2.10 Present physical condition in the Middle District

2.10.1 Land Use

The Middle Town District (hereinafter referred to as "MTD") consists primarily of three spheres in rough classification of its land use, namely;

a. Urbanized town between the coast and the canal of El Mahmoudia. (approx. 950 ha)

b. Industrial area between the canal and the Agriculture Road (approx. 222 ha)

c. Formland zone beyond the south of the Agriculture Road (approx. 5,166 ha)

In the coastal area of MTD, land shows a little undulations with about 20 meters difference in level as a whole. There urbanized town spreads out. In the interior area, on the other hand, comparatively flat land can be seen. There industiral area and farmland zone expand.

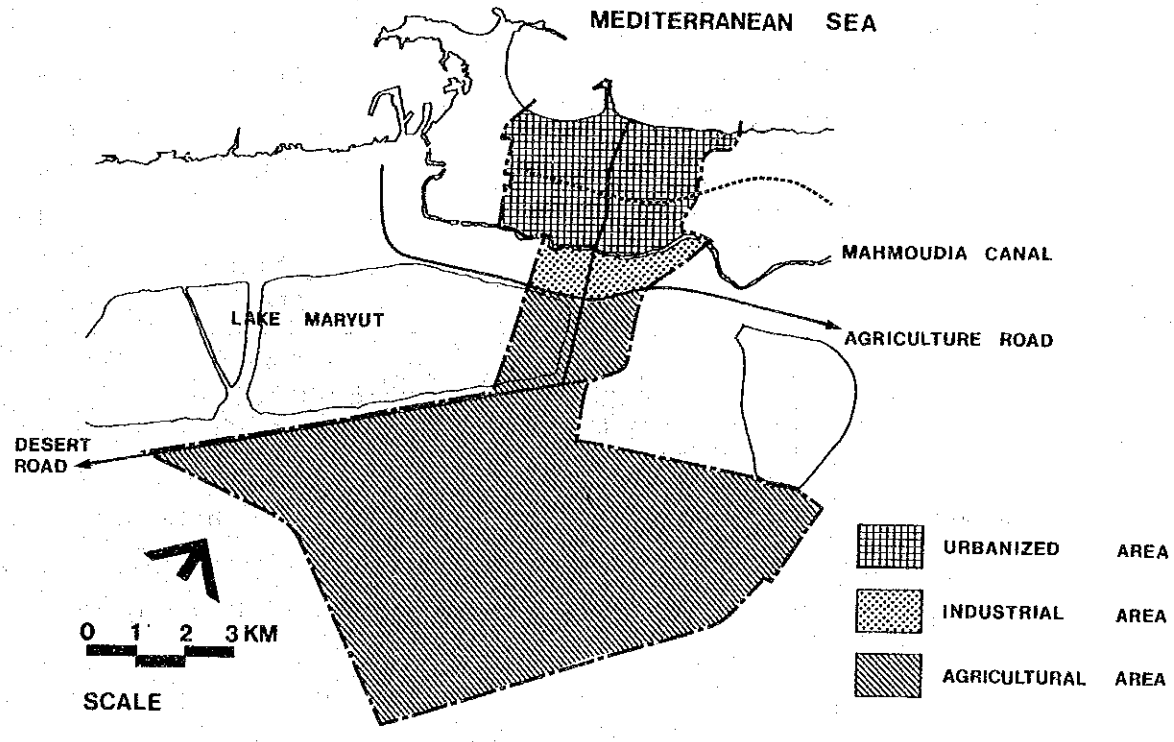


Fig. 2-10-1 DEVIDED REGIONS IN MTD

For the purpose of obtaining a fundamental characteristics of MTD, studies and surveys concerning physical condition of it were done mainly upon the urbanized area.

Results of these are woven into the study of collection planning. A rough illustration of land use on the urbanized area and industrial area of MTD is as shown in Fig. 2-10-2, and area of each classification is given in Table 2-10-1.

Tab. 2-10-1 CLASSIFIED LAND USE ON THE URBANIZED AREA AND INDUSTRIAL AREA OF MTD.

Classification	Area (ha)	Ratio (%)
Central commerce & business	43	3.6
Official establishments	47	4.0
Cultural facilities	6	0.5
Hospital & social Welfare	35	3.0
Educational & religious facilities	95	8.1
Residential quarters	431	36.8
Traffic facilities	40	3.4
Industrial factories	121	10.3
Parks & sports facilities	49	4.2
Cemetery	56	4.8
Farmland	87	7.4
Vacant land	51	4.4
Street	111	9.5
Total	1,172	100.0

Source: Measurement from a map made by JICA study team, 1985

N.B.: In more than half of residential quarters, neighborhood or strip commercial zones have fairly developed along streets of which total length extends approx. 35 kilo meters.

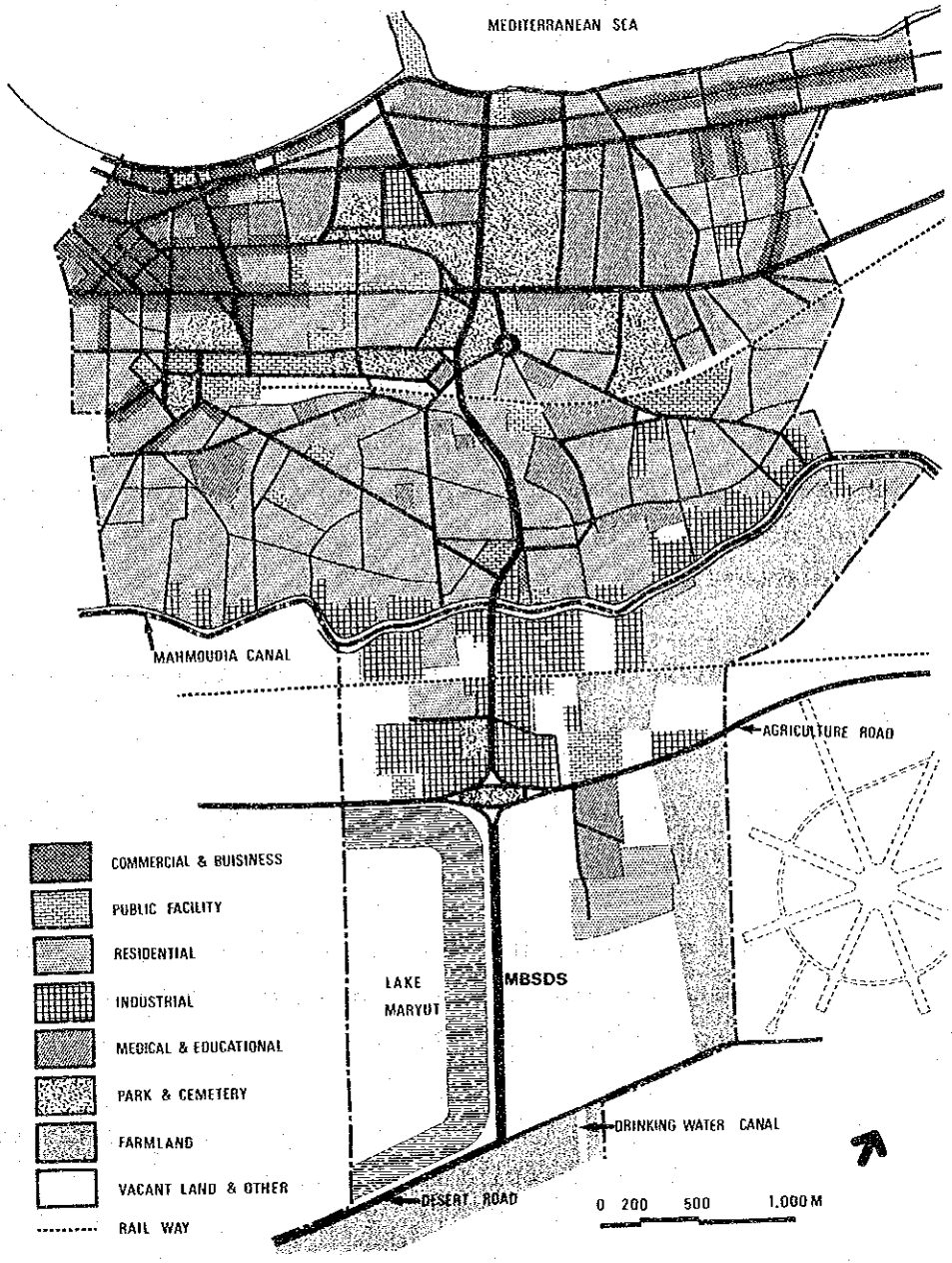


Fig. 2-10-2 A ROUGH ILLUSTRATION OF LAND USE (PRESENT)

Source: Field Survey by Naito, T. 1985.

Central land of the urbanized area is mostly utilized for cemetries, parks, stadium, university and hospitals. Surrounding this, the residential quarter is formed in circular.

In the west side of Masr Station, the terminal of the railway, numerous sorts of public offices and diplomatic offices of foreign countries are concentrated. Further west of this area is utilized for central commercial and business activities and is the busiest quarter of Alexandria.

Another side, the land along El Mohmoudia Canal is mostly used for manufacturing plants, and partly for farmland in the east of the canal. Current features of land use on the urbanized area in MTD can be summarized as follows:

1) All blocks are relatively utilized as simple use, compounded uses are little seen.

2) The portion which is utilized for public facilities and open space like cemetery is high.

3) Utilization by such extensive urban facilities as banks, speciality stores, official establishments, foreign diplomatic offices, universities, and hospitals are developed.

4) In residential quarters, every block is so crowded with houses that there are no vacant places to build new houses in.

5) Medium and small-sized factories stand close together along the canal. This condition of closeness is a possible cause of both pollution and ugliness.

Outside of urbanized area is mainly farmland and vacant place. And a small residential block - about 7 hectare - is formed to the east of the Moharam Bey Square Dump Site, called Nadi El Seid.

The condition of land use on the unurbanized area of MTD is as shown in Table 2-10-2.

Tab. 2-10-2 CLASSIFIED LAND USE OF THE UNURBANIZED AREA OF MTD

Classification	Area (ha)	Ratio (%)
Residential quarters	7	0.1
Farmland (include barns for cows)	4,557	88.2
Vacant land (include the surface Lake Maryut)	555	10.8
Other	47	0.9
Total	5,116	100.0

Source: Measurement from a map prepared by the Engineering Dept. of MTD 1985.

2-10-2 Streets

Field survey was carried out on all streets of the urbanized area in summer 1985. According to classification of width, their length was measured and the network was drawn. In addition, street inventories for five sample areas were made concerning street conditions in detail. Each of them is as given in Table 2-10-3, Fig. 2-10-3, Fig. 2-10-4, Table 2-10-4 and Table 2-10-5.

Tab. 2-10-3 STREET CLASSIFICATION IN THE URBANIZED AREA OF MTD

Classification		Width (m)	Length (km)
Trunk	more than	7	17.2
Main	"	7.5	48.8
Secondary	"	5	110.3
Tertiary	"	3.5	138.0
Other	less than	3.5	57.7
Total		372.0	

Source: Measurement on a map made by JICA study team, 1985

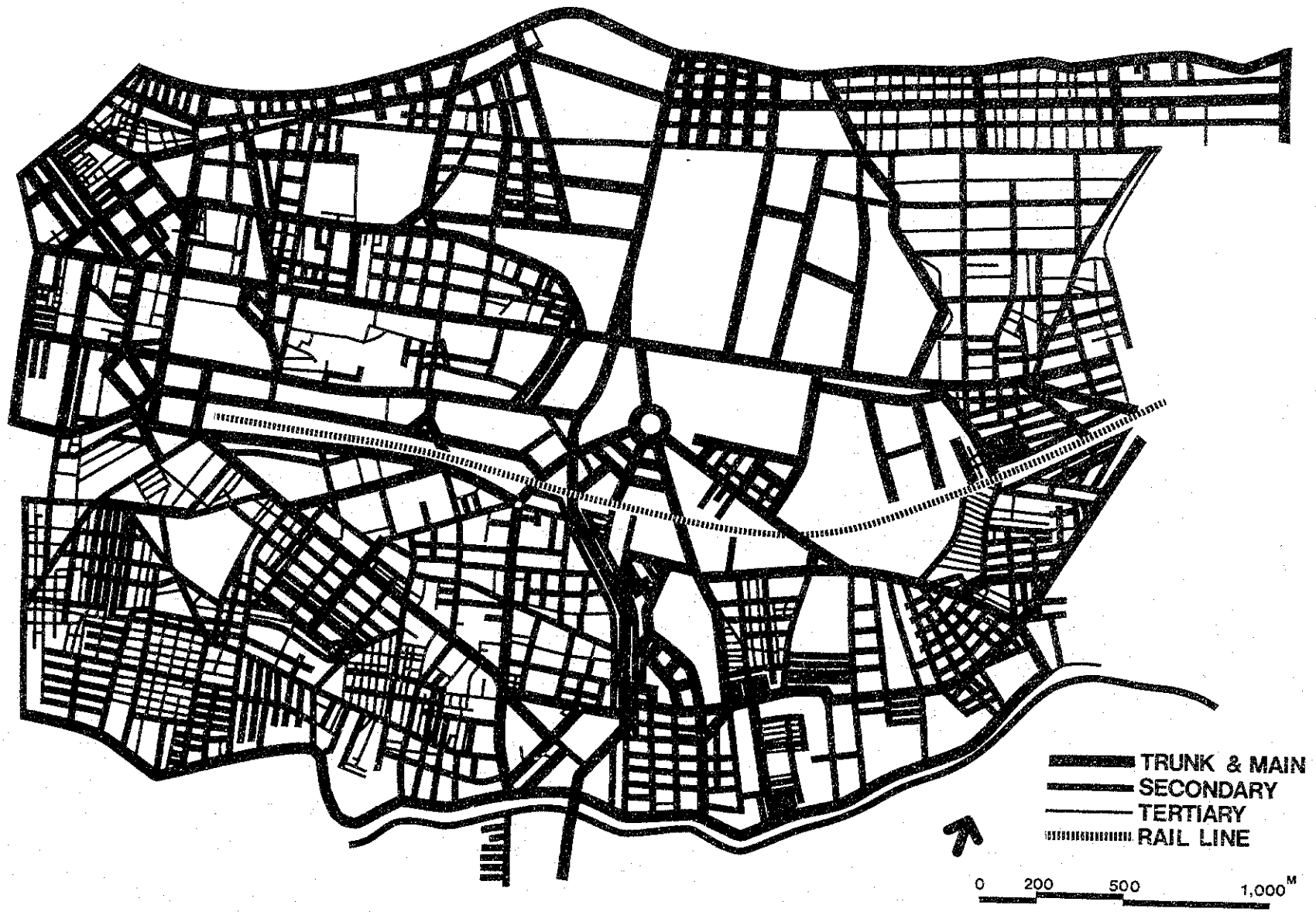


Fig. 2-10-3 STREET NETWORK IN THE URBANIZED AREA

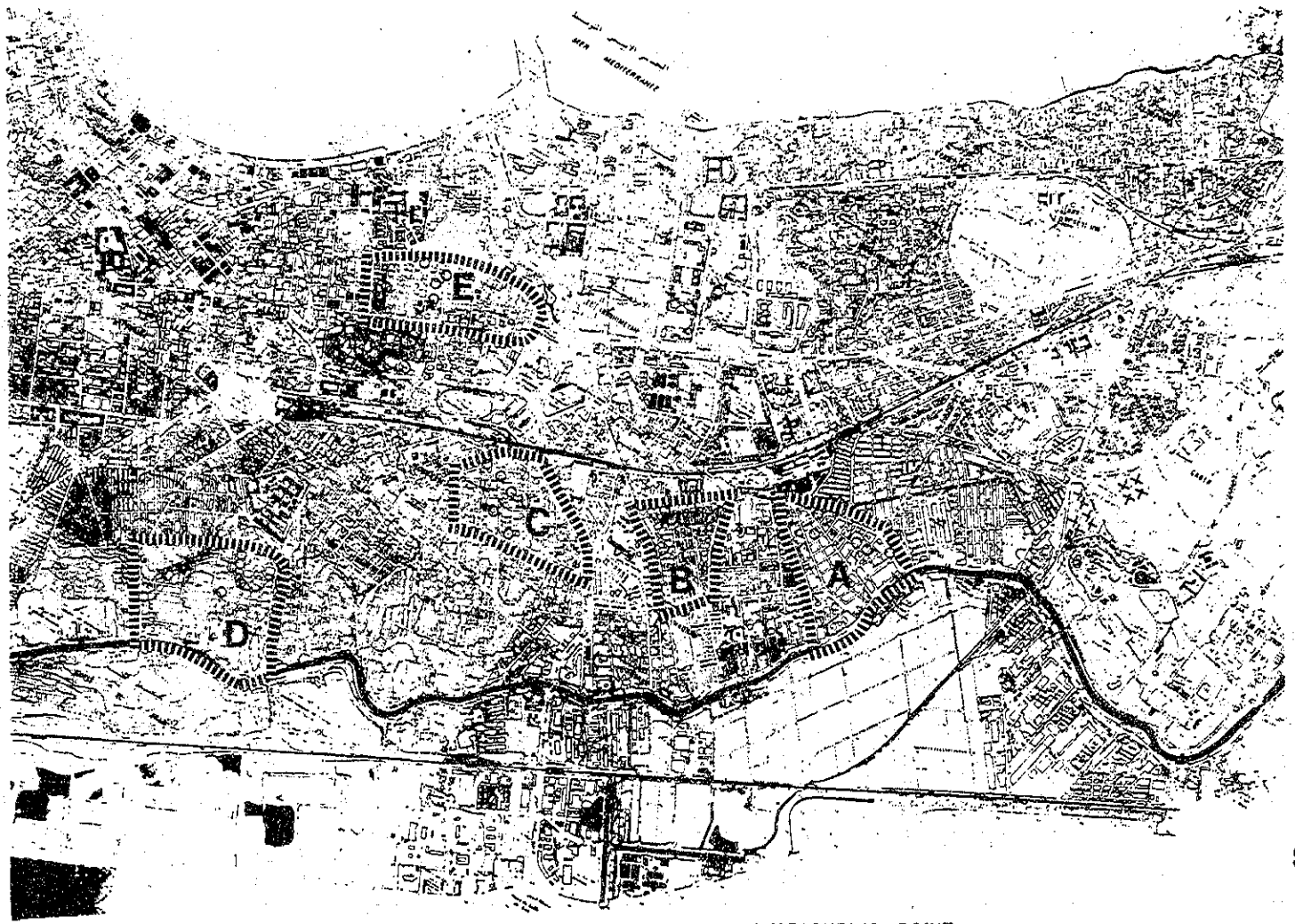


Fig. 2-10-4 SAMPLE AREA OF STREET INVENTORY

THE FEASIBILITY STUDY ON REFUSE COLLECTION, TREATMENT AND DISPOSAL IN ALEXANDRIA

Tab. 2-10-4 STREET INVENTORY OF SAMPLE AREA (1)

Sample area	Type of street	Street width (m)	Carriage way width (m)	Pedestrian width (m)	Type of pavement		Maintenance		Type of building use along the street	Parking condition	Remarks
					Carriage way	Pedestrian	Carriage way	Pedestrian			
A											
Hadrah	Trunk	22.1	13.3	8.8	Stone	Tile	Ordinal	Bad	Middle height residence	On pedestrian	Tram
	Main	19.1	9.9	9.2	Stone	Tile	Bad	Bad	Low height residence Factory	On pedestrian	Lined trees
	Main	13.2	8.5	4.7	Asphalt	Tile	Ordinal	Bad	Middle height residence	On pedestrian	-
	Secondary	9.6	6.4	3.2	Asphalt	Tile	Ordinal	Ordinal	Middle height residence	On pedestrian	-
	Secondary	7.9	6.2	1.7	Asphalt	Tile	Good	Ordinal	Middle height residence	On carriage way	-
B											
Moharam Bey I	Trunk	20.2	14.1	6.1	Asphalt Stone	Tile	Ordinal	Ordinal	Middle height residence Hospital	On pedestrian (thin)	Tram
	Main	12.2	7.7	4.5	Asphalt	Tile	Ordinal	Ordinal	Middle height residence	On carriage way	Lined trees
	Secondary	8.8	6.5	2.3	Asphalt	Tile	Good	Ordinal	Middle height residence	On carriage way (thin)	-
	Other	3.2	3.2	-	Asphalt	-	Ordinal	-	Middle height residence	On carriage way (thin)	-
	Other	3.2	3.2	-	Asphalt	-	Ordinal	-	Middle height residence	On carriage way (thin)	-
C											
Moharam Bey II	Main	17.4	9.3	8.1	Asphalt	Tile	Good	Bad Ordinal	Middle height residence Low height office	On pedestrian	Lined trees
	Main	15.9	8.9	7.0	Asphalt	Stone	Good	Good	Middle height residence Low height office	On pedestrian	Lined trees
	Secondary	9.9	6.5	3.4	Asphalt	Tile	Ordinal	Bad Ordinal	School	On pedestrian	-
	Secondary	7.9	6.0	1.9	Asphalt	Tile	Ordinal	Ordinal	Middle height residence	On pedestrian (thick)	-
	Tertiary	6.0	4.0	2.0	Asphalt	Asphalt	Bad	Ordinal Warehouse	Middle height residence	On pedestrian	-

Tab. 2-10-5 STREET INVENTORY OF SAMPLE AREA (2)

Sample area	Type of street	Street width (m)	Carriage way width (m)	Pedestrian width (m)	Type of pavement		Maintenance		Type of building use along the street	Parking condition	Remarks
					Carriage way	Pedestrian	Carriage way	Pedestrian			
D											
Raghed Ragheb	Main	12.4	8.0	4.4	Asphalt	Tile	ordinal	Bad	Middle height Residence School	On pedestrian	-
Basha	Main	12.0	7.7	4.3	Asphalt	tile	ordinal	Bad	Middle height residence	On pedestrian (thin)	-
	Secondary	11.7	7.3	4.4	Stone	Tile	Ordinal	Ordinal	Middle height residence Shops	On pedestrian (thin)	-
	Secondary	9.7	6.7	3.0	Asphalt	Tile	Good	Ordinal	Middle height residence Shops	Nothing	-
	Secondary	8.0	6.1	1.9	Asphalt	Tile	Ordinal	Ordinal	Middle height residence	On carriage way	-
	Tertiary	5.6	4.6	1.0	Asphalt	Not paved	Ordinal	Bad	Middle height residence	On carriage way (thin)	-
E											
Bab Sharky	Main	20.5	11.8	8.7	Asphalt	Tile	Good	Ordinal	High height residence Office	On pedestrian	Lined trees
	Main	14.7	10.3	4.4	Asphalt	Tile	Good	Good	High height office	On carriage way (thin)	-
	Secondary	12.1	7.2	4.9	Asphalt	Tile	Good	Good	High height residence	On carriage way (thick)	-
	Secondary	10.1	6.2	3.9	Asphalt	Tile	Good	Ordinal	High height residence	On carriage way	-
										On pedestrian	-
	Tertiary	9.3	5.5	3.8	Asphalt	Asphalt	Ordinal	Ordinal	Low height residence	On pedestrian	-
	Tertiary	5.8	4.0	1.8	Asphalt	Asphalt	Bad	Bad	High height residence Musium	On one side of carriage way	-

From the viewpoint of solid waste collection and street cleansing, problems of streets can be summed up in the following three points;

1) Parking along streets

It is common to find cases of illegal parking along the streets where parking is prohibited. Even in main streets, parking along both sides reduces the passable space, causing long lines of motorcars and delays. To make matters worse, such parking is an obstacle for street cleansing.

2) Lack of maintenance of the streets and pedestrian walks

There is some earth and sand on either side of streets, and the pavements of pedestrian walks come off at several parts of them. At present, such situation is left as it is, so the cleansing is not done smoothly in most of the streets.

3) Unpaved streets

In residential quarters, many unpaved streets having widths less than the tertiary can be seen. In such unpaved streets, there are some problems as the following instances; street sweeping raises dust during its operations, or due to inability of being able to sweep well, dust, etc., often remain.

2-10-3 Building

Reflecting the diversity of land use in MTD, buildings are also used for various purposes. It is a usual case that the ground floor of buildings facing the main streets is utilized for shops. Nevertheless, there are few buildings which are used exclusively for commercial stores or business offices. Even if in the central commercial and business quarter, many of the buildings are used for residence above their second floor. In short, this can be called vertical compounded use of building. Such is a usual sight in MTD.

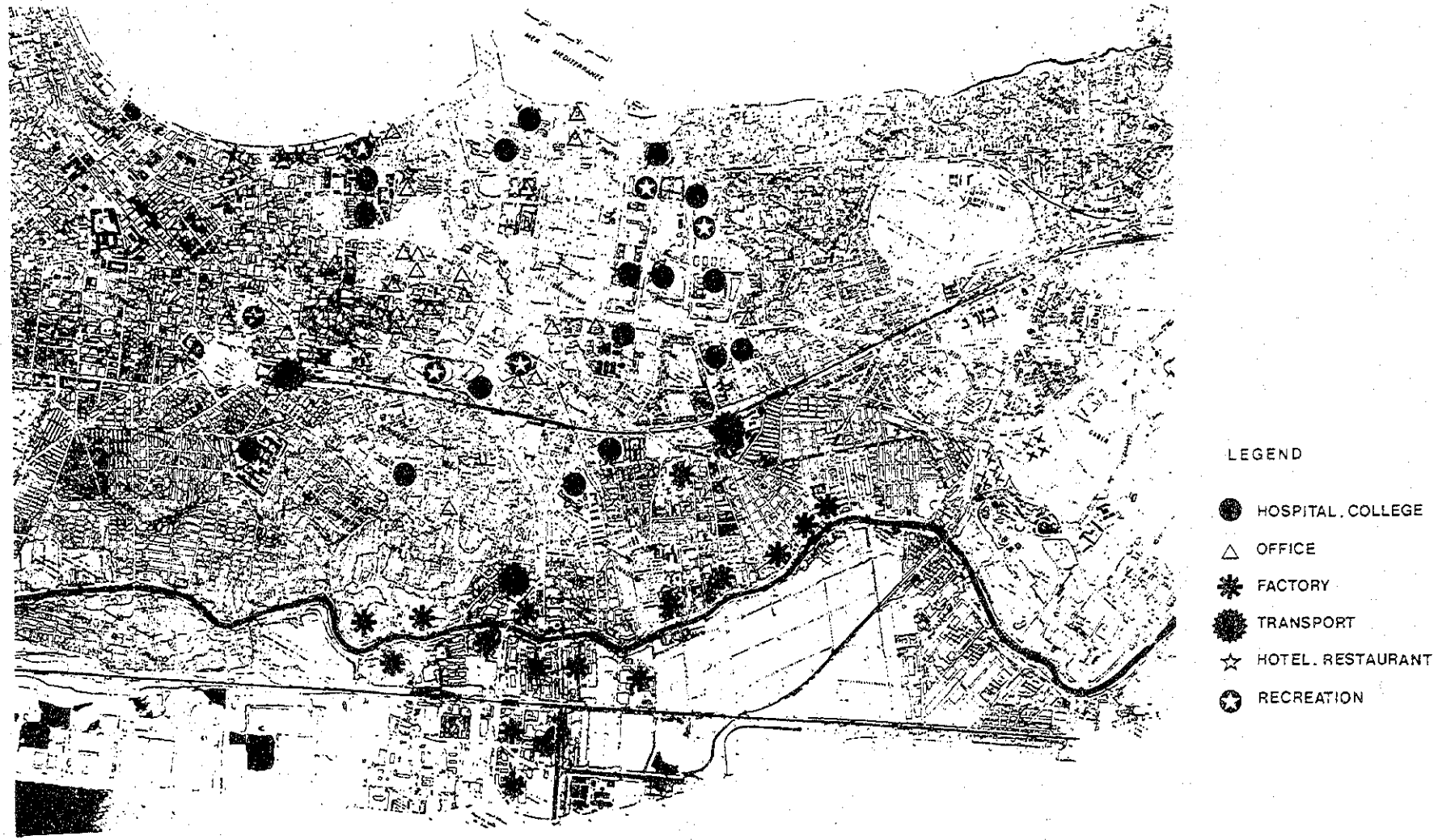


Fig. 2-10-5 THE LOCATION OF PRINCIPAL BUILDINGS IN MTD

THE FEASIBILITY STUDY ON REFUSE COLLECTION, TREATMENT AND DISPOSAL IN ALEXANDRIA

With respect to materials of buildings, most are reinforced concrete or stone, with some made from bricks as seen in the low height buildings for residence.

The heights of most buildings are between 4 and 6 stories. More than 10 stories high buildings are seldom found even in the central commercial and bus iness quarter. Also there are few low height buildings that have 1 - 2 stories. Consequently, middle height buildings are predominant.

Number of buildings in MTD is as shown in Table 2-10-6. And the principal buildings are as drawn up in the distributional map of Fig. 2-10-5.

Tab. 2-10-6 NUMBER OF BUILDINGS IN MTD

Sub-District	Zone	Number of buildings
Bab Sharky	Wabor El Maiya	477
	El Azarita	594
	Shizar	1,687
	El Ibrahimiya	1,478
	El Hadara	2,517
		6,753
Moharam Bey	Bawalino	2,446
	El Pralblby	468
	Bab El Gedid West	800
	Bab El Gedid East	3,007
	Ragheb	1,750
	El Sobhia (also Nadi El Seid)	1,578
	Imbrowzo	3,759
	Abis (7)	743
	Abis (8)	1,704
	Abis (10)	527
		16,781
Attarin	El Mesalla	508
	Sherif	322
	Attarin West	429
	Attarin East	308
	Kom El Deka West	390
	Kom El Deka East	257
	El Sory	389
	El Mirghany	292
		2,900
Total		26,434

Source: Alexandria Governorate Middle Town District Financial Supervision, 1985.

2-10-4 Population

Estimated population of MTD is 760,100, and occupies approx. 26 per cent of the city of Alexandria as of 1985.

Most of overpopulated divisional zones are in Moharam Bey Sub-district located eastwards of the rail way of Alexandria-Cairo Line. In these, the population density amounts to as much as more than 2,500 per hectore (gross) as Ragheb Basha, and there are problems in not only the waste collection but also sanitation, preventing disasters and so on.

On the contrary, Ibrahimiya and Azarita which are located west wards of the rail way, are inhabited by comparatively high income people. These areas do not have so high density.

As shown in the paragraph of land use, there is a clear partition between the residential area and unresidential area in MTD, so the population is unevenly distributed.

Population and population density of the urbanized area is as shown in TAble 2-10-7 and Fig. 2-10-6.

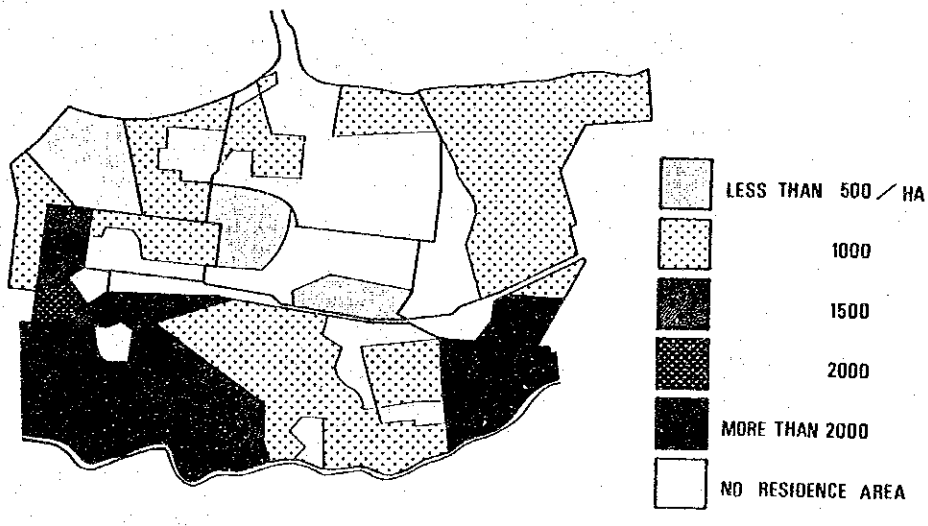


Fig. 2-10-6 POPULATION DENSITY OF THE URBANIZED AREA
(Semi-gross)

Population, in the future:

In the Master Plan provided by JICA in 1985, it is estimated that the population of MTD in 2000 will increase by 32,000 from 1984, and amount to 787,000. This number is equivalent to 33 persons increase per hectare of the present urbanized area, or a 1 person increase per 4 house holds of the same. Such degree of increase will be accommodated in the existing houses. it is to be noted, however, that the estimation stands on the assumption that the present standard of living quality will continue.

If the authorities proceed on the definite policy by which they try to absorb the pressure of the above increase of population, while on the other hand they promote the improvement of the standard of living, it will be necessary to carry out new housing projects in the east of the Mahmoudia Canal. First, because, there is little vacant place in the urbanized area; second, rebuilding or increasing heights of the existing houses depends on the initiative of the private sector, therefore there will be difficulty in the aspect of the cost to reconstruct and not so much anticipation in this policy.

Frame-work of the collection plan has to consider the housing plans. So the selection of appropriate land for housing in MTD will need to be investigated further with confirming the view of the authorities.

Additionally there is a suggestion concerning the housing at the filled up land of Moharam Bay Square Dump Site. Now, this suggestion is being studied from the aspects of; the soil's nature, foundations and land use for housing.

If the agreement is concluded, the height of buildings will be 12 - 18 meters according to the decision of the Civil Aviation Authority.

Tab. 2-10-7 POPULATION AND POPULATION DENSITY OF THE URBANIZED AREA

Sub-district	Zone	Population	Gross of area (ha)	Semi-gross of area (ha)	Population Density	
					Gross	Semi-gross
Bab Sharky	1. Ibrahimiya & El Bahariya	96,146	164	128	586	751
	2. Azarita & El Shatby	30,298	146	47	208	645
	3. Bab Sharky & Wabor El Maiya	10,596	88	51	120	208
	4. Ezbet El Gama	6,067	6.5	6.5	933	933
	5. El Hadara El Kibliya	117,676	55	55	2,140	2,140
	Sub-total	260,783	459.5	287.5	568	907
Moharam Bey	1. Bab El Gedid (Sharky)	77,581	36	36	2,155	2,155
	2. Bab El Gedid (Gharby & Menasha)	30,804	29	23	1,062	1,339
	3. Imbrouzo & Moharam Bey	134,171	156	139.5	860	962
	4. Ragheb Bahsa	72,177	28	28	2,578	2,578
	5. Bawalino & El Eskandarany	82,047	58	58	1,415	1,415
	Sub-total	396,780	307	284.5	1,292	1,395
Attarin	1. Attarin (Sharky)	9,537	9	9	1,060	1,060
	2. Attarin El Soury	9,328	7	6..5	1,333	1,435
	3. Attarin (Gharby)	17,256	20	20	863	863
	4. El Mesalla (Sharky)	18,365	43	32	427	574
	5. El Merghry	10,764	11	7	979	1,538
	6. El Mesalla (Gharby) & Strip Shirif (Gharby)	8,212	37	21	478	842
	Sub-total	91,144	164	131	556	696
Total		748,707	930.5	703	805	1,065

Note: Gross of area is measured without railway site.

Semi-gross of area is obtained by deducting public, medical and educational facilities area, parks and cemeteries from gross of area.

Source: Alexandria Governorate Statistical Central Dept. 1985.

2.11 Collection, Haulage and Street Sweeping

2.11.1 Waste Amount

Present waste amount collected by Middle District is estimated to be aprox. 400 thons per day.

Tab. 2.11.1 (tons/day)

Domestic waste*	229
Commercial waste	150
Beach waste**	3
Vacationers' waste*	18
Total**	400

Note * These amounts according to Interim Report.
** These amounts according to estimation from number of trips for each vehicle type.

And distribution of waste amount will be estimatd according to distribution of population and the collection situation in each collection zone.

The waste amount collected by District and ADS in March 1985 is shown in Fig. 2.11.1. ADS's contribution is 30% of total waste amount.

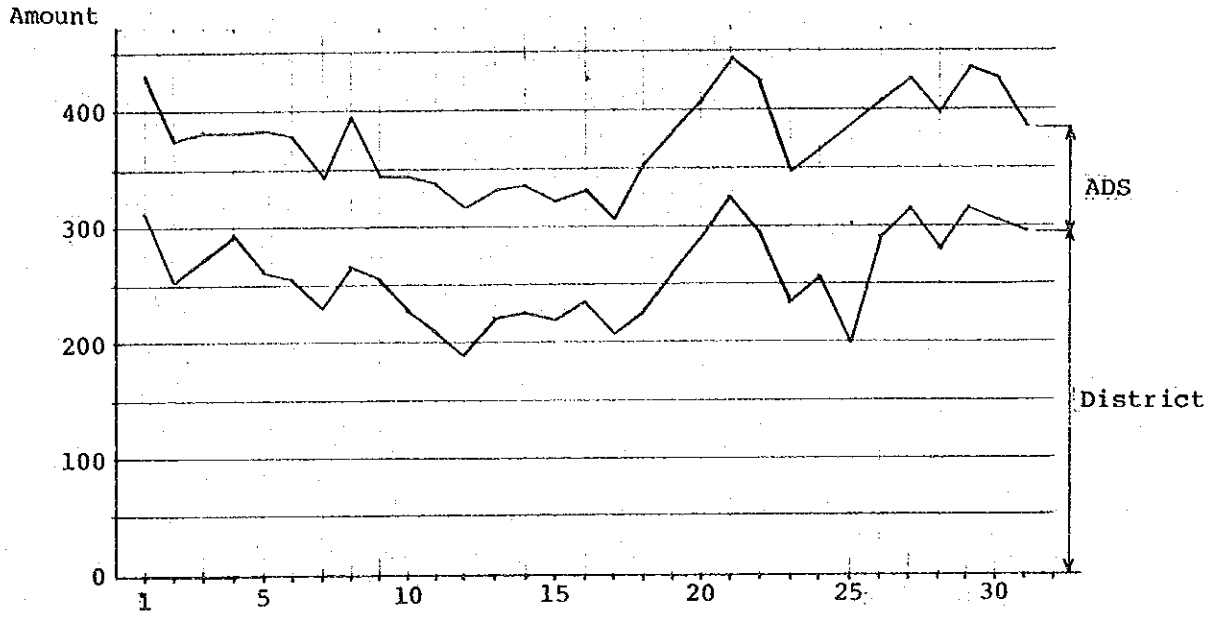
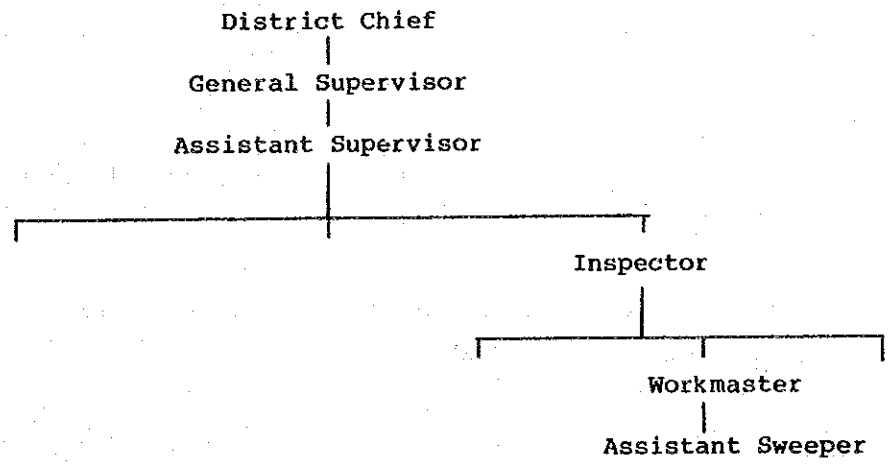


Fig. 2-11-1 WASTE AMOUNT COLLECTED BY DISTRICT AND ADS (MARCH, 1985)

2.11.2 Organization Structure & Manpower

The organization of District cleansing activities in shown in Fig. 2.11.2.



Tab. 2.11.3 shows the number of cleansing staff and labours in the Middle District. Of the total 986 employees; 570 are sweepers and 131 are assistants. 196 are employed by ADS.

Tab. 2.11.3 Total number of cleansing employees in District and ADS

	District		ADS
		(working for ADS)	
- General supervisor	1	(1)	1
- Assistant gen. supervisor	3	(3)	5
- Inspectors	12	(5)	5
- First workmasters	7	(5)	5
- Workmasters	41	(31)	31
- Drivers	40	(22)	23 *2
- Collection workers	131	(62)	106
- Sweepers	570	(54)	22 *4
- Dumpsite workers	13	(0)	0
- Public WC workers	132	(0)	0
- Store keepers	8	(0)	0
- Sick workers *5	28	(0)	0
Total	986 *1	(183)	196

Notes

*1 Of total 986 district cleansing employees, 133 are females, 93 sweepers, and 40 public WC keepers.

*2 Out of 23 drivers working for ADS, only one driver works for ADS and does not work for district.

*3 Out of 54 workers working for the district, 44 work as collection workers during ADS time. The remaining 10 work as sweepers during ADS time.

*4 Out of 22 ADS sweepers, 10 sweepers work also in the district cleansing hours, while remaining 12 sweepers are temporarily employed by DS until employemnt procedure is completed in the district (Governorate).

*5 Sick workers are present at the cleansing office every day, but do not work because of sickness caused during their work.

2.11.3 Discharge and Garbage Stations

We executed the interview survey to the citizens to know the rates, time and method by which citizens discharge waste. We are arranging the results at present. However main results are as follows;

a. It seems that nobody knows the discharge regulation prohibiting the citizens to discharge in hours other than from 8 in the everning to 8 in the next morning.

b. Most of the people discharge garbage in the morning or night, but people served by ADS discharge in the afternoon.

c. Many citizens use plastic bags when they discharge gargage. 56% of all interviewees use it.

d. The places where citizens discharge garbage are many. Certainly citizens who take garbage to a certain garbage station by themselves are very few. It is no more than 18% of all interviewees.

JICA Study Team received the information concerning garbage stations from counterparts belonging to the district cleansing dept.

Number of communal containers is aprox. 2000, 50% of which are located for specal facilities. Numbr of open stations are aprox. 759. Distribution of stations in each collection zone is very different. For instance there are few garbage stations in collection zone of city center.

2.11.4 Operation of Collection and Sweeping

1) Collection

Following items were investigated:

a. Collection zone
b. Ratio of working vehicle
c. Allocation of vehicle
d. Situation of workers absence
e. Collection route
f. Solution for problems that happen
g. Situation of ADS collection

Collection zones are 23. Number of collection vehicles which district garage now has is 57. Aprox. 28 of the total are usually working. The ratio of working vehicles is 50%. Allocation of working amount is unbslnced w.r.t. type of vehicle and collection zone. Workers absence is irregular and its fluctuation is large. Alklocation of vehicles is not stable because trobules sometimes occur. If vehicle troubles happen during working hours, the driver stops work. ADS collection is two types. In the first type the ADS vehicles in the afternoon pass through the collection areas and the citizens after hearing a specific signal take their gargages to the vehicle. The second type is that the ADS collects waste from special shops and waste which district can not collect during district working hours.

Three types of collection methods can be classified as follows;

- Frist type (ordinary)
  a. First collection by collectors (sweepers) with hand carts.
  b. Transfer the waste to open stations or vehicles under collection.
  c. Second collection by collection vehicles.

- Second type (communal container)

- Third type (ADS)
  a. Informing arrival of vehicles to residents by use of whistle.
  b. Residents take the waste to the vehicle.
  c. Assistance put it in the vehicle.

Then ADS collect the collection fee from residents of the area served by ADS. Residents of the areas not the area served by ADS. Residents of the areas not served by the ADS do not need to pay. However unfairness occurs during collection of fees.

2) Street sweeping

The present conditions of street sweeping were investigated according to the following items;

a. Classification of streets and sweeping frequency.
b. Allocation of sweepers.
c. Allocation of pushcarts.

And in order to realize the exact situation of street sweeping JICA Study Team conducted two surveys. First following some sweepers, actual sweeping time, travel distance and time needed for transfer and unloading were investigated.

Secondly, the Study Team executed the sweeping experiment in which the sweeping route and frequency were assigned to some sweepers in Ebrahimiyah and Moharam Bey. This was executed for the purpose of obtaining standard measures to make a sweeping plan. These resuslts are being arranged by the Study Team at present.

2.11.5 Collection Process

The Study Team investigated the collection process which consists of travel to the collection zone, loading of waste, transfer between each station, travel to the dump site and unloading of waste at the dump site. From the results the efficiency of each vehicle can be evaluated. Still these results are being arranged by the Study Team at present.

2.11.6 Maintenance

In order to maintain the good conditions in which vehicles are usually able to work, vehicle maintenance must be carried out. This maintenance is the lifeline of the collection activities. The Study Team surveyed the items which are shown as follows;

1) Structure of maintenance
   a. Relation between central workshop and district garage
   b. The situation of equipments and instruments arrangement
   c. Existing conditions of collction vehicles

2) Maintenance standard
   a. Maintenance utility guide book
   b. Executing preventive maintenance regularily
   c. How many troubles happen
   d. Judgement of scrap

3) Spare parts
   a. Providing spare parts to district garage
   b. Stock of spare parts in cetral workshop
   c. Procedure of purchasing spare parts

4) Organization of workshop
   a. Function : manpower and human resources
   b. Administration

Concequently it seems proper that the divisionof roles having the central workshop responsible for high-class maintenance and the district garage responsible for middle-calss one, is shared between central workshop and district garage. But lack of space and equipments in each workshop is claear. Furthermore preventave maintenance is not carried out entirely and daily maintenance is also not being carried out in spite of the fact that the engineeer has a maintenance guide of spare parts is not made and spare parts are always short. The other reasons for difficulty of procurement of spare parts may be identified as follows;

- Many different manufacture vehicle types
- Many spare parts mube be imported
- Budgets for spare parts are insufficient

2.11.7 Basic Problems of Collection

The present situation of collection service have been analysed. On evaluating this situation, following problems are found:

a. The provided service

The collection service provided to suburban areas is not sufficient.

b. Efficiency

The amount of garbage collected per car is very high, but the amount of garbage collected per working hour of workers is very low. This means low efficiency.

c. Cooperation of residents and shops

Many residents do not cooperate by following proper gargage discharge manner. Certainly residents treat cleansing workers badly, but the governerate is responsible for lack of control over the residents' behavior. For instance, lack of regulations, instructions and information concerning cleansing is the governorate's. The governorate has also to provide permenant serive and so on.

d. Operation rate of collection vehicle

Operation rate is less than 50%. This makes it clear that the present equipment is not used sufficiently. As a result, there is always a sbortage in the number of collection vehicles which can be operated.

e. Maintenance

Daily and preventive maintenance to maintain a good condition of vehicle is not done at all, and there is no control concerning carrying out the maintenance. There is always a shortage in spare parts. And in consequence of having many types of vehicles, it becomes difficult to control and purchase spare parts for all vehicles because in case of need we have to import them according to each type of vehicle.

f. Protection of workers' health

Assistants are always exposed to danger of disease, because they must touch open garbage, which contains dung, glass and putrescifle matter, with bare hands. And onloading garbage in the collection vehicles. They breath dust.

g. Standard work of collection vehicles

The standard work of collection vehicle is shown as a numbe of trips for each tupe of vehicles. For instance the truxmore driver is responsible for 3 trips. But we think we had better assign an obligation area or street to each driver where he will be responsible for gargage collection.

h. Wages

Salary is very low. This decreases the desire for work.

i. Organizational structure

The collection service includes many functions. For controlling these functions completely, we have to specify certain functions for each section and to establish a centeral office to be responsiblke for planning and controlling the operation.

j. Administration and training

Now, a daily supervision is being carried out to control cleansing activities. Middle or high class administration, whose administrators will evaluate the productivity of cleansing activities, will be required.

And we have to establish a training system for raising up the ability of administration and for improving the behavior of te cleansing staff.

k. Collection fee

ADS collects a collection fee from low income residential areas, to the south of the railway, and doesn't collect it from high income residential areas. This shows unfair treatment. And sometimes it happens that the ADS collects fees from residents of areas unserviced by ADS. These all result in distrust of residents to the cleansing work. We hope that a clear governorate's opinion will be issued to citizens and cleansing workers concerning the above mentioned matter.

l. Regulation for cleansing

Contents of National laws for cleansing are insufficient. At least, we should have the regulations concerning cleansing items in detail by governerate. We have to concentrate on the responsibility of the governerate, residents, shops, and the discharge manner and so on. Then governorate should inform this detailed regulations to citizens and cleansing workers forcefully. This is very important in order to improve the present collection system.

m. Public education

Public education concerning cleansing has never been effectively carried out. We should carry it out in order that citizens may acquire good manners. And we should offer some information on cleansing activities to citizens to have a proper understanding of our activities.

n. Fine

Citizens should pay a fine on violating the cleansing law. But the system of punishments and collection of fine is very weak. At present, everybody knows that the will not be punished by fine. The number of persons who can inflict the panishments is very few. Ion consequence, we cannot find the violators sufficiently. The violators usually discharge their garbage either after midnight or in early morning and this is why it is difficult to apprehend them.

The relation of cause and effect concerning th prementioned is shown in figure A.

Most of prementioned problems are connected with administrative aspects. This is very important, since whatever good equipemnt we have, we may not be able to use them efficiently unless we have a good administrative system. After all, this problem is the responsibility of high-position officials. If the high-position officials do not realize this matter then our efforts on the operation improving will not succeed.

In general, it requires a long time to improve the situation concerning administrative problems.

At present, we cannot decide the solutions but we can only recommend it to the governerate.

We should list high priority problems which require improvement within a short time.

These are shown in the following:

a. Improvement of low salary.
b. Improvement of maintenance.
c. Improvement of collction system.
d. Making the detailed regulations concerning cleansing.
e. Notification of the information concerning cleansing to citizens.

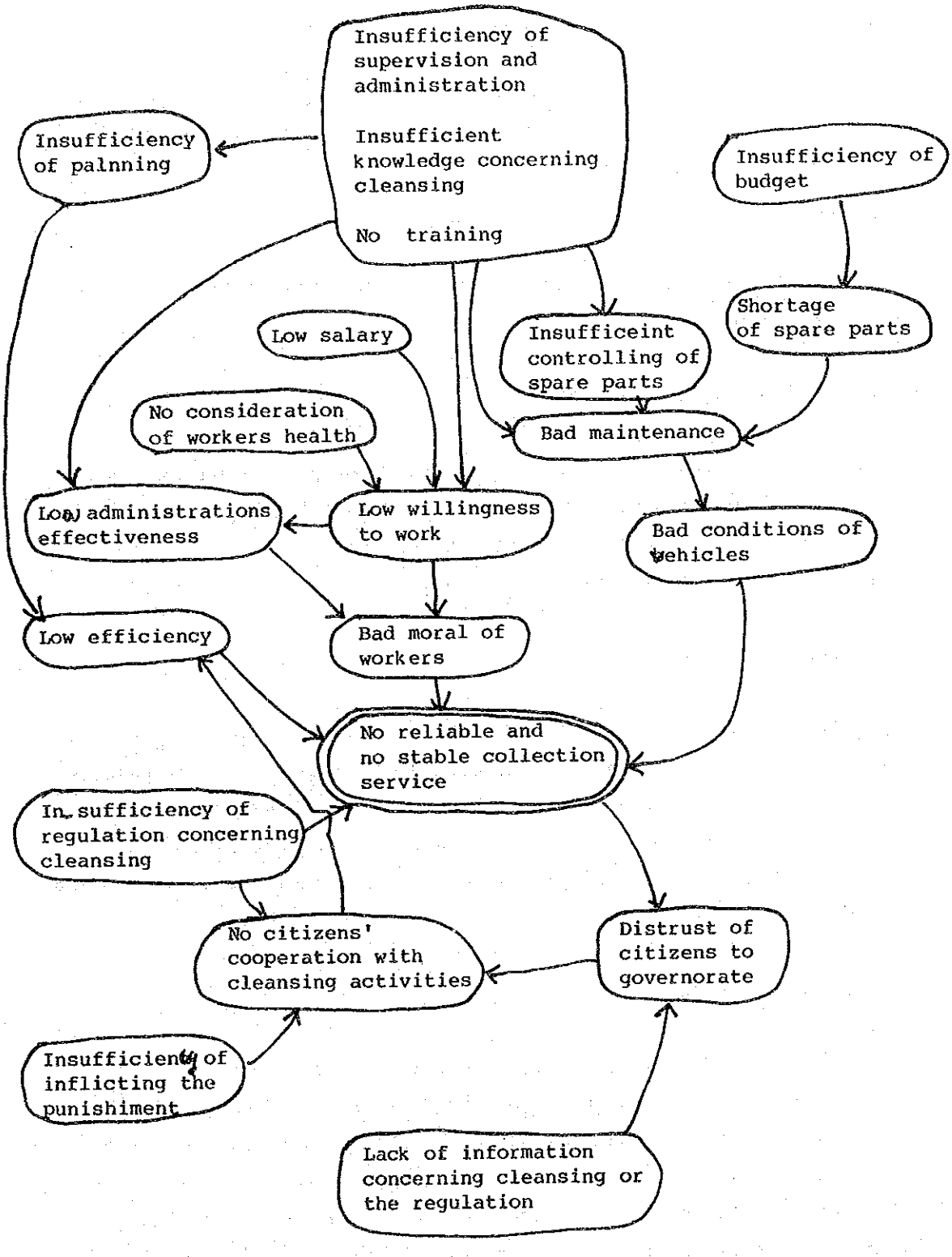


Fig. 1 Diagram of relation of cause and effect concerning collction the problems

2.11.8 Problems of Street Sweeping

Two reasons can be found as follows:

a. Citizens manner is bad.
b. Sweeping is insufficient.

We have analysed more deeply about (b). As the results we can find six factors as follows:

a. Shortage of number of sweeper

Certainly as long as sweeping is executed by present method more number of sweepers will be necessary. We should make an effort to be able to sweep effectively on all streets in Middle District with the present number of sweepers.

b. Inspection is in adequate

Certainly, it seems like that. Yet, we should not increase number of inspectors. We should find the method by which we will be able to inspect more effectively. As that method, we should make a time program of a day work which each sweeper will be assigned. Consequently, inspector will be able to know easily who is sweeping and where.

c. Cars park all day

We cannot control it at all. We should suggest the governor that cars will not be allowed to park on designated day once a month in designated zone. (This method is effective to inform importance of our sweeping to citizens). If cars park on that day without permission for parking from the govererate, we should be able to punish car owner with fine. In order to execute this plan, cooperation of the road section and the plice section must be necessary.

d. Sand accumulates are the road side

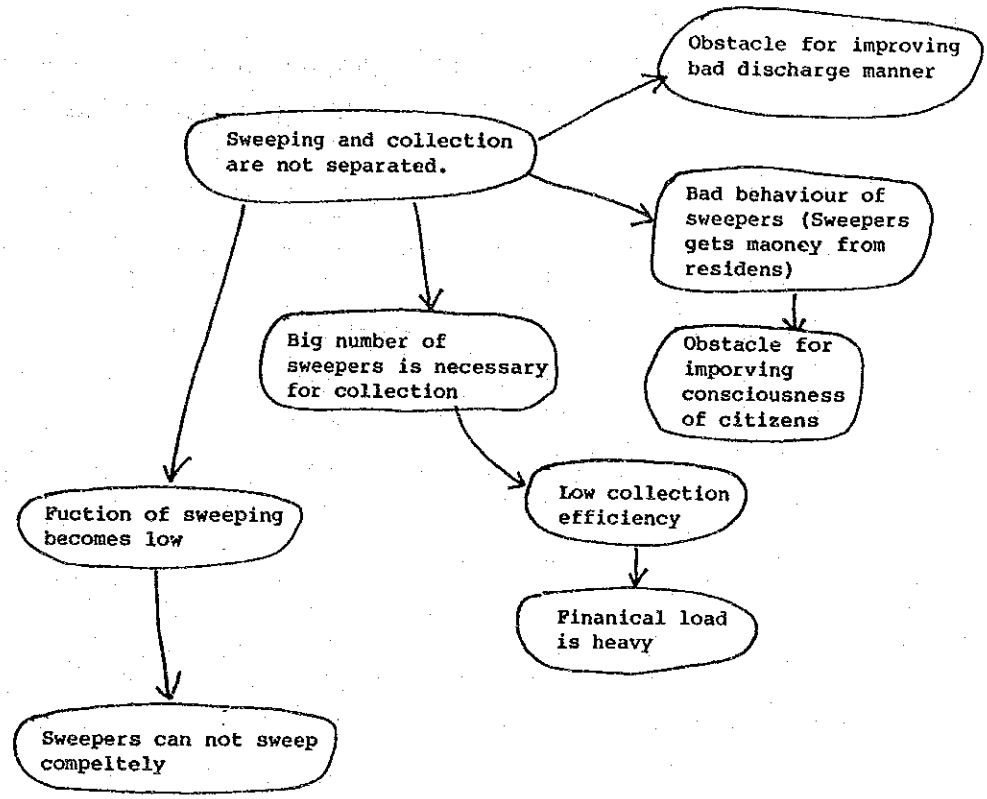
This is the same above e.

f. No distinction between collection and sweeping

We also can not control it at all. We should ask cooperation of the road section.

e. Pavement is not in good condition

This situation has been created by Zaballeens, departure, who used to collect garbage from residents. We will see what this situation has led to now. Next table is shown as relation between cause and result. In order to recover original function of sweeping, we should separate between funtion of sweeping and collection.



Sweeper must collect garbage until the collection vehicle leaves the area. Consequently, sweepers spend long time for collection of garbage. This is why sweepers can not sweep completely.

2.12 Disposal at the MBSDS

2.12.1 Incoming Solid Wastes Amount

The solid wastes, disposed of at the MBSDS, are roughly divided into two types. One is the solid wastes which are collected and hauled by the Districts Cleansing Divisions and the ADS. The other is the wastes of miscellaneous sectors such as sewage sludge, construction and demolition waste, port waste and some industrial wastes.

In regard to the former, there are no measured wastes amount records by a scale but trip records of each collection vehicle of each district. According to the trip records, the average daily solid wastes amount is calculated in S.R. Tab. 2-12-1.

S.R. Tab. 2-12-1 DAILY SOLID WASTES AMOUNT DISPOSED OF AT THE MBSDS BY THE DISTRICTS AND THE ADS

(Unit: t/d)

	Middle	Gomrok	Part of West	Total
Dec. 1984	335	240	100	675
Jan. 1985	370	210	100	680
Feb. 1985	373	211	83	667
Mar. 1985	320	208	93	621
Apr. 1985	360	218	99	677
May 1985	313	195	101	609
Jun. 1985	312	165	85	562
Jul. 1985	NA	215	NA	NA
Aug. 1985	NA	224	NA	NA

Note: NA = Not Available

With regards to the latter, there is neither measured records nor those of trips. The reasons for it are considered as unorganized operation, few wastes amount and no charge on disposal of them. Therefore, assuming that wastes amount disposed of at the MBSDS is the same as it of the Airport Dump Site in September 1984, it is estimated in S.R. Tab. 2-12-2 according to the survey results effectuated at the Airport D.S.

S.R. Tab. 2-12-2 DIALY SOLID WASTES AMOUNT DISPOSED OF AT THE MBSDS BY THE MISCELLANEOUS SECTORS

	Numbers of Vehicles (Nos.)	Average Wastes Amount (t/No.)	Total Wastes Amount (t/d)
15th Sep.	27	0.92	24.8
16th Sep.	10	0.92	9.2
17th Sep.	18	0.92	16.6
18th Sep.	36	0.92	33.1
19th Sep.	26	0.92	23.9
20th Sep.	24	0.92	22.1
21st Sep.	16	0.92	14.7
22nd Sep.	29	0.92	26.7
Average	23.3	0.92	21.4

2.12.2 Landfill Operation

Present final disposal method in the MBSDS is a traditional open dumping without any processing except the Abis Compost Plant. There is little operation which is required for a sanitary landfill. No countermeasure, preventing the Drinking Water Canal along the MBSDS from pollution, is done. Therefore, present landfill operation is not acceptable from the view point of environmental health.

a. Six bulldozers (three are out of work)
   Caterpillar D5 2 No. Caterpillar D6 1 No.
   Case 1450B 3 No.

b. One fire pump

c. Three huts for workers without sanitary facilities
   (W x L x H: 2.5m x 2.0m x 2.5m)

2.12.3 Management

At present the MBSDS is operated and managed by eight organizations shown in S.R. Tab. 2-12-3.

S.R. Tab. 2-12-3 ORGANIZATIONS CONCERNED AND THEIR ROLES IN THE MBSDS

Organizations	Nos. of Workers	Items		Job
Follow-up General Administration	3	G. Supervisor Inspector	1 2	Supervision and Inspection
Middle District	15	Supervisor Clerk Inspector Worker Guard	2 4 2 5 2	Inspection of Middle District's car and guiding
Gomrok District	3	Inspector Clerk	1 2	Car inspection of Gomrok District
West District	1	Inspector	1	Car inspection of West District
Central Workshop	11	Supervisor Operator Driver Assistant	1 6 2 2	Operation and Maintenance of Landfill Equipment
Utility Police	4	Officer	4	Safeguard
Fire Police	6	Fireman	6	Fire service
Health Department	1	Officer	1	Disinfection
Total	44			

Because of different decision of each administrations concerned with the MBSDS, there is no unified management there. Consequently, there is no unified regulation on the operation and management in the MBSDS. It makes the present operation very inefficient. Moreover, for poor working condition and low incentives, the separation rate of the MBSDS is very high.

2.12.4 Budget

There is no budget specialized on the MBSDS. Wage and incentives are provided by the Governorate budget and the cleansing box respectively. The operation and maintenance expenditure of each facility and equipment is supplied by each organization which has responsibility on it. The investment like procurement of landfill equipments is the same as operation and maintenance. There have been no expenditure yet on the acquisition of a site.

2.12.5 Related Projects

In order to set up a proper design of the MBSDS, it must be carefully considered that there are some projects in and around the MBSDS. The feature of the projects are described as follows:

a. Enlargement of the Drinking Water Canal

The plan was made by the Water General Authority to increase the water quantity from 792,000 m^3/day in 1983 to 1,200,000 m^3/day. In the plan, the enlargement will be done at the right bank (the opposite side of the MBSDS).

b. Rebuilding of two bridge

For the enlargement of the Drinking Water Canal, two bridges will be rebuilt. One is on the access from the Desert Road to the airport, and it is under-construction. The other is on the Agriculture Road.

c. Installation of approach lights

The MBSDS is located under the approach of El Nazha Airport. Then some parts of the MBSDS is specified as approach zone.

d. Widening the Desert Road

e. Enlargement of the Moharam Bey Square

2.13 Maintenance of Waste Collection Vehicles

2.13.1 Actual condition of the maintenance

The term of investigation
From August 9, 1985 to October 10, 1985 (2 months)
The detals of investigation

Since the availability of waste collecting vehicles has reduced due to frequent occurrence of troubles, which has made it impossible to perform the waste collecting business systematically, I investigated the actual condition of the maintenance of the waste collecting vehicles being operated principally in the Middle district about the following items:

a. Maintenance organization
b. Maintenance standard
c. Parts control, and execution

The investigation included the study of actual condition in the Central workshop and in the Middle district garage, confirmation of data, etc., and hearing.

Results of investigation

1) Maintenance organization

(1) Allotment of the functions of te Central workshop and the District garages
The vehicle maintenance and control organization includes a central workshop and 6 district garages. The allotment of their functions is as follows:

- Function of Central workshop

a. Execution of overhaul of vehicles, and of complicated repairs that can not be made in the District garages.
b. Planning of the purchase of parts and vehicles.
c. Control of spare parts.

d. Supply of parts, fuel, oil and grease, etc. to the District garages and distriction of vehicles.

- Function of District garages

a. Storage management of collecting vehicles.
b. Execution of periodical preventive maintenance
c. Overhaul and adjustments of the medium degree.

This allotment of functions may be considered reasonable in view of the present equipment, implements, etc. of the workshop, provided that the allotment of functions is carried out systematically and effectively. However, in fact, there are many problems as follows:

- In the case of Central workshop

* Exeuction of overahaul	- There are many overhauls due to engine trouble, which means insufficient preventive maintenance.
* Purchase plan of collecting vehicles	- Purchase of vehicles is planned and executed only by the Central workshop without adopting the requests from the District garages. - Vehicles of various manufacturers have been purchased, which is nothing but unplanned purchase of vehicles from the vehicle maintenance standpoint.
* Purchase plan of spare parts	- The control and operating organization for parts has not been established, so systematic purchase of parts has not been made, and the stock of all spare parts has not been grasped. - The budget for spare parts and parts necessary for the maintenance of all vehicles is insufficient.

* Support to District garages - Because of insufficient spare parts, absence of responsible persons, etc., parts, etc. have not been supplied smoothly to the District garages.

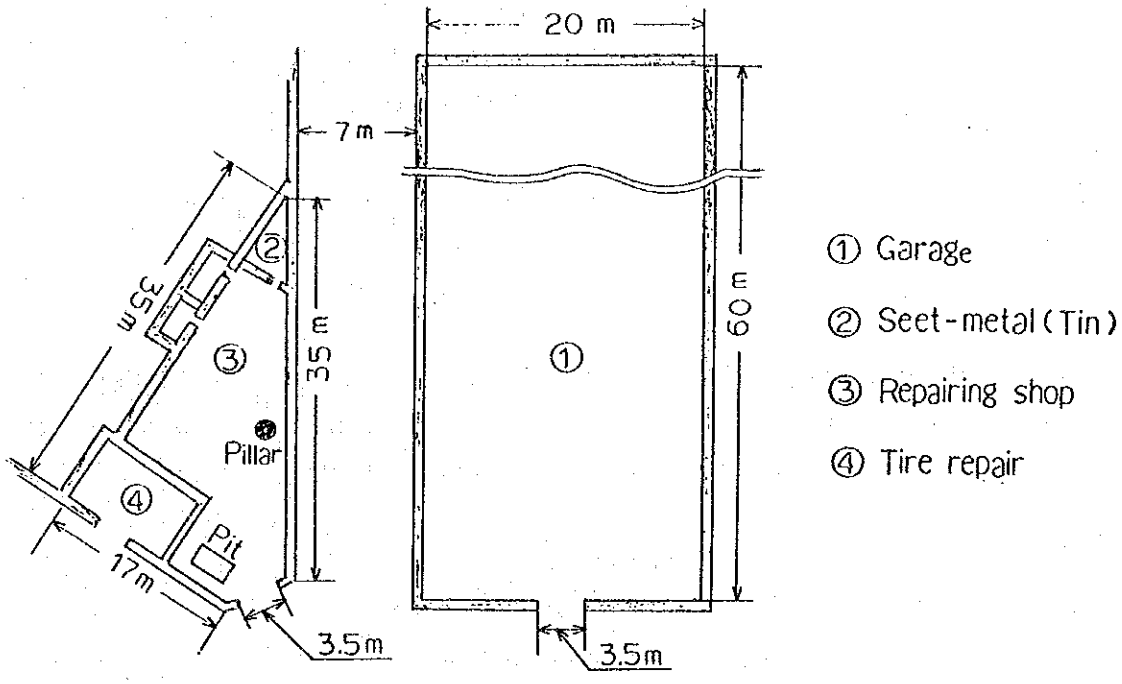
- In the case of District garages

* Execution of preventive maintenance
  - Systematic maintenance has not been executed.
  - The interval of maintenance execution and the interval of filter change made in maintenance are too long.

* Overhaul of the medium degree
  - Although repairs of vehicle are performed, the number of vehicles that can not operate has been increasing because the parts are not supplied smoothly.
  - The minimum of maintenance instruments and materials required as district garage are insufficient.

(2) Middle District garage

a. The Middle District garage is located in the Center workshop, and the garage and the vehicle repairing shop are arranged as shown below:



S.R. Fig. LAYOUT OF MIDDLE DISTRICT GARAGE AND THE REPAIRING HOUSE

As can be understood from the figure above, the inconvenient layout of garage and repairing shop has impaired their functions.

b. The maintenance of waste collecting vehicles at the Middle District garage is divided into four; vehicles repair, tire repair, electric and battery repair, and sheet-metal repair. The equipment used in repairing vehicles includes the following:

* Vehicles repair
  - Floor crane,
  - Hydraulic jack & garage jack, and
  - General tools.

* Tire repair
  - Air compressor,
  - Hydraulic jack & garage jack,
  - Bench grinder, and
  - Tire service tools.

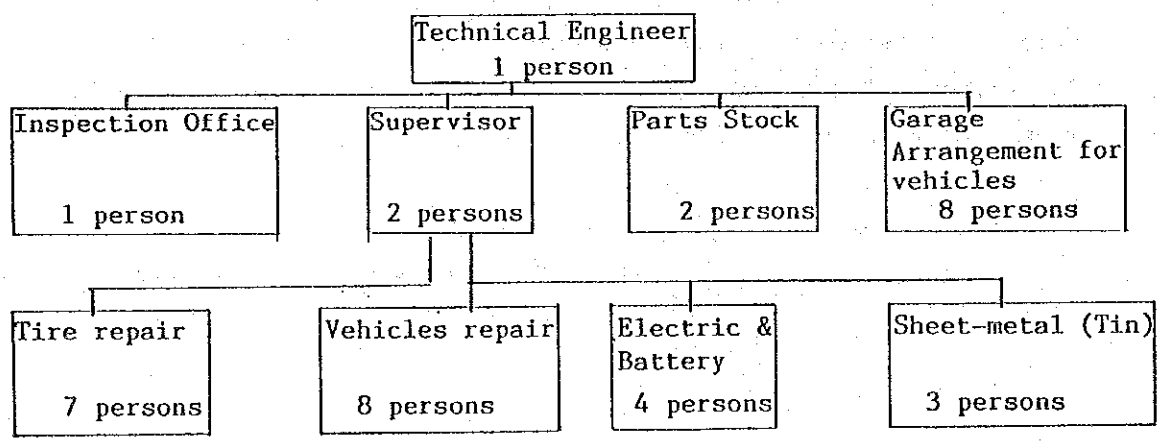
* Electric & battery
  - Battery charger,
  - Vise, and
  - General tools.

* Sheet-metal (Tin)
  - Bench drill & grinder,
  - Vise, and
  - General tools.

The condition of vehicle maintenance at the Middle District is not always satisfactory because of insufficient maintenance equipment. The following maintenance equipment is further required:

- Gas cutting equipment,
- Electric & gas welding equipment,
- Simple metering and adjusting jigs,
- Car washing machine,
- Failure and lack of general repairing tools.

c. The vehicle maintenance organization in the Middle District garage is as follows:



S.R. Fig. ORGANIZATION OF MIDDLE DISTRICT GARAGE

Although the vehicle maintenance organization is reasonable, there are some problems in the method of executing the vehicle maintenance control. As a result, the cooperating system for systematic vehicle maintenance control as the Middle District garage has not been established.

It is because:

a. The planning is incomplete.
b. Job instructions and communication are insufficient, and
c. Collection of information is incomplete, and the method of utilizing the information has not been understood.

(3) Central workshop

a. In the Central workshop, the maintenance of vehicles can not be made in the building of the workshop because of the architectural structure of the workshop building and the improper layout of the equipment and tools in the workshop building.

Furthermore, the equipment installed in the workshop includes many fabrication machines, and the metering and adjusting implements, special repair tools, etc. necessary for maintenance of vehicles are insufficient. That is, it appears that the investment for the equipment as a vehicle maintenance shop has not been performed systematically.

b. The Central workshop organization consisting of 39 sections has become complicated. In addition, the number of employees in the workshop is as many as 551 persons. As a result, exact job instructions are not given to them. (For details, refer to Attached Sheet-1.)

2) Maintenance standard

(1) Vehicles held in the Middle district garage and their operating conditions (surveyed in August, 1985)

The Middle district holds 51 waste collecting vehicles including 13 breakdown vehicles (25.5%) which are being due to troubles. Besides the

breakdown vehicles, there are some vehicles which are operating being repaired frequently due to slight troubles. Accordingly, the availability is only 26 to 28 vehicles per day (50.9 to 54.9%).
The vehicles held include:

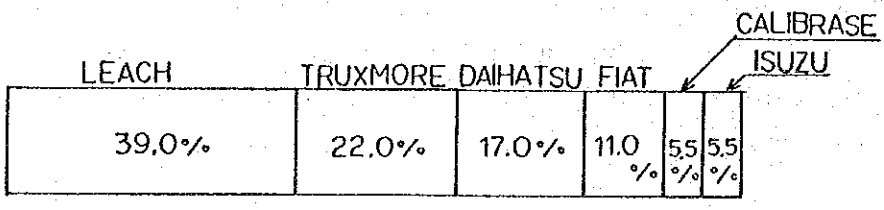
TRUXMORE	Manufactured in 1985	8		
ditto	in 1979	11	Breakdown	3
LEACH	1982	9	Breakdown	6
CALIBRASE	1984	3		1
FIAT	1979	2		1
DAIHATSU	1984	3		
ditto	1983	4		2
MAZDA	1981	1		
ISUZU	1984	5		
NISSAN	1984	2		
ditto	1983	1		
MITSUBISHI	1981	2		

(2) Occurrence of troubles (Surveyed from Jun., 1985 to Aug., 1985)

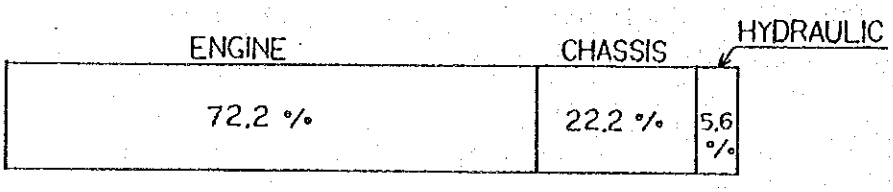
The major troubles that occurred in the Middle district garage are as follows:

Number of troubles which have occurred --- 18
Number of vehicles being repaired now --- 13

a. The state of trouble occurrence for each vehicle type



b. Details of troubles

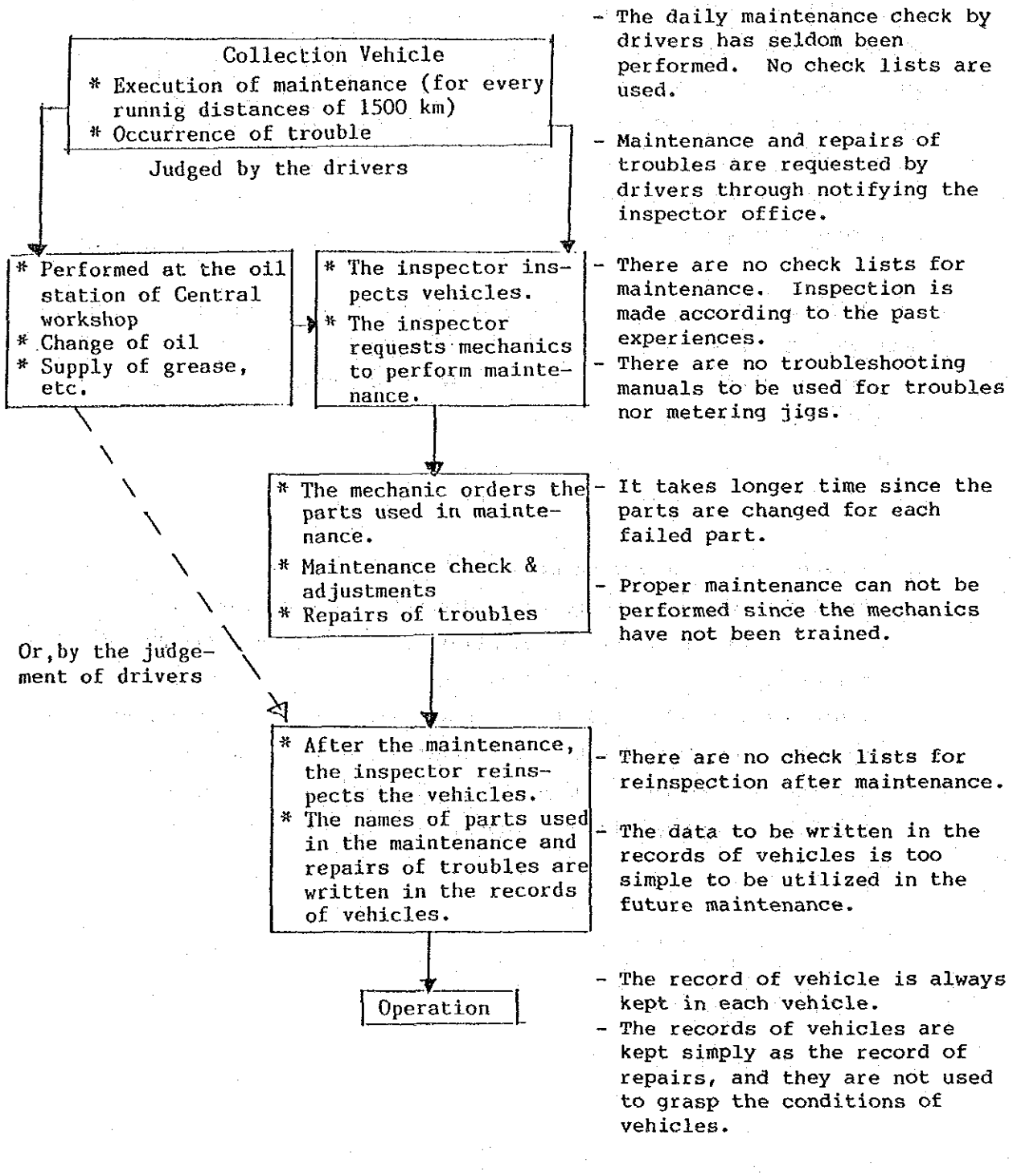


Besides, many small troubles had occurred, but they could not be grasped because of the absense of the data. However, as can be seen from the above tables, engine troubles accounted for 72.2%, which means improper maintenance of engines. Furthermore, in the case of LEACH, all troubles were engine troubles, which means that the quality of LEACH is inferior to that of other vehicles and means insufficient examination at the planning of purchase of vehicles.

In addition, the failed vehicles include those that have shut down for more than 2 years due to lack of spare parts. Shutdown for a long period of time may cause other troubles. There is a problem with respect to the method of storing the vehicles.

(3) Exeuction of preventive maintenance

a. Systematic preventive maintenance has not been executed. Maintenance is performed according to the judgement of the drivers of each vehicle. As the criterion of maintenance, it is specified that maintenance should be performed every time the running distance of a vehicle has reached 1500 km. However, in fact, so many odometers of vehicles have failed that the technical engineer himself can not grasp for what a running distance the maintenance is performed.
Maintenance and repairs of troubles are performed as follows:



S.R. Fig.

The maintenance being performed consists of periodic change of oil, etc. and simple inspection of vehicle, and such maintenance as instructed by the vehicle manufacturers (inspection, adjustment, and

repairs performed according to the maintenance check list) is not performed.

Furthermore, collection of the detailed data that is most important for the maintenance control of vehicles, analysis of them, and their use are not understood.

b. The training to enhance the technical level of mechanics and drivers has not been executed. In addition, the textbooks necessary for the training are also insufficient.

3) Parts control and execution

(1) Condition of parts stock in the Middle district garage

a. The spare parts have not always been supplied smoothly to the Middle district garage because the Central workshop can not supply them smoothly. Although district garages can purchase parts by themselves, the parts they can purchase are limited to those below 50 E, so that sufficient parts can not be supplied.

b. In 1984, the spare parts which the Middle district garage received and used are as follows (from the parts ledger of the parts warehouse):

No. of parts	Remaining 1983 Remaining stock	Warehousing 1984 Warehousng	Delivery 1984 Delivery	Remaining 1984 Remaining stock
No. of parts items	39	89	79	67
Quantity of parts	314	1,083	516	881

As can be seen from the table, the remaining stock in 1984 increased remarkably compared with that in 1983. However, the parts include few parts which can be used in repairing troubles or in maintenance.

Furthermore, the increase in the quantity of stock means that the reasonable inventory quantity was not well grasped.

(2) Planning of spare parts purchase

The purchase of spare parts is planned and performed by the Central workshop. The spare parts are purchased from abroad at intervals of 2 to 3 years together with vehicles through the basket purchase.

The spare parts purchased include:

- Filters for about an 1 year period, and
- Other repairing parts for about a 2 year period.

In this case, the filters will become insufficient one year after, but the measures to be taken at that time are not definite, and replenishing of insufficient parts according to the results of inventory taking, keeping and grasping of the reasonable inventory quantity have not been performed.

(3) Planning of vehicles purchase

The purchase of vehicles is planned and performed by the Central workshop. Selection of vehicles to be purchased is made according to the service, etc. However, the final decision is made in view of vehicle price. As a result, vehicles of many manufacturers have been purchased.

Accordingly, to maintain all of the vehicles, the parts of respective manufacturers are required, but, in the present situation, spare parts sufficient to maintain all of vehicles can not be purchased due to insufficient budget.

2.13.2 Vehicles Maintenance and Control Plan

The Alexandria municipal waste collection has been planned and executed on the basis of waste collection using vehicles.

To execute the waste collection efficiently and effectively, the availability of collecting vehicles is essential, and it is an important subject to perform maintenance of vehicles through a systematic vehicle maintenance and control organization.

For the maintenance and control of vehicles, the following should be taken into consideration in planning:

a. Places for the maintenance and control of vehicles (maintenance shop and garage)

b. Maintenance equipment, parts and materials for vehicle maintenance

c. Organization, persons, and budget for maintenance and control of vehicles

d. Future view of the maintenance and control of vehicles (Future plan)

On the basis of these, an effective and economical vehicle maintenance and control system should be established.

1) How to forward the vehicle maintenance and control

The vehicle maintenance and control means to hold always the vehicles in such a condition as to permit 100% of availability.

To hold vehicles in such a condition, it is essential to find and repair defective points through the preventive maintenance (P.M) check, and to perform maintenance such as periodic change of parts, adjustments, etc. on the basis of the data of past troubles that has been collected and analyzed. Thus, it becomes possible to reduce the number of vehicles which shut down due to troubles and to enhance the reliance on the maintenance of vehicles. At present, Alexandria holds vehicles not less than 200, and a stupendous budget is required to maintain them. If the breakdown repairs caused by poor preventive maintenance increases, the number of vehicles which shut down due to troubles will further increase, resulting in increase in expenses of vehicle repairs. Thus, the operation of maintenance shop will be greatly affected.

Accordingly, for the maintenance and control of vehicles, it is most important to execute periodical preventive maintenance, and to collect and analyze the data such as records of repairs due to failures, etc. It is essential to plan and execute these reasonably.

Furthermore, it is also necessary to perform the vehicle maintenance and control from the cost standpoint. That is, it is essential to perform the correct vehicle maintenance and control from an economical point of view so that the sum of the purchase costs of vehicles and the maintenance costs after purchase (lifecycle costs of vehicles) becomes the minimum (optimum).

2) Maintenance of vehicles

The maintenance of vehicles can be classified into the following:

a. Maintenance to prevent troubles (Preventive maintenance), and
b. Repairs after occurrence of failures (Breakdown maintenance).

(1) Preventive maintenance (P.M)

The preventive maintenance is performed in order to prevent failures of vehicle from occurring. The preventive maintenance includes also repairs of trouble, but it consists principally of cleaning, inspection, adjustments, supply of oil, change of filters, etc. It is performed by drivers and mechanics.

The preventive maintenance includes simple jobs, and its results do not appear soon, so it is apt to be neglected. As a result, as in the case of Alexandria waste collecting vehicles, frequent occurrence of troubles which results in increase in the number of vehicles of long term shutdown will be caused.

Most of failures are caused by excessive wear, overheating, undue contact, loosening of bolts, oil leakage, etc. Therefore, daily inspection and periodical inspection and maintenance may prevent the failures from occurring. It is essential to supervise sufficiently the execution of periodical inspection and preventive maintenance.

The details of the periodical inspection and preventive maintenance vary depending upon the type of vehicle used, operating conditions, etc.

It is desirable to establish the detailed maintenance standard which meets the present condition on the basis of the data that has been collected, the P.M information (operating instructions, maintenance manual, etc.)

(2) Breakdown maintenance

The beakdown maintenance means repairs of failures and troubles to be performed besides the preventive maintenance.

The troubles that occur include unexpected accidents, reduction in function due to wear and deterioraton, and momentary malfunction which occurs frequently in electricals. Further, there are so many types of troubles that it is difficult to find the causes of troubles. Repairs of troubles require a long period of time and great expenses, so the breakdown maintenance should be decreased from the standpoint of vehicle maintenance and control.

Troubles always have their causes, and it necessary to study the causes and establish countermeasures against them. It is essential to keep the following as reports (records) in order to use them for the prevention of next occurrence of troubles:

a. The time of occurrence of trouble or running distance of vehicle,
b. The state of trouble occurrence,
c. The causes of trouble occurrence, and
d. Action taken against the causes of trouble occurrence.

By collecting and analyzing these reports (records), the future rate of occurrence of troubles may be predicted. By the study of countermeasures to the future prediction of trouble occurrence, and by performing the preventive maintenance, the number of vehicles which have shut down may be reduced, resulting in enhanced reliance on the vehicle maintenance.

However, Alexandria has no such reports (records), and the method of utilizing them (the necessity) is not understood at all. As a result, occurrence of troubles can not be predicted, and no countermeasures can be taken, resulting in shortage of necessary parts and increase in the number of vehicles which have shut down.

3) Basic policy for the management and operation of maintenance shop

For the maintenance and control of vehicles, maintenance shop and equipment, parts and materials, and persons are required. It is necessary to establish a minimum organization necessary to perform maintenance and control of vehicles efficiently so as to meet the present condition. It is essential to minimize the equipment, parts and materials, and persons required, and to operate the maintenance shop effectively and economically.

In addition, in the case where, as in Alexandria, the maintenance shop is divided into a central workshop and district workshops, it is desirable that individual workshops have respective maintenance characteristics (allotment of functions) and they are operated as an integrated workshop for the purpose of maintenance and control of vehicles.

4) Tendency of maintenance shop

Recently, as the demand for vehicles increases, it has become important to maintain the performance of vehicle for their efficient operation. Further, it has been strongly required to reduce the shutdown time of vehicles by their maintenance and repairs, that is, to increase the availability of vehicle. Thus, the circumstances surrounding maintenance shop have been changing to a great extent.

To cope with the changes of circumstances surrounding maintenance shop, it has become necessary not only to save labor through the rationalization of jobs, but also to acquire the technologies for the maintenance of complicated vehicles for proper maintenance and repair. Finally, the unit replacement system has been introduced in maintenance and repair.

The unit replacement system means a system in which, in the event of failure of vehicle, the defective portion is removed from the vehicle as a unit, and it is replaced with a unit that has been repaired previously. The defective unit removed is repaired in the maintenance shop to reuse in the next unit replacement.

This unit replacement system has many advantages as follows:

(1) Shutdown time due to failure is reduced, and the availability of vehicle is increased.

(2) Special maintenance is required, so that the technical level of mechanics is enhanced and maintenance of high reliability may be achieved.

(3) The quality of repared parts is improved, resulting in reduction in frequency of re-repair.

(4) Systematic maintenance process control may be performed, resulting in reduction in the maintenance labor.

Major replacement units include the following:

- Various auxiliary machinery of engine
- Engine cylinder head assembly
- Engine assembly
- Transmission & differential gear assembly
- Hydraulic pump cylinder valve

In view of increasing number of collection vehicles and the plan of erecting district workshops in the future in Alexandria, it should be reexamined how to operate individual mainenance shops (maintenance policy).

5) Maintenance shop equipment

To operate maintenance shops properly, it is necessary to make clear the function of each maintenance shop (allotment of functions). For example, the Central workshop and the District workshops have their own function respectively, so that they should have proper layout and equipment that meet the function.

(1) Layout and function of maintenance shop

Maintenance shops should be provided with various functions necessary for repair and maintenance so as to increase the efficiency of jobs and stabilize the quality of repair and maintenance.

a. Function of chassis bay

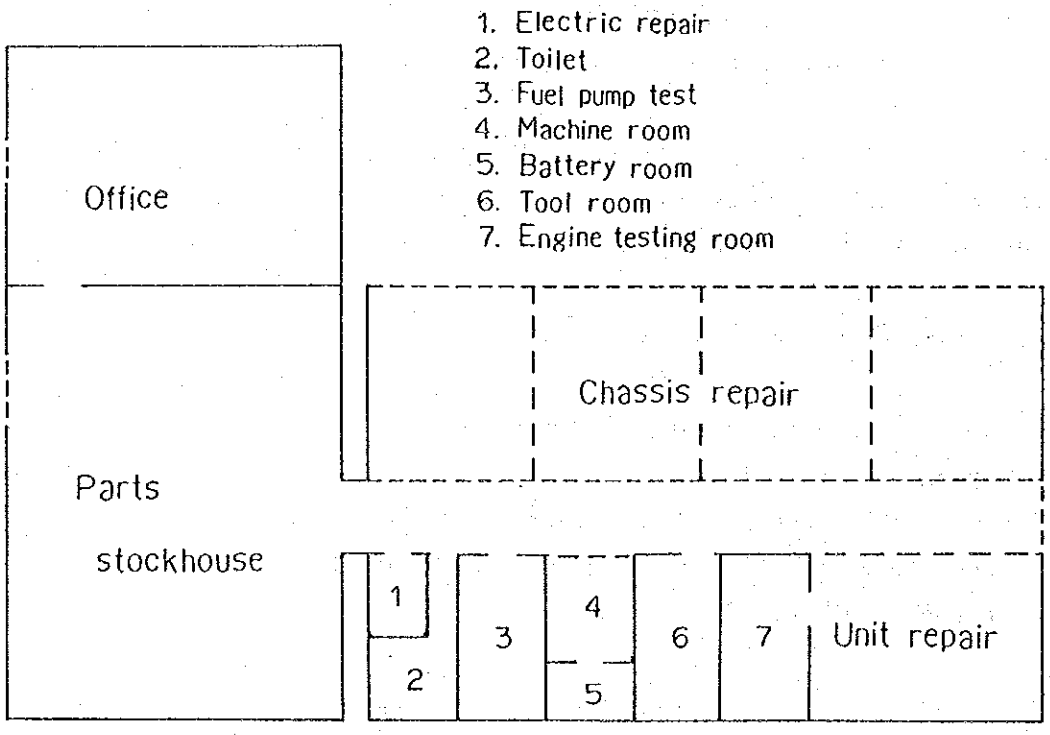
The chassis bay is provided to carry in vehicle bodies for maintenance, where principally, periodical preventive mainenance, removal and mounting of units, repair of chassis, etc. are carried out.

Accordingly, to perform such maintenance, the following equipment is required; an overhead traveling crane, repairing machines using acetylene gas or electricity, function to supply oil, grease, and water, power supply such as compressed air, electricity, etc., and so on.

b. Function of unit bay

Defective units removed are disassembled, repaired, assembled, and tested in the unit bay.

Accordingly, the unit bay should be provided with the equipment for repair, test, adjustment, etc.



S.R. Fig. EXAMPLE OF THE LAYOUT OF MAINTENANCE SHOP

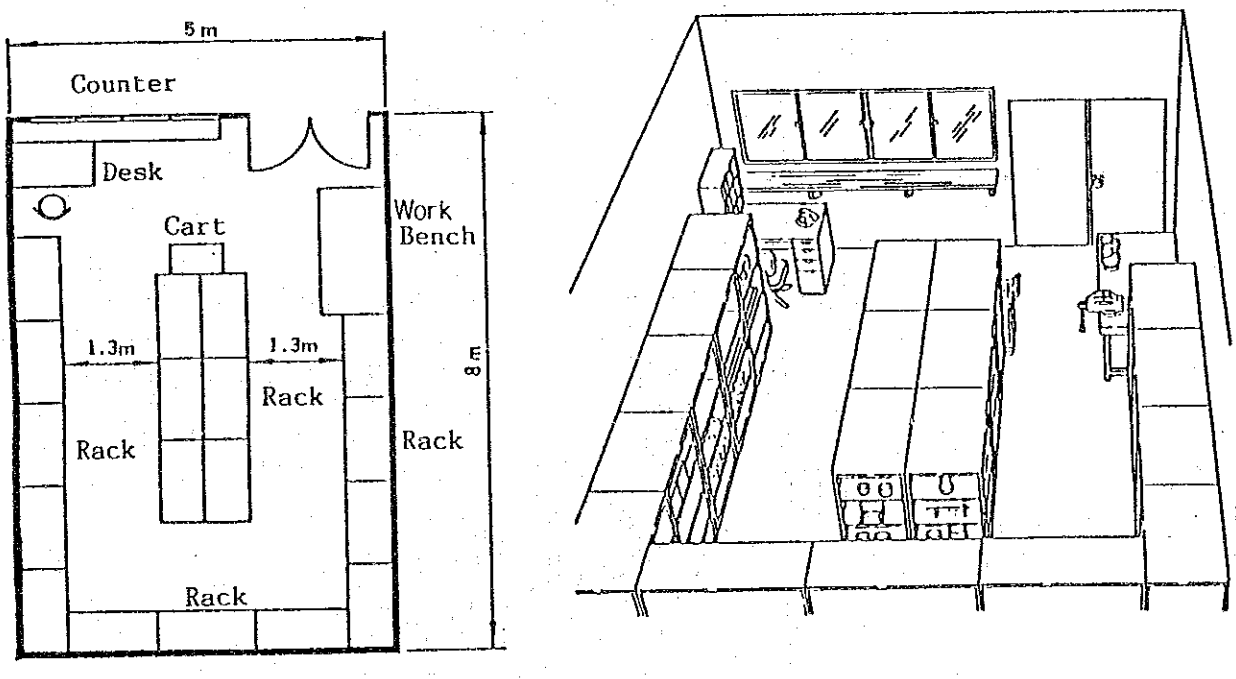
c. Office

The office is the center for the control of maintenance shop. It should be located at a position that is convenient for communication with each job site (preferably, a position commanding a view of the whole shop) so as to be able to give proper operating instructions.

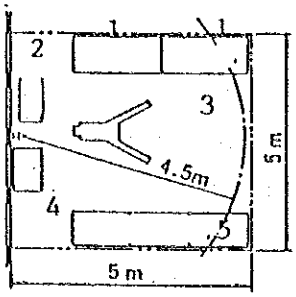
In addition, it is necessary to provide a maintenance control office in the office or in the shop so as to give daily operating instructions, to control the process of work, to store the records of troubles, and to do office work directly related to the maintenance work.

d. Tool room

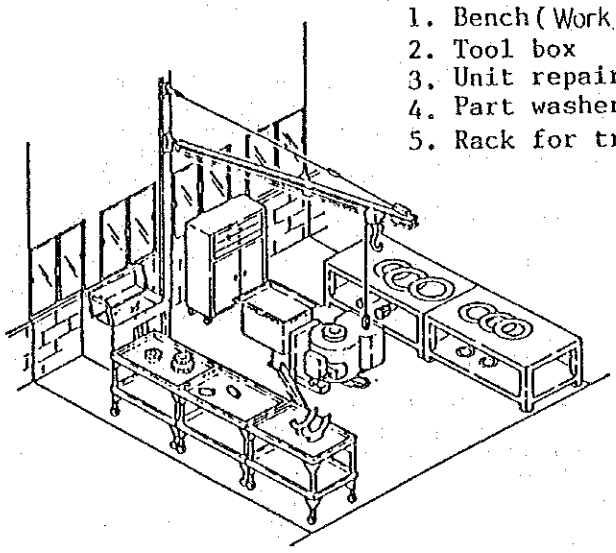
The tool room is used to store and lend out electric tools, pneumatic tools, metering tools, special tools, etc., so it should be located at a convenient position that is nearest to each job site and faces the main passage.



S.R. Fig. EXAMPLE OF TOOL ROOM

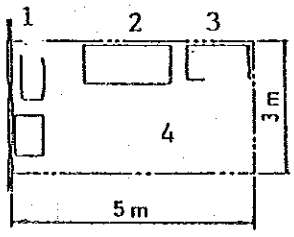


Basic space: 25 m²

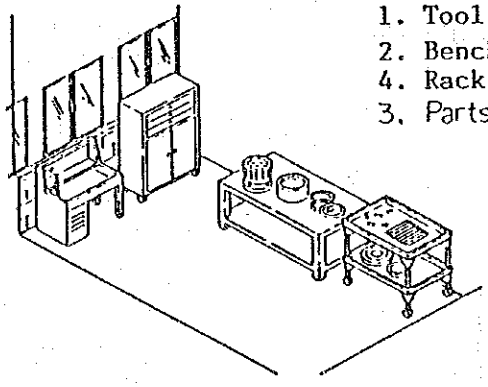


1. Bench (Work bench)
2. Tool box
3. Unit repair stand
4. Part washer
5. Rack for traveling parts

S.R. Fig. EXAMPLE OF THE TRANSMISSION GEAR DISASSEMBLING & ASSEMBLING PLACE

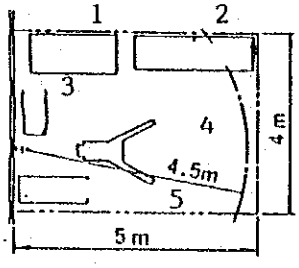


Basuc soace: 15 m²

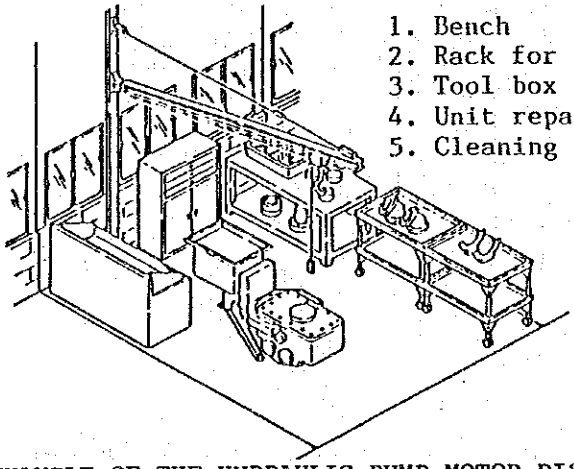


1. Tool box
2. Benck
4. Rack for traveling parts
3. Parts washer

S.R. Fig. EXAMPLE OF THE CLUTCH DISASSEMBLING & ASSEMBLING PLACE

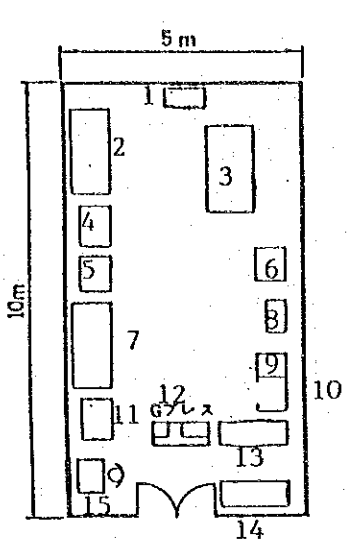


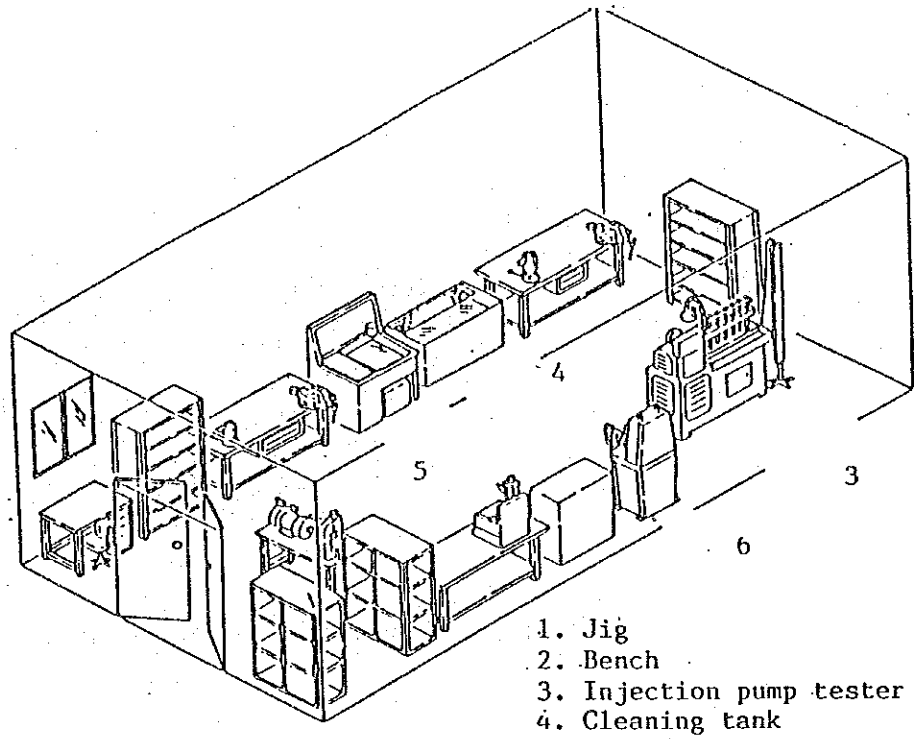
Basic space: 20 m²



1. Bench
2. Rack for traveling parts
3. Tool box
4. Unit repair stand
5. Cleaning bench

S.R. Fig. EXAMPLE OF THE HYDRAULIC PUMP MOTOR DISASSEMBLING & ASSEMBLING PLACE

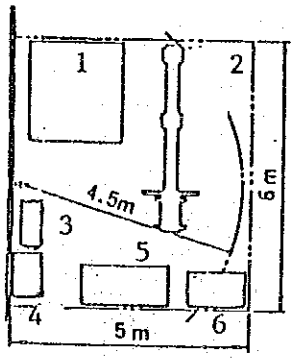


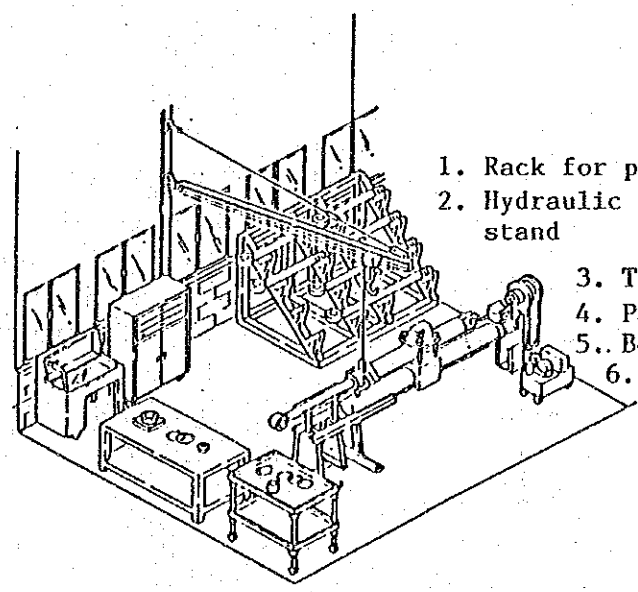


Basic space: 50 m²

1. Jig
2. Bench
3. Injection pump tester
4. Cleaning tank
5. Part washer
6. P.T pump tester
7. Bench
8. Jig
9. Injector test stand
10. Bench
11. Jig
12. G press
13, 14. Rack
15. Desk

S.R. Fig. EXAMPLE OF THE FUEL PUMP TESTING ROOM

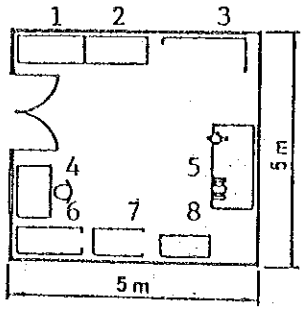




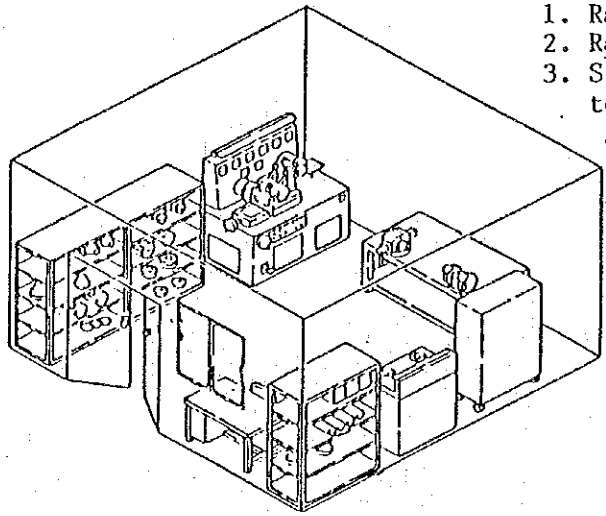
Basic space: 30 m²

1. Rack for parts in process
2. Hydraulic cylinder repair stand
3. Tool box
4. Part washer
5. Bench
6. Rack for traveling parts

S.R. Fig. EXAMPLE OF THE HYDRAULIC CYLINDER DISASSEMBLING & ASSEMBLING PLACE

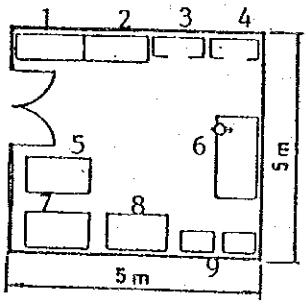


Basic space: 25 m²

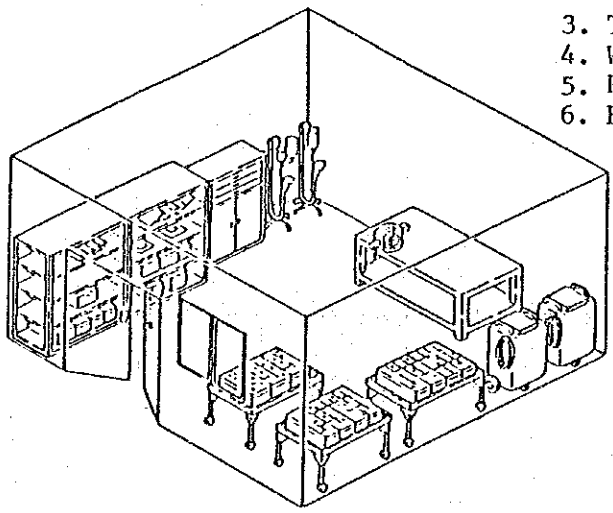


1. Rack
2. Rack
3. Starter generator test bench
4. Desk
5. Bench
6. Rack
7. Dryer
8. Tool box

S.R. Fig. EXAMPLE OF THE ELECTRIC PARTS ROOM

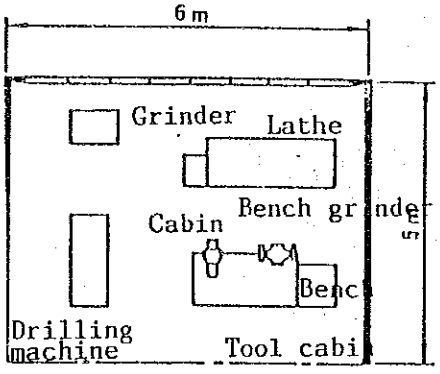


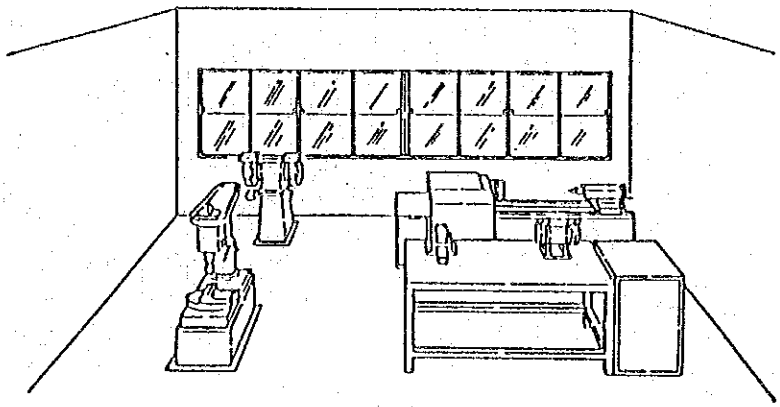
Basic space: 25 m²



1. Rack, 2. Rack
3. Tool box
4. Water washer
5. Rack
6. Bench
7. Rack, 8. Rack
9. Battery charger

S.R. Fig. EXAMPLE OF THE BATTERY ROOM





S.R. Fig. EXAMPLE OF THE MACHINE ROOM

Note: In the unit bay, the jobs are carried out in separate rooms, so parts, etc. should be arranged orderly so as to secure sufficient space to do jobs efficiently and safely.

(2) Parts control

Major elements to improve the availability of collection vehicles include "Procurement of parts for repair and maintenance". Since any parts are necessarily used in repair and maintenance of vehicles, reduction of the time required for repair and maintenance depends upon the procurement of necessary parts and holding proper quantity of them. The role of the parts control is important in maintenance shops. Accordingly, in the control of parts, it is necessary to grasp the trend of demand for necessary parts, and to be ready to supply necessary parts promptly to the repair and maintenance sections.

a. Basic policy of the parts control

Since the parts control has great effects on the maintenance and control of vehicles, it is required to hold a proper and economical quantity of necessary parts. "Establishment of a system to permit prompt delivery by holding a reasonable inventory quantity@ is an important subject. Furthermore, it should be recognized that parts are important property for a maintenance shop, and special care should be taken in storing and handling of parts and in maintaining their quality.

b. Forecasting of parts inventory

The reasonable inventory quantity implies "economical inventory list and quantity" and "inventory to permit prompt delivery". However, in practice, the inventory quantity is determined on the basis of the past records of demand. Care should be taken to hold the inventory quantity reasonable by calculating the theoretical demand through statistical analysis of the types and quantity of vehicles used, operating conditions, records of past demand for parts, etc.

c. Control and business of parts warehouse

Parts control includes the actual goods control for the parts stored in a warehouse and the business control. The business of warehouse includes 3 steps; warehousing, storage, and delivery. Each step is treated by means of warehousing slips, inventory slips, and delivery slips, respectively. It is important to establish a fixed system for treating the business and for entering them in a ledger (parts control ledger).

Inventory tags may also be used. The inventory tags are used for the parts control, and the inventory quantity is entered briefly in them to indicate the quantity of parts in stock. In addition, the parts control ledger is often collated with the inventory tags to grasp the correct inventory quantity.

d. Inventory taking

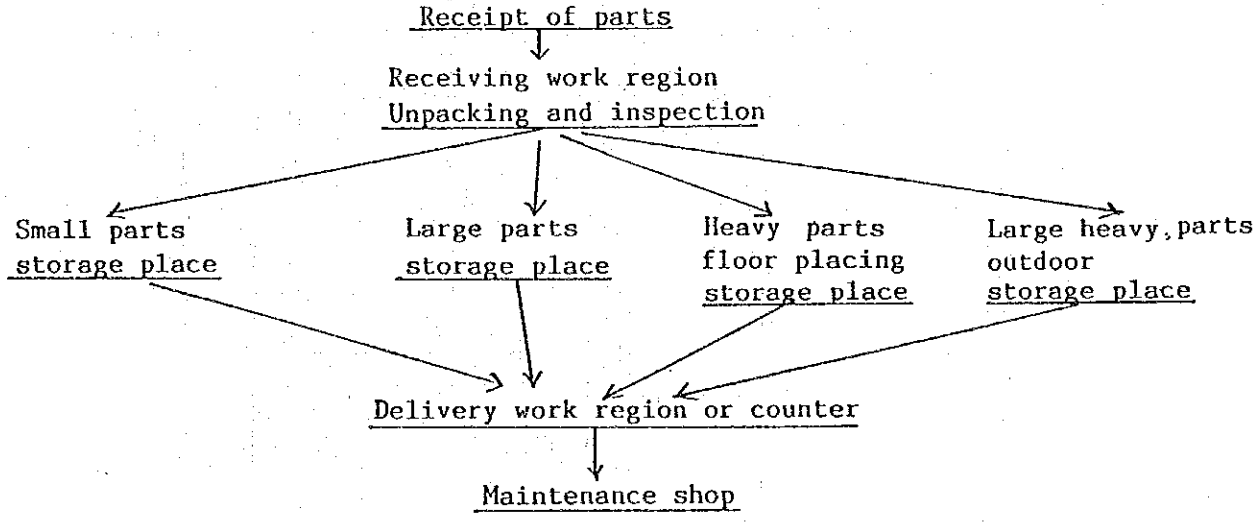
The inventory taking, which is important for the financial control of maintenance shop and for the actual goods control, is performed for the following purposes:

- To know the actual quantities of parts (checks for failure to enter).
- Collation of the actual inventory quantity with the parts control ledger (auditing).
- To examine whether the standing inventory (standard stock) is reasonable.
- To grasp the actual condition of overstock and dead stock.
- To examine whether the method of storage and the method of treating the business are reasonable.

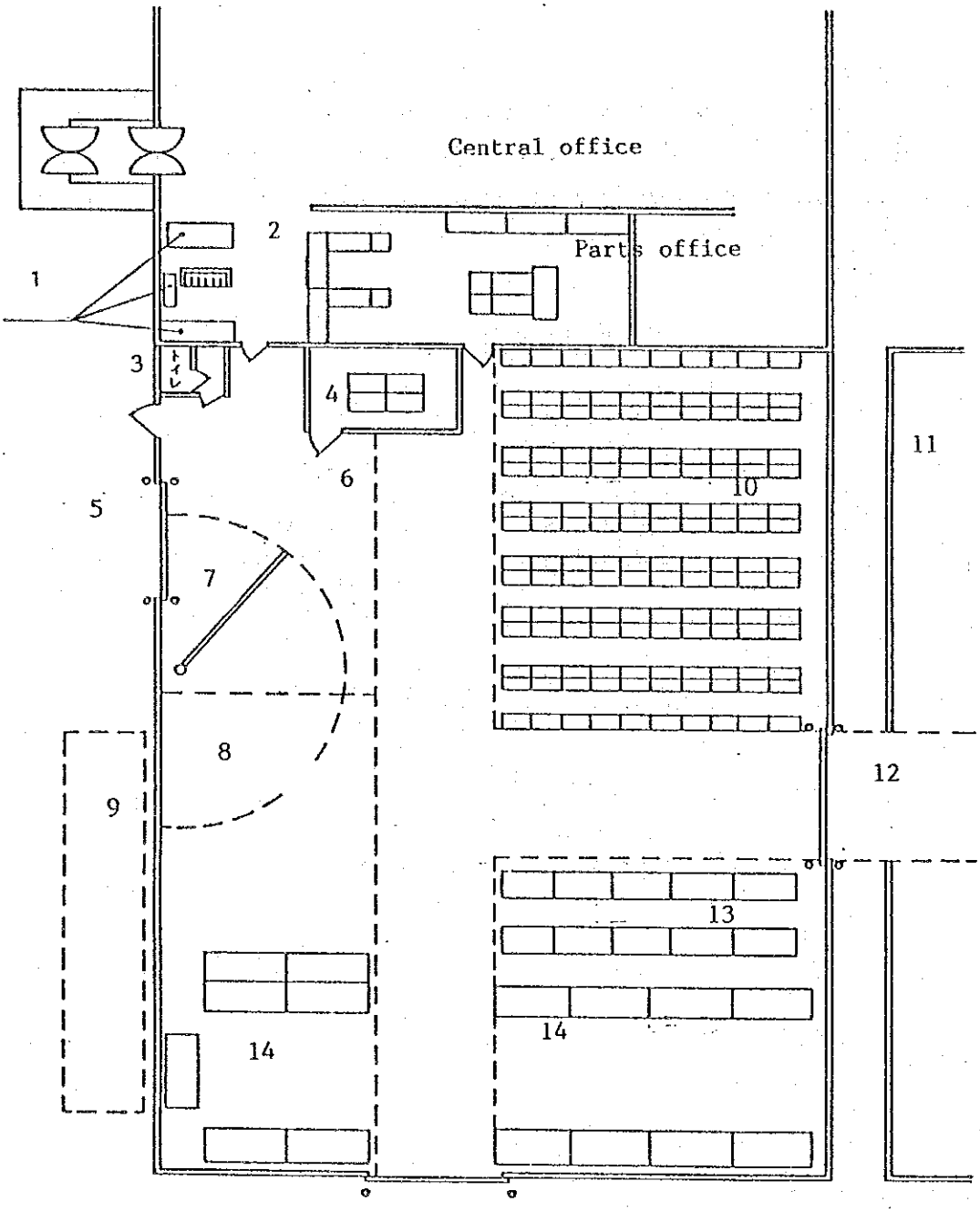
The inventory taking should be performed periodically (every 6 or 12 months) and simultaneously at all warehouses. The results should be used as the information for examination of reasonable inventory quantity and for ordering parts.

e. Function of parts warehouse

The parts for vehicle include large heavy parts and small precision parts, and it is required for the layout of warehouse to permit them to be taken out promptly when required. For this, it is necessary to understand the flow of parts.



S.R. Fig. FLOW OF PARTS



Note: In the parts warehouse, a forklift truck and a part cart is required to store heavy parts and to move many parts.

1. Rack
2. Receipt of parts
3. Toilet
4. Field office
5. Overhead door
6. Receipt and delivery work place
7. Jib crane
8. Floor placing storage place
9. Outdoor storage place
10. Rack (2 layers)
11. Repair shop
12. Main passage
13. Rack
14. Pallet rack

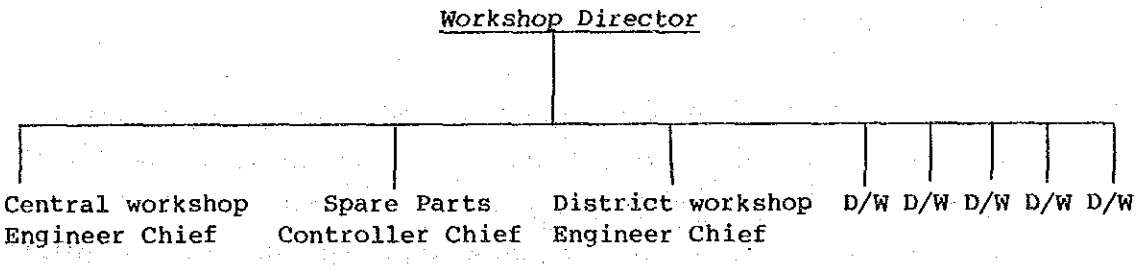
6) Conclusions

In order that waste collecting vehicles perform stably their function of collection, it is essential to establish the organization of vehicle maintenance and control, and to elevate the level of maintenance technology. For the maintenance and control of vehicles, the following are required: an organization, persons, workshops for maintenance of vehicles and their systematic operations, and sufficient equipment and materials. A control system to control the above is essential.

(1) Maintenance organization

a. It is necessary to define the allotment of functions (allotment of responsibility) of the Central workshop and the District workshops. Furthermore, change of the organization should be considered.

- Organization of workshop



For the maintenance and control of vehicles, it is necessary to control systematically the all workshops.

- Workshop Director
  He holds full power for the maintenance and control of vehicles, and his principal function is to perform overall management such as operation of workshops, planning of the purchase of spare parts, etc.

- Central workshop
  The principal function is to overhaul the vehicle units. It makes repairs of units, instrumentation, adjustments, etc. by technicians of the medium and high level.

- Spare Parts Controller Chief
  His principal function is to store and control the spare parts for all vehicles, the equipment and materials for maintenance, and the oil and fuel, and to supply parts, etc. to the Central workshop and individual district workshops.

- District workshops
  Their principal function is the maintenance and control of the vehicles held by individual district workshops. They are formed of technicians of the medium or lower level, and make preventive maintenance, simple troubleshooting and repairs.

b. The maintenance equipment for workshops is selected depending upon the layout taking into consideration the contents of maintenance, the purpose, the operating efficiency, etc.

- With respect to the equipment of the District workshop, the workshop equipment in the USAID plan is considered satisfactory to make fully the maintenance.

- With respect to the Central workshop, considering the structure of the present workshop, etc., it is desired to change the policy of maintenance, and it is necessary in the future to install the maintenance equipment (testing, metering, and adjusting equipment) required as a maintenance shop dedicated to the maintenance of units.

(2) Maintenance standard

The maintenance and control of vehicles are all carried out by persons. Accordingly, it is essential to train the persons.
The training should include"

a. Necessity of the periodical maintenance, and planning of the execution of the maintenance.

b. How to operate the equipment necessary forthe maintenance of vehicles.

c. Elevation of the technical level of mechanics by mastering the basic technology of maintenance.

d. Collection of detailed data in the maintenance and repairs of troubles, and the method of utilizing them.

e. The criteria for putting vehicles out of service.

The training should aim at giving to the employees of workshops intense interest about the maintenance and control of vehicles.

(3) Parts control

Whether the spare parts stock is reasonable or not has great effects on the maintenance and control of vehicles. Unplanned purchase of parts would increase the quantity of dead stock, resulting in interference with the smooth operation of workshop. It is required to establish a system to permit prompt delivery by holding the reasonably inventory quantity.

a. The reasonable inventory quantity should be determined for the quantity of vehicles being held at present on the basis of the past data (the quantity of vehicles held and the quantity of parts used).

b. The parts stock should be controlled by preparing inventory control ledgers (including the notebook type and the visible card type).

Note: The remaining inventory quantity and the amounts of money should also be entered.

c. Inventory taking should be carried out every 6 or 12 months to grasp the actual quantity of parts in stock, and the results should be utilized in determining the reasonable inventory quantity and as the data for future purchase of parts.

d. It is desirable to purchase parts after the inventory taking to be performed every 6 or 12 months.

(4) Recommendations

To promote the maintenance and control of vehicles, it is necessary to train the engineers including the workshop chief about workshop management, and to elevate the maintenance technology of the mechanics.

For these, it is desirable that the governorate of Egypt (Alexandria) has intense interest about the maintenance and control of vehicles and performs positively the evaluation and verification of the operating condition of workshops and of the operational plan, as well as that engineers for the operation of workshop are dispatched from Japan.

2.14 Public Communication

2.14.1 Introduction

Unlike water supply and sewage collection services, cleansing service requires much more attention, understanding and cooperation of the public. In fact, without citizens' cooperation with the city cleansing service in meeting the collection schedule, no refuse collection work is possible. In order to obtain citizens' cooperation, their understanding of the cleansing works is necessary. The public understanding and cooperation can be obtained through public communication programs which are an essential part of municipal cleansing service.

The overall objective of public communication for cleansing service is, therefore, to obtain understanding and cooperation of the public. The specific aims or expected effects of public communication programs are as follows:

(1) to ease the collection service and improve the collection efficiency,
(2) to keep streets and garbage collection stations clean and sanitary,
(3) to make people respect cleansing works and workers,
(4) to ease the siting of solid waste management facilities,
(5) to reduce the amount of garbage and reutilize materials through collection by separation, and
(6) to reduce the cost of solid waste management resulting from all the effects mentioned above.

In Alexandria no public communication program presently exists except for an annual month-long cleansing campaign in spring which has almost no impact on the response or behavior of the public. Because of the lack of public communication programs, the people of Alexandria do not seem to understand their responsibilities in cleaning the city. They do not know what to do to help the city cleansing service work better. The people of Alexandria are used to throwing garbages through the windows of houses and cars without seriously thinking what the effects of doing so would be on the cleanliness of streets and cleansing work. They are not fully aware

of the impact of ill-mannered garbage discharge on the public health, the collection efficiency and the cost of cleansing works. The people must be given the information on the city cleansing works and regulations for garbage handling in order for them to participate in the city's cleansing effort.

Public communication programs have been developed and implemented for the collection experiment conducted by the JICA study team and the Alexandria Governorate counterparts in the summer of 1985. The following sections include the report on the public communication programs of the experiment and the planning for the future public communication programs for the cleansing service of the Governorate of Alexandria.

2.14.2 Definitions of Public Communication Programs

Before reporting the results of our study, certain terms used in this report are defined for the sake of reading following sections.

Public communication for cleansing service may take various forms. Although teaching the importance of cleansing works to school children and giving instruction of discharging garbages to residents are forms of public communication, their expected responses are different (i.e. the former is concerned with a long-term response and the latter with a short-term response).

S.R. Fig. 2-14-1 presents the relationships between the public, the administrative sector and the cleansing workers. These three sectors are connected through different channels. For the sake of reading this report, the terms commonly and sometimes interchangeably used to describe various channels in public communication are defined as follows:

(1) Public Instruction

Public instruction is an activity which gives instructions to the public as to when and how to discharge their garbages. The effect of the public instruction is the cooperation of the public with the cleansing service.

(2) Public Education

The public instruction aims at a relatively short-term effect or response from the public whereas the public education aims to provide the public with the information concerning the cleansing works of the city and thereby improve the public awareness of the importance of the cleansing works. Therefore, the public education is a relatively long-term effort. Note that the public education defined here is in a narrow sense; often both the public instruction and public education as defined in this study are the public education defined elsewhere.

(3) Public Awareness

While the public education is the information transfer from the city's administration body to the public, the public awareness or the public recognition is the response of the public to that effort. Also included in the public awareness are the compliants and requests to improve the existing cleansing works.

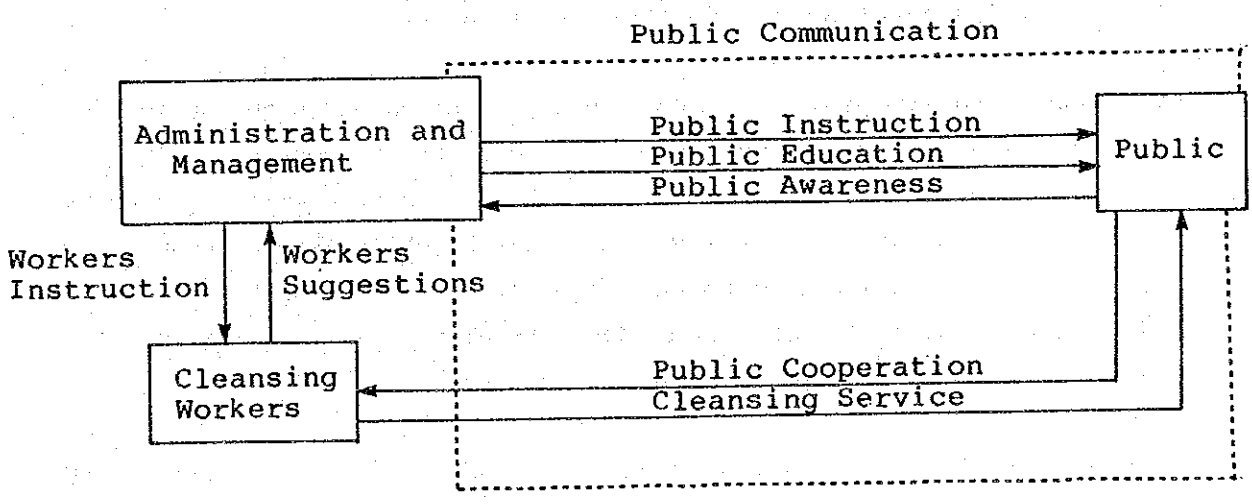


Fig. 2-14-1 PUBLIC COMMUNICATION

(4) Public Cooperation

The public cooperation or the public collaboration is defined as the effort of the public to cooperate or collaborate with the cleansing works through the public instruction and public education. The term, public participation, is often used to mean the public awareness and public cooperation combined.

(5) Cleansing Service

The cleansing service includes collection, haulage, treatment and disposal. Of these, the collection work is particularly important in the public communication since it involves the public cooperation for a successful operation. In order to gain the public cooperation, the collection work must be effective and the worker's outlook must be reasonably clean and must not create a negative image to the public. Also important is the training of the workers so that they can answer simple questions the public may have on the cleansing works. This will help to improve the images of the cleansing service and the workers themselves.

2.14.3 Public Communication Programs in Alexandria

An annual cleansing month campaign usually in March has been carried out in Alexandria. The major activities included are the contests among classes for cleaning up classrooms and other areas at elementary schools and radio broadcasting calling for the general public awareness in cleansing. Although this campaign has a certain impact on school children and a limited number of general public, its effects on the behavior of people and city's cleanliness have not been realized.

In the past the Governorate of Alexandria made cleansing experiments where several public communication methods were used. Four such experiments are summerized in Appendix A. In these experiments, campaigns were conducted using cars with microphones, radio broadcasting and leaflets for discharge instructions and campaign messages. The campaigns seemed to be carried out successfully with these methods. This indicates that the Governorate staff are capable of conducting such a campaign and the public responds well to the campaign.

However, these campaigns lasted only for the durations of the experiments, and no continuous public communication program has resulted. This problem stems from the fact that no organizational body exists in the Governorate for continuous public communication programs for cleansing works. Also there seems to be a lack of understanding of the importance of public communication among the Governorate management personnels.

2.14.4 Public Communication in the Collection Experiment

The JICA team in cooperation with the Middle District cleansing service planned and conducted a collection experiment from July 1, 1985 to September 30, 1985 as described elsewhere by the study team. Public communication programs were incorporated into this experiment as an essential part to achieve a successful experiment. These public communication programs contained discharge instructions for different collection services and campaigns to call for public participation in this experiment. The long-term public education programs were not attempted in this experiment since the time was short to allow for assessing the feasibility and effectiveness of these programs. In what follows the public instruction, campaign activities in the experiment are described, and the feasibility and effectiveness of these program were discussed. The public communication materials developed for the experiment are given in Appendix B.

1) Public Instruction

After the collection time, the locations of garbage collection stations, the possible discharge time for shops and offices and the availability of plastic bags had been determined, the discharge instructions for the experiment areas were developed. These discharge instructions specified the time and location of garbage discharge, whether to use plastic bags and notes on the prohibition of throwing garbages through windows and the fine for the violation. The instructions were then delivered to the households and shops in the experiment areas in a leaflet form, henceforth called instruction sheet. The instructions were also written on a sheet of paper, called station panel, and posted at the garbage collection

stations. During the experiment, the instructions were given on a person-to-person basis by visiting households and shops. The areas were also inspected and patroled to enforce the regulation by fine collection. The following summarizes the public instruction activities.

(1) Instruction Sheet

Instruction sheets were delivered and explained to all the households, shops or offices of the experiment areas for 3 days from August 11 to 13, 1985 by 27 assistant workers, of which 17 assistant workers were supplied by the Alexandria Directorate of Health.

(2) Station Panel

Station panels were put on all the containers and the walls near the garbage stations in order to inform the residents of the location of the garbage collection stations and the designated garbage discharge time and manner.

(3) Inspection and Patrol

Throughout the experiment period, inspection and patrol were done in order to guide the residents and enforce the required discharge and collection system. Inspectors visited houses and shops when necessary. For this purpose, 10 assistant workers were used in addition to District inspectors and workmasters of the experiment areas.

All the above programs can be fairly easily developed and implemented. Some station panels were taken off because the residents or the shops rejected to have the garbage collection stations in front of their buildings. The person-to-person instruction and imposition of penalty were found more effective than the written materials to get the immediate response.

2) Campaign

Various campaign programs were developed to get the attention and cooperation of the people to the experiment. The media used for campaigning included radio, posters, badges, meeting at regional society,

microphone-loudspeaker on a vehicle and religious meeting at mosques and churches. The following list gives a summary description of each activity.

(1) Radio Broadcasting by the Alexandria Radio Broadcasting Station
The experiment was announced by the radio twice a day from August 7 to 14, 1985.

(2) Posters and Badges
Posters calling for residents cooperation were put on some of the building walls of the three experiment areas. Badges were given to all the personnel involved in the experiment.

(3) Regional Meeting with Loyal Nubian Society
A regional meeting was held at Loyal Nubian Society on August 9, 1985. The meeting started at 7 p.m. with the talks presented by a JICA member and a District cleansing service personnel, followed by an open discussion. In the meeting, opinions of both sides (citizens and the District) were exchanged.

(4) Microphone and Vehicle
The garbage discharge instruction was delivered through a microphone-loudspeaker equiped on a vehicle in the three experiment areas for a week before and the first week of the experiment.

(5) Mosques and Churches
A message concerning our experiment was delivered to the people during preaches in the mosques (on August 9th, Friday prayer time) and the churches (on August 11th, Sunday morning meeting) in the experiment areas.

The radio broadcasting was easily performed without any charge by the Alexandria Radio Broadcasting Station since this is a Governorate radio

station. Most Governorate announcements are done by the Alexandria Radio Broadcasting Station. However, the Middle East Broadcasting Station gives more effective means to transfer information since more people listen to this station, although a considerable charge is required.

Posters and badges were made with no trouble. They are usually included in a campaign of this kind and attract people's attention.

Regional meetings cannot be conducted easily since it is hard to find places suitable for the meeting. In fact, the Loyal Nubian Society was the only place we could find in all the three experiment areas. The meeting itself had hot debates between the cleansing people and the residents and was considered to be effective in keeping the communication between the cleansing side and the public.

The microphone and vehicle method has more direct impact on people's attention than the radio broadcasting. This method has been used several times before and has proved to be an effective method. The Middle District Cleansing Office has a small truck with a microphone and a loudspeaker for campaign.

Use of a religious channel such as mosques and churches for getting the attention and cooperation of people is an attractive method for public communication. However, at present the Governorate can only provide mosques and churches with a campaign message and the mosques and churches make a decision as to whether and how the message is presented. Therefore the Governorate has a limited ability to control the effectiveness of the method.

Other possible, but not probable, methods for campaign include newspaper advertisement, a TV program and a short film shown in movie theaters. Since the Governorate publishes no newspaper, the cost of newspaper advertisement is very high. For the two most popular papers, El Akhbor and El Ahram, a quarter page advertisement costs approximately 3,000 LE a day. The TV and movie films are also expensive, and it takes a long time to develop them. For this kind of experiment, new development of these films is not feasible. Use of existing films should be considered.

3) Staff and Cost

The personnel, materials and cost required to develop the public communication activities in the experiment are summarized in S.R. Tab. 2-14-1, except for the cost of personnel. The Governorate personnels were capable of conducting public communication programs. Almost any materials available in Japan was also available in Alexandria. The cost of printing took most of the material cost.

S.R. Table 2-14-1 REQUIREMENTS FOR PUBLIC COMMUNICATION PROGRAMS DURING THE EXPERIMENT

Activity Items	Personnel	Materials	Cost
1) Instruction Sheet			
Development of Contents	2 to 3 senior cleansing personnels	-	
Printing	(Printshop)	-	16 LE/1000 papers x 4,500 papers
2) Station Panel			
Development of Contents	2 to 3 senior cleansing personnels	-	-
Drawing	1 artist for drawing and letter writing	Paint and paper Letter writing* Drawing*	27 LE* 3 LE* 20 LE*
Printing (covered with plastic sheets)	(Printshop)	(Color print)	386 LE (200 badges included)
3) Badge			
Development of idea	1 to 2 senior cleansing personnel	-	-
Drawing	1 artist for drawing and letter writing	(See "Station Panel")	(See "Station Panel")
Printing	(Printshop)	(See "Station Panel")	(See "Station Panel")

Activity Items	Personnel	Materials	Cost
4) Poster			
Development of idea	1 to 2 senior cleansing personnel	-	-
Drawing	1 artist for drawing and letter writing	(See "Station Panel")	(See "Station Panel")
Printing	(Printshop)	6 colors	725 LE for 500 posters
5) Radio			
Development of message	2 to 3 senior cleansing personnels	-	-
Broadcasting	(Radio station)		(Governorate station)
6) Microphone and Vehicle			
Development of message	2 to 3 senior cleansing personnels	-	-
Speaking	1 cleansing personnel	Car, loudspeaker microphone (District supplies)	0 LE
7) Mosque and Church			
Development of message	2 to 3 senior cleansing personnels	-	-
Speaking	Preachers at mosques and churches	-	0 LE
8) Regional Meeting			
Development of leaflet	2 to 3 senior cleansing personnels	-	-
Speaking	1 cleansing personnel and 1 JICA	Slides, hall, chairs	25 LE (for drink)

* This is paid for the artist work.

CHAPTER 3. PLANNING CONDITION AND PLAN FOR THE MASTER PLAN

3.1 Estimated Waste Amount and Composition of Solid Waste

3.1.1 Basic conditions

Basic conditions for the estimation of waste amount are summarized as follows.

(1) Area to be planned

From the standpoint of the waste management plan, Alexandria may be broadly divided into three areas: namely, the existing urban area, the area in which new urban areas are likely to expand, and the agricultural area that is unlikely to be urbanized.

The former two categories are deemed as the areas to be covered under the master plan.

(2) Target year

The target year of the plan shall be 2000 A.D. All references to the present condition shall be that of 1984 A.D.

(3) Type of waste

Wastes generated from the city area of Alexandria are the following.

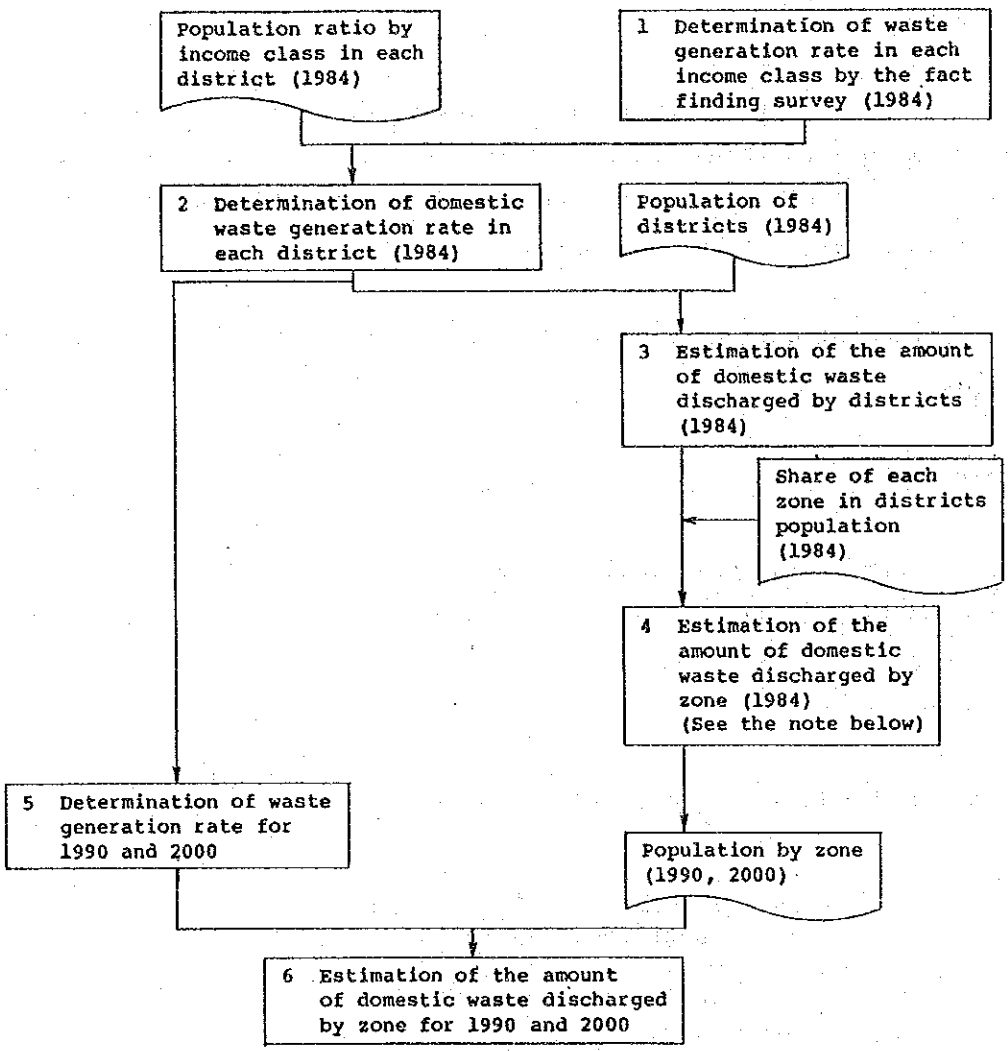
- Domestic waste
- Commercial waste
- Summer vacationers waste
- Street waste
- Factory and port waste
- Sewage sludge

The wastes that will be considered in the master plan are domestic waste, commercial waste, summer vacationers waste and street waste. The existence of so called industrial wastes such as factory and port waste and sewage sludge, which should be treated on the basis of Polluters' Pay Principle, while of course being kept in mind in formulating the master plan, will not be included in this plan as wastes to be managed.

3.1.2 Method of estimating waste amount

(1) Domestic waste

The procedure for estimating domestic waste amount is as shown in Fig. 3-1-1.



*Note: The amount of domestic waste currently generated in each zone was basically determined by distributing the amount generated in each district according to the population ratio. (The percentage distribution of household by income class may differ among the zones of each district, but it is difficult to determine the percentage distribution of household by income class for each zone.)

Fig. 3-1-1 PROCEDURE FOR ESTIMATING AMOUNT OF DOMESTIC WASTE

What serves as the basis of this estimation procedure is the waste generation rate. A survey has revealed the rate of domestic waste generation in 1984 by income class to be as shown in Tab. 3-1-1.

Tab. 3-1-1 DOMESTIC WASTE GENERATION RATE BY INCOME CLASS

	LOW INCOME	MIDDLE INCOME	HIGH INCOME	MEAN
Generation Rate (g/capita/day)	221	344	362	284
Density (kg/m^3)	254	224	192	236

The composition of households by income class in each District has been determined as per Tab. 3-1-2.

Tab. 3-1-2 COMPOSITION OF HOUSEHOLDS BY INCOME CLASS IN EACH DISTRICT (%)

DISTRICT	LOW	MIDDLE	HIGH
Montazah	70	22	8
East	52	36	12
Middle	35	51	14
Gomrok	32	58	10
West	59	37	4
Ameriyah	55	36	9

The domestic waste generation rate in each district as of 1984 estimated on the basis of these propositions is as per Tab. 3-1-3.

Tab. 3-1-3 MEAN DOMESTIC WASTE GENERATION RATE ACCORDING TO THE DISTRICTS

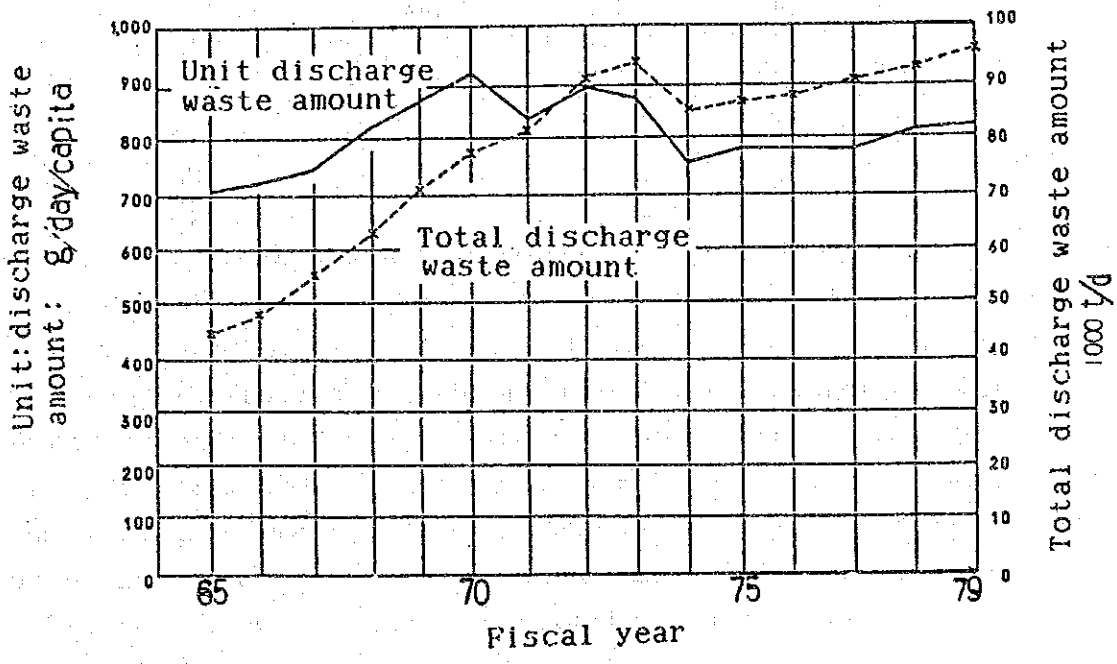
Unit: g/capita/day

DISTRICT	CALCULATED RESULTS
Montazah	259
East	282
Middle	303
Gomrok	306
West	272
Ameriyah	278
Mean	284

The domestic waste generation rate in 1990 and 2000 for the city as a whole was assumed to rise from the current 284 g/capita/day to around 360 g/capita/day which is close to the current generation rate of medium and high income classes, or approximately 1.25 times the current level (an average annual rate of increase of 1.5%). For the existing urban areas, the generation rate was determined by multiplying the current generation rate by this rate of increase. With respect to the new urban areas, the generation rate was assumed to be the same as the mean generation rate in the existing urban areas.

The abovementioned 360 g/capita/day is a little over 70% of Japan's domestic waste generation rate of around 500 g/capita/day. The projected growth rate also is slightly in excess of Japan's growth rate (an annual average increase of 1.14%) of the past 14 years shown in Fig. 3-1-2, but considering that in the years around 1965 the amount discharged in Japan was frequently measured on the basis of vehicle tonnage which tended to be fairly larger than the amount measured on a truck scale so that the growth rate in effect was underestimated, the foregoing estimated generation rate and growth rate for Alexandria seem quite reasonable.

Fig. 3-1-2 CHANGES IN THE TOTAL AMOUNT OF WASTE DISCHARGE AND WASTE GENERATION RATE PER CAPITA PER DAY IN JAPAN



Including the commercial waste except carried directry into final disposal site

The domestic waste generation rates by District and by year based on the above line of reasoning are shown in Tab. 3-1-4.

Tab. 3-1-4 DOMESTIC WASTE GENERATION RATE

(g/capita/day)

DISTRICT	1984	1990	2000
Montazah	259	283	329
East	282	308	358
Middle	303	331	385
Gomrok	306	334	388
West	272	297	345
Ameriyah	278	304	353
Mean	284	308	356

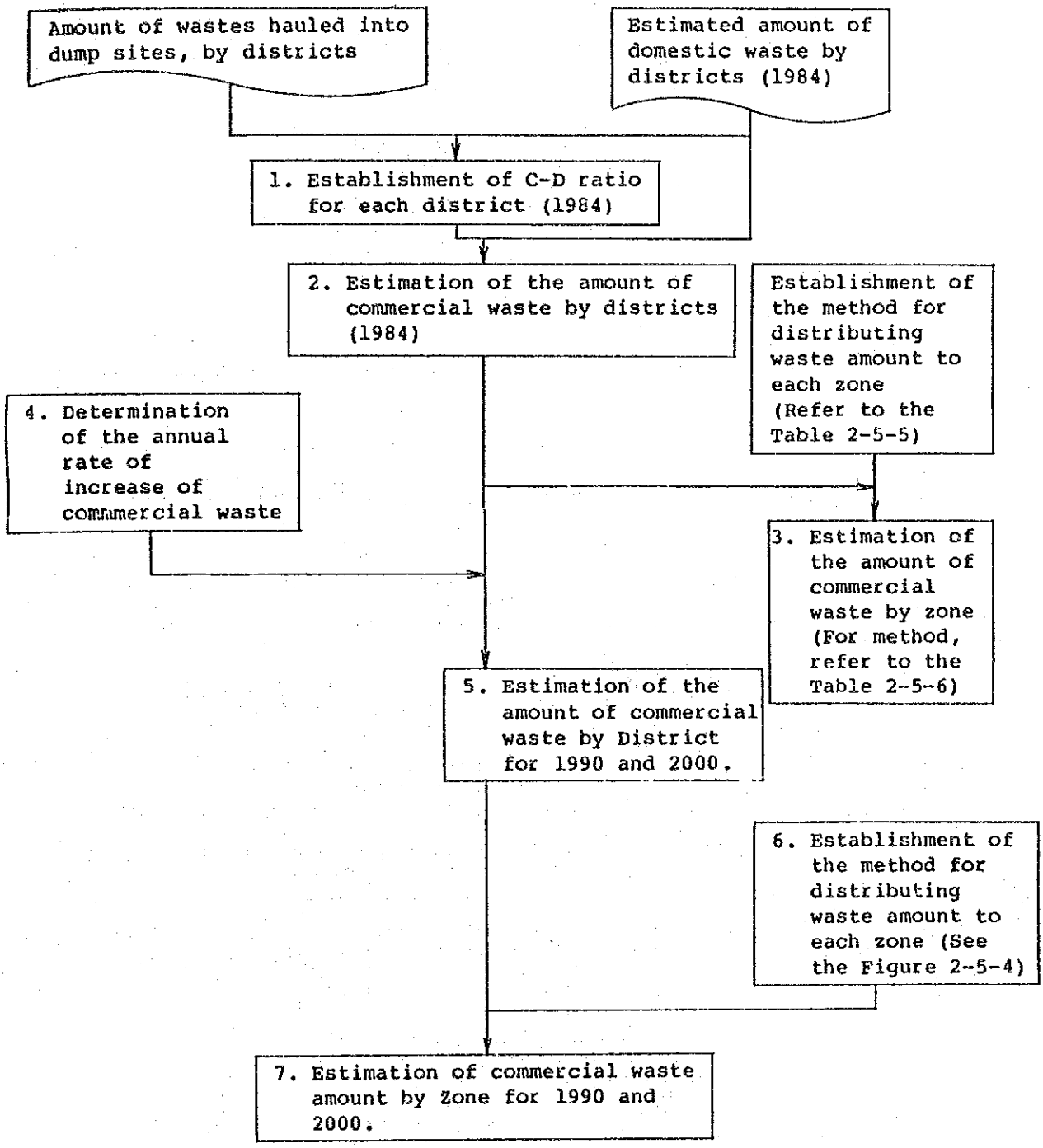
(2) Commercial waste

In order to estimate the amount of commercial waste generated, it is necessary to quantitatively grasp the commercial activities in each assumed area. However, since such data are scanty in Alexandria, we were compelled to estimate the amount of commercial waste generated by the indirect approach of determining the ratio of the sum of commercial waste and domestic waste to domestic waste (which is, hereafter called the C-D ratio) by comparing the amount of wastes hauled into dump sites with the estimated amount of domestic waste generated and seeking a certain pattern in the amount of additional commercial waste generated by the degree of agglomeration of commercial installations. This pattern which provides the basis for establishing the C-D ratio was identified by the unit of district upon an overall evaluation of the degree of commercial activites.

The 1984 values of C-D ratio established for each district are as shown in Tab. 3-1-5.

The amount of commercial waste estimated for each district on the basis of this C-D ratio was distributed among the zones along the line of reasoning indicated in Tab. 3-1-6.

Fig. 3-1-3 ESTIMATION FLOW OF COMMERCIAL WASTE AMOUNT BY ZONE FOR 1990 AND 2000



Tab. 3-1-5 C-D RATIO BY DISTRICT

(for 1984)

DISTRICT	C-D RATIO
Montazah	1.35
East	1.50
Middle	1.70
Gomrok	1.94
West	1.20
Ameriyah	1.20

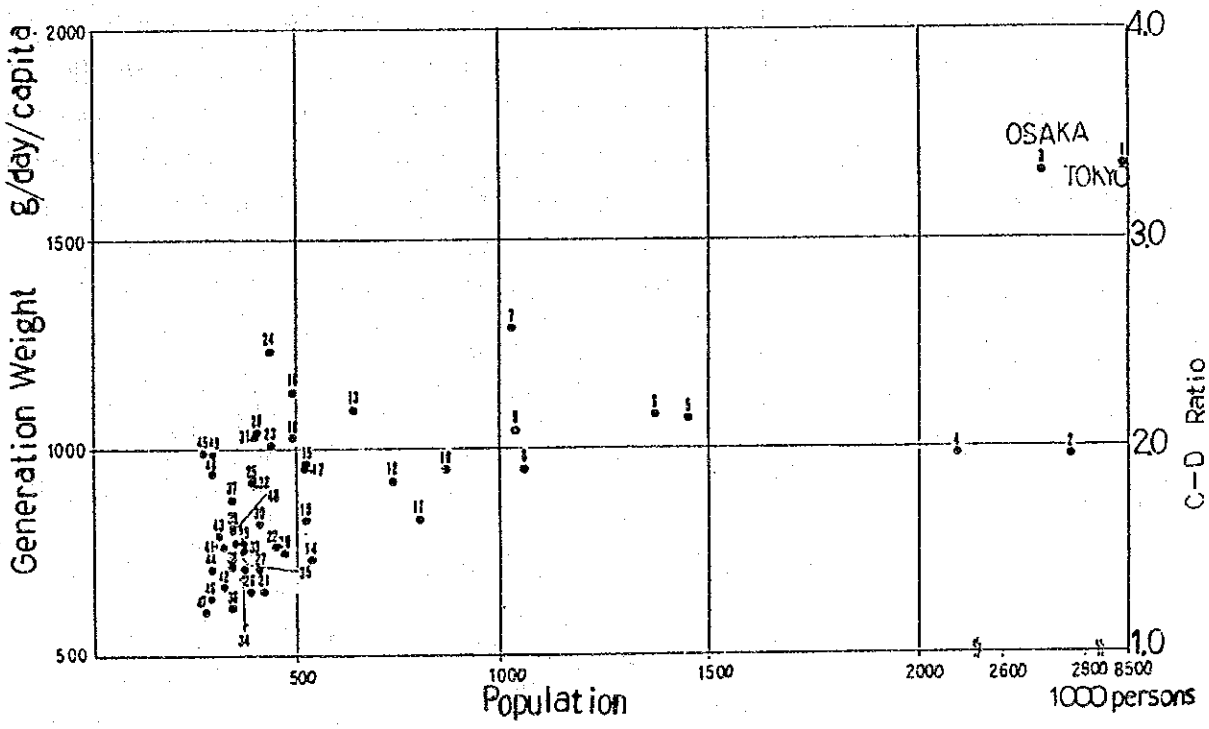
Tab. 3-1-6 DETERMINATION OF C-D RATIO FOR EACH ZONE (for 1984)

DISTRICT	DETERMINATION OF CURRENT C-D RATIO BY ZONE
Montazah	Zones 3, 4, 6 were defined as the residential areas for which C-D ratio of 1.2 was assumed. C-D ratio for Zones 1 and 2 was obtained by the following formula: $\frac{\text{Waste amount of whole District - Waste amount of Zones 3,4 \& 6}}{\text{Domestic waste amount of Zones 1 and 2}}$
East	C-D ratio of 1.20 was assumed for Zones 5, 6, and 7. C-D ratio of 1.35 was assumed for Zone 4. C-D ratio for Zones 1, 2 and 3 was obtained by the following formula: $\frac{\text{Waste amount of whole District - Waste amount of Zones 4,5,6 \& 7}}{\text{Domestic waste amount of Zones 1, 2 and 3}}$
Middle	C-D ratios were determined by analyzing the results of survey on the amount of waste hauled into dump sites as follows: Zone 1 3.04 Zone 4 1.50 Zone 2 1.65 Zone 5 1.50 Zone 3 1.58
Gomrok	Same method as the Middle District. Zone 1 2.13 Zone 2 1.50 Zone 3 1.75
West	C-D ratio assumed to be 1.20 for both Zone 1 and Zone 2.
Ameriyah	C-D ratio assumed to be 1.2 for all of Zones 1, 2, 3, 9 and 10.

In estimating the C-D ratios for 2000, the population of the city as a whole was assumed to increase by approximately 40% during the remaining 16 years until 2000, but when a city expands by that much, the agglomeration of commercial activities is likely to proceed more than commensurate to the population growth. However, it is difficult to estimate the extent of the rise in C-D ratio from the data available from the Egyptian counterparts.

In view of this, a study was made of the c-D ratios of Japanese cities by size of population using the data on urban solid waste generation rates of Japanese cities with a population of 300 thousand or more.

Fig. 3-1-4 URBAN SOLID WASTE GENERATION RATES IN MAJOR JAPANESE CITIES

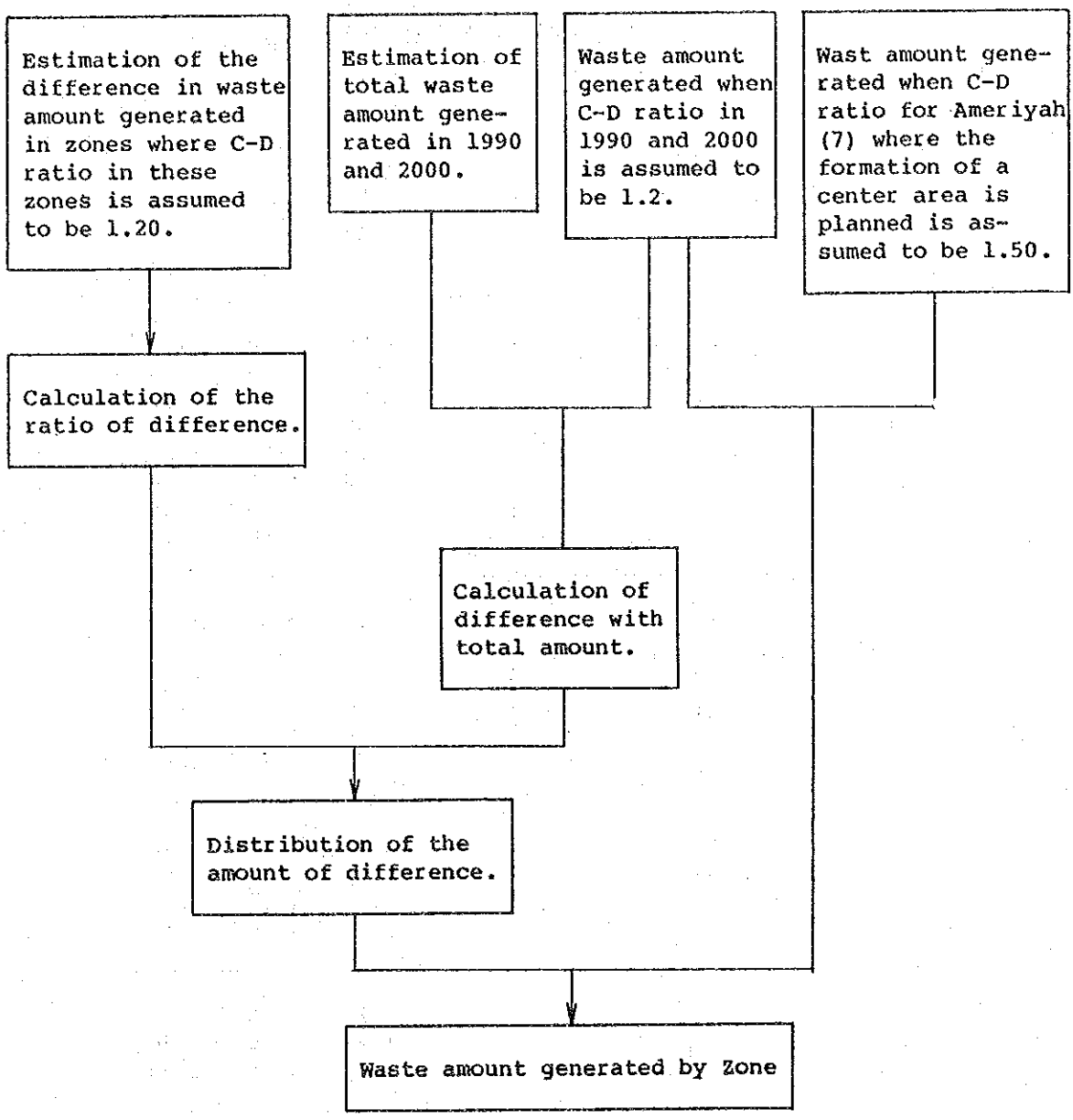


As can be seen from this Fig., the urban solid waste generation rate in Japanese cities of this scale tend to rise in keeping with the rise in the size of the population, and when assuming the domestic waste generation rate to be approximately 500 g/capita/day regardless of the size of the city, the C-D ratio generally ranges between 1.7 and 2.0.

Furthermore, the solid waste generation rates of cities with a population of 500,000 or more are seen to be more or less the same at around 1,000 g/capita/day regardless of the size of the population, however with the exception of the wards of Tokyo and Osaka.

The C-D ratio for Alexandria as a whole in 1984 is 1.53 which is equivalent to that of a city in Japan with a population of 300 to 400 thousand, but it is difficult to predict how this C-D ratio will change in Alexandria in the future. It was therefore decided that the total amount of waste generated should be estimated on the assumption that the C-D ratio for the entire city will remain at the current level like in the Japanese cities with a population of 500 thousand or more and distribute the difference between the total amount of waste generated and the amount of waste generated when the C-D ratio is assumed to be 1.20 according to the characteristics of each Zone. This distribution flow is shown in Fig. 3-1-5 and the C-D ratios of each Zone in Tab. 3-1-7.

Fig. 3-1-5 ESTIMATION FLOW OF WASTE AMOUNT GENERATED BY EACH ZONE



Tab. 3-1-7 PRESENT AND FUTURE C-D RATIO

DISTRICT	SUB DISTRICT	ZONE NUMBER	1984	1990	2000
Montazah	Montazah	1	1.62	1.67	1.70
		2	1.65	1.65	1.67
		3	1.20	1.20	1.20
		4	1.20	1.20	1.20
		5	-	1.20	1.20
		6	1.20	1.20	1.20
	Sub Total		1.35	1.35	1.35
East	Sidi Gaber	1	2.00	1.96	1.98
		2	2.00	2.04	2.18
		3	2.00	2.00	1.98
		4	1.35	1.35	1.41
	Raml	5	1.20	1.20	1.20
		6	1.20	1.20	1.20
		7	1.20	1.20	1.20
	Sub Total		1.50	1.52	1.57
Middle	Ataryn	1	2.96	3.03	3.33
	Bab Sharki	2	1.65	1.69	1.78
		3	1.50	1.51	1.58
	Moharam Bey	4	1.50	1.43	1.48
		5	1.50	1.50	1.57
	Sub Total		1.70	1.71	1.81
Gomrok	Gomrok	1	2.17	2.22	2.40
	Manshia	2	1.50	1.56	1.64
	Labban	3	1.75	1.78	1.89
	Sub Total		1.94	1.99	2.12
West	Karmouz	1	1.20	1.20	1.20
	Mina el Basal	2	1.20	1.20	1.20
	Sub Total		1.20	1.20	1.20
Ameriyah	Dekhilah	1	1.20	1.20	1.20
		2	1.20	1.20	1.20
		3	1.20	1.20	1.20
		4	-	1.20	1.20
		5	-	1.20	1.20
	Ameriyah	6	-	1.20	1.20
		7	-	1.50	1.50
		8	-	1.20	1.20
		9	1.20	1.20	1.20
		10	1.20	1.20	1.20
	Sub Total		1.20	1.28	1.27
Total			1.52	1.52	1.52

(3) Summer vacationers waste

As stated before, Alexandria is the leading resort city of Egypt where one million vacationers through each year during the summer vacationer season.

The waste amount discharged by these vacationers was estimated by assuming the generation rate to be 360 g/capita/day which according to the 1984 survey is equivalent to that of the high income class, and multiplying this by the number of vacationers staying in each zone.

Also, the current level of vacationers' waste was deemed to be sustained in the future too.

We have avoided reflecting the vacationers' waste immediately in the facility plan because the waste amount discharged by vacationers is unstable. For the time being, it was assumed that the vacationers' waste will be directly hauled to the disposal sites for sanitary land fill.

(4) Street sweeping wastes

Most of the street sweeping wastes which originate from dumping of domestic waste on the streets have already been included in domestic waste. What are considered as street sweeping wastes here are the street wastes in the general sense which are seen to generate on arterial streets where domestic waste is rarely to be seen.

According to the results of the actual survey along the arterial streets, a generation of 16 kg/day of street wastes per 1 km of extended length of arterial street is to be expected. The width of the arterial streets being generally 20 m, the street sweeping waste generation rate on the quasiarterial street sweeping is considered to be around 8 kg/day/km at the most.

Accordingly, if the extension of arterial streets and quasiarterial streets were assumed to be 400 km and 900 km respectively, the amount of waste generation would be around 15 tons per day at the most.

3.1.3 Estimated waste amount

The estimated waste amount for the entire city of Alexandria calculated according to the foregoing estimation procedure is as shown in Tab. 3-1-8 which by the year 2000 is estimated to increase by a little short of 80% over that of 1984 (excluding vacationers' waste).

However, a considerable portion of this increase is due to the formation of new urban areas. As far as the existing urban areas are concerned, the waste amount in 2000 is estimated to be 1,852 tons per day which is an increase of slightly less than 50% over the current level.

Tab. 3-1-8 ESTIMATED WASTE AMOUNT OF ENTIRE ALEXANDRIA

(ton/day)

	1984	1990	2000
Domestic waste	822	983	1460
Commercial waste	430	511	759
Vacationers' waste	(360)	(360)	(360)
Total	1252 (1612)	1494 (1854)	2219 (2579)

Note: Figures in parentheses are vacationers' waste generated between June and August.

Besides the above, around 15 tons per day of sweeping waste from main streets are generated each day.

The domestic waste amount and estimated waste amount which is the sum of domestic waste and commercial waste for each zone are shown in Tabs. 3-1-9 and 3-1-10 respectively. The changes in the estimated waste amount in total and by District are as per Fig. 3-1-6 and 3-1-7 which show that the ratio of waste amount generated in the new urban areas of Montazah and Ameriyah is bound to rise in the future.

Fig. 3-1-6 CHANGES IN ESTIMATED WASTE AMOUNT
(excluding vacationers' waste)

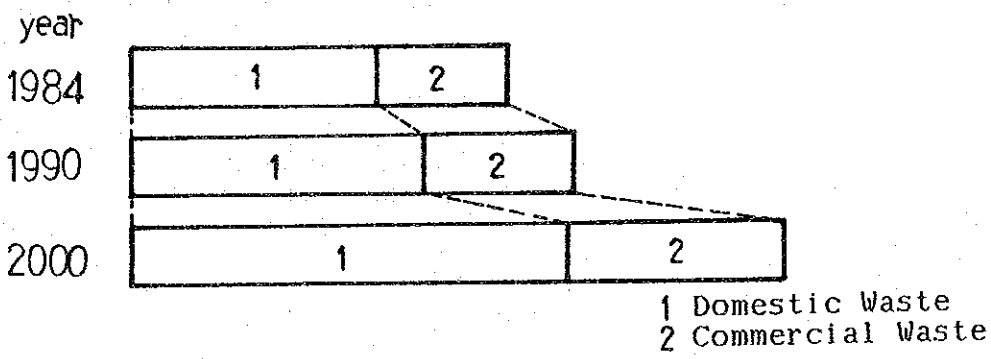
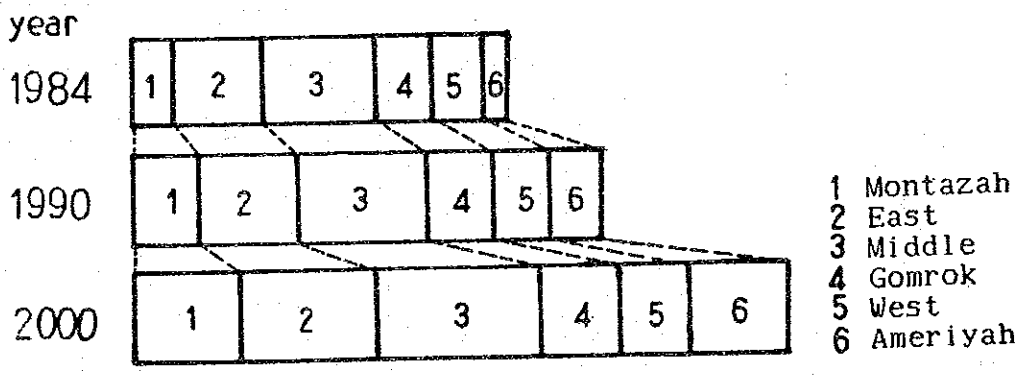


Fig. 3-1-7 ESTIMATED WASTE AMOUNT BY DISTRICT



Tab. 3-1-9 PRESENT AND FUTURE DOMESTIC WASTE QUANTITY OF EACH DISTRICT

(ton/day)

DISTRICT	SUB DISTRICT	ZONE NUMBER	1984	1990	2000
		1	21	28	46
		2	17	23	37
Montazah	Montazah	3	33	41	53
		4	29	35	49
		5	0	17	51
		6	14	19	34
	Sub Total		114	163	270
	Sidi Gaber	1	22	28	40
		2	21	23	28
		3	25	31	44
East		4	34	37	44
	Raml	5	35	39	47
		6	25	28	34
		7	42	46	55
	Sub Total		204	232	292
	Ataryn	1	27	30	36
	Bab Sharki	2	44	48	58
Middle		3	35	39	47
	Moharam Bey	4	21	23	27
		5	102	113	136
	Sub Total		229	253	304
	Gomrok	1	53	58	70
Gomrok	Manshia	2	17	18	22
	Labban	3	29	32	38
	Sub Total		99	108	130
	Karmouz	1	70	78	93
West	Mina el Basal	2	75	84	103
	Sub Total		145	162	196
	Dekhilah	1	1	2	4
		2	14	18	24
		3	8	12	29
		4	0	4	31
Ameriyah		5	0	3	24
	Ameriyah	6	0	3	25
		7	0	5	46
		8	0	4	31
		9	5	9	27
		10	3	7	31
	Sub Total		31	65	268
Total			822	983	1460

Tab. 3-1-10 PRESENT AND FUTURE SOLID WASTE QUANTITY IN EACH ZONE

(ton/day)

DISTRICT	SUB DISTRICT	ZONE NUMBER	1984	1990	2000	VACATIONER WASTE
		1	34	47	78	
		2	27	39	62	
Montazah	Montazah	3	40	49	64	
		4	35	42	59	
		5	0	20	61	
		6	17	23	41	
	Sub Total		154	220	365	180
	Sidi Gaber	1	45	55	79	
		2	42	47	61	
		3	51	62	87	
East		4	46	50	62	
	Raml	5	42	47	56	
		6	30	34	41	
		7	50	54	66	
	Sub Total		306	349	452	126
	Ataryn	1	80	91	120	
	Bab Sharki	2	73	81	103	
Middle		3	53	59	74	
	Moharam Bey	4	30	33	40	
		5	153	169	213	
	Sub Total		389	433	550	18
	Gomrok	1	115	129	168	
Gomrok	Manshia	2	26	28	36	
	Labban	3	51	57	72	
	Sub Total		192	215	276	0
	Karmouz	1	84	94	112	
West	Mina el Basal	2	91	101	124	
	Sub Total		174	195	236	0
	Dekhilah	1	1	2	5	
		2	17	22	29	
		3	9	14	35	
		4	0	5	37	
Ameriyah		5	0	4	29	
	Ameriyah	6	0	4	30	
		7	0	8	69	
		8	0	5	37	
		9	6	11	32	
		10	4	7	37	
	Sub Total		37	83	340	36
Total			1252	1494	2219	360

Note: The amount of vacationer waste is the same every year and is generated and accounted for between June and August.

3.1.4 Determination of waste composition

(1) Domestic waste composition

In this study, the domestic waste composition was analyzed by income class along with a fact-finding survey on the domestic waste amount. The mean values obtained from this analysis of the composition of domestic waste by income class are as shown in Tab. 3-1-11.

The results of the calculation of bulk specific gravity which were made at the same time are shown in Tab. 3-1-12.

Tab. 3-1-11 PHYSICAL COMPOSTION OF DOMESTIC WASTE IN ALEXANDRIA BY INCOME CLASS
Unit: % in wet base

CLASSIFICATION	LOW INCOME	MIDDLE INCOME	HIGH INCOME
Garbage	67.3	54.8	57.8
Paper	13.8	21.5	23.2
Textiles	4.5	3.6	2.8
Plastics	3.9	3.1	5.4
Grass/Wood	6.6	5.2	3.5
Leather/Rubber	0	0.3	0
Metals	1.6	4.6	2.8
Glass	2.1	2.5	2.5
Bones	0.3	1.1	0
Miscellaneous Inerts	0	3.3	2.0
Total	100.0	100.0	100.0

Note: Mean values of 6 days; September 16, 17, 18, 19, 21, & 22, 1984

Tab. 3-1-12 BULK DENSITY OF WASTE

	KG/M^3
Low Income	254
Middle Income	224
High Income	192

Note: Mean values of four days; September 16, 19, 20 & 22, 1984

The above mentioned results indicate almost no difference between the middle income group and the high income group, however they show a considerable difference between the low income group and the former two groups.

Accordingly, it was decided in this study that waste composition should be classified by the two divisions of low income class and middle & high income classes as shown in Tab. 3-1-13. It was also decided that the waste composition for 1984 should be in accordance with the actual analytical results.

Tab. 3-1-13 ASSUMED VALUES OF DOMESTIC WASTE COMPOSITION BY INCOME CLASS

(% in wet base)

	LOW INCOME			MIDDLE & HIGH INCOME		
CLASSIFICATION	1984	1990	2000	1984	1990	2000
Garbage/Grass	73 (6)	69 (5)	64 (4)	61 (4)	56 (3)	50 (3)
Papers	14	16	17	23	25	27
Textiles	4	4	5	3	3	3
Plastics	4	5	6	4	5	6
Metals	2	3	4	3	4	7
Glass, etc.	2	2	3	3	4	5
Miscellaneous others	1	1	1	3	3	2
Total	100	100	100	100	100	100

Note: The figures in the parenthesis indicate the percentage of grass only.

Regarding yearly changes in the waste composition, no data whatsoever is available in Alexandria. Even in Japan there are only a limited number of cases in which waste composition on a wet base have ever been reported for any extended period such as in some wards of Tokyo and elsewhere.

In this study, therefore, the rates of yearly increase in papers, plastics, metals and glass which are anticipated to increase were assumed as indicated in the rightmost column of Tab. 3-1-14 on the basis of the actualities of Tokyo shown in the same table, and the increments were offset by reducing garbage, plants (grass/wood) and other incombustibles to arrive at the estimated waste composition for 1990 and 2000. The results are as shown in Tab. 3-1-13, and by using these values, the future waste amount by type and district was estimated according to the same procedure as for 1984.

Tab. 3-1-14 CHANGES IN WASTE COMPOSITION IN TOKYO

(% in wet base)

CLASSIFICATION	AVERAGE BETWEEN 1968-1972	AVERAGE BETWEEN 1978-1982	YEARLY CHANGE	ESTIMATED YEARLY CHANGE IN ALEXANDRIA
Garbage/Grass	36.4 (of which 3.4 is grass)	34.9 (4.3)	-1.1	Decrease by the increment of others
Papers/Textiles	36.4	36.6	+0.0	1
Plastics	8.5	10.3	+1.9	2
Metals	3.3	5.9	+6.0	5
Glass	6.4	8.9	+3.4	3
Rubber/Leather	0.9	1.1	+0.0	Included in other combustibles
Other incombustibles	5.3	2.3	-	Decrease due to increment of others

Note: In Japan, much of the papers are collected before being discharged. On the assumption that it is the same in Alexandria, the rate of its yearly increase was contained to the above extent. For average between 1968 and 1972, some abnormal data were excluded.

It was also assumed that although there may be a general rise in the income level, the composition of households by income class would remain unchanged in every District.

(2) Commercial waste composition

The commercial waste composition was studied by the following two methods based on the analytical data of waste composition obtained by the current survey.

Case 1. The waste composition in the commercial area was assumed to be commercial waste composition.

Case 2. The mean value of all samples was deemed to be the mean value of urban solid waste, and by subtracting the domestic waste therefrom, the remainder was deemed to be the commercial waste.

The analytical results of waste composition in the commercial areas are as shown in the table below, and the composition of commercial waste given in Case 1 are the mean values.

Tab. 3-1-15 ESTIMATION RESULTS OF COMMERCIAL WASTE COMPOSITION IN CASE 1

(% in wet base)

CLASSIFICATION	ANALYTICAL RESULTS			MEAN VALUE
	MIDDLE	GOMROK	WEST	
Garbage/Grass	50.4	57.6	51.1	53.0
Papers	27.9	11.5	15.5	18.3
Textiles	1.8	14.8	13.1	9.9
Plastics	9.9	12.0	11.4	11.1
Metals	8.0	2.0	9.0	6.3
Glass, etc.	1.9	0.9	-	0.9
Others	-	1.2	-	0.4

In case 2, the commercial waste composition is estimated as per Tab. 3-1-16.

Tab. 3-1-16 ESTIMATION RESULTS OF COMMERCIAL WASTE COMPOSITION, IN CASE 2

(% in wet base)

CLASSIFICATION	WEIGHTED AVERAGE OF DOMESTIC WASTE	AVERAGE OF COMBINED WASTE	COMMERCIAL WASTE COMPOSITION
Garbage/Grass	65.5	62.7	57.1
Papers	18.7	19.4	20.7
Textiles	3.9	5.6	8.8
Plastics	4.9	6.0	8.1
Metals	3.2	3.0	2.6
Glass, etc.	2.3	2.3	2.3
Others	1.5	1.0	0

Note: The percentage of commercial waste is approximately 35%.

The estimation results of both cases show the waste composition to be roughly the same.

In this study, therefore, the 1984 values were assumed to be the average of the two Cases, and the future waste composition was assumed to change by the same rate of increase and decrease of each kind of domestic waste. The assumed values of commercial waste composition to be used as a basis for master plan are as shown in Tab. 3-1-17.

Tab. 3-1-17 ESTIMATION RESULTS OF COMMERCAIL WASTE COMPOSITION
(AVERAGE OF CASES 1 & 2)

(% in wet base)

CLASSIFICATION	1984	1990	2000
Garbage/Grass	55	51	41
Papers	20	21	23
Textiles	9	10	11
Plastics	10	11	14
Metals	3	4	7
Glass, etc.	2	2	3
Others	1	1	1

(3) Summer vacationer waste composition

Most of the summer vacationer waste is the living waste of vacationers staying at the resort apartment houses. There is no data on the vacationer waste composition, but the Governorate Authorities consider it to be close to domestic waste composition. Therefore, in this study, it was assumed to be the same as the waste composition of the middle and high income classes in 1984 as shown in Tab. 3-1-17.

Also, since the facts on vacationer waste are so uncertain, its yearly changes in amount and composition were not considered in this study.

(4) Street waste composition

On street waste composition, a fact finding survey was conducted on three routes of arterial streets and two routes of ordinary streets within the same area, the results of which are shown in Tab. 3-1-18. As can be seen by this waste composition, most of the waste littered on the sub-streets within the area are domestic and commercial wastes that people have thrown away. The results of the survey therefore can not serve as a reference to determine what the street waste composition will be when there is no longer any littering.

Tab. 3-1-18 STREET WASTE COMPOSITION

(% in wet base)

	TYPE OF STREET		MAIN STREET				SUB-STREET WITHIN THE AREA		
	CLASSIFICATION		HORIYAH STREET	COMMERCIAL STREET	COAST STREET	AVERAGE	MOHARAM BEY (1)	MOHARAM BEY (2)	AVERAGE
COMBUSTIBLE	I	Paper	19.6	18.8	26.7	21.7	15.8	13.8	14.8
		Textiles, Rag	-	-	-	-	1.9	2.7	2.3
	II	Plastics	-	13.7	9.1	7.6	5.1	4.1	4.6
		Leathers, Rubber	-	-	-	-	-	-	-
	III	Greens, Grass Wood, Bamboo	26.0	-	3.6	19.9	4.1	6.9	5.5
	IV	Vegetable/ Putrescible	2.1	4.3	7.3	4.6	38.4	44.1	41.3
	VI	Cigarette butts	2.5	5.1	6.7	4.8	-	-	-
		(Sub-total)	(50.2)	(41.9)	(53.4)	(48.5)	(65.3)	(71.6)	(68.5)
NON-COMBUSTIBLE	V	Metal	-	1.4	1.8	1.6	1.4	0.9	1.2
		Glass, Ceramics	-	-	-	-	6.6	0.5	3.6
		Bones	-	-	-	-	0	0.2	0.1
		Stones	-	-	-	-	4.2	2.7	3.5
	VI	Sand	49.8	56.8	44.8	50.5	22.6	24.2	23.4
		(Sub-total)	(49.8)	(58.2)	(46.6)	(51.5)	(34.8)	(28.5)	(31.7)

Therefore, the waste composition shown in Tab. 3-1-19, which was prepared in accordance with the average of wastes on the main streets, was assumed to be the street sweeping waste composition in this study.

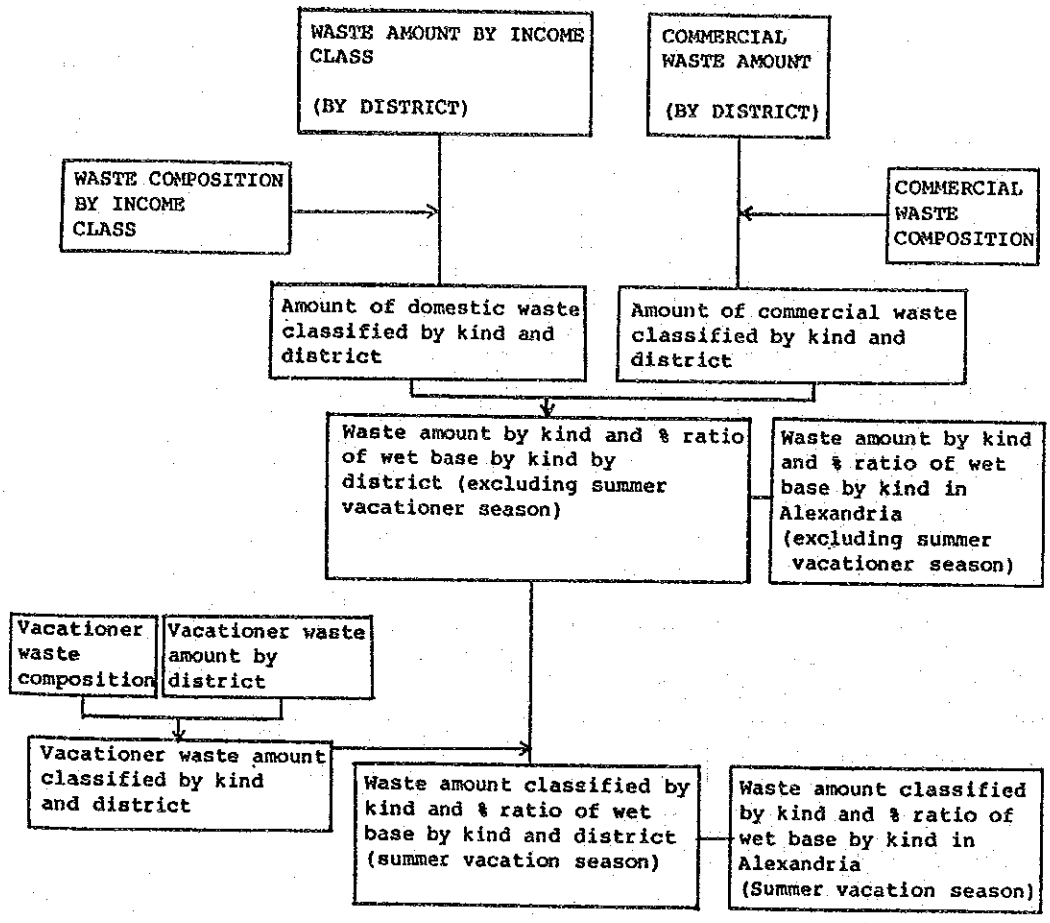


Fig. 3-1-8 ESTIMATION FLOW OF WASTE AMOUNT (WASTE COMPOSITION) BY KIND AND DISTRICT

The waste composition (excluding vacationer waste and street sweeping waste) for each district estimated by the foregoing procedure is as shown in Tab. 3-1-20.

As can be seen from this table, there are slight differences in waste composition due to the difference in income class composition and the degree of agglomeration of commercial installations in each district, but in veiw of the accuracy of analyzed waste composition which constitutes the basis, the differences cannot be claimed to be as large as to necessitate the establishment of waste composition by Zone and to have it reflected in the solid waste management system.

Tab. 3-1-19 AVERAGE STREET WASTE COMPOSITION

(in wet base)

CLASSIFICATION		
Garbage/Grass	19	%
Papers	22	
Textiles	0	
Plastics	7	
Metals	2	
Glass and the like	0	
Others *2	50	

Note: *1 Includes cigarette butts

*2 Mostly sand

3.1.5 Amount of waste discharge by kind

Based on the waste composition established in the preceding paragraph, the composition of waste discharged in each district, or the amount of waste discharge by kind may be estimated according to the procedure shown in Fig. 3-1-8.

Tab. 3-1-20 WASTE COMPOSITION BY DISTRICT (Excluding July, August, and September)

(% in wet base)

DISTRICT	CLASSIFICATION	1984	1990	2000
Montazah	Garbage/Grass	65	60	54
	Papers	18	20	21
	Textiles	5	5	6
	Plastics	6	7	8
	Metals	3	4	6
	Glass & the like	2	3	4
	Others	1	1	1
East	Garbage/Grass	62	58	50
	Papers	20	21	23
	Textiles	5	6	6
	Plastics	6	7	9
	Metals	3	4	6
	Glass & the like	2	3	4
	Others	2	1	2
Middle	Garbage/Grass	60	56	48
	Papers	21	22	24
	Textiles	6	6	7
	Plastics	6	8	10
	Metals	3	4	7
	Glass & the like	2	3	4
	Others	2	1	0
Gomrok	Garbage/Grass	60	55	47
	Papers	20	22	24
	Textiles	6	7	8
	Plastics	7	8	10
	Metals	3	4	7
	Glass & the like	2	3	4
	Others	2	1	0

(% in wet base)

DISTRICT	CLASSIFICATION	1984	1990	2000
West	Garbage/Grass	65	60	54
	Papers	19	21	22
	Textiles	4	5	5
	Plastics	5	6	7
	Metals	3	4	6
	Glass & the like	2	3	4
	Others	2	1	2
Ameriyah	Garbage/Grass	64	60	54
	Papers	19	21	23
	Textiles	4	5	5
	Plastics	5	6	7
	Metals	3	4	6
	Glass & the like	2	3	4
	Others	2	1	1
Average	Garbage/Grass	62	57	51
	Papers	20	21	23
	Textiles	5	6	6
	Plastics	6	7	9
	Metals	3	4	6
	Glass & the like	2	3	4
	Others	2	2	1

Tab. 3-1-21 AVERAGE WASTE COMPOSITION OF ALEXANDRIA

(% in wet base)

CLASSIFICATION	1984	1990	2000	WASTE COMPOSITION INCLUDING VACATIONER WASTE, 1984
Garbage/ Grass	62	57	51	62
Papers	20	21	23	21
Textiles	5	6	6	5
Plastics	6	7	9	6
Metals	3	4	6	3
Glass & like	2	3	4	2
Others	2	2	1	1
Total	100	100	100	100

The above shown values are calculated based up on the waste composition and generation rate by income and by waste type as shown below.

Note: See the table below:

(i) Composition by income and waste type

(%)

	1984			1990			2000		
	DOMESTIC			DOMESTIC			DOMESTIC		
CLASSIFICATION	L	H&M	COMMERCIAL	L	H&M	COMMERCIAL	L	H&M	COMMERCIAL
Garbage/ Grass	73	61	55	69	55	51	64	50	41
Papers	14	23	20	16	25	21	17	27	23
Textiles	4	3	9	4	3	10	5	3	11
Plastics	4	4	10	5	5	11	6	6	14
Metals	2	3	3	3	4	4	4	7	7
Glass & like	2	3	2	2	4	2	3	5	3
Others	1	3	1	1	3	1	1	2	1

(ii) Generation ratio by income

Low Income	221g/cap. day x 50% =	110.50g/cap. day	38.9%
Middle Income	344g/cap. day x 40% =	137.60g/cap. day	48.4%
High Income	362g/cap. day x 10% =	36.20g/cap. day	12.7%
		284.30g/cap. day	100.0%

. The percentage of waste amount between low income class and high & middle income class shall be the same every year.

(iii) Generation ratio of entire city

(%)

DOMESTIC WASTE		COMMERCIAL WASTE
LOW INCOME	HIGH & MIDDLE INCOME	
65.4%		
25.4%	40.0%	34.6%

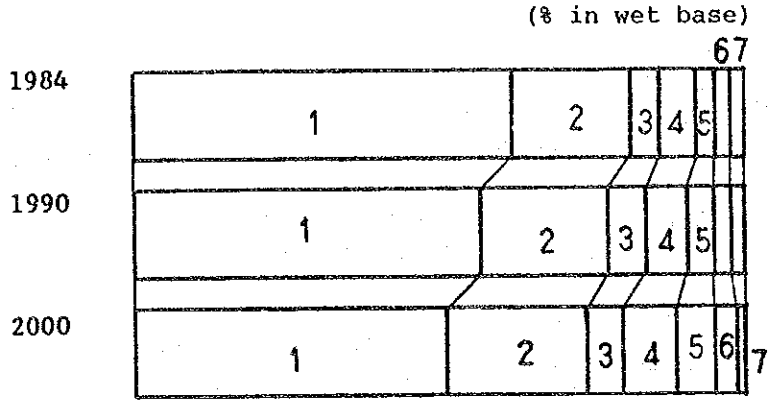
C-D ratio: 1.52

Accordingly, the waste composition in every district shall be deemed hereafter to be the same as the average waste composition of the city as shown in Tab. 3-1-21.

The waste composition including summer vacationer waste of the entire city shown in the right column of Tab. 3-1-21 is not much different from the waste composition excluding vacationer waste.

The amount of waste discharge by kind was estimated for Alexandria as shown in Tab. 3-1-22 from the estimated waste composition and the estimated waste amount mentioned in the previous paragraph.

Fig. 3-1-9 CHANGES IN WASTE QUALITY IN ALEXANDRIA



(1) Garbage/Grass
(2) Papers
(3) Textiles
(4) Plastics
(5) Metals
(6) Glass
(7) Others

Tab. 3-1-22 AMOUNT OF WASTE DISCHARGE BY KIND IN ALEXANDRIA
(Excluding street waste and vacationer waste)

(ton/day)

	1984	1990	2000
Garbage/Grass	776	822	999
Papers	250	314	510
Textiles	63	90	133
Plastics	75	120	244
Metals	38	75	178
Glass & like	25	45	111
Others	25	28	44
Total	1,252	1,494	2,219