

CHAPTER 4 BASIC DESIGN

4.1 Basic Plan for Equipment

Equipment proposed by this Basic Plan are classified as shown in Table 4.1.

Table 4.1 Classification of Required Equipment

Classification	Description
Trucks	Dump truck
	Compactor truck
	Detachable container truck
	Workshop truck
Containers	1m ³ (for compactor)
	8m ³ (for detachable container truck)
Cars	Four Wheel-Drive Vehicle
Disposal and collection equipment	Wheel loader
Others	Telecommunications system
	Video projector and screen

4.1.1 Trucks

Trucks are segregated to chassis and body, and their uses are classified according to the shape of the body. Figure 4.1 shows the required characteristics of the body and chassis.

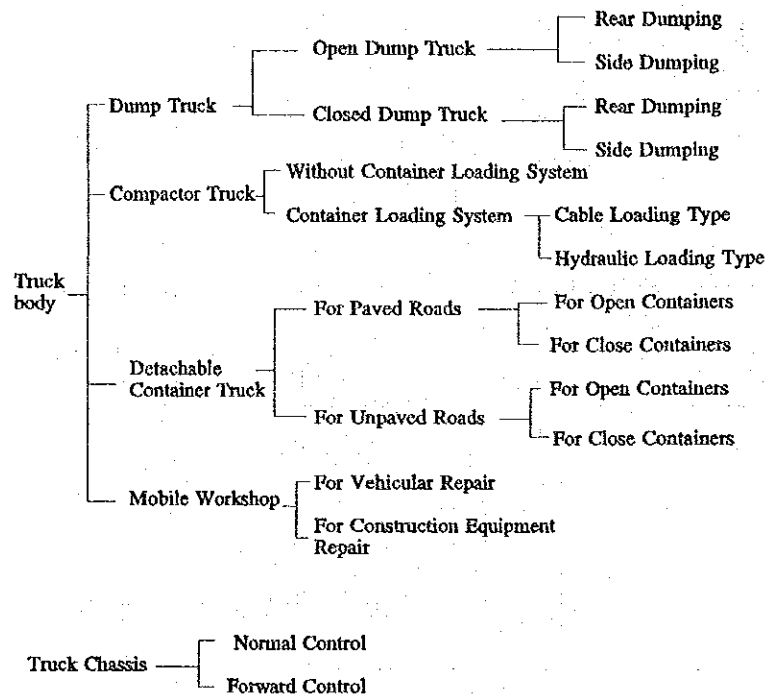


Fig.4.1 Classification of Trucks

(1) Chassis

Sana'a City is becoming congested year by year and as it lacks adequate parking space there are a large number of illegal parking cases, causing blockages in the flow of traffic in unsupervised areas. In order to deal with these foreseen problems forward control was chosen for the following reasons:

Merits of Forward Control:

- As the engine is below the driver seat it insures safety.
- Its turning radius is less than that of the normal control.

The chassis type is compatible with tropical conditions.

(2) Body

1) Dump Trucks

Since waste and soil are loaded manually or with a wheel loader on trucks, open top body type trucks should be used. Rear dumping system is adopted because waste and soil are dumped from the rear.

2) Compactor Truck

The 10m³ compactor truck for door to door collection shall be without a container loading system. 15m³ compactor truck shall be equipped with a hydraulic operating loading system, according to table 4.2.

Table 4.2 Comparison of Container Loading System

Container Loading system	Road Condition	Evaluation
Cable type	For paved roads	B
Hydraulic type	For paved roads or unpaved roads	A

Note: A = good
B = bad

3) Detachable Container Truck

As there are a large number of unpaved roads in Sana'a City, the truck suitable for unpaved roads will be adopted.

4) Workshop truck

The main purpose of the workshop truck is to provide repair services to disposal equipment; the truck body must be able to accommodate such equipment.

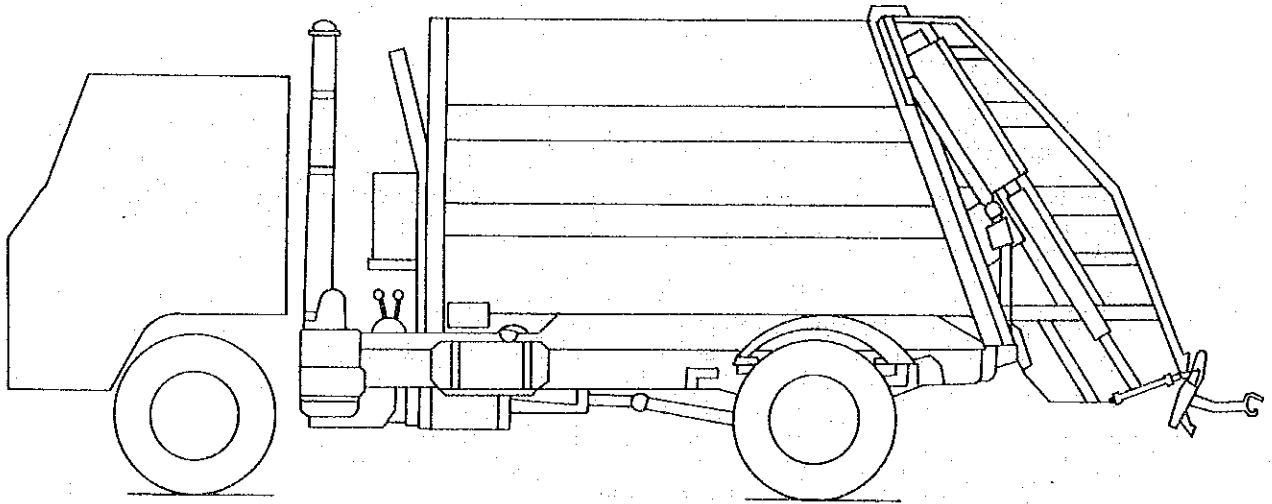


Fig.4.2 Compactor truck with hydraulic operation loading system

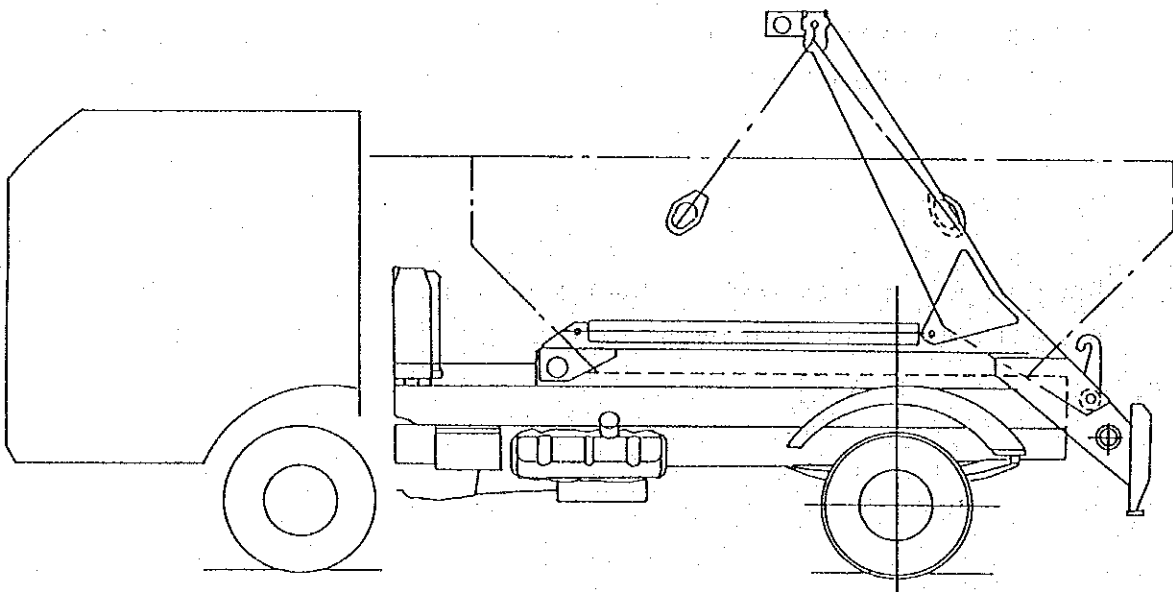


Fig.4.3 Detachable container truck

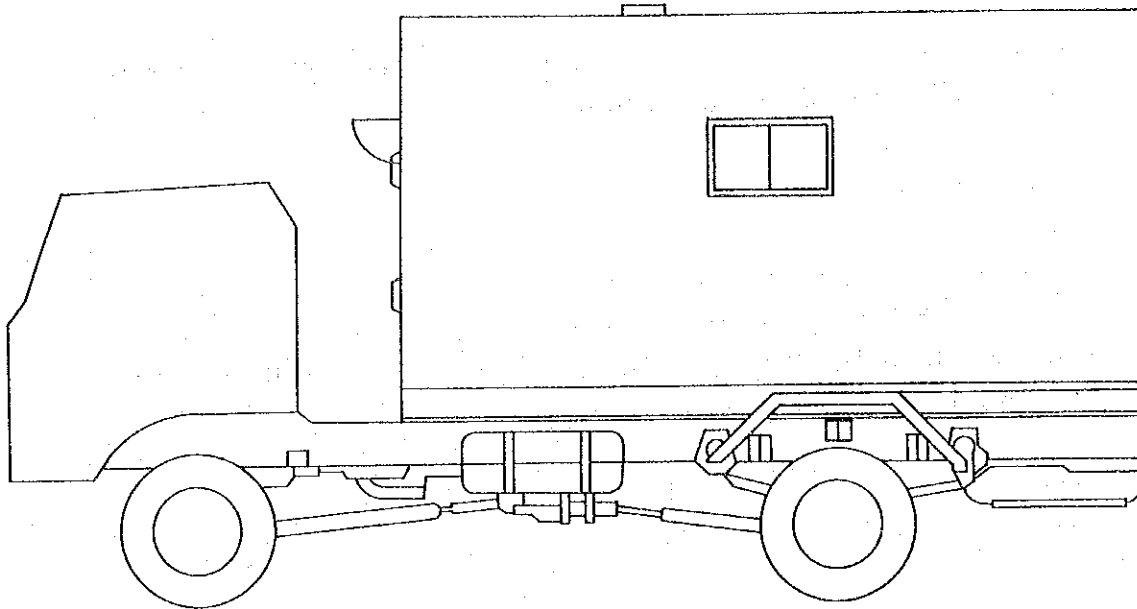


Fig.4.4 Workshop truck

4.1.2 Container

(1) Container for 1m³

The container used must be in accordance with the hydraulic operation loading system so the open type will be adopted, which is easily kept. The material shall be galvanized because of high durability.

(2) Container for 8m³

Like the 1m³ container the body must be in accordance with the hydraulic operation loading system so the open type will be adopted, which is easily used as communal garbage boxes. The material shall be iron with paint coating.

4.1.3 4 x 4 Jeep

A small type vehicle with a capacity for four passengers shall be adopted. The body shall comply with the tropics.

4.1.3 Four Wheel-Drive Vehicle

A small type vehicle with a capacity for four passengers shall be used. The body shall be compatible with the tropical conditions.

4.1.4 Disposal Equipment

The main disposal equipment included in this plan is a wheel loader. The primary requirement of the wheel loader is enough bucket height to cope with the loading of waste and soil on the dump truck. The wheel loader shall be compatible with tropical conditions.

4.1.5 Others

(1) Telecommunications System

a. Basic Policy

- A communication system shall be established between SCP and final disposal site.
- A central station shall be established at the headquarters and smaller receivers in the vehicles.
- Central station and the receivers can communicate with each other by this system.
- The Mayor and the Director of SCP shall each be given a radio telephone in order to have direct contact in case of emergency.

b. Specifications

Operational Field	25km
Frequency	155,000-160,000MHz
Power	25kW

c. Numbers Required

Main Radio Transmitter	1 unit (including antennae)
Receivers	26 units (all vehicles with the exception of the wheel loader)
Radio Telephone	4 units (Mayor, Director of SCP, Managing Director, Chief Technical Engineer)

(2) Audiovisual System

a. Video Projector

- . Multiple reception system
- . Projection capability greater than 100 inches
- . Amplifier and speakers included

b. Screen

- . Dimensions – 2.0 x 1.5m

c. Numbers Required

Video Projector	1
Screen	1

4.2 Implementation Plan

4.2.1 Implementation Policy

The following items are required for the enforcement of Japanese Grant Aid in the Plan.

(1) Allocation of Responsibilities

The responsibilities of both the Japanese and the Yemeni sides for the enforcement of the main plan are listed in table 4.3.

Table 4.3 Sphere of Responsibility for Project

Country	Sphere of Responsibility
Japan	Procurement of equipment cost 1. Consulting fee 2. Equipment cost 3. Sea transport and insurance cost from Japan to Hodeidah 4. Inland transport and insurance cost (Hodeidah to Sana'a)
Yemen	Fullness of SWM 1. Employment of new office staff 2. Collection and transportation 3. Maintenance of equipment 4. Education for solid waste management 5. Extension of storage area

The operational division of the SCP for the enforcement of the plan is shown in the table below:

Table 4.4 Operational Division of SCP

Classification of Equipment	Division
1. Cover soil equipment in the final disposal site	Operation Division
2. Collection and transportation equipment	Operation Division
3. Maintenance equipment	Technical Division
4. Operational equipment	Operation Division
5. Educational equipment	Health and Education Division

(2) Dispatch of Engineer

The equipment provided will be divided into transportation vehicles telecommunication systems and public education equipment, i.e. Video projector, etc.. These equipment are easy to operate and maintain, however, in the case of the telecommunication system, which the SCP are not familiar with, the engineer's guidance is needed for a short while.

In the case of the transportation vehicles, there should be no need for familiarization. There is a need for proper guidance in the use of the workshop truck in conducting minor repair works.

4.2.2 Consulting Policy

(1) Detailed Design

The objectives of the detailed design is to determine the requirements of the equipment and to prepare bid documents.

(2) Supervisory Plan

The supervision of the works will be conducted as follows:

- (1) Approval of Drawing for manufacturing
- (2) Progress control through the monthly report
- (3) Quality control of manufactured products through shop inspections after the completion of the equipment
- (4) Supervision of inland transportation work process in Yemen
- (5) Completion of inspection of equipment before handing over

4.2.3 Procurement Plan

(1) Procurement Policy

a. Vehicles

As there are no car manufacturing industries in Yemen, vehicles must be obtained from other countries, e.g. Japan or a third country. The vehicles shall be procured from Japan for the following reasons:

- i. It is desirable to employ trucks which are similar to those currently used by SCP as it will facilitate the training and use of special tools.
- ii. The trucks employed at present are listed. Among these, the Italian vehicles are reported to be frequently out of order.

Holland:	DAF
Italy:	Fiat
Japan:	Nissan Diesel
	Hino
	Mitsubishi
	Toyota
- iii. The Japanese models are cheaper than Holland's
- iv. Spare parts made in Japan are the most popular in Sana'a City (90-95% of vehicles in Sana'a are said to be Japanese).
- v. Spare parts of Japanese models are the cheapest.

b. Containers

The containers which are in current use were manufactured in Sana'a City. Their quality exceeds the basic requirements; the containers acquired shall be manufactured in Sana'a for the following reasons:

- i. It is not economically reasonable to transport the containers from Japan.
- ii. It is usual practice to galvanize the containers in order to obtain enough durability. In Yemen this practice is applied to 1m³ and not 8m³ containers. Therefore, the 1m³ containers shall be galvanized and the 8m³ containers shall be painted with an anticorrosive coating. If galvanizing is not possible, the material should be thicker to secure enough durability.

c. Wheel Loader

Very little difference was observed in the of Japanese and other countries' models. However, since Japanese companies are obviously regarded as significantly superior in terms of spare parts availability and after care services, Japanese wheel loaders shall be used.

d. Telecommunication System

For Japanese vehicles, Japanese radio systems shall be installed.

e. Video Projector

Audiovisual equipment and their spare parts are not manufactured in Yemen. Audiovisual systems shall be Japanese in consideration of aftercare services and availability of spare parts.

Table 4.5 Procurement Plan

Equipment		Procurement in Yemen	Procurement in Japan
For collection and transportation	Compactor (15m ³)		+
	Container (1m ³) for the above compactor	+	
	Compactor (10m ³)		+
	Detachable container truck		+
	Container (8m ³) for the above truck	+	
	Dump truck		+
	Wheel Loader		+
	Small Tipper		+
For covering soil	Dump truck		+
	Wheel Loader		+
For maintenance	Workshop truck		+
For operation	Four Wheel-Drive vehicle		+
	Telecommunications system		+
For education	Video Projector		+

(2) Considerations on the Procurement of Equipment

The equipment will be unloaded in Hodeidah port, approximately 230 km from Sana'a. Because of the distance, it is necessary to check on possible methods of inland transportation. Cars or trucks can be transported by trailers or can be driven up to its destination. As for video projectors and spare parts of equipment, they can be loaded on the freights or on the driven cars or trucks.

Considering roads and their surface conditions, the following transportation methods are proposed:

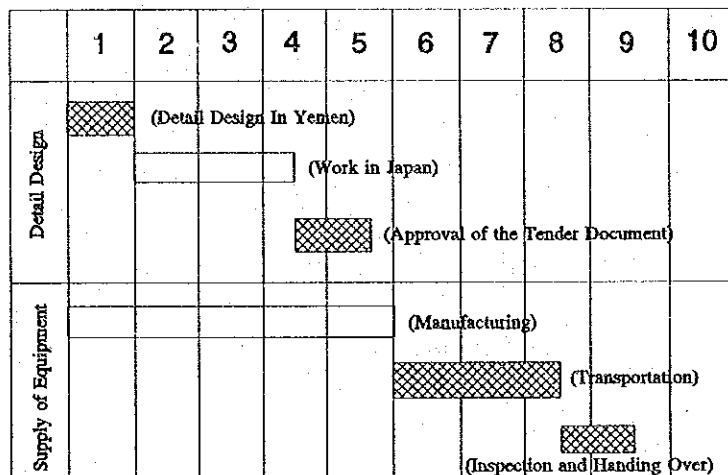
Compactor Truck Four Wheel-Drive Vehicle Work Shop Truck Small Tipper Dump Trucks Detachable Container Truck	all are driven to its destination
Wheel Loader	by trailer
Video Projector Spare Parts	loaded onto the driven cars or trucks

Very experienced drivers will be employed because the route includes many steep and narrow sections.

4.2.4 Implementation Schedule

The scheduled period for the implementation of the plan is 8.5 months after the conclusion of supply contract, of which 5 months is appropriated for manufacturing equipment (see Table 4.6).

Table 4.6 WORF Flow Chart



4.2.5 Scope of Work

If the Project is to be implemented through the Japan Grant Aid program, the Government of Yemen is requested to carry out the following items:

- 1) Enlargement of the storage area for spare parts of the equipment.
- 2) Acquisition of land for the storage of equipment.
- 3) Improvement of the workshop for maintenance and repair of the equipment.
- 4) Proper personnel disposition and allocation of budget for operation and maintenance of equipment.

Especially for a smooth use of materials, the enlargement of the storage area for spare parts and improvement of the workshop is necessary. A preliminary estimate for these changes is shown in the table below.

Table 4.7 Project cost shouldered by Yemen

Items	Price in USD
1) Enlargement of storage area for spare parts	23,940
2) Improvement of workshop	23,940
Total	47,880

CHAPTER 5

PROJECT EVALUATION AND CONCLUSION

CHAPTER 5 PROJECT EVALUATION AND CONCLUSION

5.1 Effects of the Project

This project intends to strengthen the foundation of SWM in Sana'a City, Yemen Republic. It also intends to improve the environment of Sana'a City.

With the equipment to be installed through the implementation of the project, the residents will directly and indirectly benefit from the following:

- (1) With the arrangement of the waste collection and transportation vehicles, the 300,000 people uncovered by the services before will be covered, and this would largely contribute to the improvement of the environment.
- (2) With the expansion of collection services in point sources like markets, wastes in central Sana'a can be certainly disposed of. This in turn will lead to the improvement of the residents' environment and beautify the city towns and streets.
- (3) Insanitary areas will be reduced, hotbed factors of disease will decrease and public health can be safeguarded.
- (4) With the sanitation of the environment, the beautiful sights of the city can be maintained and its reputation as a renowned tourist place because of its being the oldest city will be further enhanced.
- (5) By properly laying the cover soil in the final disposal site, the scattering of wastes in the area will be eliminated and the number of accidents of livestock eating inorganic substances will be reduced.
- (6) Through the introduction of equipment for educational purposes, educational programmes can be carried out and the residents' consciousness on sanitation will be heightened.

5.1.2 Estimation of Waste Service Coverage

Table 5.1 presents the designed waste collection ratio of Sana'a city.

The present service coverage ratio is 57.3% and this project will improve it to 85.5%.

The population covered by the service is estimated at 300,000, assuming the generation of 0.6 kg of waste daily.

This project will improve the service coverage ratio of the southern district from 49.9% to 79.2%, and from 68.1% to 100% for the district with the existing collection service.

Shifting existing equipment from the southern district to the northern district will improve the service coverage ratio of the northern district as well.

Table 5.1 Estimation of Waste Service Coverage

	Population (persons)	Ratio of Population (%)	Waste Dis-charged (tons/day)	Waste collected at present (tons/day)	Design Waste Collection Amount (tons/day)	Remaining Waste Amount (tons/day)	Coverage Ratio (%)	
							Present	Proposed
Sana'a City	1,076,090	100.0	687.2	394.0	587.54	99.68	57.3	85.5
Northern District	695,628	64.6	442.9	272.0	394.00	48.90	61.4	89.0
Area with collection service	511,811	47.6	332.6	272.0	332.60	0.00	81.8	100.0
Area without collection service	183,817	17.1	110.3	0.0	61.40	48.90	0.0	55.7
Southern district	380,462	35.4	244.3	122.0	193.54	50.78	49.9	79.2
Area with collection service	271,700	25.2	179.0	122.0	179.02	0.00	68.1	100.0
Area without collection service	108,762	10.1	65.3	0.0	14.52	50.78	0.0	22.2

5.2 Conclusion and Recommendations

5.2.1 Conclusion

For the improvement of the environment of Sana'a city, the implementation of this project is considered to be extremely important and this importance is fully acknowledged. There are no problems in the operation of solid waste management and budgetary measures of SCP, and the equipment to be provided by this project will be effectively utilized.

Consequently, the implementation of this project through the grant aid program of the Japanese Government will contribute to the sanitation of the Sana'a environment and safeguard public health.

5.2.2 Recommendations

This project only intends to supply and install the equipment required in waste collection and transportation works in order to strengthen the SCP foundation. However, with the installation of these equipment, the cleaning services of the city will certainly improve largely.

The following items must be considered to smoothly operate cleaning works and to effectively and efficiently conduct waste collection and disposal in the future.

(1) Formulation of a Master Plan

Since this plan only covers a small part of SWM, the formulation of a master plan for the entire Sana'a city is recommended, and an urgent measure is desired to ensure a more effective use of the equipment installed by this plan.

(2) Personnel Training and Hiring

Experienced and capable staff are indispensable to effectively carry out the works. There is a need, therefore, to establish a technical training system in schools and government agencies.

(3) Completion of Education Programmes on Environmental Sanitation

Wastes, such as vinyl bags and twigs originating from Cart which is a significant part of the culture of Yemen, could be minimized if residents would independently discharge them into waste bins or containers.

Guidance in the direct presentation and means of solving a problem is not only particularly important. Its application is also an important educational factor. Therefore, one of the uses of the main educational equipment would be for the execution of intensive educational activities on Cart and Waste.

APPENDIX 1	Member List of Survey Team
APPENDIX 2	Survey Schedule
APPENDIX 3	Member List of concerning Party in Yemen
APPENDIX 4	Minutes of meeting

APPENDIX 1. Member List of Survey Team

- | | |
|-------------------------|--|
| (1) Junji ISHIZUKA | Leader/
Deputy Director
Consultant Contract Division
Procurement Department
JICA |
| (2) Kazuo TAKADA | Waste Disposal Planner/
Chief of Procurement Unit of Facility Division
Environmental Works Bureau
Nagoya Municipal Government |
| (3) Shin-ya KAWADA | Chief Consultant for SWM/
Kokusai Kogyo Co., Ltd. |
| (4) Junichi AOKI | Equipment Planner/
Kokusai Kogyo Co., Ltd. |
| (5) Masatsugu YOSHIKAWA | Operation and Maintenance Planner/
Kokusai Kogyo Co., Ltd. |

APPENDIX 2. Survey Schedule

Schedule of the field survey is shown below.

Date	Movement	Activities
Nov.14 (Sat)	[Consultant members] Tokyo (via Frankfurt) ⇒ Sana'a	
15 (Sun)		
16 (Mon)		Visit to JPN Embassy Meeting at SCP (about Inception Report)
17 (Tue)		Workshop and final disposal site survey
18 (Wed)		Survey of the collection in the southern area
19 (Thu)		Survey of the collection in the northern area
20 (fri)		Japanese Group Meeting (estimation of the generation waste amount)
21 (Sat)		Meeting at SCP (about design policy) Meeting with agency of vehicles
22 (Sun)		Survey of the markets in the southern area Meeting with the agency of vehicles
23 (Mon)		Meeting at SCP (about collection plan and budget)
24 (Tue)	[JICA members] Tokyo (via Frankfurt) ⇒ Sana'a	Survey of the factory manufacturing container
25 (Wed)		Meeting at SCP (about equipment plan)
26 (Thu)		Meeting at SCP Courtesy visit to Sana'a Capital Secretariat
27 (Fri)		Japanese Group Meeting (about equipment plan)
28 (Sat)		Meeting at SCP (about the Minutes of the Discussion) Site Survey (workshop, final disposal site, collection condition)
29 (Sun)		Site Survey Courtesy Visit to JPN Embassy Courtesy Visit to MOPD
30 (Mon)		Japanese Group Meeting (about the Minutes of the discussion)
Dec. 1 (Tue)		Signing of the Minutes of the Discussion
2 (Wed)		Report to JPN Embassy
3 (Thu)	Sana'a (via Frankfurt) ⇒ Tokyo	
4 (Fri)		

APPENDIX 3. Member List of concerning Party in Yemen

1) Sana'a Capital Secretariat

Hussen Al Masware	Mayor
Hamdy Al Sonidar	Assistant of Mayor
Ahmad Al Sonidar	Local Council Chairman, Sana'a City
Ali A.Al-Sanhany	Public Relation Manager, Sana'a Capital secretariat

2) Sana'a Cleaning Project

Abdullah M. Sunbol	General Manager
Mohawed A. Rageh	Assistant Manager
Abelulla Kassim	Operational Manager
Mohawed Haza'a	Assistant Operational Manager
Abaulgani Ali	Technical Manager
Hussein Ahmed Abdu	Assistant Technical Manager
Altaf	Manager, Health & Education Division

3) Ministry of Planning Development

Abdulwali Al-Agel	Deputy Minister of Planning & Development
Hamoud Hamdani	Director
M. Zohra	Assistant Director

4) Embassy of Japan

Kazuo Wanibuchi	Ambassador
Mitsuru Murase	First Secretary
Yasuo Nakano	First Secretary
Anwar	Secretary

5) Private Companies

Abdulla A. Nadeesh	Commercial Director, Adhban Group of Companies
Sreekumar Varma	Manager, The Halal Shipping Co., Ltd.
Fadl Dafr Salen	Manager, Yemen Company for Manufacture and Maintenance

Ahmed H. Alwatary

Commercial Manager, Alwatary General Trading
and Agricultural Development

Kasem Hussein

President, China Yemen Metal Co., Ltd.
(CYMCO LTD)

Al-Mashdaly

MINUTES OF MEETING
BASIC DESIGN STUDY ON THE PROJECT
FOR SANA'A MUNICIPAL SOLID WASTE MANAGEMENT IMPROVEMENT
IN THE REPUBLIC OF YEMEN

In response to the request from the Government of The Republic of Yemen, the Government of Japan decided to conduct Basic Design Study on the Project for Sana'a Municipal Solid Waste Management Improvement (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent the Study Team to Yemen, which was headed by Junji Ishizuka, Deputy Director, Consultant Contract Division, Procurement Department, JICA, and was scheduled to stay in the country from November 15th to December 3rd, 1992.

The Team held meetings with the officials concerned of the central and local government of Yemen and conducted a field survey at the study area.

In the course of discussions and field survey, both parties have confirmed the main items described on the annexes. The Team will prepare the Basic Design Study Report based on the confirmation.

Sana'a City, December 1st, 1992

J. Ishizuka

JUNJI ISHIZUKA
 Leader
 Basic Design Study Team
 JICA

Abdulwali Al-Agel
 11/21/92

ABDULWALI AL-AGEL
 Deputy Minister
 of Planning and
 Development



Hussen Al Masware

HUSSEN AL MASWARE
 Mayor of Sana'a



ANNEX I

1. Objective of the Project


The objective of the Project is to supplement the equipment for the improvement of municipal solid waste management in order to maintain clean environment.

2. Project site

The site of the Project is the area as shown in ANNEX II.

3. Executing agency

Sana'a Capital Secretariate is responsible for the administration of the Project under coordination of the Government of Yemen.



4. Items requested by the Government of Yemen

After the discussion with the Basic Design Study Team, the following items were finally requested by the Government of Yemen.

(1) Target year is 1992.

(2) Target area is the southern part of Sana'a City divided by ZUBAIRY STREET.

area = approx. 20km²

population = approx. 300,000

(3) The composition of required equipment is shown below;

NO.	DESCRIPTION	Q'TY	GENERAL SPECIFICATION
1	Compactor A	4	G.V.W: not less than 15ton Body capacity: not less than 15m ³ Loading system: DIN standard
2	Container A	500	Capacity: not less than 1.0m ³ Galvanized steel
3	Compactor B	8	G.V.W: not less than 11ton Body capacity: not less than 11m ³ Without container system
4	Detachable container truck	2	G.V.W: not less than 11ton Lifting capacity: not less than 12ton
5	Container B	20	Capacity: not less than 8.0m ³ Painted steel
6	Dump truck	3	G.V.W: not less than 24ton Body capacity: not less than 10m ³
7	Small tipper	6	G.V.W: not less than 4.5ton Body capacity: not less than 1.5m ³
8	4x4 Jeep	2	Engine: not less than 1000cc
9	Workshop truck	1	G.V.W: not less than 9.0ton repair for landfill equipment
10	Wheel loader	2	Bucket capacity: not less than 1.9m ³
11	Wireless communication system		Base station : 1set Mobil transceiver : 25set Handy transceiver : 4set
12	Video projector		Projector : 1set Screen : 1set
13	Spare parts		15~20% of FOB price

5. Japan's Grant Aid system

- (1) The Government of Yemen has understood the system of Japan's Grant Aid explained by the Study Team.
- (2) The Government of Yemen will take necessary measures, described in Annex III for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

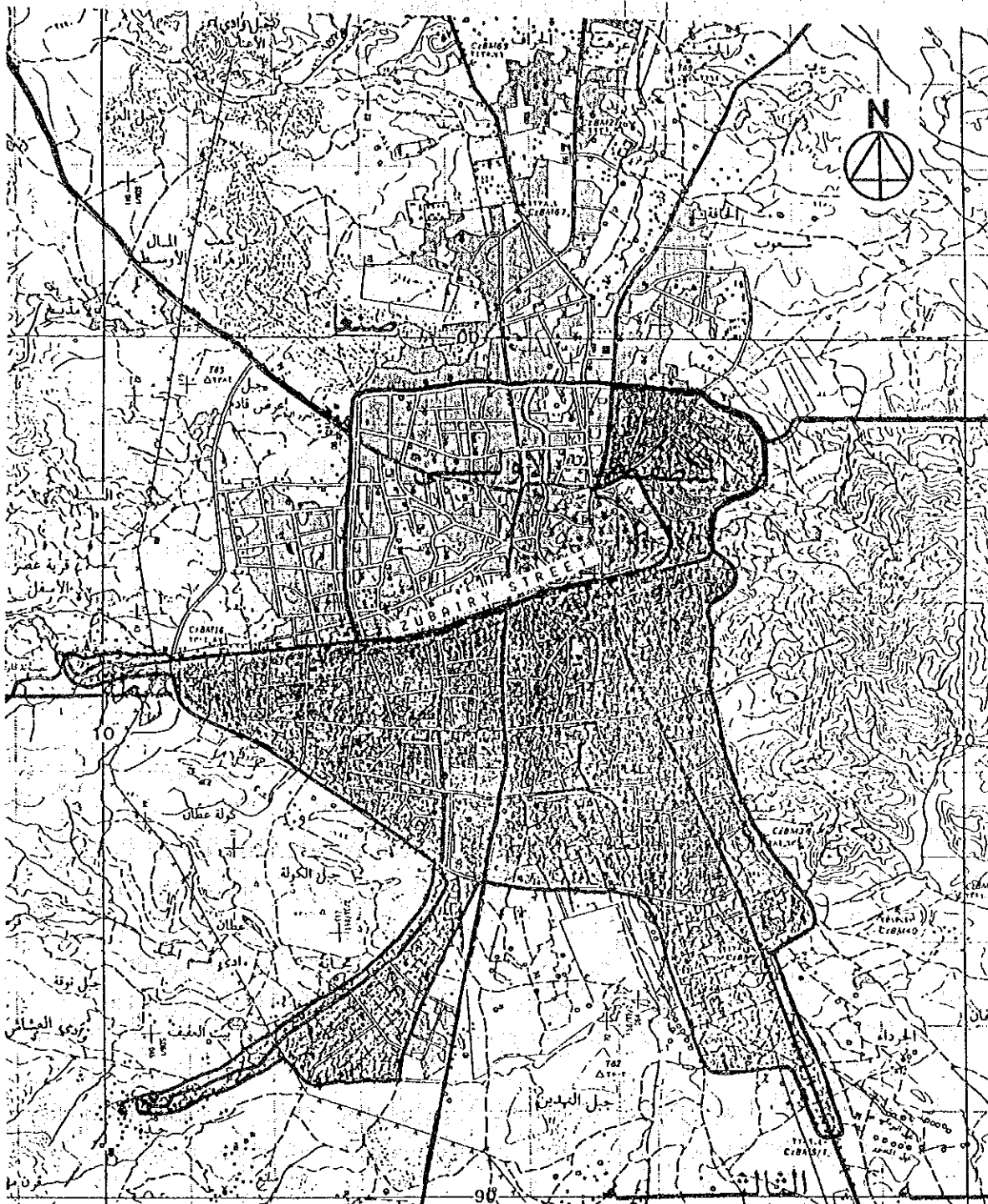
6. Schedule of the Study

Based on the Minutes of Meeting and the technical examination of the study results, the Study Team will complete the final report and submit it to the Government of Japan by the end of March, 1993. It will be submitted to the Government of Yemen by the end of April, 1993.

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ANNEX II

Site of the Project



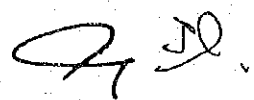
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Annex III

MEASURES TO BE TAKEN BY THE GOVERNMENT OF THE REPUBLIC OF YEMEN

Necessary measures to be taken by the Government of the Republic of Yemen in case that Japan's Grant Aid is executed are as follows:

1. To bear payment commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement(B/A).
2. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Yemen with respect to the supply of the products and services under the Verified Contracts.
3. To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the Verified Contracts such facilities as may be necessary for their entry into the Republic of Yemen and stay therein for the performance of their work including preparation of ID card for them.
4. To bear all the expenses, other than those covered by the Grant, necessary for the Project.
5. To provide necessary data and information for detailed design.
6. To take necessary actions to expedite the approval for executions of the Project by the authorities concerned in the Republic of Yemen.
7. To ensure prompt unloading and customs clearance at ports of disembarkation in the Republic of Yemen and internal transportation therein of the products purchased under the Grant.
8. To ensure that the products purchased under the Grant are maintained and used properly and effectively for the execution of the Project.



JICA