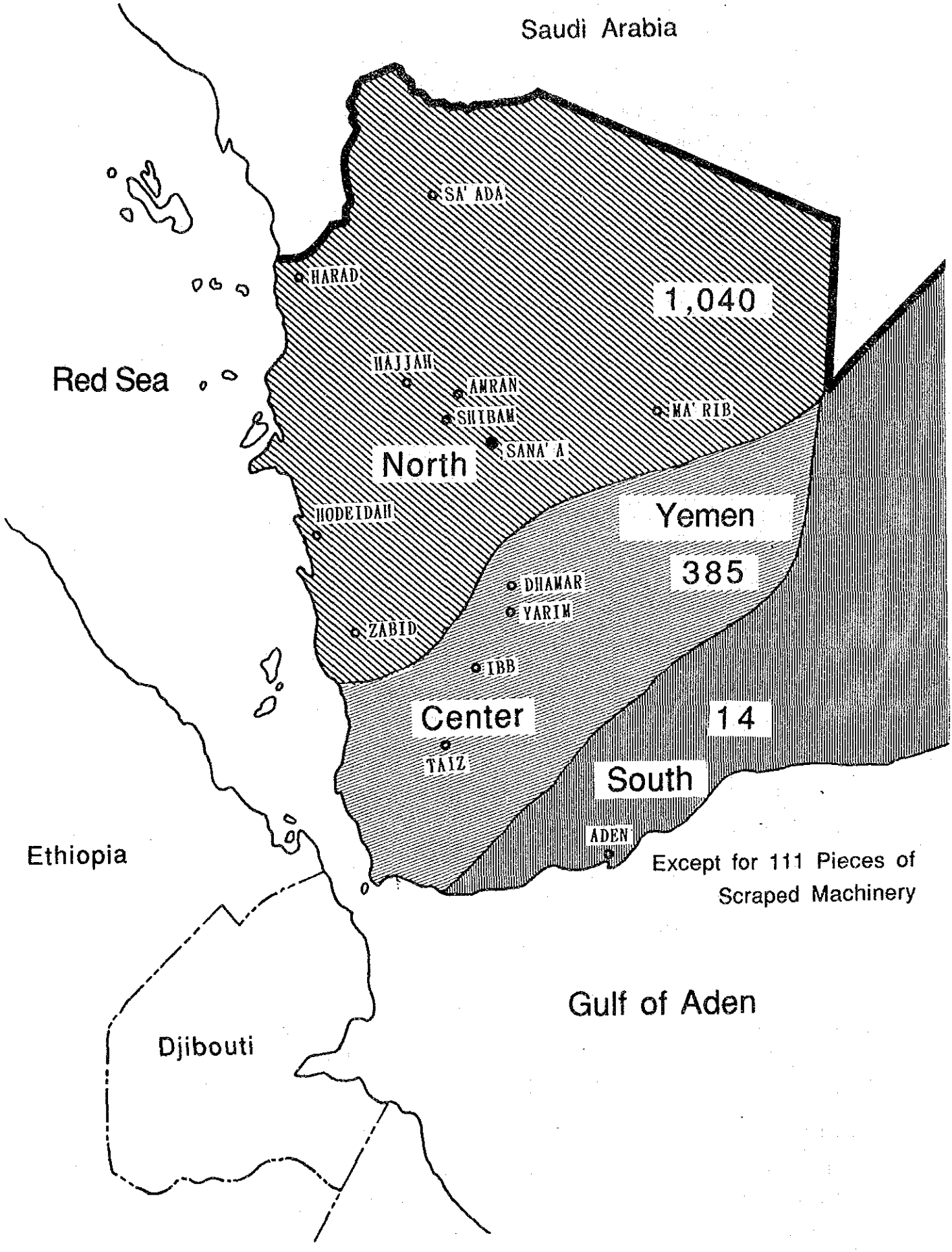


Fig. 2-6 Distribution of Road Construction Machinery

① Inaccurate maintenance

② Inappropriate handling/operation of machines

③ General deterioration of machines

④ Inadequate repair skills

⑤ Shortage of technicians/mechanics

⑥ Shortage of spare parts

⑦ Inadequate provision of repair facilities and equipment

Table 2-9 Estimated Number of Construction Machines and Vehicles in Operation in Five Years' Time in Northern Yemen

1992				
	Number Owned	Operation Rate (%)	Awaiting Repair (%)	To be Scrapped (%)
Construction Machinery	726	413 (57)	242 (33)	71 (10)
Heavy Vehicles	128	83 (65)	40 (31)	5 (4)
Ordinary Vehicles	285	173 (61)	89 (31)	23 (8)
Targets for 1997: Those to be scrapped are excluded and new machines/vehicles added				
	Number Owned	Operation Rate (%)	Awaiting Repair (%)	To be Scrapped (%)
Construction Machinery	705	600 (85)	80 (11)	25 (4)
Heavy Vehicles	111	100 (90)	8 (7)	3 (3)
Ordinary Vehicles	256	230 (90)	16 (6)	10 (4)

(Source: GCRB)

As shown in Fig. 2-7, the GCRB carries out the actual repair of construction machinery at 3 different levels, i.e., at the central workshop in Sana'a, at one of the three local workshops and on site, depending on the degree of trouble. All the above facilities, however, suffer from an inadequate provision of the tools and equipment required to conduct proper repair work as described earlier.

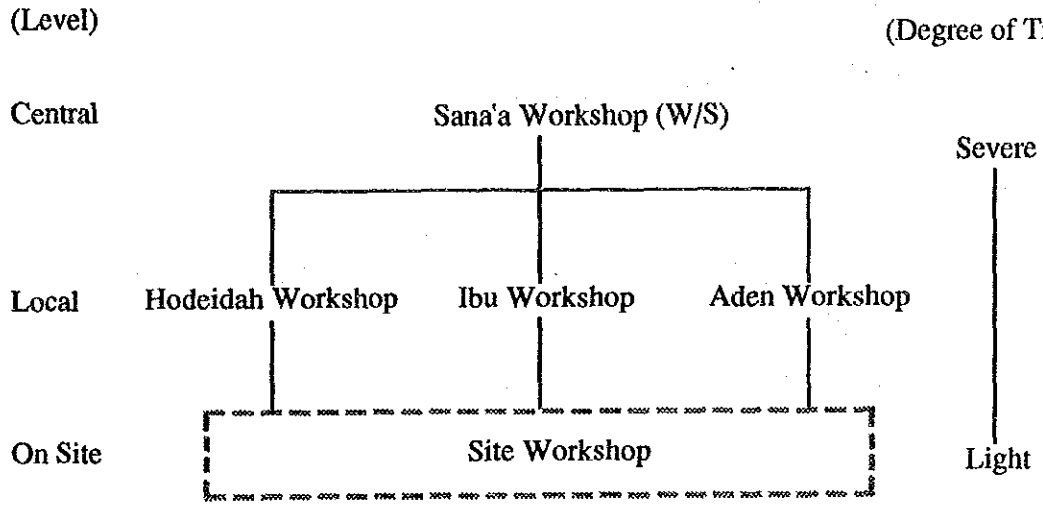


Fig. 2-7 Construction Machinery Maintenance System of GCRB

The existing central workshop in Sana'a is run based on the organizational structure shown in Fig. 2-8 and with the budget shown in Table 2-10. The survey findings on each facility or equipment in place at this workshop are summarised below by item.

1) Chassis Repair

The present level of equipment is inadequate. For example, no overhead crane is provided which is essential to remove the engine unit and body panels, etc. from a chassis.

2) Engine Repair

Although a crane is essential to remove an engine and caterpillars, etc. from the chassis, no overhead travelling crane is provided. In addition, there is a general shortage of the relevant equipment.

3) Fuel Injection Pump Tester

Although the necessary equipment is provided, it is old. The transfer of the present equipment to a new workshop is questionable because of the unavailability of spare parts.

4) Electrical Equipment

The repair of electrical equipment associated with engines, such as starters and generators, is generally considered to be specialist work and outside the scope of the normal repair of construction machinery. The absence of a workshop specialising in electrical equipment, however, necessitates the provision of such capability together with the relevant tools and equipment in a new workshop.

5) Hydraulic Equipment

While the existence of a strong repair demand is suspected because of dusty air in Yemen, there is a noticeable shortage of repair tools and equipment in this regard.

6) Battery Recharging

Despite being old, basic equipment is available.

7) Motorised Equipment

Most tools for engine repair are used for the repair of motorised equipment. However, there is a general shortage of the necessary repair tools and equipment.

8) Tyre Service

Repairs for tyres are being done but a minimum number of spare parts should be provided.

9) Machine Tools

Many machine tools are available and their transfer to a new workshop appears plausible. In general, machine manufacturers only provide standard parts and it is often necessary to machine special parts and/or those parts which are difficult to obtain using the machine tools owned. In view of the fact that many recent machine parts are heat-treated, however, parts manufactured in-house through simple machining processes carry a risk of immediate failure or of causing accidents.

10) Welding and Body Repair

While there is an old welding facility, there is no body repair facility. The currently available equipment is inadequate to process steel sheets into large parts.

11) Suspension and Travelling Mechanisms

The repair cost of suspension and travelling mechanisms accounts for some 60 percent of the total repair cost in Japan. It is estimated that the corresponding figure in Yemen could be at least 50 percent, but hardly any of the essential repair equipment is available at present. As the deterioration of these parts is assumed to be faster in Yemen than in other countries in view of the fact that Yemen is a typical mountainous country, to prevision of such repair equipment is necessary as well as indispensable.

12) Compressor

No compressor was provided in the existing repair shop. Compressors are essential for machine repair.

13) High Pressure Washer

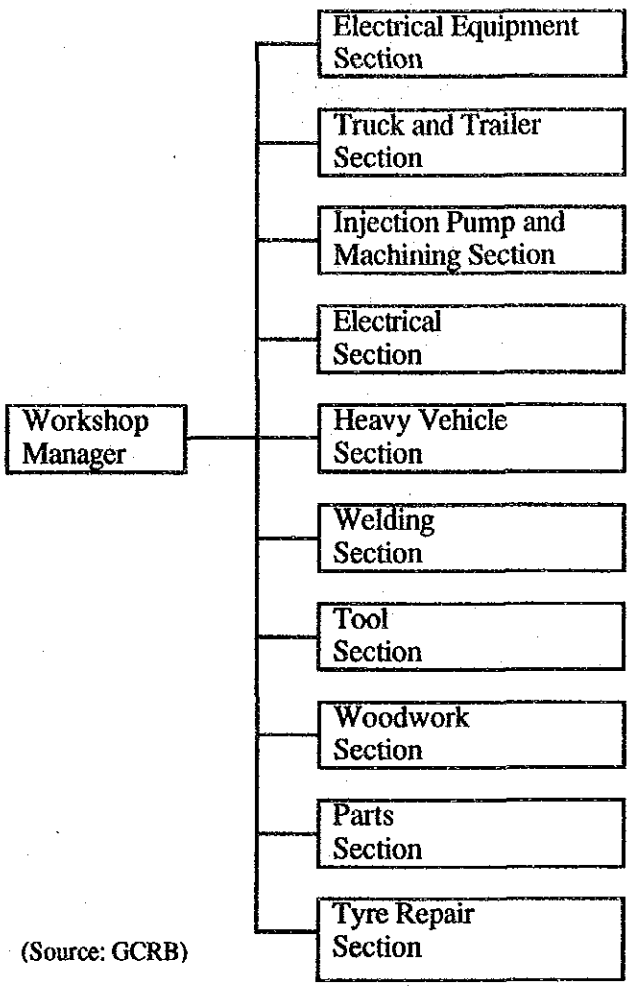
The machines brought to the workshops should be thoroughly washed using pressurised water to prevent the intrusion of sand and other unwanted materials into the engine cylinders and other sections. No high pressure washer is currently available.

14) Painting Facility

A painting facility is required for the painting over of welded and other repaired sections. No such facility is currently available.

15) Tool Room

Expensive tools for common use and those which are infrequently used should be kept in a secured room or storage facility. The current control of these tools is inappropriate.



(Source: GCRB)

Fig. 2-8 Organizational Structure of GCRB Sana'a Workshop

Table 2-10 Planned Budget of Existing Workshop in Sana'a

Items	Budget
Expert Salaries	1,056,000
Local Staff Salaries	7,788,000
Fuel, Oil & Lubricants	1,892,000
Dept. Value of Machines	2,970,000
Supare Parts	1,056,000
Dep. value of Buildings	2,442,000
Water & Electricity	924,000
Micellanious	660,000
Administrative charges	2,719,000
(Total)	20,847,000

The situation at the existing Sana'a workshop, which plays a central role in the repair work of construction machinery in Yemen, is rather unsatisfactory as described above and the following general problems can be pointed out in regard to the GCRB's construction machinery maintenance system.

1) Shortage of Facilities and Equipment

Since the present provision of repair facilities and equipment is rather unbalanced, it is impossible to provide proper services to repair problems relating to engines, transmissions, hydraulic units, suspensions and electrical systems. It is assumed that the absence of a crane causes great difficulty in chassis-related repair work.

2) Insufficient Regular Inspections

Regular inspections and daily maintenance are essential to reduce both the frequency and severity of breakdowns. Regular inspections should be conducted on a daily, weekly and monthly basis for the same and/or different inspection items.

3) Shortage of Spare Parts

Appropriate spare parts inventory control based on an adequate procurement programme reflecting accurate consumption records should settle the situation where machines requiring repair are left idle due to the lack of parts (a plan to computerise inventory control is currently in progress under the leadership of a member of Japan Overseas Cooperation Volunteers).

4) Inadequate Operation Control

Records of operation, inspection and repair, etc., should be maintained for individual machines to provide useful data at the time of repair. Therefore, a rule should be introduced to make it compulsory to keep a history of each machine.

5) Unbalanced Technical Background of Technicians

Because of the unbalanced provision of repair facilities and equipment, the speciality fields of the existing technicians are also unbalanced. In addition to the acquisition of new repair equipment, the training of technicians and their balanced distribution should be conducted to meet a wide range of repair requirements.

(2) Current Conditions of Vocational Training Centre Run by GCRB

The General Corporation for Roads and Bridges (GCRB) of the Ministry of Construction, which has been the sole government organization for road construction and maintenance since unification, has inherited the Taiz Vocational Training Centre from the Highway Authority of the former North Yemen government. This centre is currently the only training centre of its kind in the unified country.

The Taiz Vocational Training Centre is currently run by 16 senior staff members and 27 junior staff members with a northern background and the organizational structure of the centre is shown in Fig. 2-9.

90% of the trainees are new junior high school graduates who are recruited by various government ministries, predominantly by the GCRB. The remaining 10% are sent by private companies. Some 80 trainees complete training every year and are assigned to various parts of the country.

At present, the centre provides 7 training courses. The training period is generally one year except for the Plant Operation Course which lasts for 6 months and is, therefore, provided twice yearly. The training subjects include 8 general subjects, such as mathematics, English, electrical engineering and production control, etc. The Plant Operation Course is again the exception as it concentrates on specialised subjects.

The outline and capacity of each course are given below.

① Road Management Course (capacity: 10)

- Road (and bridge) design and surveying
- Trigonometry and practical training of cost estimation and surveying

② Construction Machinery Course (capacity: 12)

- Basics of vehicle (bulldozer and grader, etc.) engines
- General subjects and practical training of engine maintenance

③ Electrical Course (capacity: 12)

- Basics of vehicle electrical systems
- General subjects and practical training of electrical systems

④ Plant Course (capacity: 10)

- Basics of various plants, including asphalt, macadam and paving plants
- General subjects and basic knowledge of various plants

⑤ Welding Course (capacity: 6)

- Welding techniques
- General subjects and practical training of welding and related work

⑥ Machining Course (capacity: 8)

- Machining techniques, mainly for machine tools, to foster workshop mechanics/engineers
- General subjects and practical training of machine tools and other equipment

⑦ Plant Operation Course (capacity: 12, year total: 24)

- Operation techniques of various plants
- Mathematics, drawing, safety control and practical training

A monthly wage of 800-2,000 rials is paid to civil servant trainees during the training period from which a boarding fee is deducted. The expenditure of the Taiz Vocational Training Centre between 1986 and 1990 is shown in Table 2-11.

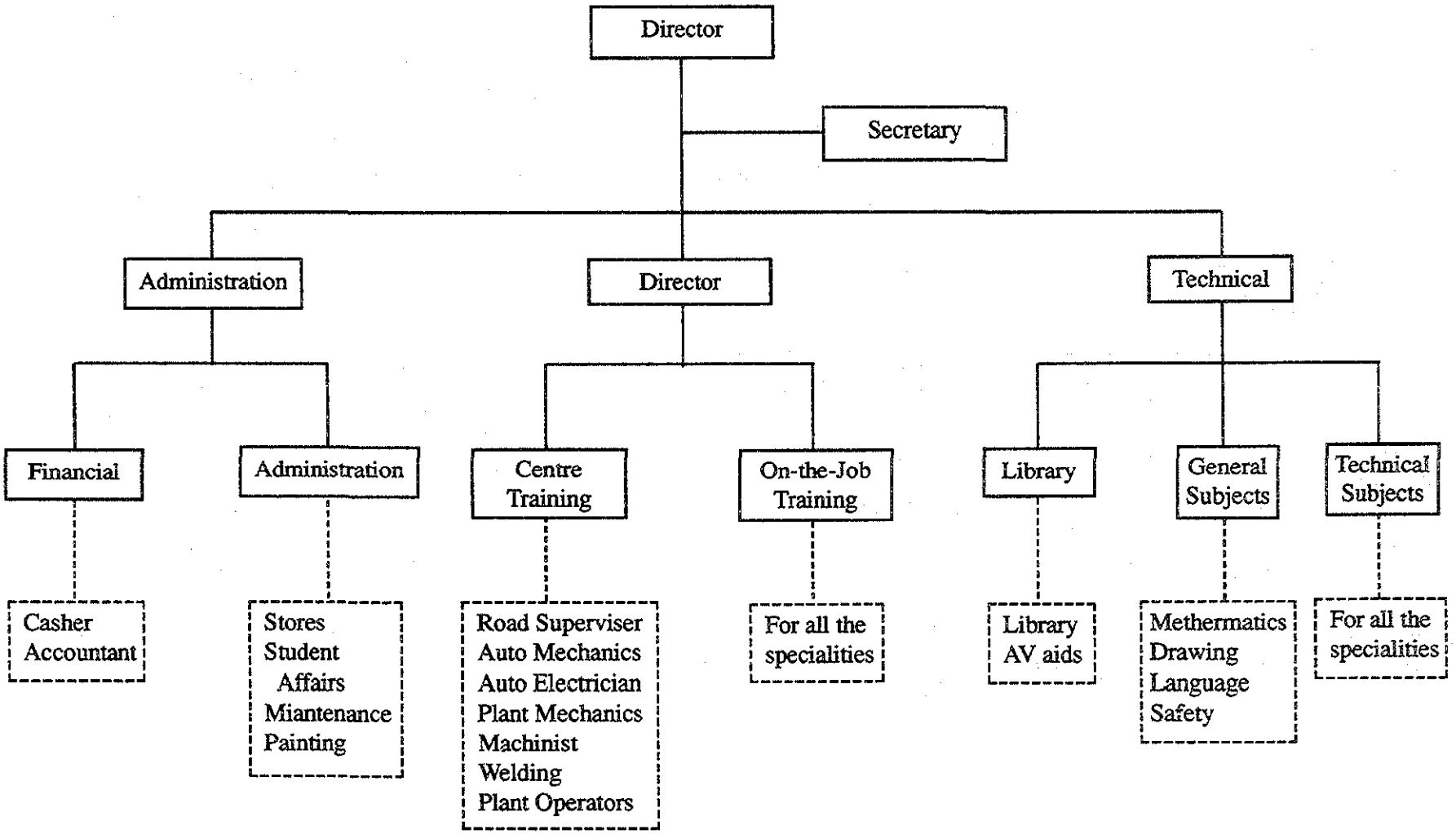


Fig. 2-9 Organizational Structure of Taiz Vocational Training Centre

Table 2-11 Expenditure of Taiz Vocational Training Centre for 5 Years Between 1986 and 1990

	Salaries		Fuel & Oil	Dep M/C	Spare Parts	Rental Cost		Dep Build	Water & Elec.	Miscell.	Total	15%	Grand Total
	Experts	Local				Houses	Office						
1990	1,110,938.00	1,503,280.92	113,750.83	410,794.47	254,218.00	367,064.16	156,000	504,000.00	73,214.15	69,916.80	4,548,119.44	682,217.92	5,230,337.00
1989	1,219,027.50	1,448,097.22	98,566.22	410,475.57	79,229.00	513,592.02	156,000.00	504,000.00	129,965.00	59,960.00	4,618,916.23	692,837.43	5,311,753.00
1988	1,024,405.27	1,579,835.94	132,289.73	150,697.18	133,719.70	418,959.49	156,00.00	504,000.00	150,247.00	60,858.00	4,311,012.22	646,651.58	4,957,663.00
1987	988,846.11	1,777,977.44	122,014.00	162,474.77	60,672.00	405,681.24	156,000.00	504,000.00	141,185.00	92,133.00	4,411,084.01	661,662.59	5,072,746.00
1986	1,032,526.69	1,688,800.78	109,226.40	126,776.97	119,421.00	418,959.38	156,00.00	504,000.00	123,944.00	126,167.72	4,385,822.94	657,873.36	5,043,696.00

Average 5,123,239.00

Note :

Dep. M/C	Depreciation Value of Machines.
Dep. Building	Cepreciation Value for Building.
Miscell.	Miscellaneous.
15%	Administrative Charges.

(3) Direction of Future Progress

The maintenance of construction machinery is essential for the progress of road construction/improvement efforts in Yemen. The GCRB currently conducts all repair work in-house at its own workshops and does not commission the work to the private sector. There are several privately-owned machine workshops in Sana'a and Taiz conducting engine repairs for private vehicles and simple machining work.

The construction machinery not in use is generally stored at material yards attached to the existing workshops of the GCRB or construction sites and repair work is also conducted there. The present facilities and equipment at these workshops are inadequate and the construction machinery management is rather insufficient. The breakdown ratio of the existing construction machinery is as high as 40 percent. The fact that some machines are repairable while others are not indicates the insufficient level of management or maintenance. This high breakdown ratio can be explained by (1) insufficient regular inspections, (2) inadequate handling of machinery, (3) general deterioration of machinery, (4) inadequate repair capability, (5) shortage of technicians, (6) shortage of spare parts, and (7) shortage of repair facilities and equipment as already described in the previous section (2-2-3-(1)).

It is very important for Yemen, where the implementation of a road construction/improvement project is difficult without the proper management of construction machinery, to improve the present operation and maintenance conditions of machinery to achieve more efficient and effective use. Moreover, efforts to upgrade maintenance, repair and operation skills will have a positive impact on the progress of road construction/improvement efforts in the future. In order to achieve such facility and equipment improvement and to upgrade skills, it is of crucial importance to establish new workshops in areas where road construction/improvement projects are planned, particularly in the northern part of Yemen where some 80 percent of the existing machinery is in operation, and to improve the operation rate of construction machinery in addition to refurbishing and improving the existing workshops.

2.3 Summary of Related Plans

2.3.1 National Development Plans

Government-led national development plan preparation in North Yemen only commenced in the mid-1970's when the central government at last began to exercise administrative authority across the country following the end of the civil war which started after the revolution. The Dhamar earthquake immediately after the formulation of the second 5-Year Plan (1982-1986), however, forced the government to divert its limited development funds to the rehabilitation of the disaster-hit areas, effectively halting the implementation of this plan. The announcement of the third 5-Year Plan (1987-1991) had to wait until 1989 but was not implemented in large part due to difficulties in securing the necessary funds. The unification of the two Yemens in the midst of the plan period (1990) appears to have resulted in the final suspension of the implementation of the plan.

Table 2-12 Third 5-Year National Development Plan in North Yemen (1987-1991)

(Unit: million YR at 1986 prices)

Planned Fields of Investment	1987	1988	1989	1990	1991	Total
Agriculture/Fisheries	491	558	565	658	801	3,073
Mining/Petroleum/Natural Gas	1,152	1,076	935	1,010	1,260	5,433
Manufacturing Industry	600	689	692	700	758	3,439
Electricity/Water	550	582	430	510	500	2,572
Construction	40	40	40	40	40	200
Commerce/Hotels/Restaurants	418	401	406	429	303	1,957
Transport/Telecommunications	548	647	621	979	1,354	4,149
Broadcasting and Other Media	85	135	145	153	170	688
Company Housing/Business Services	610	620	625	625	615	3,095
Finance/Banking	50	60	60	60	70	300
Social Services	10	13	13	14	14	64
Public Services	2,116	2,356	2,750	3,080	3,310	13,612
Total Investment	6,670	7,177	7,282	8,258	9,195	38,582

(Source: Third 5-Year Plan Paper)

Table 2-13 Third 5-Year National Development Plan in South Yemen (1986-1990)

(Unit: million YR)

Planned Fields of Investment	1986	1987	1988	1989	1990
Manufacturing Industry	54.5	44.2	48.2	45.1	19.1
Crude Oil/Mining	15.6	20.1	117.9	109.1	24.3
Agriculture	20.8	15.2	15.9	13.5	14.2
Fisheries	4.4	6.3	6.3	4.7	1.3
Construction	0.2	0.1	0.1	0.1	0.1
Transport/Telecommunications	32.5	31.1	35.1	35.4	20.1
Foreign Trade/Beverages	2.8	3.8	5.8	4.8	1.0
Housing	11.0	8.4	4.8	8.7	5.2
Education	9.6	9.0	8.4	7.7	3.0
Welfare	7.4	5.1	5.5	3.6	0.7
Culture/Tourism	0.5	0.5	1.7	1.9	-
Others	8.4	5.9	4.2	2.3	1.9
Total Investment	167.6	149.7	253.9	236.9	90.9

(Source: Ministry of Development and Planning)

In comparison, the preparation of medium-term development programmes was fairly well organized in South Yemen because of its preference for a socialist economic system. There was a mechanism to evaluate the willingness of bureaucrats to meet policy targets and their achievements and all progress were reported at regular party conferences of the Yemen Socialist Party. Unfortunately, however, not all statistical figures were announced publicly, making it difficult for outsiders to establish a comprehensive picture of development plans or to assess plan results because of the availability of only information on some successful outcomes. Financial aid from the Eastern Bloc began to dwindle in the late 1980's, putting the Government of South Yemen in a much harder position vis-a-vis securing development funds than its counterpart in the north.

As the third Plan period came to an end in South Yemen and North Yemen in 1990 and 1991 respectively, a new 5-year plan (1991-1996) should have been prepared for a unified Yemen. This has not been the case, presumably because of administrative

confusion following unification and economic difficulties following the outcome of the Gulf War. Some time may still be required for the new government to prepare meaningful medium and long-term development programmes.

Development projects prepared by ministries and agencies in individual fields will act as substitutes for a meaningful national development plan for the immediate future. These projects include the development of oil resources (Ministry of Oil and Mineral Development), a road network (Ministry of Construction), a national power grid (Ministry of Electricity and Water), agriculture (Ministry of Agriculture and Water Resources) and water supply (Ministry of Electricity and Water), etc. Many of these projects have been prepared by international organizations (mainly the IBRD) independently from the national 5-year plans and have continued over a number of years with different phases (each phase lasting several years) addressing different areas. It appears that the Government of Yemen is prepared to rely on these organizations for the formulation of concrete development projects for the foreseeable future. Unification upgraded the Central Planning Organization of former North Yemen to the Ministry of Planning and Development which is responsible for the preparation of new development programmes/projects. For the time being, however, the Ministry appears to be concentrating on the coordination of ongoing projects.

2.3.2 Road-Related Development Projects

(1) GCRB Projects

The GCRB is implementing the Road Improvement Master Plan for 1986-1996, prepared by a Lebanon's consultant in 1989. Table 2-14 shows the budget for this Master Plan while Table 2-15 shows the planned extensions of various types of roads during the plan period. The Master Plan has separate targets for the construction of new roads, the paving of existing gravel roads, the construction of new gravel roads, the widening of existing roads, the upgrading of two lane roads and the repair of paved roads. Although the Master Plan is supposed to be coordinated with the fourth 5-Year Plan (1992-1996), its implementation has been delayed from the beginning due to the failure of the fourth Plan to materialise. While the completion of the Master Plan is expected to be delayed by 4-5 years, the GCRB intends to review all the road construction/improvement project since the unification on the basis of the Master Plan and to implement them on the priority basis.

The planned budget size of the GCRB for fiscal 1992 and its breakdown are given in Table 2-16.

Table 2-14 Planned Budget of Master Plan

	Budget (million YR)			
	1987-1991	%	1992-1996	%
Construction of New Roads	2,715.45	63.6	1,933.21	48.8
Widening of Existing Roads	192.30	4.5	928.10	23.4
Repair	753.30	17.7	346.50	8.7
Maintenance	605.00	14.2	754.50	19.1
Total	4,266.05	100	3,962.31	100
Annual Budget	853.21		792.46	

(Source: GCRB)

Table 2-15 Planned Work Under Master Plan

	Work Volume (km)	
	1987-1991	1992-1996
Construction of New Roads	509.0	254.9
Paving of Existing Gravel Roads	319.3	453.1
Construction of New Gravel Roads	-	192.0
Widening of Existing Roads to 2 Lanes	44.4	219.3
Repair of Paved Roads	783.2	342.7

Source: GCRB

Table 2-16 Budget for Road Construction Section in Yemen for Fiscal 1992

(Unit: 1,000 YR)

	Government Funds	Foreign Funds	Private Funds	Total
Ministry of Construction	1,897,866	1,320,572	122,488	3,340,926
GCRB	1,822,728	1,320,572	122,488	3,265,788
Others	75,138	-	-	75,138

YEMEN ARAB REPUBLIC
Ministry of Transport and Public Works
Highway Authority

الجمهورية العربية اليمنية
وزارة النقل و الاشـغال العـامة
مصلحة الطرق

الخطة العمومية لشبكة الطرق
١٩٨٦ - ١٩٩٦

THE HIGHWAY MASTER PLAN
1986 - 1996

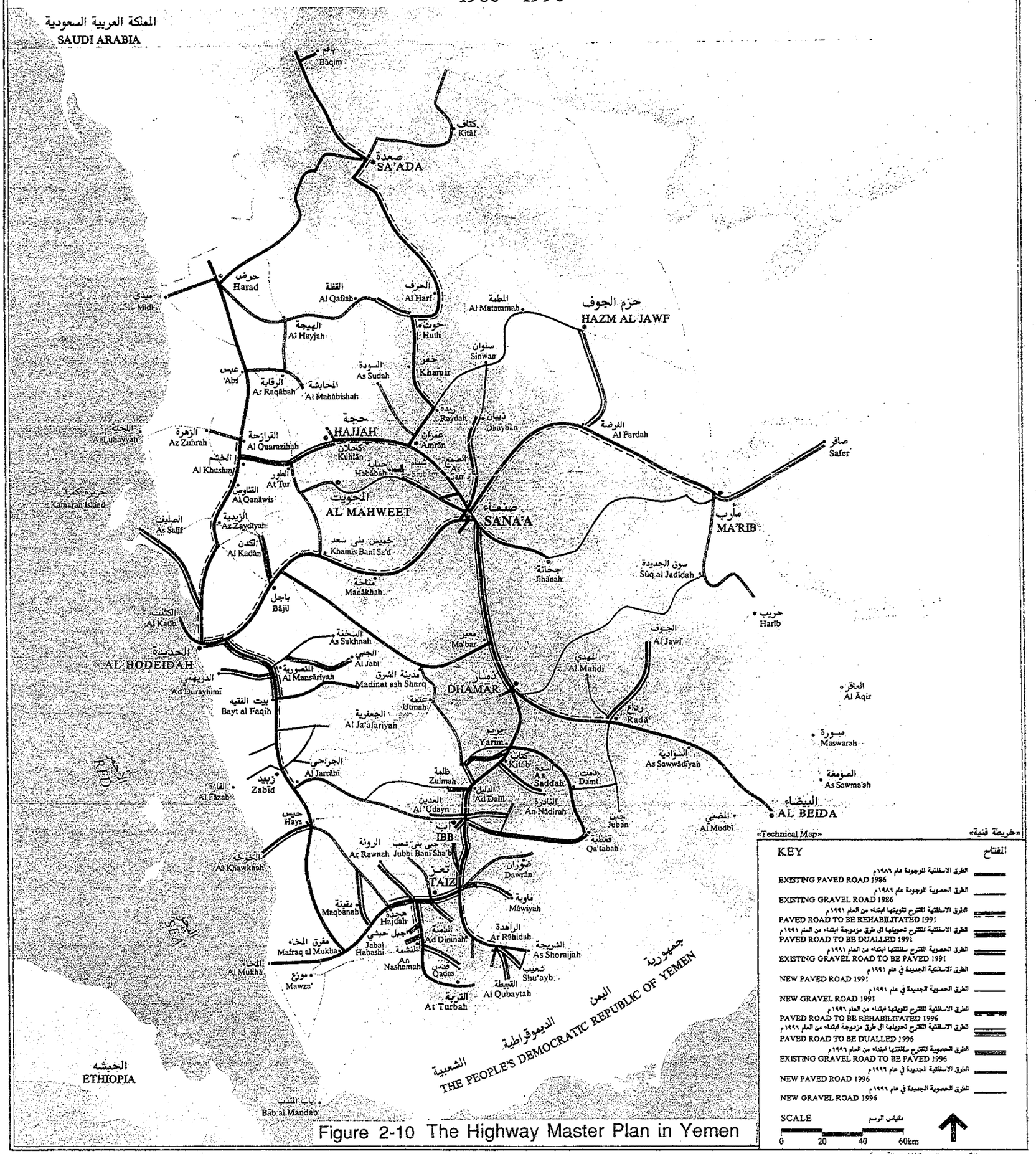


Figure 2-10 The Highway Master Plan in Yemen

(2) Relationship Between Present Project and Related Development Projects

Road construction/improvement work in Yemen has so far mainly been conducted with financial and technical assistance provided by foreign governments and international aid organizations. As a result, the completed roads tend to have special technical features of the countries providing such assistance. While roads in former South Yemen show British influence, their northern counterparts show United States influence. The cooperation by various countries in the building of the road network in Yemen has at the same time fostered domestic road construction skills.

The People's Republic of China constructed the Sana'a-Hodeidah Road in the mid-1950's while the United Kingdom constructed the Aden-Taiz Road. In addition, the Hodeidah-Al Mukha Road was constructed by the Soviet Union. The Sana'a-Taiz-Al Mukha Road was constructed in the 1960's by the USAID which was subsequently paved in the late 1980's with cooperation of West Germany and other countries.

Since the unification of Yemen, the World Bank has come up with the Multi-Mode Transport Project which intends the construction of a new road linking Harad and Huth with 30 million dollars, including elements of both grant and technical cooperation, over the period between 1991 and 1999.

Prior to the field survey for the present report, the progress of this World Bank project was checked and confirmed by the Basic Design Study Team members. The principle aid policies of the World Bank for road construction and improvement in Yemen are summarised below.

1) There will be no loans for new roads except the Harad-Huth Road, the construction of which is being implemented under the Multi-Mode Transport Project. (The construction of new roads should be conducted by the own efforts of the Government of Yemen and its private sector in addition to assistance provided by aid organizations in individual countries.)

2) The World Bank will continue to provide financial and technical cooperation for the improvement (road widening and paving) of the existing road network and for repair.

3) In regard to the Construction Machinery Training Center in Taiz for which financial assistance has been provided for building construction, further assistance will be provided in terms of equipment and expert instructors.

4) The GCRB will be provided with continuous loans for the procurement of spare parts for construction machinery and vehicles.

While providing the above assistance, the World Bank is trying to establish a project effect observation system by which the effects of the provided assistance are observed and evaluated prior to a decision on the continuance of assistance (provision of assistance → observation and evaluation → continuance of assistance) to accurately determine the extent of the assistance effects on the progress of each project.

The above assistance policies and projects of the World Bank are compatible with the GCRB's Master Plan described in 2.3.2.(1). They and the present project to construct a construction machinery workshop have a cooperative relationship in regard to promoting the consolidation of the road network in Yemen but do not overlap with each other.

2.4 Background and Contents of the Request

2.4.1 Background of the Request

(1) Original Request and Revised Request

Road transportation has historically played a crucial role in land transportation in Yemen. Recognising the importance of the road network as an essential component of the economic infrastructure, the Government of Yemen has been giving high priority to the consolidation of the road network which has been further reinforced since unification.

The total length of roads under government management in 1989 was 6,585.5km, of which 4,475.5km were paved. Although the total road length and paved road ratio have been rapidly increasing with the strong government commitment, the overall national and local road network is far from adequate.

There are two organizations in Yemen which are responsible for road construction and improvement, i.e., the General Corporation for Roads and Bridges (GCRB) which is under the jurisdiction of the Ministry of Construction and which is responsible for the construction and maintenance of intercity trunk roads, and the Services Activities Department of the Local Council Sector which is under the jurisdiction of the Ministry of Local Administration and which plays a central role in the construction and maintenance of local roads. Unfortunately, however, the operation rate of essential road construction/improvement machinery in Yemen is low, partly because of the general shortage of maintenance technicians and operators and partly because of the inadequate provision of repair tools and equipment at workshops, presenting a great obstacle to road construction and maintenance efforts.

The Government of Japan has provided assistance to increase agricultural production in the form of agricultural chemicals, fertilizers and agricultural machines on more than 10 occasions since 1980 to both North Yemen and South Yemen (on only 1 occasion in 1989 in the case of South Yemen). However, the lack of proper maintenance skills has created a problem of the inefficient use of this assistance.

In response to the situation described above, the Government of Yemen has established a road maintenance technicians training centre in Taiz. However, this centre is finding it difficult to meet the demand for such technicians because of the shortage of necessary training facilities and equipment as well as inadequate management. Moreover, the existing workshops are not operating properly due to various reasons. Under these

circumstances, the Government of Yemen has prepared a project to construct a training centre relating to construction machinery and agricultural machinery (because of the mechanical similarities between these two types of machinery) and a workshop and has requested the Government of Japan's provision of grant aid cooperation for the project. In response to this request, the Government of Japan Cunducted to Preliminary Study between November 8th and November 27th, 1991. During consultations between the Preliminary Study Team and the Government of Yemen which followed the Preliminary Study, it was decided that the repair workshop and training for agricultural machinery would be dropped from the project in view of the fact that the Ministry of Agriculture was not designated as the project implementation body. Consideration of the size of the proposed project, i.e., necessitating to keep the project at a manageable size, also contributed to this decision.

The Minutes of Discussions for the Preliminary Study, dated November 18th, 1991, incorporate the following contents of the Yemeni request.

1) Construction of Buildings

   ① Workshop and training centre buildings

   ② Office building

   ③ Dormitory building

   ④ Others

2) Provision of Equipment and Others

   ① Maintenance and repair tools and equipment

   ② Machinery and equipment for training of plant operators and technicians and latest construction machines for training

   ③ Furniture for training centre

   ④ Vehicles (microbuses and others)

   ⑤ Emergency power generation unit

   ⑥ Mobile repair shop (service truck)

During the Basic Design Study, conducted between April 9th and May 9th, 1992 following the preliminary study results, the requested contents of the project were again

examined by both the Japanese and Yemeni sides. It was concluded that it would be preferable to delay the construction of a full-scale training centre until some time in the future when the more pressing need to upgrade basic skills had been successfully met, although the necessity to establish a training centre of appropriate size and capability was fully recognised. The upgrading of basic skills meant the active use of the proposed workshop for on-the-job training (OJT) to expand human resources and to improve their quality, suggesting the addition of OJT-related training space and supplementary equipment for the workshop to enhance the OJT function of the workshop.

The following contents of the requested project were confirmed by both sides during the Basic Design Study.

1) Main Buildings

① Workshop

② Accommodation facility for trainees

③ Auxiliary buildings

- Power generator shed

- Car-park

- Petrol station

2) Main Equipment

① Maintenance and repair tools and equipment

② Vehicles (microbuses and station wagons)

③ Emergency power generating unit

④ Mobile repair shop (service truck)

⑤ Teaching materials for OJT

⑥ Standard furniture for accommodation facility for trainees

(2) Project Site

The GCRB plans to use a site owned by the Ministry of Construction which is located to the east of Sana'a for project purposes as shown on the Site Location Map. This site is on a slope of Mt. NUKUM , facing suburban Sana'a across the First Ring Road which runs in front of the site. The back of the site faces Mt. NUKUM.

The site covers some 4ha and is 170m in length and 230m in width.

(3) Project Implementation Body

The project implementation body in Yemen is the GCRB, the organizational structure of which is shown in Fig. 2-4.

CHAPTER 3 CONTENTS OF THE PROJECT

CHAPTER 3 CONTENTS OF THE PROJECT

3.1 Objectives of the Project

The Government of Yemen has been actively conducting the expansion and improvement of the road network which is the very basis of all the country's economic activities. However, the insufficient availability of road construction machinery maintenance and repair facilities, the shortage of the required tools and equipment, and the inadequate technical skills of the workers have resulted in a decline of the machinery operation rate, hampering the efficient and economical implementation of road construction / improvement work.

One objective of the present Project is to improve the operation rate of road construction machinery in order to rapidly improve the above situation by means of constructing a model workshop (for maintenance and repair purposes), as well as providing the necessary equipment, in suburban Sana'a to serve the northern part of the country. The Project also intends the construction of an accommodation facility for trainees. The workshop will be used to train and upgrade technicians through OJT who will then disseminate maintenance and repair skills to local areas.

3.2 Examination of Contents of Request

3.2.1 Appropriateness and Necessity of the Project

Road transport in Yemen accounts for 95 percent of the total volume of domestic passenger transportation and 90 percent of the total volume of cargo transportation. In view of the predominant importance of road transportation, the Government of Yemen gives high priority to the improvement of the road network as one of the most important components of the economic infrastructure.

As the topography of Yemen is characterised by mountain ranges with many undulations, the efficient and effective use of construction machinery to cut through these mountain ranges is essential for all road construction work.

The shortage of highly skilled operators of and mechanics for such machinery in Yemen, together with the inadequate provision of maintenance and repair facilities as well as equipment, has caused insufficient regular inspections and maintenance and the improper handling of the machinery, in turn resulting in highly noticeable deterioration of the machinery. Consequently, road construction work itself is inefficient (some 40 percent of the machinery currently owned by the GCRB is out of order).

The workshop planned under the Project will be constructed to improve the operation rate of construction machinery which is essential for road construction work, to improve the technical skills of maintenance and repair technicians/mechanics and to stimulate the transfer of these skills to local areas in Yemen through OJT at the workshop. In view of these advantages of the workshop, the Project appears to have high priority vis-a-vis the Government of Yemen to further facilitate road construction work and, therefore, the implementation of the Project is deemed highly necessary.

If the operation rate of the construction machinery is improved as planned due to the progress of its maintenance and repair following the implementation of the Project, road construction work will become more efficient, contributing to both economic and industrial development through the smooth transportation of people and goods, in turn significantly contributing to the progress of the establishment of the stability of public life.

3.2.2 Management Plan

Following the completion of the Project, the GCRB will bear the overall responsibility for the proper management of the workshop and other facilities with the General Directorate for Workshops and Stores exercising immediate control.

(1) Management Structure

The management structure of the workshop is shown in Fig. 3-1. The workshop manager will have total management responsibility for the workshop which will employ a total of 168 persons.

(2) Recruitment

The existing workshop in Sana'a will be closed down with the opening of the workshop to be constructed under the Project. All the facilities, as well as the 90 employees, of the existing workshop will be transferred to the new workshop. Of the remaining 78 persons required for the new workshop, almost all will be selected from among current GCRB staff members who have undergone training at the Taiz Training Centre. Fresh recruitment from the private sector is, therefore, not currently anticipated.

(3) Personnel Cost

The personnel cost of the new workshop is already accounted for in the annual budgets of the various sections of the GCRB. It is assumed, therefore, that the personnel cost will be secured as in the case of staff members. According to the GCRB's calculations, the total personnel cost of the workshop for the first year of operation will be approximately 12,382,000 YR (135 million yen).

(4) Other Operation and Maintenance Costs

The operation and maintenance cost of the workshop, excluding the personnel cost, for the first year is estimated to be approximately 10,150,000 YR (110 million yen) as shown in 3.3.6 (3). Of this, 7,250,000 YR is accounted for by the budget of the existing workshop in Sana'a. The remaining 2,900,000 YR will require extra funding by the GCRB. As this figure represents less than 0.1 percent of the GCRB's annual budget, no problem is anticipated in regard to this figure being borne by the GCRB.

(5) Spare Parts

The GCRB is building up a stock of spare parts for construction machinery with the financial assistance of the World Bank and other organizations and is currently constructing a spare parts warehouse on the project site in question with its own funds. The World Bank has indicated its intention to continue to assist the procurement of spare parts and it is unlikely that the present Project will come to a halt due to a lack of spare parts. Table 3-6 shows the present inventory level of spare parts.

Based on the standard penetration test results, a soil bearing capacity of 40 tons/m^2 can be safety assumed.

3.2.3 Relationship with Similar Aid Projects

At the centre of the road development programme in Yemen is the Master Plan which has been prepared in line with the fourth 5-Year Plan (1992-1996) as described in 2.3.2-(1).

Road construction/improvement work in Yemen has largely been conducted with the financial and technical assistance of foreign countries. However, some of Western aids for development project in Yemen were suspended after the Gulf War. The only exception in the road construction/improvement sector is the Multi-Mode Transport Project of the World Bank. As described in 2.3.2-(2), there is no overlapping of or conflict of interest between the present Project and the World Bank's aid policy.

3.2.4 Project Components

As described in 3.1, the ultimate objectives of the Project are to improve the operation rate of construction machinery through improved maintenance and repair capabilities and to upgrade the maintenance and repair skill levels of technicians dispatched from local workshops to undergo OJT at the new workshop. To achieve these objectives, the Project envisages the construction of a model workshop with modern equipment suitable for the technical level in Yemen and also the construction of an accommodation facility for trainees.

The Project consists of the following components to achieve the above objectives.

- Workshop (including OJT-related lecture rooms as well as practical training rooms and an administration office)
- Dormitory for trainees
- Other auxiliary facilities (carpentry shop, car-washing bay and unloading bay)
- Materials and equipment for maintenance and repair purposes
- Materials and equipment for OJT purposes
- Management organization (staff structure) to administer the workshop and other facilities
- Japanese experts dispatched to Yemen to provide technical cooperation
- Trainees dispatched from existing workshops other than the workshop in Sana'a, other government ministries and agencies and private companies
- Maintenance and repair plan and OJT plan to achieve the Project objectives

3.2.5 Requested Facilities and Equipment

During the visit of the Basic Design Study Team, the Government of Yemen made a request for the provision of the following items to achieve the objectives of the Project.

- Main Buildings

  ① Workshop

  ② Accommodation facility for trainees

  ③ Auxiliary buildings

  - Power generator shed

  - Car-park

  - Petrol Station

- Main Equipment

① Maintenance and repair tools and equipment

② Vehicles (microbus and station wagon)

③ Emergency power generating unit

④ Mobile repair shop (service truck)

⑤ Teaching materials for OJT

⑥ Standard furniture for accommodation facility for trainees

(1) Necessary for and Purpose of Use of Main Buildings and Equipment

The necessity for and purpose of use of the requested items were confirmed through the field survey and domestic analysis.

① Workshop and Maintenance/Repair Tools and Equipment

The workshop and the maintenance/repair tools and equipment to accompany it are the core items of the Project and the workshop will be used to conduct the full-scale maintenance and repair of construction machinery and also to provide OJT opportunities for trainees to be sent from the existing local workshops and other organizations.

② Accommodation Facility for Trainees

The accommodation facility for trainees is, in fact, a dormitory to meet the accommodation requirements of those trainees sent from the existing local workshops to undergo OJT at the new workshop. This dormitory is also planned to provide a place for technical exchange between staff members of the GCRB's local and regional offices, branches and local workshops. The trainees staying at the dormitory will use this facility for not only homework and preparatory work after the daily OJT sessions, but also for technical exchange amongst themselves to improve their technical knowledge and to stimulate their pursuit of technical progress. The standard furniture to be provided as part of the Project will be of the built-in type (personal lockers and others). Desks, beds, chairs and kitchen facilities will also be provided.

③ Emergency Power Generating Unit

Although a 15KV distribution line is available at the project site, the supply often fails to meet the demand due to poor operation, causing black-outs, particularly in winter. In the worst case, daily black-outs as long as six hours can last for several days. The provision of an emergency power generating unit is, therefore, an absolute necessity to meet at least the minimum power load so that any disruption of the planned facilities and equipment can be kept to a minimum in order to guarantee efficient maintenance and repair work. The planned capacity of the power generator of 100-125KVA is rather modest. There will be no need to construct a shed if a package-type generator is selected.

④ Vehicles (Microbus and Station Wagon)

The implementation of regular servicing of the construction machinery in use at road construction sites is essential to improve the operation rate and also to prolong the life of such machinery. It is, therefore, planned to provide a pick-up truck and a station wagon for the speedy and efficient movement of mechanics, tools and spare parts so that on-site maintenance and repair services can be efficiently conducted.

The provision of a microbus has, however, been dropped from the Project due to the following reasons.

- The Yemeni side will have the management responsibility for the facilities and equipment to be provided under the Project (including personnel cost, maintenance cost and procurement of spare parts, etc.) As the main use of these vehicles is for staff commuting, this must be arranged by the GCRB.

- The commuting means for the staff to be transferred from the existing Sana'a Workshop have already been secured.

⑤ Mobile Workshop (Service Truck)

The provision of a service truck is necessary to provide the workshop with the mobility to repair construction machinery on site.

⑥ Teaching Materials for OJT

These are supplementary materials to assist OJT at the workshop and consist of wall charts, slides, AV equipment and cut models, etc.

(2) Technical Difficulties and Necessity

In principle, the equipment to be provided should be capable of carrying out the proper maintenance and repair of the construction machinery currently owned by the GCRB. In addition, it should be able to deal with the maintenance and repair requirements of recently automated machinery to a reasonable extent. The equipment should be durable and the procurement of spare parts should not be difficult. Particular care should be exercised in the selection of the latest machine tools and other equipment with built-in electronic components taking the present technological level in Yemen into consideration.

(3) Facilities to be Added

It is necessary to add the following administrative offices and OJT-related rooms to the original list of items to be provided under the Project in view of the efficient and effective use of the buildings and equipment.

- Workshop Manager's Office
- Administration Office
- Engineers' Room
- Tool Room
- Work Control Room
- Meeting Room(s)
- Practice Room(s)
- Others

3.2.6 Examination of Appropriateness of Technical Cooperation

The planned workshop will be constructed as a medium-size workshop which is capable of providing full-scale machine maintenance and repair services. As such, its equipment and technical levels will be much higher than those of existing workshops in Yemen. In view of the facts that the equipment to be provided for the workshop is not manufactured in Yemen and that the Project will be implemented under Japan's grant aid cooperation system, most of the equipment will be made in Japan.

Upon completion of the Project, the equipment provided must be effectively used to maintain and repair construction machinery and vehicles. However, it appears difficult for the Yemeni technicians and mechanics to be assigned to the workshop to begin using the equipment efficiently due to the following reasons.

1) Yemeni mechanics have no experience conducting full-scale repairs using an overhaul facility although they do conduct certain types of repair work at construction sites or at the existing workshops.

2) Although not currently available at the existing workshops, some repair equipment which is essential for full-scale maintenance and repair work is planned for the new workshop.

3) While it is planned to assign people who have completed training courses at the Taiz Training Centre to the new workshop, the level of technical guidance (including OJT) currently available is inadequate to foster mechanics of a high calibre.

4) There is a lack of adequate ability to judge whether the construction machinery currently out of order should be repaired or scrapped.

Upgrading of the technical capability of construction machinery maintenance and repair workers in Yemen appears to require the dispatch of experts from Japan to provide technical guidance for at least a few years in time for the opening of the new workshop. To be more precise, the dispatch of the following three technical experts is required to transfer the necessary skills.

1) Operation and maintenance expert to train Yemeni's to pass proper judgement on work control, process control and the appropriateness of repair work.

2) Engineer to instruct on repair work using the newly provided repair tools and equipment.

3) Engineer to instruct on the maintenance and control of the newly provided maintenance and repair tools and equipment.

Likely candidates are supervisors, group leaders and service engineers working for manufacturers or the agents of manufacturers or those with previous experience in these fields.

3.2.7 Basic Policy for Project Cooperation

The proposed Project has been examined from multiple viewpoints, including its background, objectives, contents, appropriateness and implementation/management plan, etc., and the necessity for the Project, its feasibility and the implementation capability of the Yemeni side have been confirmed. The Project also satisfies Japan's grant aid cooperation criteria as it will not only improve the operation rate of construction machinery, essential for road construction work to consolidate the basis for all economic activities, and upgrade machine maintenance and repair skills but will also contribute to the creation of a capable workforce through the provision of education and OJT at the planned workshop. The provision of Japanese grant aid cooperation for the Project is, therefore, deemed appropriate. The Project outline is examined and the basic design carried out in the following sections on the assumption that the Project is implemented with Japanese grant aid cooperation.

3.3 Project Outline

3.3.1 Implementation Body and Management System

The Project implementation body will be the GCRB (of the Ministry of Construction) and the actual management team will be formed by the General Directorate for Workshops and Stores of the GCRB. The organizational structure of the new facilities to be constructed under the Project is outlined next.

(1) Organization

The GCRB is currently planning to introduce the organizational structure shown in Table 3-1 to run the new facilities. The workshop manager will have overall responsibility and there will be two deputy workshop managers, i.e., one responsible for the workshop and one responsible for the warehouse. The actual services will be provided by five sections, i.e., Transport and Service Section, Construction Machinery Service Section, Heavy Vehicles Service Section, Light Vehicles Service Section and Parts Control Section.

(2) Staff

The present Yemeni plan for staff distribution and the fields of specialization are shown in Table 3-1. The total number of staff for the workshop, warehouse and dormitory, etc., will be 168 which appears a reasonable figure to run the facilities of the proposed size.

Table 3-1 Staff Distribution Plan for New Workshop (1/5)

(Administration Section)

Job Description	No.	Remarks
Workshop Manager	1	
Deputy Workshop Manager (Workshop)	1	
Deputy Workshop Manager (Warehouse)	1	
Chief Administrator	1	
Administrative Officer	1	
Accounting Officer	1	
Parts Officer	1	
Transport and Service Officer	1	
Assistant Service Officer	1	
Office Boys	4	
Guards	8	
Sub-Total	21	

Table 3-1 Staff Distribution Plan for New Workshop (2/5)

Job Description	No.	Remarks
(Construction Equipment Repairing & Overhauling Section)		
Foreman	1	
Skilled Workers	8	
Semi-skilled Workers	12	
Test Drivers	2	
Tool Controller	1	
Sub-Total	24	
(Machine Shop)		
Foreman	1	
Skilled Workers	4	
Semi-skilled Workers	5	
Pump Controllers	2	
Hydraulic Pressure Inspectors	2	
Helpers	2	
Sub-Total	16	
(Electric & Electronic Shop)		
Foreman	1	
Skilled Workers	2	
Electrical Engineer	1	
Semi-skilled Workers	2	
Battery Controllers	3	
Sub-Total	9	

Table 3-1 Staff Distribution Plan for New Workshop (3/5)

Job Description	No.	Remarks
(Welding Shop)		
Foreman	1	
Skilled Workers	2	
Welders	2	
Helper	1	
Sub-Total	6	
(Tyre Repair Shop)		
Tyre Repairers	3	
Helpers	2	
Sub-Total	5	
(Body Repair and Paint Shop)		
Foreman	1	
Skilled Worker	1	
Semi-skilled Workers	2	
Skilled Painter	1	
Semi-skilled Workers	2	
Helpers	2	
Sub-Total	9	
(Carpentry Shop)		
Skilled Worker	1	
Semi-skilled Worker	1	
Helper	1	
Sub-Total	3	

Table 3-1 Staff Distribution Plan for New Workshop (4/5)

(Transport and Service Section)

Job Description	No.	Remarks
Petrol Serviceman	1	
Assistant Petrol Serviceman	1	
Grease Servicemen	2	
Assistant Grease Serviceman	1	
Cleaners	3	
Drivers	4	
Trailer Drivers	12	
Sub-Total	24	

(Heavy Duty Tracks Repairing & Overhauling Shop)

Job Description	No.	Remarks
Foreman	1	
Skilled Workers	7	
Semi-skilled Workers	12	
Test Driver	1	
Tool Controller	1	
Sub-Total	22	

(Light Duty Vehicles Repairing & Overhauling Shop)

Job Description	No.	Remarks
Foreman	1	
Skilled Workers	4	
Semi-skilled Workers	8	
Tool Controller	1	
Sub-Total	14	

Table 3-1 Staff Distribution Plan for New Workshop (5/5)

(Ware house)

Job Description	No.	Remarks
Section Manager	1	
Inspector	1	
Senior Parts Controllers	2	
Junior Parts Controllers	5	
Helpers	4	
Sub-Total	13	

Dormitory Wardens	2	

Total	168	

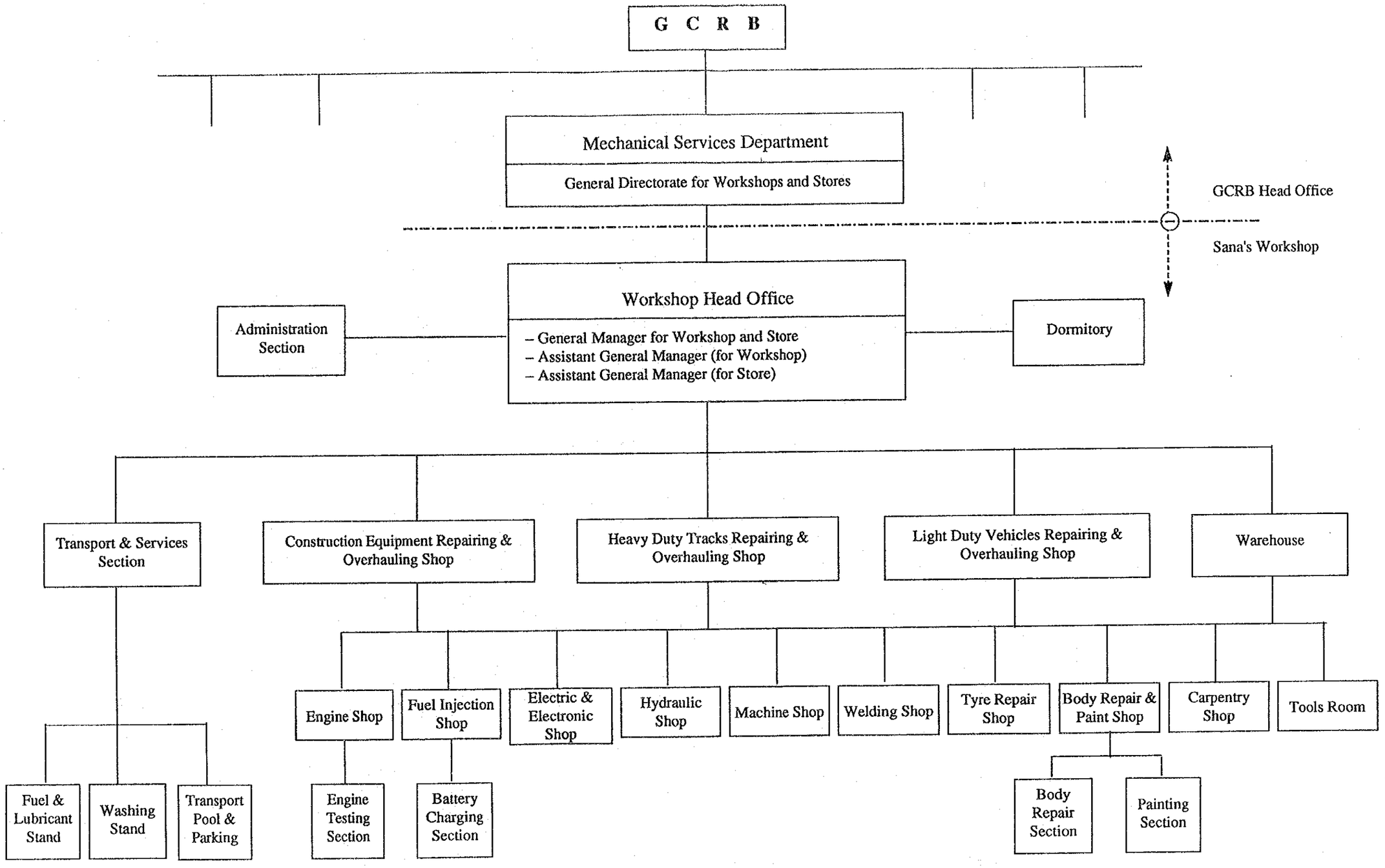


Fig. 3-1 Organization Chart