Japan International Cooperation Agency (JICA)
The Ministry of Public Works and Regional Planning
The Municipality of Bucharest
Romania

The Study on the Solid Waste Management System for Bucharest Municipality in Romania

Final Report

Volume 1

Summary

December 1995

EX Corporation
Yachiyo Engineering Co., Ltd.

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PREFACE

In response to a request from the Government of Romania, the Government of Japan decided to conduct the Study on the Solid Waste Management System for Bucharest Municipality in Romania and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Romania a study team headed by Mr. Masato Ohno, EX Corporation from August 1994 to October 1995.

The team held discussions with the officials concerned of the Government of Romania, and conducted four field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

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

I wish to express my sincere appreciation to the officials concerned of the Government of Romania for their close cooperation extended to the team.

December 1995

Kimio Fujita
President
Japan International Cooperation Agency

N INTERNATIONAL COOPERATION AGENCY (JICA)
IĂRIA MUNICIPIULUI BUCUREȘTI

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JAPAN INTERNATIONAL COOPERATION AGENCY (

Contents of Summary

INTRODUCTION

1. Study Objectives and Scope

The prime objective of the "Study on the Waste Management System for Bucharest Municipality in Romania" is to prepare plans for improvements of solid waste management of the Bucharest Municipality.

The study consists of the following 3 phases:

Phase 1: Formulation of principles

Phase 2: Formulation of master plan for period 1996 - 2010

Phase 3: Feasibility study on priority projects

During the phase 3, the following studies were carried out:

1) Feasibility study on the development of the 3 sanitary landfill sites in Balaceanca, Cretuleasca and Glina

2) Study on technical assistance

3) Study on waste education

4) Study on waste bin supply

The study covered the following aspects:

1) Operational and technical aspects

   a. waste collection and haulage
   b. street sweeping
   c. treatment and disposal
   d. recycling
   e. industrial demolition and hospital waste management

2) Institutional aspects

   f. privatization (institutional options)
   g. contract management
   h. organization and management

3) Financial and economic aspects

   i. financing plan
   j. waste tax and citizens' affordability

4) Legal aspect

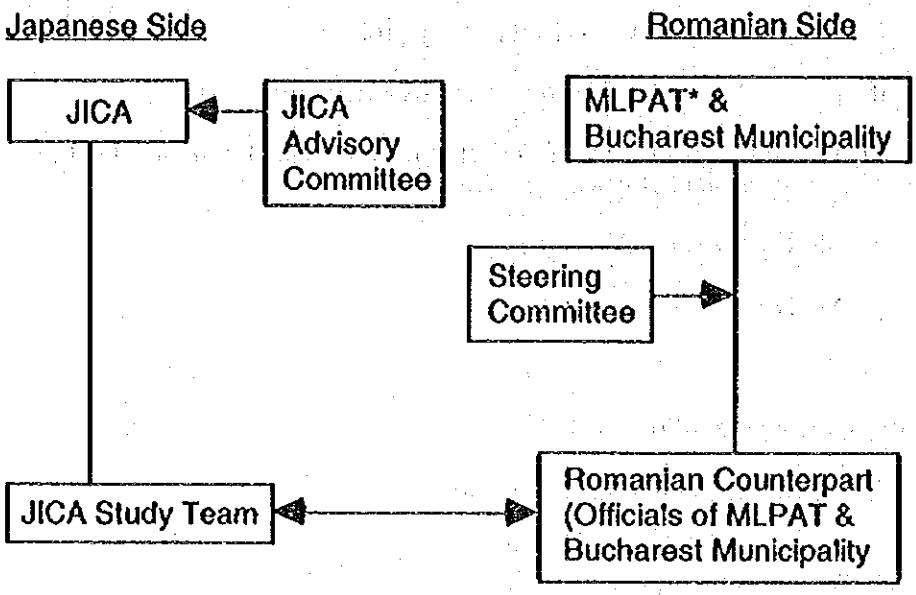
   k. Bucharest Sanitation Norm
   l. Laws, regulations and guidelines

The study activities included field observation, diagnosis of the current situation, discussion with the Romanian counterparts, meetings with relevant authorities and other agencies including World Bank office in Bucharest, field surveys (topographic, geological and environmental surveys), and environmental impact assessment (EIA).

2. Study Organization

The study was carried out jointly by the JICA Study Team headed by Mr. Masato Ohno and the Romanian Counterparts led by Mr. Ursu Tirla of the Bucharest Municipality. In the Romanian side, a Steering Committee for the Study headed by Mr. Radu Dumitrescu of the Bucharest Municipality was organized. The committee includes representatives from Ministry of Public Works and Regional Planning (MLPAT) represented by Mr. Aureliu Dumitrescu, Ministry of Environment, and Ministry of Industry. In Japanese Side, an Advisory Committee headed by Dr. Sachiho Naito was organized to provide advises to the Study Team.

The study organization is shown in the figure below:



* MLPAT: Ministry of Public Works and Regional Planning

Fig. 1 Study Organization

3. Reports

Through the Study, the following reports were produced:

1) Inception report
2) Progress report (1)
3) Progress report (2)
4) Interim report (1)
5) Progress report (3)
6) Interim report (2)
7) Draft final report
8) Final report

The final reports comprises of 8 English reports, 2 Romanian reports and 1 Japanese summary as listed below:

English Reports

1. Summary
2. Principles and Master Plan
3. Appendices to the Master Plan
4. Feasibility Study on the Development of the 3 Sanitary Landfill Sites in Balaceanca, Cretuleasca and Glina
5. Appendices to Feasibility Study on the Development of the 3 Sanitary Landfill Sites in Balanceanca, Cretuleasca and Glina
6. Basic Design Drawings for the Planned Sanitary Landfill Sites in Balaceanca, Cretuleasca and Glina
7. Studies on Technical Assistance, Waste Education and Waste Bins Supply
8. Guidelines for Formulation and Implementation of Master Plan for Improvement of Municipal Solid Waste Management and for Feasibility Study on Solid Waste Management Improvement Projects

Romanian Reports

9. Summary
10. Guidelines for Formulation and Implementation of Master Plan for Improvement of Municipal Solid Waste Management and for Feasibility Study on Solid Waste Management Improvement Projects

Japanese Report

11. Summary

In addition, the study team plepared a report of Environmental Impact Assessment in Connection with Construction and Operation of Proposed Landfill in Balaceanca, Cretuleasca and Glina

Part A
Summary of Master Plan

1 OUTLINE OF BUCHAREST

1. City of Bucharest

Bucharest is situated at about 60 km away from Danube river in the southern part of the country on the Romanian Plain.

It was in 1862 that Bucharest was declared as the capital city of Romania after the unification of Wallachia and Moldavia in 1859. Bucharest is the political, economic, scientific and cultural center of Romania.

The population of the city of Bucharest is estimated to be about 2.05 million in 1995. There has been a slight decrease in population over the past few years.

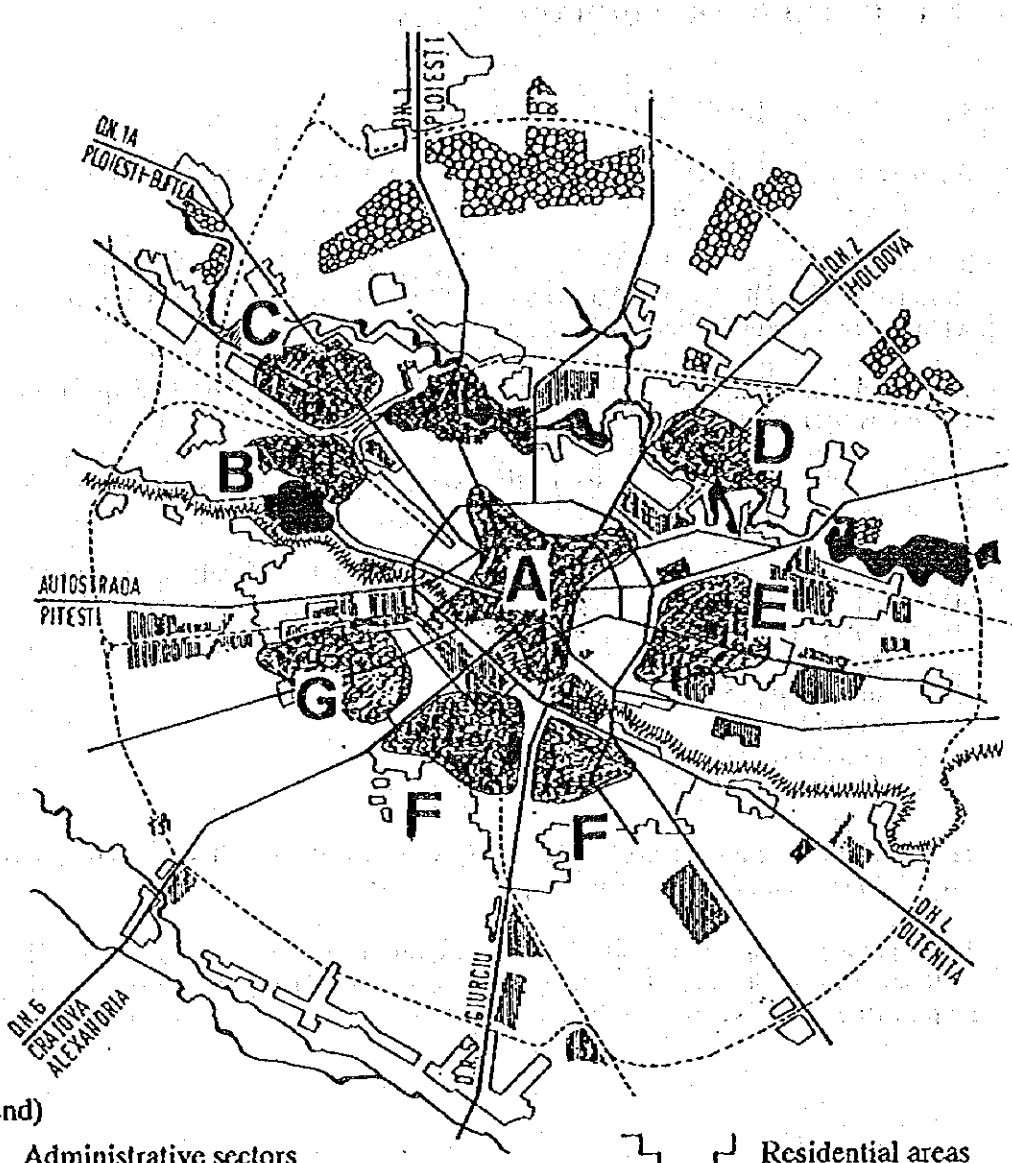
Bucharest has good public transportation systems including street cars, buses, trolley and subway.

According to the document entitled BUCHAREST 1993, Bucharest's contribution to the Romanian economy is:

- Sales of goods: 16.6 %
- Jobs: 14.0 %
- Industrial production: 13.1 %
- Capital assets: 12.1 %
- Population: 10.6 %
- Territory: 0.8 %

The area under the jurisdiction of Bucharest Municipality is 228 km^2. The province of Bucharest has a total area of 1,821 km^2.

There is little vacant land available in the municipality's jurisdiction area. However, quite large vacant land exist in the agriculture sector of Bucharest province. Land use map of Bucharest is shown in Fig. 1-1.



(Legend)

..... Administrative sectors

Residential areas

____ Main streets/roads

Industrial zones

A Central-residential zone

Forest

------ Railways

B,C,D,E,F & G Blocks of flats with their respective centers & facilities

Source: Bucharest Figures and Syntheses 1992 - 1993 (Page 45)

Fig. 1-1 Land Use Map of Bucharest

2. Bucharest Municipality

1) History and Status

In 1991 a new Constitution was adopted in which the principle of decentralization and returning autonomy to local government was established. Under it a two tier system of government at central and local level was established. Although the principle of local autonomy has been established, implementation remains slow, primarily because of a lack of legislation to devolve financial responsibilities to local government.

The local structure, which follows the French system, comprises 41 counties or judets. Each Council has its own Council and contains municipalities with their own Councils. The exception is Bucharest county which has no County Council, but is split between Bucharest Municipal Council and the Ilfov agriculture sector lying outside the city limits.

The city is further subdivided into 6 sectors each with their own Councils and administrations (ADPs).

In 1991 the Law of Public Administration, Law 69, elaborated the Constitution's intentions and new Councils were established in early 1992.

2) Organization

Municipality of Bucharest (MB) is comprised of a legislature, the Council, and an executive, headed by the Mayor. MB's organization chart is shown in Fig. 1.2-1. Under Law 69, MB is assigned with the responsibility of providing all public services including solid waste management, to its citizens. But in practice most public services are provided independently of MB either by the Regii Autonome or by the 6 Sector

Councils through their local Administrations (ADPs). Although the ADPs are autonomous of MB they are financed by from Municipal tax revenues.

Bucharest has 5 Regiis, including RASUB. Their responsibilities are given in the following table:

Table 1-1 Services provided by Regie Autonome in Bucharest

Bucharest's Regii Autonome	Service Function
RASUB	waste collection, haulage and disposal
RATB	public transportation
RADET	central/district heating
RGA	water and sewerage
DRUPO	roads and pavements

Each the 6 Sector Administrations (ADPs) provides street cleansing, road maintenance and green spaces maintenance. No street cleansing services are provided by MB. MB does provide some public services but these are relatively small, examples are public gardens, the zoo, cemeteries, housing etc.

A great deal of the Municipality's activities are therefore spent in monitoring and general administration of the Regiis and the ADPs, rather than in hands on management of the services themselves. These administration responsibilities basically comprise:

1. informal policy and planning
2. formulating norms
3. monitoring and enforcement of the norms
4. contract management where there is private sector involvement
5. approval and financing of Regii's investment plans

MUNICIPALITY OF BUCHAREST - ORGANIZATION CHART

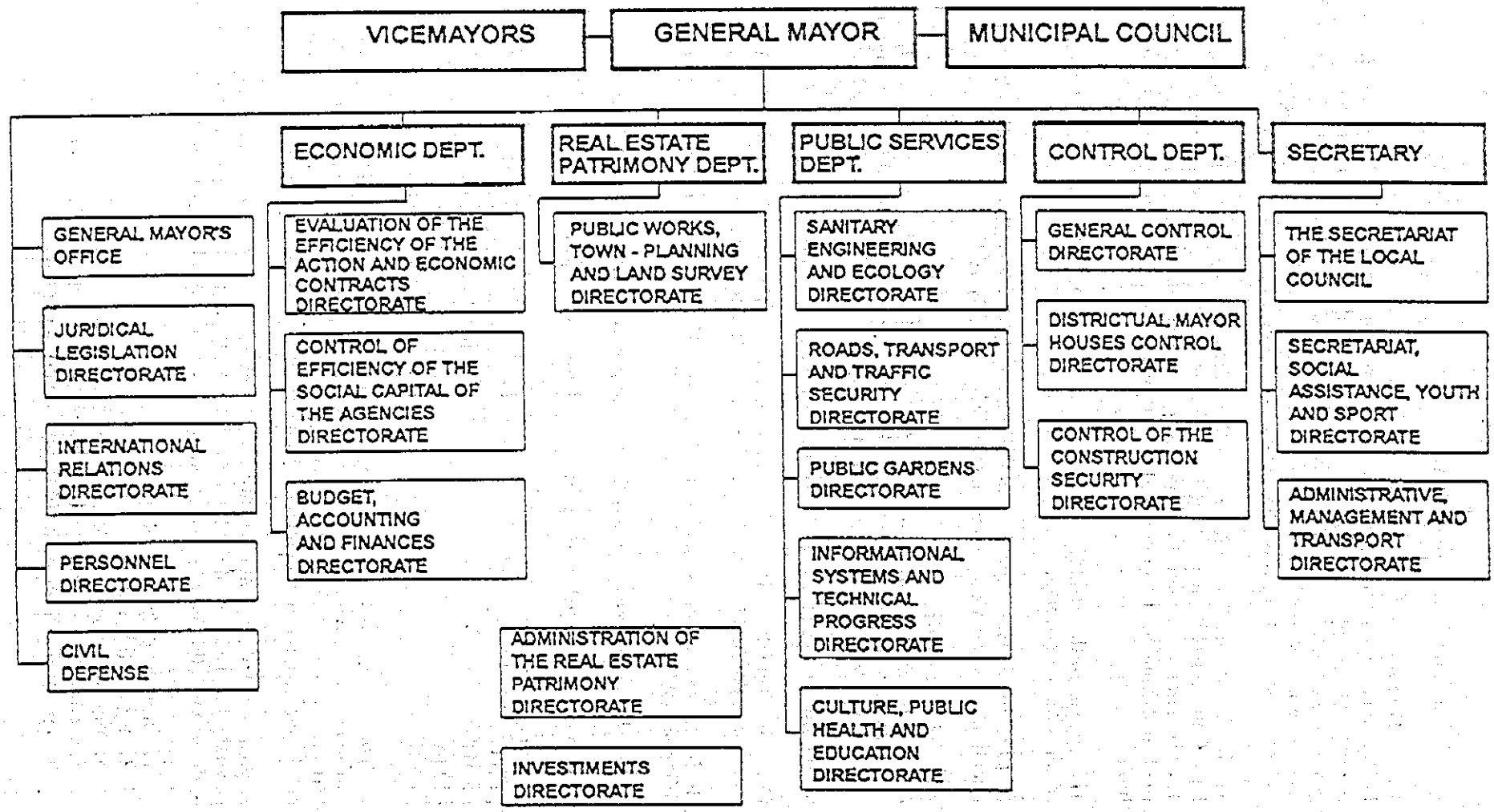


Fig.1-2 Organization Chart of Municipality of Bucharest

2 MAJOR DEFICIENCY AND CONSTRAINTS

1. Deficiencies in Service Output

Both the collection and haulage and the disposal services are poorly delivered.

1) Waste Collection Service Level is Inadequate

The collection and haulage service is characterized by low frequency, poor reliability and a significant amount of illegal dumping. Furthermore, it is estimated on the basis of the amount of waste tariffs billed by RASUB, that 14 % of citizens are not covered by the collection service contract.

66 % of citizens are not satisfied with the collection service according to the opinion survey conducted by JICA Study Team in November 1994. Reasons for dissatisfaction include irregularity and low collection frequency. These deficiencies are a direct consequence of the following operational shortcomings:

a. Shortage of waste bins;
b. Collection trucks are old and in bad condition;
c. Poor maintenance facilities;
d. Too many types of collection trucks including inefficient ones; and
e. Long haulage distance because there is only one landfill site (Glina).

Further details are given in Chapter 6.

2) The Existing Glina Landfill Site and Former Dump Sites may Cause Environmental Risks and may Affect Local Residents Living Nearby

Smoke, smell, and rodents are generated from Glina landfill site because the site is environmentally unsound. There is also contamination of water by leachate. Public nuisance and health risks to the local residents are increasing. These problems are caused by serious operational deficiencies. These are:

a. Insufficient application of cover soil;
b. No control of leachate;
c. No control of incoming of hazardous waste; and
d. No monitoring and management of former landfill sites.

2. Underlying Causes of Poor Delivery of SWM Services

Although the reason for poor service delivery is a consequence of a number of operational shortcomings, detailed above, these shortcomings are in turn the result of much deeper underlying causes. Five principal underlying causes of the poor delivery of SWM services in Bucharest are identified:

1. **absence of a formal legal and institutional framework between MB and RASUB** which delimits the contractual relationship between them, their corresponding rights and obligations and ensures that performance objectives are met. The lack of a framework greatly weakens MB's ability to oversee and regulate RASUB's activities and has greatly contributed to service deficiencies;

2. **RASUB's weak organisation and management.** Senior management is not autonomous and is therefore ineffective, there is no formalised planning capability and a lack of clear and coherent goals, there are no MIS and budgetary planning and control systems, accountability amongst the staff is very low and RASUB lacks of financial independence;

3. **there is no national comprehensive law on SWM and policy and planning of SWM is fragmented at national level.** Existing law on municipal waste is contained in a hotch potch of laws. However, we note that the MoE is formulating a new waste law and also the Ministry of Industry has issued Ordnance 33 concerning Material Recycling. Laws governing contracting arrangements are deficient.

   No central government body is responsible to develop SWM policy and carry out strategic planning. Ministries pursue their own initiatives but do not coordinate. As a result there is an absence of robust guidance from central government to municipal government on setting SWM standards and regulations, recommending institutional arrangements and how to contract services and monitor contracts;

4. **MB's monitoring of RASUB's and RGR's services is weak.** Furthermore, MB's finds it difficult to effectively sanction RASUB when it breaches the Bucharest Sanitation Norm (BSN) because of deficiencies in legal procedures and because it has no contract with RASUB. This means that RASUB has been able to avoid complying with the BSN; and

5. **the lack of citizens' awareness and responsibility towards SWM.** Bucharest needs a citizens' education program.

3 PLANNING FRAMEWORK

1. Current Waste Quantity and Quality

1) Current Waste Quantity

It is estimated that average waste generation in Bucharest is 1,622 tons/day, of which 1,034 tons/day is household waste. Daily average household waste generation per capita is 473 grams/day. Average per capita generation including recyclable material sold to REMAT is 504 grams/day. Daily average collection is 1,339 tons/day, of which 822 tons/day is household waste. This means that 85% of household waste is collected after recyclable material is separated, while non-collection rate of municipal waste including business waste is 14 % as shown in Fig. 3-1. Fig. 3-2 shows waste generation by sources. Fig. 3-3 shows waste flow and average daily waste quantity by waste type.

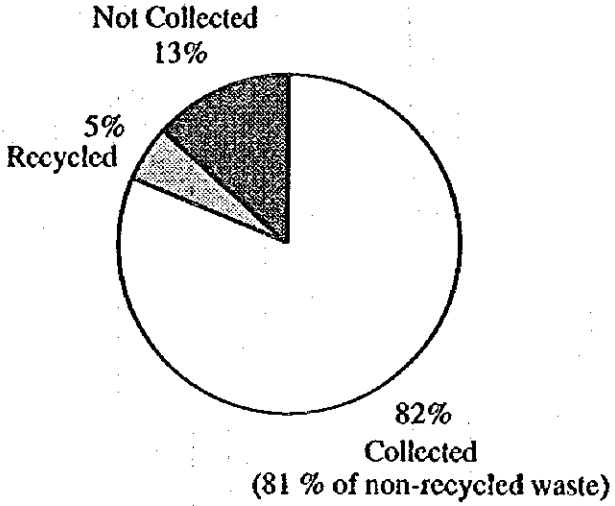


Fig. 3-1 Waste Collection and Recycling

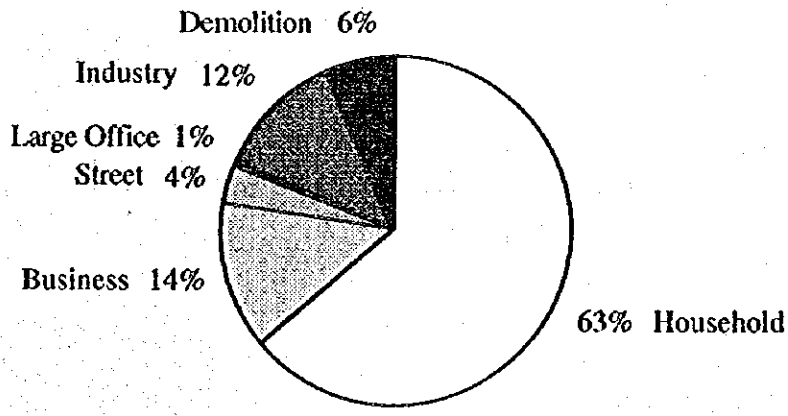
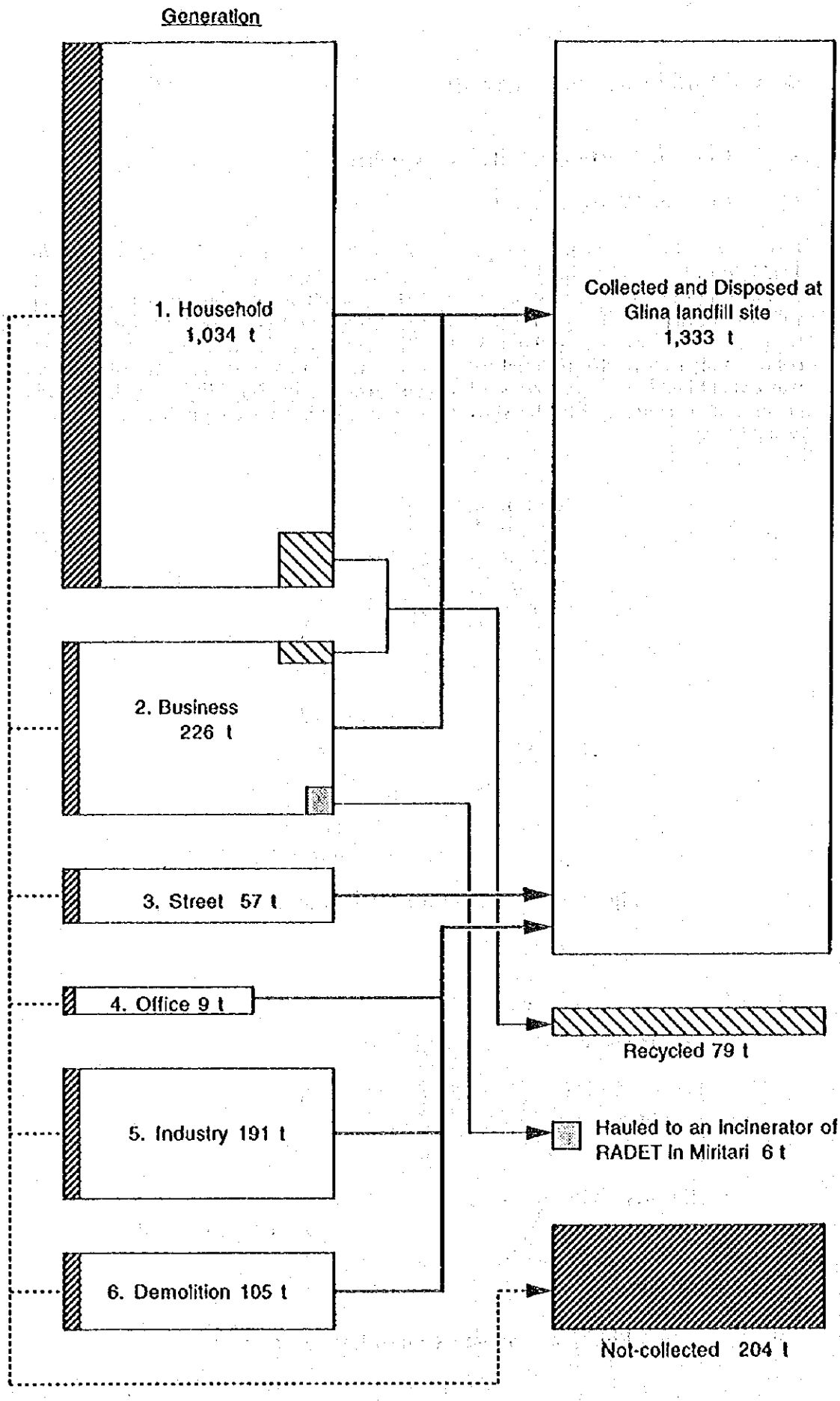


Fig. 3-2 Waste Generation by Sources



A. Municipal Waste (1+2+3): 1,317 tons/day
B. Non-municipal Waste(4+5+6) : 305 tons/day
Total : 1,622 tons/day

Fig. 3-3 Waste Flow in Bulcharest 1995

2) Current Waste Quality

a. Physical Composition

Household waste has the following composition (dry base): garbage 29 %, paper 25 %, glass 9 %, metal 4 %, textile 4 %, plastic 8 %, other combustible 1 %, other incombustible 20 %. See Fig. 3-4.

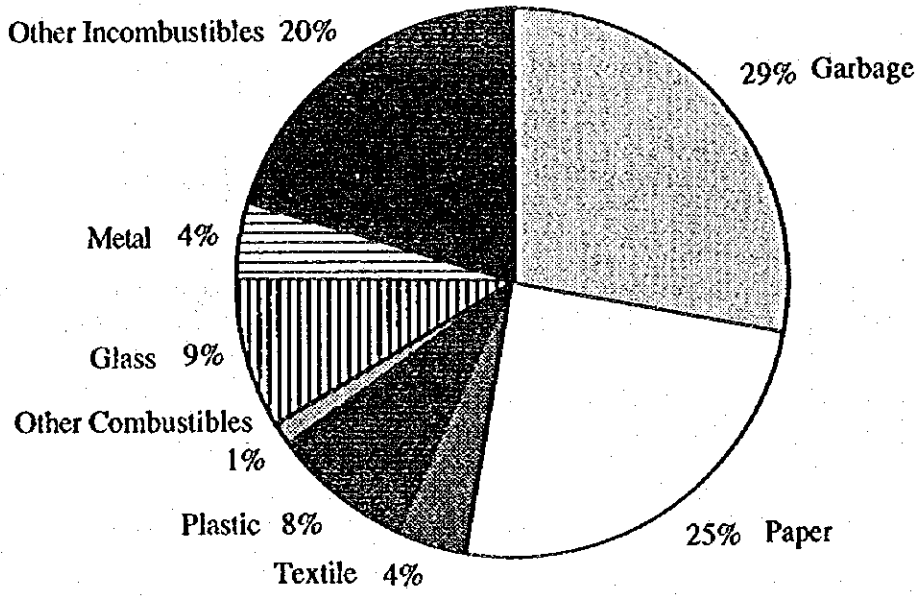


Fig. 3-4 Composition of Household Waste (dry base)

b. Bulk Density and Contents of Water, Ash and Combustible

Bulk density of household is estimated to be 0.23 (230 kg/m^3). Contents of water, ash and combustibles are approximately 55 %, 20 % and 25 % respectively.

c. Lower Calorific Value

Average lower calorific value of household waste is 844 kcal/kg. The reason for this low value compared to those of developed countries is its high water content which originates from fruits and vegetables in garbage. Waste with such low calorific value is not suitable for heat recovery by incineration.

2. Projection of Waste Generation

In 1995, it is estimated that the waste generation amount was 1,622 ton/day, and per capita generation was 504 grams/capita/day. The corresponding quantities in 2010 are estimated to be 2,388 tons/day, and 667 gram/capita/day based on growth projection of economy and population. See Table 4-1. Waste generation growth rate differs by year. During 1995 - 2010, average annual growth of waste generation is estimated to be 2.5 %/year. Assumptions used for the projection of waste generation are shown in the Master Plan main report.

4 OBJECTIVES AND TARGETS

1. Objectives of Solid Waste Management

1) Overriding Objectives

The major objectives of solid waste management are to:

1. protect public health;
2. protect the environment; and
3. maintain public cleanliness in order to keep public places aesthetically acceptable;

2) Service Objectives

The service objectives are to provide proper storage, collection and safe treatment and disposal of municipal waste.

3) Management Objectives

A key concept for the improvement of municipal solid waste management is "do more (better services) with less (money)". The management objectives include the following:

1. improving the quality of the service. This would include:
   a. collection frequency
   b. reliability
   c. collection method;
2. extending service coverage to areas which may not be served or are inadequately served; and
3. upgrading environmental disposal standards and enforcement procedures.
4. enhancing efficiency and reducing costs

2. Service Level Targets

1) Recycling

In principle, all recyclable waste should be recycled. It is estimated that the current household waste of Bucharest include metals (4 %), glass (9 %), plastic (8 %) and paper (25 %) based on the waste composition analysis (dry base) conducted by the JICA Study Team in 1995. Most of paper and plastic contained in the household waste are not recyclable. Therefore, main target recycling objects would be metals and glass. In view of the waste composition shown above, recycling target for household waste is proposed to be 10 - 15 % in the year 2000 and thereafter. Recycling target should be reviewed periodically based on the socio economic conditions of Bucharest and changes in the future recycling systems.

At present, the recycling rate of household waste is estimated to be 6 %. Needless to mention, the proposed targets would not be achieved without the citizens' full cooperation, which however is not necessarily guaranteed. Therefore, recycling rate of 8 % in 2000 and thereafter is used for the purpose of planning waste collection and disposal on the safe side.

2) Collection and Haulage

It is estimated that 13 % of the citizens in Bucharest are not covered with waste collection contracts based on the information given by RASUB and RGR. According to the citizens' opinion survey conducted by the JICA Study Team, 26 % of the interviewees answered that they receive waste collection service once in 10 days or less frequently, while 93 % of the interviewees wished to receive the service at least once a week.

Waste Collection Service Targets

A. Targets to be Achieved by 2000
   1. The municipality should provide collection service to all (100 %) citizens of Bucharest by the year 2000.
   2. The municipality should collect 100 % of waste generated.
   3. The collection frequency should be at least once a week by 2000.
      After the year 2001, collection frequency should be a twice weekly for summer season.
   4. Collection and haulage services for each of the 6 sectors should be contracted out for improvement of service quality and efficiency.

B. Targets to be Achieved by 2005
   5. The collection frequency should be twice a week for all households, and twice a week or more for all business waste.

C. Targets to be Achieved by 2010
   6. Bucharest will become the cleanest city in Eastern Europe.

Collection frequency should be determined according to needs which depend on seasons and waste generation quantity. A once weekly collection is a minimum frequency in any case.

3) Street Sweeping

Sweeping costs should be reduced through the following arrangements:

1. contracting out of the street sweeping service. (Initially, the sweeping service will be contracted out together with collection and haulage services, but later, street sweeping should be contracted out separately from the collection and haulage service to achieve further cost reduction of street sweeping.)
2. use of patrol system (explained in the chapter of street sweeping.)
3. control of illegal dumping of demolition waste in the open spaces and streets

4) Disposal

The existing Glina landfill sites is not environmentally sound, and generates smoke, smell, and rodents. There is contamination of water by leachate. Public nuisance and health risks to the local residents are increasing. In view of this situation, the following is proposed:

1. The municipality will directly manage municipal waste disposal.
2. Introduction of sanitary landfill for all new landfill sites to be constructed in the future.
   (It is proposed that the first new landfill site of sanitary landfill will be constructed in 1998.)
3. Improvement of Glina site in order to reduce public health risks of the local residents living nearby the site.
4. Acquisition of land necessary for landfill.
   (It is estimated that landfill sites with a total waste receiving capacity of about 12 million m^3 (equivalent to area of 167 ha) will be required by 2010. The Study Team identified 5 sites at Balaceanca, Cretuleasca, Berceni, Afumati and Jilava. Total area of these sites will be equivalent to the required area.)
5. At present, incineration is not feasible from both technical and economic view points. However, possibility of a pilot incinerator may be considered after 2000 due to changes in socio economic conditions.

5) Management Targets

1. MB will contract out of the collection/haulage service and street sweeping for all the sectors by 2000 at the latest. MB will immediately establish a good contract management system.
2. MB will establish a municipal disposal organization in 1996.

3. MB will establish a system for monitoring the SWM services performance.
4. MB will introduce the waste tax in 1996. 100 % cost recovery will be achieved by 2000.
5. Through the contracting out of the collection/haulage services and resulting reduction of the costs, the future total unit cost ($/ton) of solid waste management should remain at the same level as the current one though the unit disposal cost will increase remarkably due to the introduction of sanitary landfill. See Fig. 4-1.

3. Waste Quantity Projection

Table 4-1 and Fig. 4-2 show projection of quantity of waste generation and recycling, and target waste collection rate and quantity.

Waste Generation
See Chapter 3 Section 2.

Recycling
The current recycling rate of household waste is 6 %. Target rate should be 10 - 15 % in 2000 and thereafter. However, for planning of waste collection and disposal systems on the safe side, minimum target of 8 % is assumed in 2000 and thereafter.

Collection and haulage
The current collection rates are 85 % for household waste, and 90 % for other waste. The target rate is 100 % for both waste in 2000 and thereafter. As a result, collection amount will increase from the current 1,339 ton/day in 1995 to 2,233 ton/day in 2010.

Incineration
The current waste amount incinerated at the RADET's incinerator in Militari is estimated to be 6 ton/day. It is not considered that the further continuation of the operation would be feasible due to the extremely poor conditions of the operation. Therefore, it is assumed that the RADET' incinerator would stop its operation in 2000.

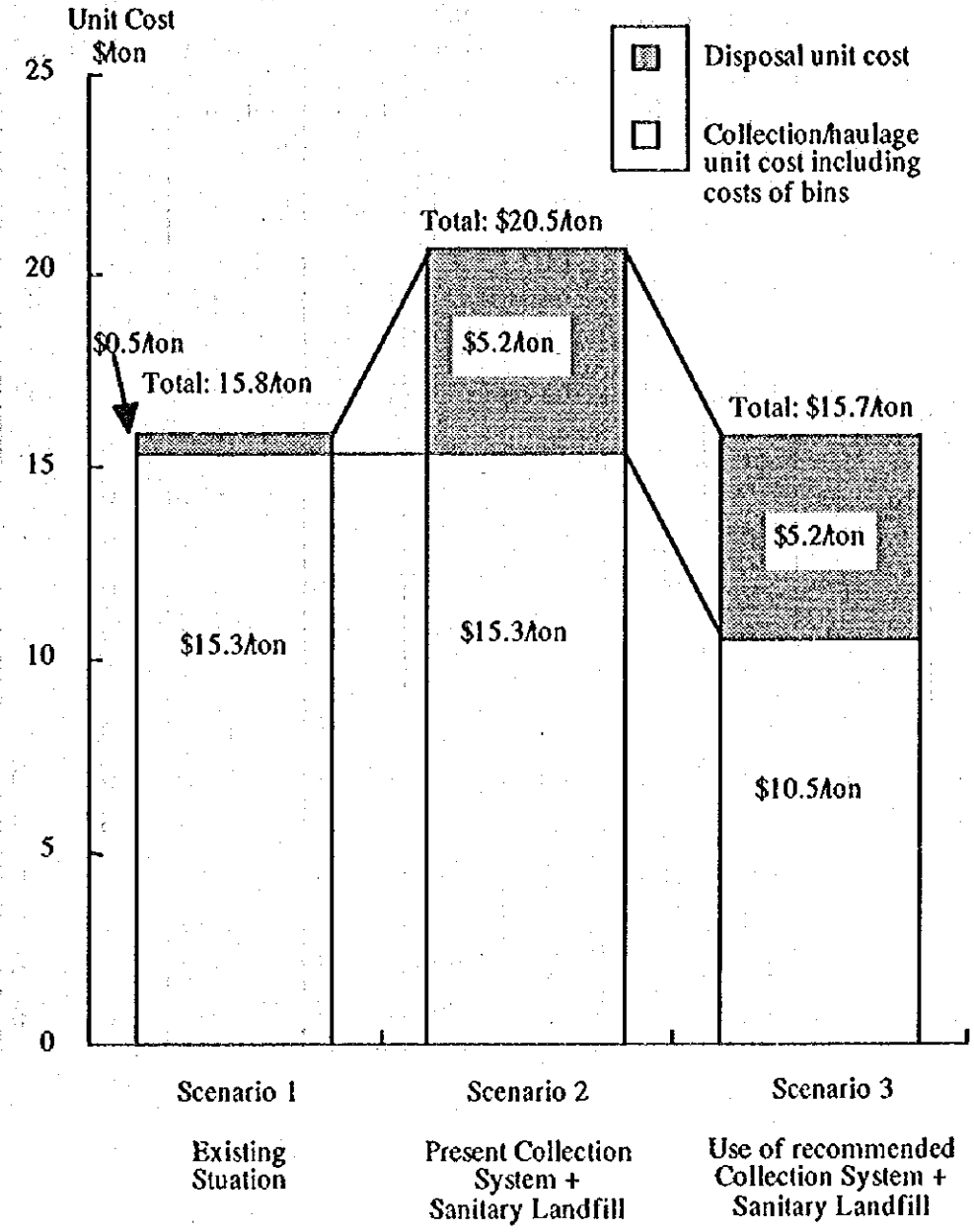


Fig. 4-1 Comparison of Unit Costs of the Existing Solid Waste Management System and Recommended System

Table 4-1 Projection of Waste Generation and Targets of Recycling & Collection during 1995 - 2000

Unit: ton/day unless otherwise indicated

Year	Generation including non-municipal waste (a)	Recycling of Municipal Waste (b)	Collection Rate (Household) (c)	Collection Rate (All other waste) (d)	Average Non-Collection Rate (e)	Recycled Municipal Waste (f)	Target Collection including non-municipal waste (g)	Incineration (h)	Non-collection (i)
1995	1622	6.0%	85%	90%	13%	79	1339	6	204
1996	1639	6.0%	86%	92%	11%	80	1384	6	175
1997	1668	6.5%	89%	94%	9%	88	1435	6	144
1998	1714	7.0%	92%	96%	7%	97	1512	6	105
1999	1762	7.5%	96%	98%	3%	107	1601	6	54
2000	1812	8.0%	100%	100%	0%	118	1694	0	0
2001	1862	8.0%	100%	100%	0%	121	1742	0	0
2002	1915	8.0%	100%	100%	0%	124	1790	0	0
2003	1968	8.0%	100%	100%	0%	128	1840	0	0
2004	2023	8.0%	100%	100%	0%	131	1892	0	0
2005	2080	8.0%	100%	100%	0%	135	1945	0	0
2006	2138	8.0%	100%	100%	0%	139	1999	0	0
2007	2198	8.0%	100%	100%	0%	143	2055	0	0
2008	2260	8.0%	100%	100%	0%	147	2113	0	0
2009	2323	8.0%	100%	100%	0%	151	2172	0	0
2010	2388	8.0%	100%	100%	0%	155	2233	0	0

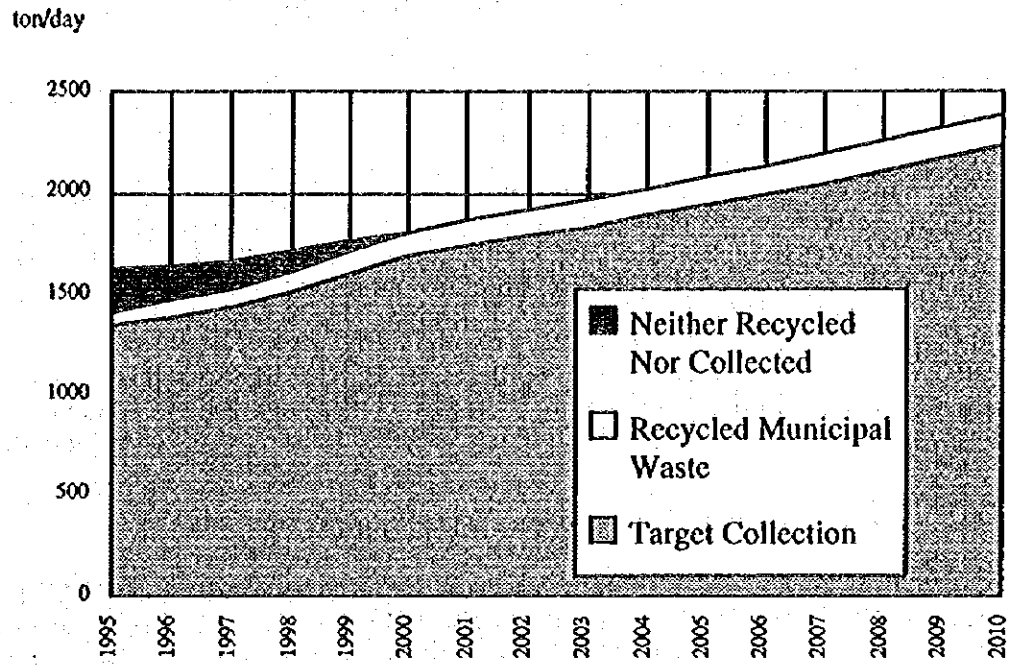


Fig. 4-2 Projected Waste Generation, Recycling, Collection and Non-Collection during 1995 - 2000

5 WASTE PREVENTION AND UTILIZATION

1. Current Situation

1) Reuse of Household Waste

Approximately 60% of glass bottles of mineral water or refreshment drinks of major brand are returned to shops through a deposit system and reused. This rate is considered fairly high and should be maintained. However, in recent years, some private shops have not accepted these bottles because these shops are not part of the recycling chain. This is an obstacle in deposit system.

PET (Polyethylene Terephthalate) bottles entered the market place in Romania only four years ago (1991). At present 80% of PET bottles are reused as containers within households, but it is likely that PET bottles will be disposed of as general waste in near future.

2) Recycling of Household Waste through REMAT

20 to 40 % of household recyclable waste has been collected by REMAT through these collection points, but amount of collected materials from citizens seems to be decreasing in these years. Citizens' cooperation also seems to be decreasing. Probable reasons are;
- Decreases in prices of recyclable waste due to falls in demand
- Limited acceptability of the collection points, because they opens for short hours.

3) Business Waste Recycling

Some materials are recycled by business enterprises such as offices, hotels and restaurants. Major recycled items are glass bottles, paper, plastic bottles and metal cans. Some of iron, wood and metal caps of bottles are also recycled, but their recycling rates are low. According to the Study Team's survey in Autumn 1994, 32% of business enterprises recycle some kind of waste mentioned above. The participation rate is considered high, but the total recycled quantity is estimated to be low because of insufficient routes for recycling these business waste. It is noteworthy that some private buyers of business waste have already begun recycling business in Bucharest.

2. Methods of Waste Prevention and Utilization

1) Methods of Waste Prevention

Manufacturers and dealers should share the responsibility of waste prevention as well as consumers, because all the process of production, distribution and consumption generate waste. Measures to be taken by manufacturers and dealers include the following.:

1) Simple packages of their products
2) Use of reusable containers or those of recyclable material
3) Development of the route for reuse.

These measures by manufacturers and dealers are required to answer consumers' effort for waste prevention.

2) Methods of Waste Utilization

"Waste Prevention" and Waste Utilization" are two major ways for waste reduction. Waste utilization is achieved either of these way shown below.

1) Reuse; this means secondary use as it is
2) Recycling: this means material recovery
3) Heat recovery; this means use of waste as fuel

Among them, Reuse and recycling are discussed in this chapter, while heat recovery is discussed in Master Plan Section 7.1.

A waste utilization plan should be economically feasible, otherwise it cannot be workable.

Promotion of waste utilization requires formulation of policy at national level. In Romania, material recycling from waste is carried out by REMAT, a state owned company specialized for material recovery. REMAT was originally established under the National Commission of Material Recycling in the Ministry of Industry. Besides, the Ministry of Industry proposed a new law "Recyclable Materials Law" in autumn 1994.

3. Target of Recycling Rate

At present, recycling rate of household waste is estimated to be 6 % based on the quantity of recyclable material collected by REMAT in 1995. Package waste including paper, plastics and metal cans are increasing, which means that recyclable portion in waste will increase. Including recycling of paper, glass and metal, 10 -15 % is a desirable target rate of recycling of household waste. However, this 10 -15 % can not be easily achieved. The municipality should strongly promote citizens' cooperation to recycling. It is also necessary to develop collection system of recyclable material to facilitate it, and the municipality should also support it. Ideas of the collection system is discussed in the following section.

4. Proposed System for Collection of Recyclable Material

1) Scheme of the Collection System

Considering the cost efficiency and possibility of participation of private collector, collection by collection boxes seems most suitable for current situation of Bucharest. At present, as market values of glass and steel seems not so high, recycling of them can not be handled only by private collectors and the support by the municipality may be necessary to support them. Though aluminum has high value as recyclable material, its current quantity in waste is still small. Collection of aluminum can not yet be successful. Collection of paper can be continued by REMAT because of its stable large quantity. Therefore, glass and steel which mainly come from waste glass bottle and steel cans are proposed as recyclable material to be collected by the collection boxes. Basic scheme of the collection box system is shown in Fig. 5-1.

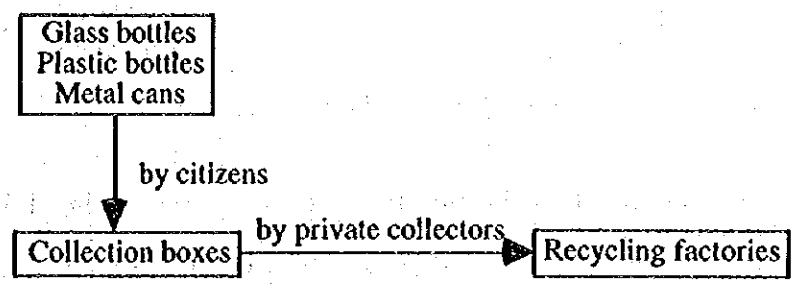


Fig. 5-1 Scheme of collection system by the collection boxes

An introduction of private collectors is a feature of this system. Two ways can be considered to use private collectors. One is contracting out and the other is license

system. The license system is better because it stimulates ambitious activity of the private collectors. The municipality should prepare the license system in which responsibility of private collectors is defined in written form. In future, a new collection system similar to German Dual System or French Eco-emballage System may be introduced to Romania. This collection box system involving private business enterprises can be basis of the new system.

If $2m^3$ of collection box with two sections is used, necessary units of the collection boxes which are installed all over the city is estimated as follows:

- The collection boxes necessary : 1,540 units

This estimation is made according to the following assumptions.

Assumption:

1) The capacity of the collection boxes to be introduced is $2m^3$. A box is divided into two sections, each of which is for glass bottles and steel cans.
2) Frequency of collection by collectors is once a week.
3) Total recycled quantity in the year 2010 will be 228 tons/day which is 15 % of total household waste. 110 tons (about 48 %) of them is collected by the collection boxes.
4) Bulk density of these waste to be collected is 0.25 tons/ m^3.

Based on these assumptions, the volume of collected bottles and cans is estimated to be 440 m^3/day = 3,080 m^3/week. To cover this volume, 1,540 units of 2 m^3 box with two section is necessary.

2) Estimated Cost of Collection

Annual quantity of glass bottles and steel cans collected by the collection boxes is estimated to be 40,150 tons/year (= 110 tons x 365 days), while annual cost required to collect the glass bottles and steel cans from the collection boxes is 430,250 US$/year as shown in the table 5-1. Unit cost of collection is 10.7 US$/ton.

Table 5-1 Estimated Cost of Collection by the Collection Box System

1.	Annual Depreciation		
	Collection Truck	34 cars	106,250 US$/year
	Collection Box	1,540 units	77,000 US$/year
2.	Operation and Maintenance		
	Salary of Collection Workers	82 persons	147,600 US$/year
	Salary of Administrative Workers	8 persons	14,400 US$/year
	Fuel		85,000 US$/year
	Total		430,250 US$/year

This estimation is made according to the following assumptions.

Assumption:

1) The capacity of the collection truck is $6m^3$ corresponding 1.5 tons of the collected material in weight.
2) Average number of daily trip of the collection trucks is three. 34 trucks is necessary in this assumption.
3) Two persons are crews for one truck as collection workers. Working rate is 1/1.2. Total number of necessary crews is 82 persons.
4) 10 % of the number of crews is necessary for administrative work to manage this collection.

5) 5 days are working days per week.
6) One truck costs 25,000 US$. One collection box costs 400 US$.
7) Duration of depreciation of the trucks and the collection box is 8 years.
8) Annual cost of fuel of one truck is 2,500 US$.
9) Monthly salary of the workers is 150 US$.

5. Recommendation

As collection cost of recyclable material is increasing, only private collectors will not be able to manage it in near future. As mentioned in the section 4.2, not only consumers but also manufacturers and dealers must share the responsibility of recycling. In Germany and France, for example, law concerning package waste is promulgated in which responsibility of manufacturers and dealers is defined. Manufacturers and dealers are obliged to establish collection system for recyclable packages and share the cost of collection and recycling of waste package by their sales amount, while collection cost is put on prices of the products. In Romania also, it is desirable to formulate national policy for nation wide promotion of recycling, to establish the law concerning package waste based on the policy, and to define the responsibility of manufacturers and dealers. Such legal basis defining the manufacturers' and dealers' responsibility and collection and recycling system will be required to be a member country of European Union.

On the other hand, it is recommendable that Bucharest Municipality should prepare a plan to promote such recycling activity before a problem emerges, although the promotion of package waste recycling requires firstly formulation of a national policy as mentioned above.

6 COLLECTION AND HAULAGE

1. Current Condition

1) Introduction

There are two major organizations providing waste collection and haulage services in Bucharest; RASUB and RGR. RASUB is the major provider of waste collection and haulage services in Bucharest. RASUB provides waste collection service mainly for 5 sectors (sectors 1, 2, 3, 4 & 5). It had 1,638 staff and workers, 204 trucks and 8 tractors. Its total expenditures was 6.1 billion Lei in 1994.
RGR collects house household waste in Sector 6, and business waste from some business enterprises in the whole Bucharest. RGR is a private firm established in 1994. It has 72 personnel and 15 trucks for collection and haulage. RGR's total expenditures was 1.19 billion Lei (including 0.54 billion Lei for repayments) in 1994.

2) Contract Coverage

Based on the information given by RASUB and RGR, it is estimated that 87 % of the citizens of Bucharest are covered by collection service contracts either with RASUB or RGR. 13 % of the citizens are not covered by the contract as shown in the following table:

Remark: In terms of collection amount, it is estimated that 85 % of generated household waste excluding recycled waste is collected.

Table 6-1 Household Waste Collection Contract Coverage in 1995

Collection Service Provider	Population Covered by Collection service Contract	
1. RASUB	1,404,754	69 %
2. RGR	370,800	18 %
3. Sub-total (1 + 2)	1,775,554	87 %
4. Not-Covered	274,803	13 %
5. Total	2,050,357	100 %

SOURCE: RASUB and RGR

2. Major Problems

Major problems with respect to waste collection haulage are listed below:

1) Lack of discharge-container
2) Bin used by RASUB is heavy and not easy to handle
3) Complicated Collection System of RASUB
4) Old equipment of RASUB
5) Poor productivity at workshop
6) Long haulage distance

3. Target Service Level

Collection and haulage service should be provided based on the Governmental Law and MB's Sanitation Norm. In principle, all the municipal wastes generated and discharged by citizens should be collected and disposed of at appropriate hygienic level under MB's responsibility.

The following targets are proposed:

1. Collection Coverage	:	100% in terms of both served population and collection amount by the year 2000
2. Collection frequency	:	Once a week at least by the year 2000. After the year 2001, collection frequency should be twice a week for summer seasons. By 2005, twice a week for all households, and at least twice a week for business waste.
3. By 2010, Bucharest will be the cleanest city in eastern Europe.		

Collection frequency should be determined considering seasonal changes in weather and waste generation quantity.

4. Collection Policy and Improvement Measures

The following policy and measures are recommended with respect to waste collection:

1) Use of Contractors
The Municipality of Bucharest will use contractors for waste collection. The municipality should use at least 3 contractors to have sound competition among contractors.

2) Responsibility of Generators of Non-Municipal Waste
The municipality will collect only municipal waste. Generators will collect non-municipal waste, i.e., industrial waste, demolition waste and large quantity waste of commercial companies.

3) Establishment of Monitoring System
The municipality will establish a system for monitoring waste contractors' performance. It is proposed that Sector governments will monitor the performance and reports to the municipality. Monitoring plan is shown in Section 7.

4) Acquisition of Disposal Sites in the Western Part of Bucharest
The municipality will acquire at least one more disposal site at western part of Bucharest. The location will be within 20 km from the city center. Transfer stations will not be necessary. Having 2 disposal sites, on the opposite sides of Bucharest will substantially contribute to the upgrading of service level (as more number of trips can be made by collection trucks in one day) and/or the saving of haulage costs if the same level of service is provided.

5) Selection of Most Economical Collection Systems
The municipality will select most economical and efficient collection system and truck types, which are recommended in Section 5. Number of truck types should be minimized.

6) Full Cost Recovery
The municipality should collect full collection and haulage costs from the citizens.

7) Supply of Bins
Use of the imported used plastic bins should be encouraged by the municipality as those bins are the most economical.

5. Recommended Collection Systems and Truck Types

In Bucharest, bin system and container system are the 2 major systems applied for waste collection. At least 4 different types of trucks are used for bin system, and 2 types of trucks are used for container system. The current deficiency in RASUB's collection service is partly attributable to the use of many different types of trucks, which causes maintenance problems and high collection costs. It is highly recommendable to select most appropriate types of trucks and reduce number of types of trucks.

Criteria used for selection of appropriate collection systems and truck types include the following:

1. Cost efficiency
2. Compatibleness with street conditions

As shown in Table 6-2, RGR's collection system with Compactor RGR-16 and 240 litre plastic bins is the most economical. Its unit cost including truck and bins is US$ 10.1/ton. The second most economical system is the one with Container Compactor PELC-CON and 4 m^3 containers. Its unit cost is US$ 12.8/ton. Comparison of waste collection amounts of respective systems results in the same ranking as the that obtained from cost comparison.

Table 6-2 Cost Efficiency by Collection System

System	Waste Collected/Year (ton) (1)	Collection Cost/Year (US$) (2)	Unit Cost/ton (US$) (2)/(1)=(3)	Cost Index	Ranking
A. Bin System					
1) Compactor RGR-16	3,838	38,910	10.1	100	1
2) R-Compactor PELICAN	2,376	31,486	13.3	132	3
3) R-Compactor LIAZ	2,187	33,954	15.5	153	4
4) Compactor MEDIAS	1,782	29,262	16.4	162	5
B. Container System					
5) Con. Compactor PELC-CON.	2,403	30,761	12.8	127	2
6) Container SRDAC	945	18,923	20.0	198	6

Source : RASUB

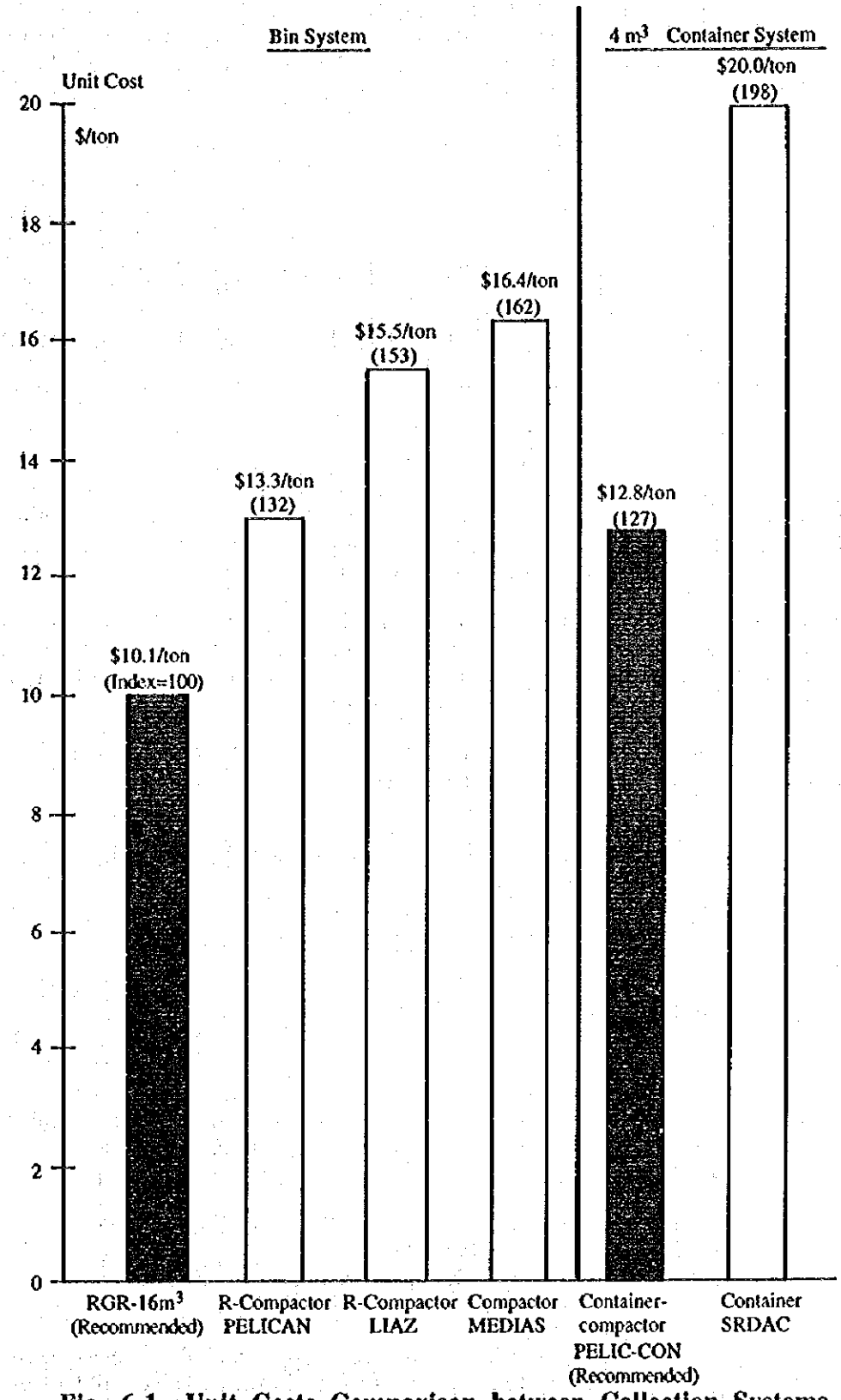


Fig. 6-1 Unit Costs Comparison between Collection Systems

Note: All the costs include costs of bins or containers.

Although the container compactor system is less economical than RGR-16, container system is necessary for factories and markets that generate large amount of waste. Therefore, both RGR-16 system and container-compactor system are recommended for future selection; the former as bin system, and the latter for container system. Some details of the recommended systems are shown in Table 6-3.

Table 6-3 Recommended Collection System for the Improvement

Collection System	Truck	Loading	Bin or Container used
1) Bin System	Compactor (16 m^3)	Two mechanical lifts	Plastic bin with casters (240 ℓ)
2) Container System	Compactor (12 m^3)	Mechanical arm-roll	Large container (4 m^3)

6. Vehicle Maintenance Plan

RASUB uses 4 workshops in Berzei, Serban Voda, Fintinica, and Timisoara. All the workshops provide some maintenance services. Generally, buildings, maintenance facilities and tools are old. Most of them are not workable.

In case that the municipality wishes to continue to use the workshops, rebuilding of workshops and renewal of maintenance facilities are necessary. Another alternative is to discontinue the use of the existing workshops, and use external private workshops for maintenance. These alternatives are discussed in Main Report Section 9.2.

In case that the municipality wishes to use the existing workshops without using external workshops, the following actions are necessary:

1) Rebuilding of workshops
2) Renewal of maintenance facilities and provision of maintenance equipment and tools including those for measurement
3) Provision of spare parts
4) Preparation of shop manual for overhauling and assembling

7. Monitoring Plan

1) Objectives

The municipality plans to use contractors for collection, haulage and street sweeping services on municipal waste from 1995. It is necessary for the municipality to establish a well functioning monitoring system on contractor's operation. The purposes of monitoring are as follows.

1. To check degree of contractors' compliance with collection contracts.
2. To know current conditions and problems..
3. To check hazardous waste is not hauled to disposal sites.

2) Monitoring Responsibility

Sector Salubrity Administration (SSA) should be responsible for collection of monitoring information with respect to all the parameters shown in Table 7.6-1 of the Master Plan, while the Public Service Department (PSD) of Bucharest Municipality will be responsible for analysis, and use of the monitoring information in addition to application of sanctions to providers who are in breach of their contracts.

PSD should also be responsible for preparing monitoring plan and monitoring report form that will be used by SSA.

8. Cost Estimation

1) Unit Cost

The current unit cost of collection and haulage in Bucharest is estimated to be $15.3/ton, while the unit cost of RGR alone is $10.5/ton. It is expected that the unit cot could decrease as the Municipality would increasingly use efficient contractors through competitive tenders, and the unit cost would decrease to $10.5/ton by 1999.

2) Annual Cost

Because of the increasing use of efficient contractors it is projected that annual costs of collection and haulage will decrease year by year till 1999 in spite of waste quantity increases. However, the annual cost will increase thereafter as the waste collection quantity will increase. See the Table below.

Table 6-4 Estimated Annual Costs of Collection and Haulage 1996 - 2010

Year	Unit Collection & Haulage Cost including Costs of Waste Containers ($/ton) (a)	Annual Municipal Waste Collection Quantity excluding Street waste (ton/year) (b)	Collection & Haulage Cost to the Citizens a x b = (c)	Collection Cost to the Municipality (excluding cost of containers to be paid by the citizens) (83 % of c) (d)
1996	14.1	383,225	5,403,473	4,484,882
1997	12.9	397,055	5,122,010	4,251,268
1998	11.7	418,812	4,900,100	4,067,083
1999	10.5	444,899	4,671,440	3,877,295
2000	10.5	471,924	4,955,202	4,112,818
2001	10.5	484,675	5,089,088	4,223,943
2002	10.5	498,245	5,231,573	4,342,205
2003	10.5	512,196	5,378,058	4,463,788
2004	10.5	526,538	5,528,649	4,588,779
2005	10.5	541,281	5,683,451	4,717,264
2006	10.5	556,437	5,842,589	4,849,348
2007	10.5	572,017	6,006,179	4,985,128
2008	10.5	588,033	6,174,347	5,124,708
2009	10.5	604,498	6,347,229	5,268,200
2010	10.5	621,424	6,524,952	5,415,710
Total		7,621,259	82,858,336	68,772,419

Note:
It is assumed that the citizens will purchase containers from the waste contractors. Therefore, the future waste tax will not include costs of containers. It is assumed that the cost of waste containers is 17 % of the total collection/haulage costs.

7 STREET SWEEPING

1. Current Condition

1) Outline

In Bucharest, ADP of each sector is responsible for street sweeping. ADP uses 2,084 workers for street sweeping, and has 48 mechanical sweepers and 46 trucks for haulage of street waste. ADP in each Sector has budget at around 3 billion lei /year for its activities. Among them 20 % to 28 % are used for street sweeping

2) Service Level

Street sweeping service is not adequate in terms of sweeping area and frequency in some streets. A high rate of workers' absence is a reason for the inadequate service. Another reason is that as much as 40% of mechanical sweeping truck are older than 8 years.

2. Recommendations

1) Introduction of Patrol System

MB has responsibility to maintain all the streets, and to keep them clean and safe as those are domain of MB.

Street sweeping should be provided according to needs. Patrol cars should be introduced to check and find streets that need sweeping. For streets except for trunk roads, it is recommended to increasingly replace daily sweeping with a system whereby patrol cars check streets and sweeping teams are mobilized for places that need cleaning. Small type compactor trucks (2 ton or 3 ton) should be used for both patrol and collection purposes.

2) Use of Efficient Mechanical Sweepers

Among the existing mechanical sweepers, FAWN (made by Mercedes) shows the best cost performance, that is, $210/ton, which is $74 more efficient than a sweeper made by Ford if its loading capacity is fully utilized. (But the cost data related to import duty, value added tax and precise depreciation are still needed for further analysis.)
Note: See Appendices for further detail.

Therefore, FAWN or other mechanical sweepers of better cost performance is recommended.

3) Provision of Equipment

So the priority of improvement should be put on selecting light containers, efficient collection trucks and small trash box for passengers to reduce waste littering on streets.

Municipality's expenses for street sweeping because the Municipality needs a large fund to invest in new disposal sites, and other municipal projects.

3. Monitoring Plan

1) Objectives

The municipality plans to use contractors for street sweeping services, therefore the municipality should establish a well functioning system for monitoring contractor's operation. The purposes of monitoring of street sweeping service are: 1) to check degree of contractors' compliance with collection contracts, and 2) to know current conditions and problems.

2) Monitoring Responsibility

The municipality should be responsible for planning of monitoring, analysis and use of monitoring data, and application of sanctions to service providers who did not comply with the service contract.

Sector office (Salubrity Administration) should be responsible for the field monitoring, and obtaining data.

4. Cost Projection

It is expected that the street sweeping cost will decrease in the future as the municipality introduce a patrol system, and decrease regular sweeping. Estimated annual cost of the street sweeping are shown in the following table:

Table 7-1 Preliminary Cost Projection for Street Sweeping

Year	Nos. Mechanical sweeper		Mechanical sweeper cost* a (10^3US$)		Nos. Manual team (shift)	Manual team cost b (10^3US$)	Other equipment cost* c (10^3US$)	Total cost (a+b+c) (10^3US$)
	Existing sweeper	New sweeper	Existing sweeper	New sweeper				
1996	22	0	540.1	-	50	737.4	36.9	1,314.4
1997	22	0	540.1	-	43	639.2	36.9	1,216.2
1998	22	0	540.1	-	43	645.8	36.9	1,222.8
1999	15	(13)	381.8		42	638.9	36.9	1,057.6
2000	0	13	-	295.0	41	629.8	36.9	961.7
2001	0	13	-	295.0	40	623.5	36.9	955.4
2002	0	13	-	295.0	39	615.4	36.9	947.3
2003	0	13	-	295.0	38	606.1	36.9	938.0
2004	0	13	-	295.0	37	596.7	34.6	928.6
2005	0	(13)	-	295.0	36	588.6	34.6	920.5
2006	0	13	-	295.0	36	593.9	34.6	925.8
2007	0	13	-	295.0	34	569.3	34.6	901.2
2008	0	13	-	295.0	33	561.0	34.6	892.9
2009	0	13	-	295.0	32	551.2	34.6	883.1
2010	0	13	-	295.0	32	555.1	34.6	887.0

Note) 1) (13): newly purchased.
2) *: including interest, salary, O/M cost as well as depreciation.

Assumptions used for the cost estimation is shown in Main Report Section 6.5.

8 TREATMENT AND DISPOSAL

1. Disposal Policy

The following disposal policy is proposed:

1. The Bucharest municipality should be responsible for disposal
2. Introduction of sanitary landfill
3. Staged improvement of disposal standard
4. Systematic acquisition of landfill sites of large area
5. Acquisition of at least 2 landfill sites
6. Use of appropriate guidelines for the selection of landfill sites
7. Improvement of the existing Glina landfill site
8. Management and monitoring of former dumpsites
9. Non-recovery of methane gas

2. Methods of Solid Waste Management

1) Alternative Methods

It is considered that the following two alternative methods are worth studying their applicability as a major means of waste disposal in Bucharest:

Alternative 1 Sanitary landfill
Alternative 2 Incineration

Composting is not considered feasible as a major means of waste disposal in Bucharest judging from the fact that the composting was carried out in Bucharest but several years ago stopped because compost product contained heavy metals and there was not sufficient demand for the product.

2) Evaluation

Both sanitary landfill and incineration are considered environmentally sound and acceptable. Therefore a meaningful evaluation of the two alternatives can be made in terms of cost.

Cost of sanitary landfill and incinerator vary greatly depending on level (specifications) of respective facilities. For the purpose of meaningful comparison, environmentally-sound facilities of minimum cost were assumed.

Table 8-1 Estimated Costs of Sanitary Landfill and Incineration

Unit: US $/ton in 1994 price

Cost Items	Sanitary Landfill	Incineration
1. Depreciation of Investment Cost	4.58	36.97
2. Operation & maintenance	0.59	12.91
3. Total cost (1 +2)	5.17	49.88
4. Sales of heat	-	7.83
5. Net cost (3 - 4)	**5.17**	**42.05**
6. Index of net cost	100	813

Note: Assumptions used for the estimation of the costs are shown in Section 2.3.3 of the Feasibility Study Report on the Landfill Development.

3) Conclusion

1. Incineration is 8 times costlier than sanitary landfill.

2. Feasibility of sanitary landfill crucially depends on land availability. Judging from the land use condition of Bucharest, it is likely that the Bucharest municipality can obtain, in the agriculture sector, land of area required for landfill up to the year 2010 (167 ha in total).

3. Therefore, it is judged that sanitary landfill is more economical, suitable and recommendable for Bucharest than incineration.

4. Appropriate level and specifications of sanitary landfill depend on such conditions as 1) geographical and geological conditions of sites, 2) distance from site to the nearest human settlement area, and 3) national environmental standards and regulation.

5. Althouh the incineration is not feasible at present, it may become feasible for Romania some time in the future as there will be changes in the Romanian socio economic conditions which will affect waste composition and land availability. Therefore, the incineration should not be excluded from a future option.

   It may be an appropriate strategy for Bucharest to have a pilot incinerator to develop incineration technology suitable for conditions of Romanian waste. It took about 10 years for the Japanese local governments to develop incineration technology suitable to Japanese waste conditions after they first importedmodern incinerators from European countries.

   It is generally said that if a local government wishes to apply incineration as major means of waste disposal without causing a serious economic load on the citizens, GDP per capita of $ 4,000 or more would be needed.

   It would be beyond the financial capability of the Municipality of Bucharest to entirely finance even a pilot incinerator with the capacity of 200 ton/day within 10 years time. (Minimum construction cost would be $ 40 million.) In view of the possibility of diffusion of the incineration technology to other local governments, it makes a sence that the central government should finance a major portion of the cost of construction of such pilot incinerator. Timing of the construction of such pilot incinerator depends mainly on availability of funds and speed of changes in socio economic conditions. The appropriate timing would not be before the year 2000.

   Chapter 4 of Report 8 Other Studies (Report 13 in Romanian version) shows technical information on incinerators.

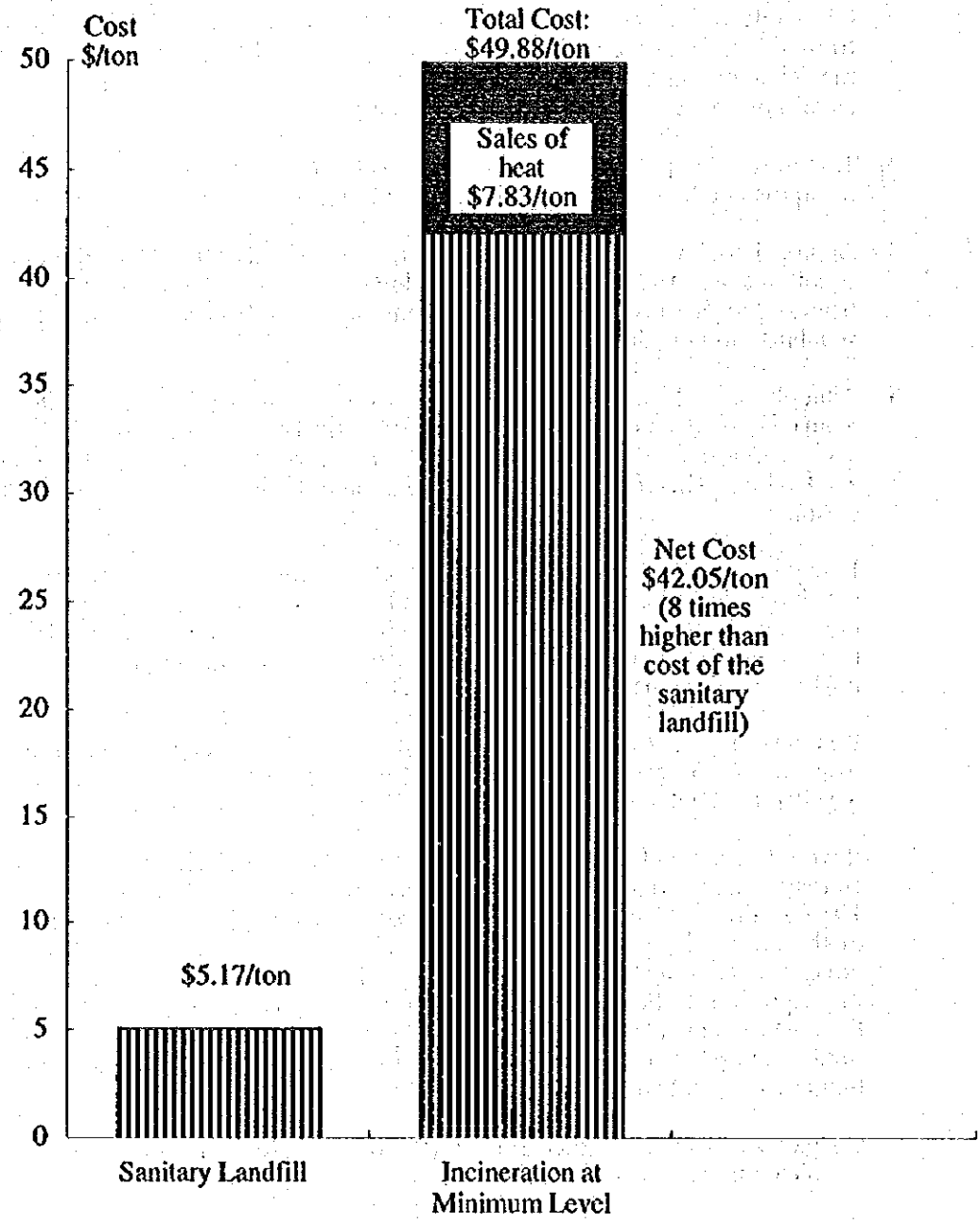


Fig.8-1 Unit Cost Comparison between Sanitary Landfill and Incineration

3. Future Disposal Plan

1) Disposal Site Area Requirement

It is estimated that 167 ha of land will be required in addition to the existing Glina site to satisfy landfill demand arising from 1995 till 2010. Refer to Main Report Section 7.4.1 for estimation.

Considering the future landfill area requirement arising by 2010 and efficiency of waste houlage, it is proposed that the Bucharest municipality should acquire 5 new landfill sites (Balaceanca, Cretuleasca, Berceni, Afumati, and Jilava) as shown in Fig. 8.2. Total area of these 5 sites will be 167 ha and have capacity of desposing 11.85 million tons of waste. Of the 5 sites, the municipality should start arrangements for acquiring the first 2 sites (Balaceaca and Cretuleasca) as soon as possible.

2) Identification of Candidate Landfill Site

There are not suitable sites found in Bucharest city area considering the land use conditions and city development plan. Therefore, candidate sites have been selected in the agriculture sector area surrounding the city. The existing Glina disposal site is located also in the agriculture sector.

Important criteria for selection of landfill sites include the following:

- Efficiency of collection and transport (locations should be within 20 km from the center of Bucharest.)
- Compliance with related urban planning regulations
- Area of sufficient size (one site area should be larger than 10 ha.)
- Suitable topographical conditions to ensure landfill capacity efficiency
- Sites should be located more than 200 m away from the property lines of premises such as residences and stores.
- The landfill site should be located at least 200 m away from rivers or lakes
- Approach road and access road should be available.
- In addition, Technical Guidelines of Selection of Landfill Sites shown in the Attachment 1 of the Master Plan Report was used by he Study Team for the identification of candidate landfill sites.

The locations of selected candidate sites are shown in Fig. 8-2.

3) Evaluation

The results of the evaluation of the candidate landfill sites are given in Table 8-2. The evaluation is based on a consideration of location, landuse and construction cost. Construction costs of each candidate site were estimated for the following 2 cases:

Case 1 : Off-site Leachate Treatment (Leachate will be collected and transmitted through pipelines to the nearest public sewer line, transmitted to and treated at the existing Glina Sewage Treatment Plant.)

Case 2 : On-site Leachate Treatment (Leachate will be collected and treated both biological and chemically by an independent treatment facility to be provided at each site.)

The detail information of construction costs is attached in Appendix 7.3.

Based upon the result of the evaluation, it is planned that new landfill sites are constructed in Balaceanca and Cletureasca so that they can open in 1999. A feasibility study has been carried for construction of these 2 sites as well as for improvement of the existing Glina site. To meet the future disposal demand, 3 more landfill sites should be developed in Berceni, Afumati and Jilava in the next stage.

(Triple circles indicate the first 3 sites to be obtained now.
Double circles indicate the other 3 sites to be constructed later.)

Fig. 8-2 Locations of Candidate Sites

Table 8-2 Evaluation of the Candidate Landfill Sites

NO.	Location (Distance from residential area)	Land use	*Remark	Construction Cost		Priority
				Case 1 (US$ / m^3)	Case 2 (US$ / m^3)	
1	BALACEANCA about 800m A	Swanpy Land A	***	2.30	4.12	1
2	CRETULEASCA More than 1000m A	Agriculture Area B	***	3.50	5.68	2
3	BERCENI More than 1,000m A	Agriculture Area B	**	2.26	3.80	3
4	JILAVA about 500m A	Agriculture Area B	**	2.21	3.78	4
5	AFUMATI about 400m A	Agriculture Area B	**	2.34	4.38	5
6	POPESTI - LEORDENI II about 200m B	Agriculture Area B		1.03	2.20	6
7	POPESTI - LEORDENI I about 200m B	Agriculture Area B		1.44	2.54	7
8	FUNDENI about 200m B	Agriculture Area B		2.37	4.41	8
9	VIDORA about 1000m A	Agriculture Area B		3.10	4.99	9
10	CHIAJNA about 500m *Water Resourse Area B	Reed Plain and Agriculture Land B		2.08	4.41	10
11	DUDU About 400m *Water Resourse Area B	Borrow Pit and Fish Pond B		3.11	5.31	11

Note : Grading

A : Good

B : Acceptable

Remark : *** : The 1st priority sites studied in the current feasibility study.

** : The 2nd priority sites to be chosen.

4) Facilities Plan

Table 8-3 shows major facilities required for sanitary landfill, their function, and specifications for Cases 1 and 2. Plan for each facility is shown in Main Report Section 7.6.2.

Table 8-3 Outline of Major Facilities for Cases A and B for New Landfill site

MAJOR FACILITY	FUNCTION	SPECIFICATION	
		CASE 1	CASE 2
Embankment	To prevent garbage from flowing out of the site and rainfall water from flowing in	Soil band of 7 m height around the site	Same as Case 1
Lining	To avoid seepage of leachate and contamination of ground water	Artificial liner Thickness = 2.0 mm	Same as Case 1
Leachate Collection Facility	To collect leachate quickly	Crushed stone & PVC pipe	Same as Case 1
Rain Water Drain Facility	To prevent water from flowing into the site	Concrete drain ditch (Width=depth= 30mm) are constructed around the site	Same as Case 1
Leachate Treatment Facility	To treat leachate and improve quality of water to be discharged outside the site	Off-site treatment	On-site treatment (both biological & chemical)
Gas Exhaust Facility	To collect and release the gas generated from decomposed waste	Crushed stone & PVC pipe	Same as Case 1

Note:
It is assumed that waste soil excavated from Cretuleasca landfill site construction will be used for construction of embankment and on-site and access roads.

5) Operation and Maintenance and Monitoring Plan

The important points include the following:

1) Application of cover soil
2) Application of bedding and compaction
3) Application of cell method
4) Monitoring of leachate, ground water, exhaust gas, odor, and settlement of ground, etc.

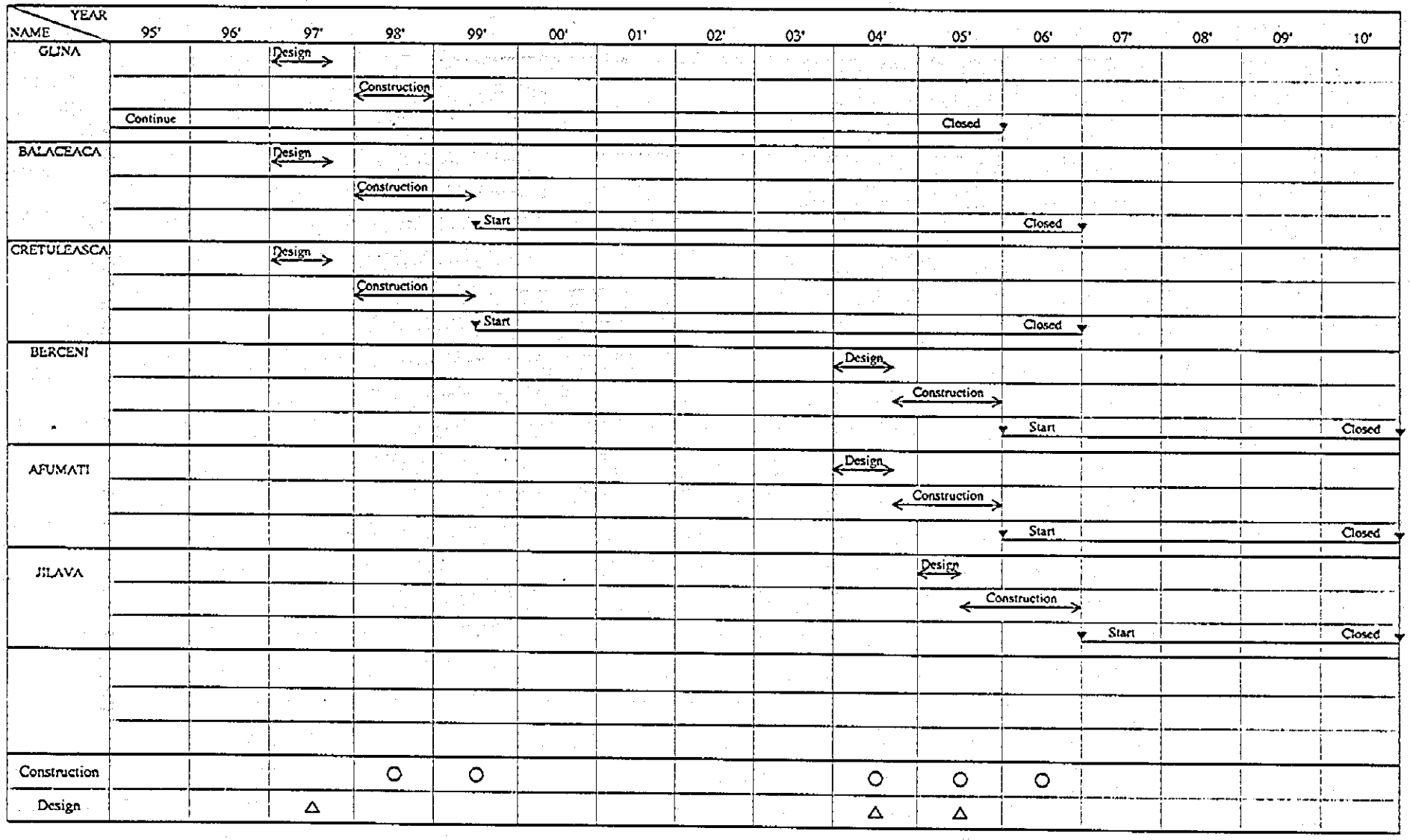
Operation, maintenance and monitoring plan are explained in Chapter 6 of Part B in this summary.

6) Construction Schedule

A proposed construction schedule is shown is Table 8-4. Of the 5 sites, the municipality should start arrangements for acquiring the first 2 sites (Balaceaca and Cretuleasca) as soon as possible. It is proposed the municipality will design 2 sites in 1997, start construction works in the beginning of 1998, and commence sites operation in the mid 1999.

Fig. 8-3 shows a plan for allocation of waste to each site.

Table 8-4 Final Disposal Sites Development Schedule



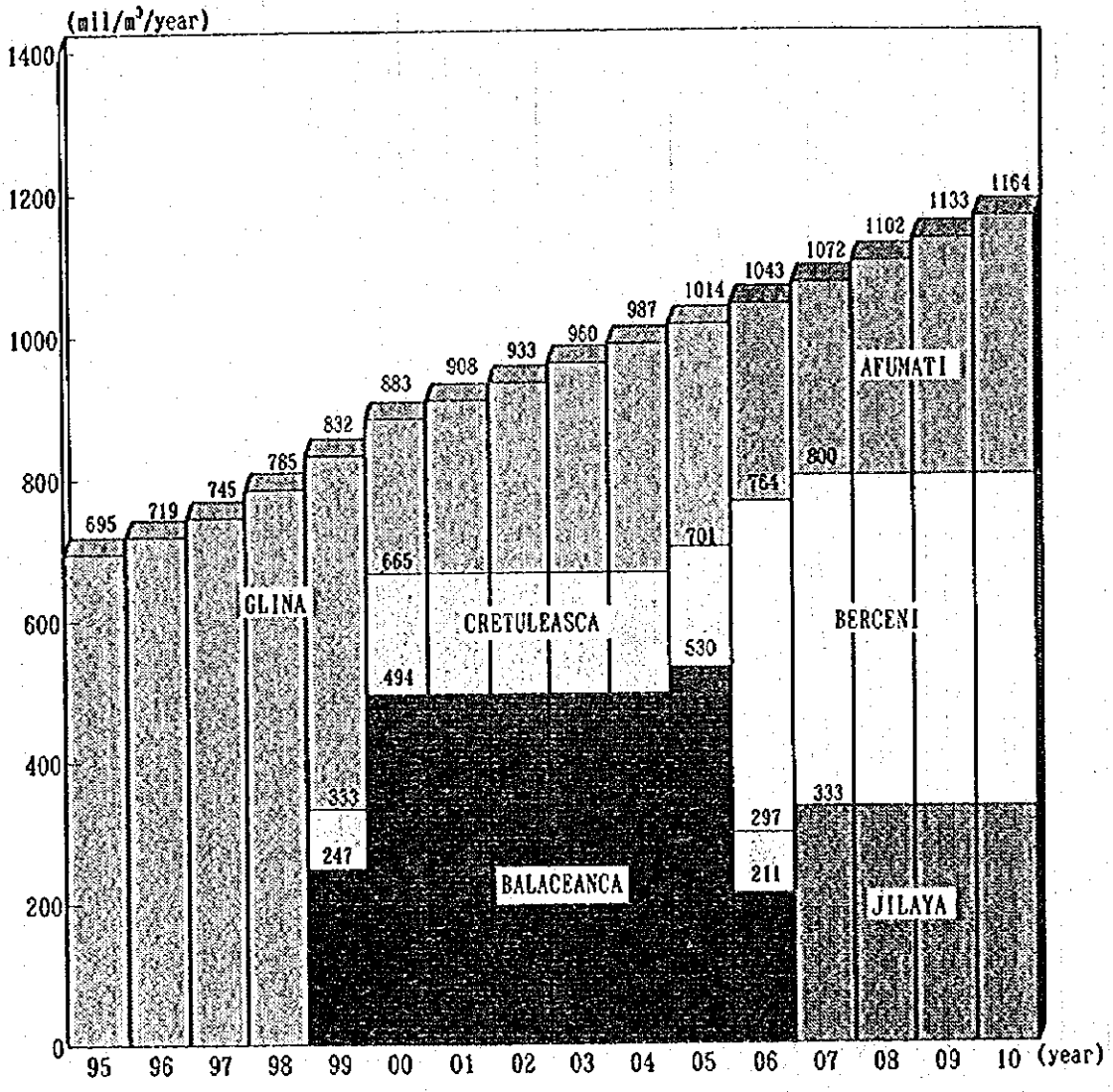


Fig. 8-3 Annual Disposal Volume and Allocation Plan

7) Improvement Plan for Glina Disposal site

a. Improvement Policy

Improvement policy of Glina landfill site is as follows:

1. Number of incoming trucks should be reduced to improve landfill operation. Reduction in number of incoming trucks will be made possible by having other landfill sites.
   Remark : At present, control of incoming of unsuitable types of waste and area designation for waste unloading have not been done properly because too many trucks are coming to the site.
2. Embankment will be provided 50m inside the site boundary on the north west side to minimize risks of pollution to local residents living in Popesti-Leordeni village.
3. Leachate collection facility will be provided for the remaining area. Collected leachate will be transmitted to the existing Glina Sewage Treatment Plant through transmission pipes for treatment.
4. Daily soil should be applied to minimize adverse impacts on surrounding residential areas.
5. Landfill operation efficiency should increase.
6. Work conditions should improve through provision of basic facilities.
7. It is proposed that the municipality should provide water supply to the local residents living near the Glina site.

b. Improvement Plan

The proposed improvement plan include the following components:

1. Regular application of cover material in order to prevent fire, reducing surface movement of waste and odor
2. Provision of access road
3. Provision of site boundary (embankment)
4. Provision of drainage system in order to divert storm water
5. Provision of leachate collection pipes and connection to the Sewage Treatment Plant in Glina.
6. Provision of gas exhaust facility

See Section 7.5 of the Master Plan Report for details.

4. Cost Estimation

As shown in Table 8-5, it is estimated that total expenditures needed for waste disposal from 1996 to 2010 will be $ 47.8 million, of which about 38 million will be used for development and operation of 3 landfill sites in Balaceanca, Cretuleasca and Glina (herein after called " the project "); $ 22 million will be required for development and operation of another 3 sites in Berceni, Afumati and Jilava; $ 1 million will be needed before the Project for Immediate improvement of the Glina site and other purposes. It is estimated that the average unit cost of disposal for the period 1996 - 2000 is $5.17/ton.

Table 8-5 Estimated Disposal Expenditures 1996 - 2000 (Including Contingency and Value Added Tax)

Unit : US$ in 1995 price

Items	Price
A. Pre Project Expenditures	
A1. Immediate improvement of the Glina site	52,081
A2. Purchase of bulldozers of Glina site	105,000
A3. Operation and maintenance of the Glina site 1996 - 1998 before the three sites open	662,129
Total of Item A	**819,210**
B. Project Expenditures	
B1. Engineering Services for B3 & B4	1,807,170
B2. Technical assistance	86,140
B3. Construction work	19,919,580
B4. Equipment procurement	1,270,860
B5-1 Engineering services for water supply & sewage for local residents	453,102
B7. Operation & maintenance of landfill sites (1999 - Mid 2007)	3,003,555
Total of Item B	**26,087,305**
C. Post Project Expenditures	
C1. Additional civil works for the 3 sites (Construction of embankment)	1,939,920
C2. Construction of other landfill sites in Afumati, Berceni & Jilava (2004 - 2006) including engineering cost	16,702,600
C3. Operation and maintenance of Afumati, Berceni & Jilava sites (Mid 2006 - 2010)	2,253,231
Total of Item C	20,895,751
Ground Total (A + B + C)	**47,802,266**

9 INDUSTRIAL, DEMOLITION AND HOSPITAL WASTE MANAGEMENT

1. Current Situation

According to the Romanian laws, generators are responsible for management of non-municipal waste including industrial, demolition and hospital waste. In reality, there is little control over the management of those waste by the government and the Municipality.

2. Recommendations for Improvement

In order to reduce environmental and public health risks associated with industrial, demolition and hospital waste, the following measures are recommend:

1) The municipality should clearly specify types of waste to be collected under the responsibility of the municipality and those to be collected by waste generators. The municipality should make and enforce regulations which prohibit waste generators to mix former type waste with the latter. The regulation should also include an article stipulating penalty to be applied to those who violate the regulations.

2) The municipality should specify types of waste to be accepted or rejected at the municipality's disposal site.

3) The municipality should make and enforce regulations that require industrial factories 1) to report on disposal of their waste, and 2) to obtain a permission from the municipality for the use of the municipality's disposal site.

4) The municipality should strengthen inspection of industrial waste at the municipality's disposal sites, and should not accept hazardous waste.

5) The municipality should establish data management system for industrial waste brought into the municipality's disposal sites. Installation of adequate number of truck scale will be necessary.

6) The municipality should make and enforce regulations to specify who is responsible for management of demolition waste. The regulations should also empower the municipality to remove demolition waste and recover the necessary costs from bodies responsible for management of the demolition waste in case they did not do it by themselves.

7) The municipality should make and enforce regulations that empower the municipality to monitor hospital waste management and give guidance to hospitals so that they will properly manage their waste.

8) The municipality should organize a section responsible for monitoring, inspection and data management in connection with hospital and industrial waste management. This section should provide industries and hospitals with guidance and information useful for improvement of management of their waste.

9) There should be a law that requires industrial factories and hospitals to have a person responsible for management of their waste within their organization. Training programs as well as license system should be established for persons to be assigned with this responsibility.

10) Ministry of Health should prepare technical guidelines for management of hospital waste.

10 INSTITUTIONS AND LAWS

1. Institutional Deficiencies

The following deficiencies in institutional arrangements and laws are presented. They cover both the national level and the local level in Bucharest.

1) Institutional Framework: There is no formal legal or institutional framework between MB and RASUB which delimits the contractual relationship between them, their corresponding rights and obligations, and ensures that performance objectives are met. The lack of a framework greatly weakens MB's ability to oversee and regulate RASUB's activities. This has greatly contributed to service deficiencies.

2) Institutional Responsibilities: The current organisation of the disposal, collection and haulage and street sweeping services amongst RASUB, RGR (collection) and the 6 sectors (street sweeping), is ineffective. Some reorganisation and rationalisation of responsibilities is necessary. This will cover service provision, contracting and monitoring and financing services.

3) Policy and Planning: Formulation of SWM policy and planning is weak and fragmented at national and local level. No single government body is responsible to develop SWM policy, to carry out strategic planning and to issue SWM guidelines for municipal government. Ministries pursue their own initiatives but do not coordinate.

4) Setting SWM Standards and Formulating SWM Regulations: There is fragmentation of setting SWM standards and regulations amongst MLPAT, MoE, MoH (Min of Health), MoI and MB. These activities should be coordinated and rationalised at national level by one Ministry. However, we note that the Interministerial Technical Committee for Setting Standards for Urban Salubrity is in the process of issuing the first municipal waste standards. The committee aims to set about 3 SWM standards per year.

5) Issuing Permits and Licenses: There is a lack of coordination in issuing permits/licenses for SWM activities. These activities should be coordinated within a national policy and plan.

6) Contracting: MB's contract management capability is weak. Without a strong capability MB will be unable to ensure that good contractors are selected for collection and haulage and street sweeping, and that contractors comply with performance standards and contract terms and conditions.

7) Monitoring and Enforcement: MB's monitoring of RASUB's and RGR's services is weak. A more serious issue is MB's inability to effectively sanction RASUB when it breaches the Bucharest Sanitation Norm (BSN). This means that RASUB has been able to avoid complying with the BSN. As a result the quality of collection and haulage services has suffered.

8) Linkages between Institutions: There are few linkages between institutions involved in SWM. There are no reporting lines between MB and central government for SWM. Likewise, there are no reporting line responsibilities between RASUB and central government. As a result, the coordination of policy, planning, legislation and service provision is virtually non-existent.

2. Legal Deficiencies

There is no national law on SWM yet. However, the MoE is formulating a new waste law with assistance from the Secretariat of the Basel Convention and the Ministry of Industry (MoI) has recently issued Ordnance 33 concerning Material Recycling. Ordnance 33 was prepared by the MoI's National Commission for Materials Recycling (NCMR).

3. Recommendations for Institutional Arrangements for SWM in Bucharest

Overview

Recommendations for institutional reform are given for Bucharest only. The proposals cover waste type responsibilities and then recommendations for collection and haulage, street sweeping and disposal. National reform is beyond the scope of this study. A summary of the implementing actions is given in section 4. below.

The proposals focus on four key areas: 1) responsibility for provision of SWM services, 2) contractual arrangements between MB and service providers, 3) monitoring of services and 4) financing responsibilities for operating and capital expenditures.

Under the proposals RASUB is transformed under GoR Ordnance No 69, 1994 and GD 135, 1994, and **disposal** and **collection and haulage** are assigned to MB and SALUB, a new commercial enterprise, respectively. Those assets which RASUB owns are vested in SALUB.

If SALUB is not set up, RASUB will substitute for SALUB in the proposals presented below.

In selecting options for collection and haulage and street sweeping, it is assumed that private sector involvement is the best solution to improve service quality, reduce costs and increase efficiency. Empirical evidence from international experience and from RGR supports this.

Waste Type Responsibilities

MB should be responsible for the management of municipal waste, whilst generators of non-municipal waste are responsible for managing their wastes. Definitions of municipal and non-municipal waste are given in Chapter 3 of the Master Plan.

For hazardous wastes it is recommended that central government should 1) prepare a regulation defining hazardous waste, and 2) take the initiative to establish a central system for treating hazardous waste.

Collection and Haulage

1) Service Responsibilities

Our preferred option is that collection and haulage services are fully contracted out. Initially, MB contracts out the service to SALUB and RGR, but also MB phases the contracting out of all 6 sectors to the private sector. This could be completed within 1 to 2 years.

The contractor is remunerated through the contract, which MB finances from the proposed waste tax. The contractor will be either SALUB, RGR or a private sector company. In all cases the optimal contract length is 3-5 years.

The transition to full contracting out requires the development of a SWM market in Bucharest. Joint ventures with foreign companies are a good way to access technology, tap foreign capital markets and develop a stable market. In the transition we recommend SALUB is fully privatised, assuming that it becomes commercially viable and is not eclipsed by the competition.

It is also recommended that maintenance is contracted out. Private sector contractors of collection services should be free to decide how to source their maintenance. In SALUB's case it is recommended that its maintenance facilities cease to be used and that it contracts out maintenance to the private sector. SALUB's old facilities could be sold or used for garaging.

The recommended options are relatively low risk, keep options open, are easy and cheap to implement, encourage competition and cost minimisation, are responsive to citizens needs and secure improvements to service quality.

To ensure that the preferred option is implementable, **it is proposed that MB receive technical assistance (TA) from the World Bank to strengthen its contract management and service monitoring capabilities.** Details of the TA are given in Chapter 1 of the Report, Studies on Technical Assistance, Waste Education and Waste Bins Supply.

2) Financial Responsibilities

It is recommended that MB finance its SWM services through the waste tax. There will be separate household and business waste taxes. Until the tax is introduced contractors will continue to levy tariffs and street sweeping will be financed from MB's local tax revenues.

The tax must be set at a level which ensures that SWM is financially viable, there is appropriate cost recovery, contractors are sufficiently remunerated to finance their functions, taxes are structured which optimise revenues and which are socially equitable and there is due consideration to the affordability of citizens and businesses.

It is assumed that MB will not incur or subsidise contractor's operating costs in any way, ie that there is full opex cost recovery from the contract remuneration.

Concerning capex, private sector contractors will recover all their capex from the contract remuneration. In SALUB's case it is recommended that it procures all its own equipment and that MB ceases to procure any on its behalf. However, SALUB's garaging facilities, which MB owns, will remain MB's responsibility.

To ensure that the option is implementable, **it is proposed that MB receive technical assistance (TA) from the World Bank to enable it to set and implement the waste tax.** Details of the TA are given in Technical Assistance Studies, Chapter 1 of the Report, Studies on Technical Assistance, Waste Education and Waste Bins Supply.

3) Service Monitoring

It is recommended that a performance measurement system should be established by MB to enable it to monitor and report on service performance and to check for contract compliance. The system should also enable MB to periodically assess whether a contract is giving Value for Money (VFM).

It is proposed that monitoring arrangements are split between the Public Services Department (PSD) and the 6 Sectors' Salubrity Administration Sections which will carry out the service monitoring and provide monitoring data to the PSD.

It is proposed that the PSD's responsibilities are to implement its monitoring plan, to analyse monitoring data, to check that contracts comply with performance standards and their terms and conditions, to follow up serious service deficiencies, to apply sanctions to providers who breach their contracts and to prepare aggregate quantity and quality data for planning and forecasting.

Detailed organisational requirements are covered in Chapter 9 of the Master Plan.

It is also proposed that a workable structure to resolve legal and commercial issues with contractors is implemented.

Street Sweeping

1) Service Responsibilities

It is proposed that street sweeping is initially provided by SALUB to resolve the conflict over who collects illegally dumped waste, but that it is subsequently contracted out by MB to the private sector when conditions are appropriate.

Under this scenario, each of the 6 sectors is contracted out and street sweeping is provided independently from collection and haulage. The responsibility for contracting could be given to the Sectors themselves when they are capable of managing a contract. The deciding reasons are:

1. it is easy to contract out street sweeping. The risk is low and contracting periods can be short, eg 1-2 years;
2. it increases competition. Capital costs are not a barrier to market entry.
3. it should reduce service costs and improve service quality; and
4. it is common practice in many countries.

It is also recommended that maintenance is contracted out by SALUB to the private sector.

2) Financial Responsibilities

It is proposed that the same financial responsibilities as those recommended for collection and haulage services in section 10.2.3, 2) above, are implemented.

3) Monitoring and Regulation of the Service

It is proposed that the same monitoring arrangements as those for collection and haulage are implemented.

Disposal Services

1) Institutional Options for Service Provision

Our preferred option is that MB form a joint venture with a foreign company. The joint venture company (FJVC) would manage Glina and later Balaceanca and Cretuleasca sites.

If a foreign partner cannot be found, **it is recommended** MB sets up a Municipal Waste Disposal Administration (MWDA), subsumed under it, to manage disposal at Glina. Under this option, operational management of Balaceanca and Cretuleasca sites is contracted out, since it is assumed that MB will have sufficient contracting capabilities by the time these sites become operational.

It is also recommended that maintenance is contracted out by the FJVC or the MWDA.

The deciding reasons for selecting FJVC as the preferred option are:

Firstly, at the present time, disposal is too **risky** to contract out to the **local** private sector which lacks experience of managing landfill sites, is largely motivated by market forces, ie to reduce costs in order to maximise profits, and with whom contracts may be difficult to control and manage at the current time. Therefore, contracting out to local providers is rejected because of the risk to public health and environmental protection.

Secondly, a joint venture with a foreign company is a secure way of benefiting from private sector involvement. It gives MB, 1) access to foreign expertise which local contractors lack, and, 2) more control because it co-owns the joint venture company.

Organisational arrangements for both options are:

FJVC: The FJVC is set up by a Local Government Decision (LGD). MB would agree a performance contract with FJVC and which MB would finance from the waste tax. The performance contract would be monitored by a waste administration set up within the Municipality specifically for that purpose.

MWDA: The MWDA is set up by an LGD. MWDA's operating costs will be recovered from the waste tax. Investment expenditure could be financed from either the Municipal budget, the State budget or the waste tax. These financing issues will be dealt with in the waste tax TA which the World Bank is intending to provide to MB.

Detailed organisational arrangements for both the FJVC and the MWDA are presented in Chapter 9 of the Master Plan.

4. Principal Implementing Actions for Institutional Changes

Firstly, RASUB is transformed and its collection and haulage activities are transferred to a newly created SALUB and its disposal activities to a new disposal administration, the proposed FJVC. MB receives technical assistance (TA) to set up the new disposal administration. MB agrees a performance contract with the FJVC.

Secondly, after RASUB's transformation, MB receives TA for implementing contract management arrangements and TA for implementing the waste tax **before the waste tax and contracting are introduced.**

Thirdly, the waste tax and the joint contracting out of collection and haulage and street sweeping are simultaneously implemented. Contractors cease to levy tariffs and are remunerated by MB through their contracts which are financed by MB from the waste tax.

Fourthly, initially only SALUB and RGR are contracted with. But subsequently there is a phased contracting out of collection and haulage services and street sweeping.

Indicative scheduling of these actions is given in **Figure 10-1** below.

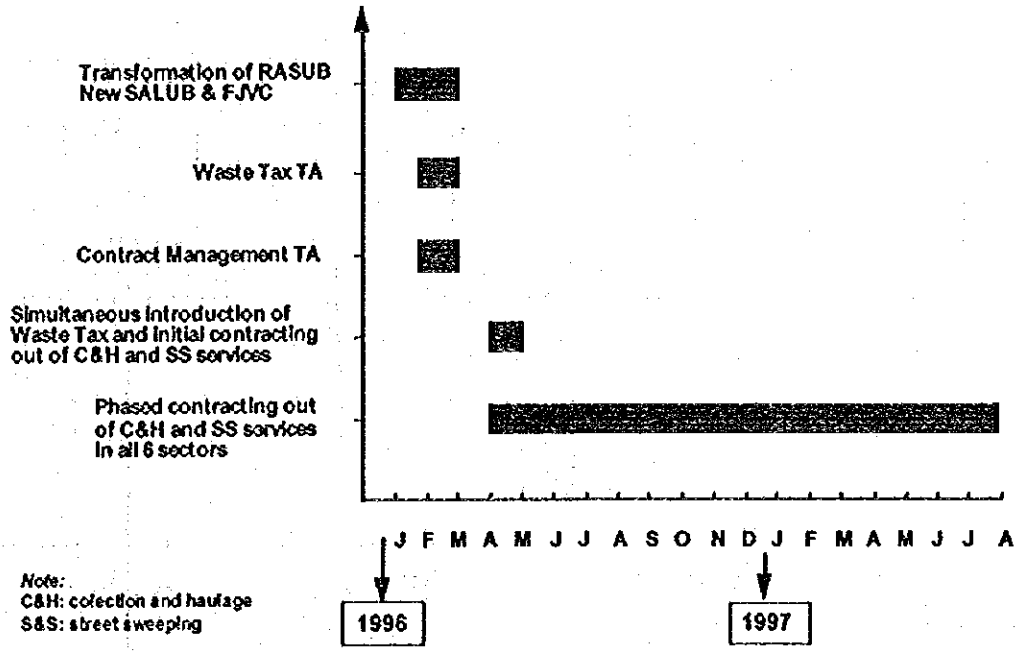


Fig. 10-1 Schedule of Actions

5 Recommendations for the Government of Romania

It is recommended that the Government of Romania:

1. prepare a national strategy and plan for solid waste management. This would include:
   - identifying the number of municipal disposal sites which need to be constructed including an estimate of the investment cost; and
   - setting quantitative targets for SWM and preparing guidelines for achieving targets.

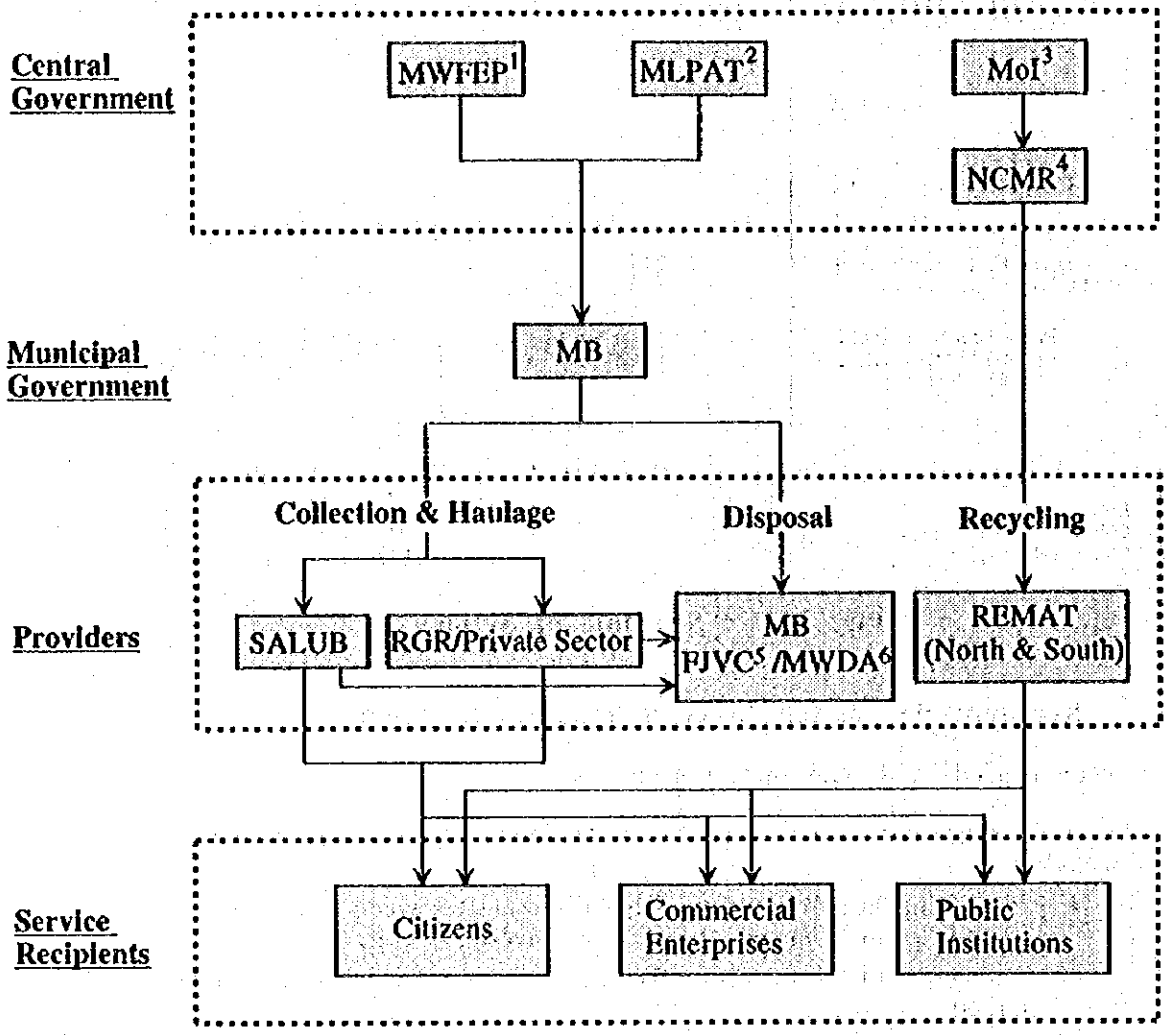
   Output from the plan would include the preparation of guidelines for local government strengthening of SWM organizations;

2. establish a monitoring and reporting under system which local governments report municipal SWM information to the MLPAT including, (1) service coverage, (2) costs, (3) waste tax or other revenues billed and collected, (4) types and quantity of equipment used, and (5) disposal methods used.

   The information reported to MLPAT will be used to evaluate municipal SWM conditions, and to issue guidelines to local government.

6. Summary of Proposed Institutional and Financial Arrangements

The chart in Figure 10-2 summarises the linkages between the main institutions involved at the national and local level, in SWM in Bucharest.



Note: 1. Ministry of Water, Forests, and Environmental Protection
2. Ministry of Public Works
3. Ministry of Industry
4. National Commission for Materials Recycling
5. Foreign Joint Venture Company
6. Municipal Waste Disposal Administration

Fig. 10-2 Institutions Responsible for Solid Waste Management (Including Recycling) for Bucharest

11 ORGANIZATIONAL AND MANAGEMENT

Deficiencies in the organisation and management of MB and RASUB and recommendations for strengthening institutional capacity are presented below. These deficiencies have greatly contributed to the poor delivery of SWM in Bucharest.

1. Bucharest Municipality's Organisational Deficiencies and Recommendations for Strengthening Institutional Capacity

1) Service Responsibilities: MB is unable to effectively oversee, control and sanction RASUB to ensure the proper delivery of SWM services for which MB is ultimately responsible.

Recommendation: MB needs to establish a legal framework with RASUB to enable MB to oversee and when necessary regulate RASUB's activities. MB and RASUB should agree a service contract which defines their operational relationship, their corresponding rights and obligations, and sets performance objectives.

2) Contract Management Capabilities: MB's lacks the capability to manage contracts with the private sector. Pre contract award procedures are deficient. Post contract award monitoring hardly exists; see section 3) below. Without a strong capability MB cannot ensure that contract objectives are met, VFM is assured and contractors comply with terms and conditions.

Recommendation: MB implements a contract management capability which comprises pre contract activities of preparing the specification, setting tender evaluation criteria, prequalification, tendering, negotiation and award. And post contract activities of monitoring services, contract compliance, managing "contract change", as well as, VFM assessment. **It is also proposed** that MB receive technical assistance from the World Bank to implement these arrangements.

It is also recommended that a legal expert is employed in the PSD to strengthen its contracting capabilities. The expert would report to the Chief of the PSD.

3) Service Monitoring and Enforcement: MB's monitoring of RASUB's and RGR's services is weak because it lacks the staff and expertise. MB is also unable to effectively sanction RASUB when it breaches the Bucharest Sanitation Norm (BSN).

Recommendation: a performance measurement system is established to enable MB to monitor and report on service performance and to check for contract compliance. The system should also enable MB to assess whether a contract is giving Value for Money (VFM).

It is proposed that monitoring arrangements are split between the PSD and the 6 Sectors' Salubrity Administration Sections. Sectors will carry out the detailed service monitoring. The PSD will monitor the Sectors' activities, check contracts comply with performance standards and terms and conditions, follow up serious service deficiencies, apply sanctions to contractors and prepare quantity and quality data for planning and forecasting.

It is also proposed that a workable structure to resolve legal and commercial issues with contractors is established.

4) Planning Capability: The preparation of MB's first annual plan in 1994 to which the PSD contributed is a very welcome step. However, there is no formalised planning capability by which annual, medium and long term planning is prepared by the PSD.

Recommendation: A planning capability is implemented under which service objectives and policies, performance targets, action plans and scheduling are prepared. Resource plans including a financing plan should also be prepared.

5) Delegation and Assignment of Responsibilities: Although job descriptions are prepared for each member of staff, in practice there is little accountability for individual staff performance. Furthermore, there are no formal procedures to monitor individual performance.

Recommendation: Responsibilities should be clearly assigned and delegated to staff who should be held accountable for them.

6) Objective Setting and Performance Measurement

There are no procedures to set and monitor objectives for managers and supervisors. There should be a periodic assessment of managers and supervisors performance against agreed performance targets and objectives.

Recommendation: managers performance should be periodically assessed against agreed performance targets and objectives.

7) Management Information Systems (MIS): The MIS capability of MB is generally weak. This is aggravated by the reluctance of departments within MB to share information. As a result monitoring of RASUB is weak because of the lack of accurate and timely data.

Recommendation: The MIS capability should be improved in the PSD. However, we note that PSD is making very good efforts to improve its MIS. It has implemented two new software applications; Agenda and Dox. Both applications facilitate task and document management and were developed by MB's computing resources. This is a very welcome step and indicates that MB is taking steps to develop an "information culture". PSD anticipate further MIS developments.

8) Human Resource Capabilities: There is no human resources development program or training provided to staff except for basic skills. In particular MB's managers lack management and financial skills. Staff in the PSD's Sanitary Service section lack contracting, financial and planning skills.

Recommendations: Staff in the PSD receive specific training for contract management, finance and service planning. Contract management training will be provided under the technical assistance MB will receive from the World Bank.

Generally MB should implement a human resources development program for all its staff. The program should identify training needs and set up annual staff assessment procedures. In particular a management development program should be provided for senior and middle managers. Development of financial management skills is a priority.

9) **Financial Constraints:** MB is unable to ensure that SWM is adequately financed in Bucharest. In particular MB has been unable to finance capital investment in SWM because it is financially constrained. This is due to the Municipality's lack of financial autonomy, as well as, the lack of financing of RASUB's capex from the State Budget.

Recommendations: MB finances its SWM services through the proposed waste tax. The tax is set at a level which ensures that RASUB and RGR are sufficiently remunerated through their contracts to finance their functions. MB finances capital investment in disposal services (which will be transferred to MB) from its general tax revenues and/or from the waste tax.

It is proposed that MB receive technical assistance (TA) from the World Bank to enable it to set and implement the waste tax and to restructure its financing of SWM. The TA will assist MB to identify how much capital investment in disposal can be financed from the waste tax or from general tax.

It is also recommended that MB ceases to procure any equipment for RASUB since this will be financed from the contract remuneration.

2. RASUB's Organisational Deficiencies and Recommendations for Strengthening Institutional Capacity

The following organisational and management deficiencies have greatly contributed to RASUB's poor delivery of collection and haulage and disposal services.

1) **Senior Management:** RASUB's senior management is bureaucratic and ineffective. Its Council of Administration has failed to implement strategic planning and to develop practical policies to resolve RASUB's major problems. The Board of Directors is similarly ineffective. Much of this is a result of deficiencies in national law governing the Regii Autonomes however reform of national law is beyond the scope of the study.

Recommendations:

1. the Directors are trained in management skills;
2. the Council delegates planning, policy formulation and other tasks to the Board; and
3. MB explores ways of implementing legislation which clearly assigns management responsibilities to RASUB's senior management.

2) **Organisational Structure:** The spans of control for the General Manager, and for a) the billing and collection, and, b) the maintenance and asset management compartments are too wide.

Recommendation: These spans of control should be reduced to 5 or 6 people.

3) Functional Departmentation: There is fragmentation of some responsibilities across the organisation, and a number of functional omissions which impact on organisational efficiency and effectiveness.

a. Both maintenance and collection and haulage functions are fragmented over a number of sections.

Recommendation: a new maintenance division and a new collection division are created to which all functions are respectively assigned.

b. The accounting function is fragmented across a number of compartments/sections.

Recommendation: accounting is organised into one department and managed by the Economics Director.

c. The personnel function is fragmented between the Personnel, Salaries and the Operational Monitoring Sections under the Production Director.

Recommendation: a new Personnel Department is established and a Personnel Director appointed. A human resource development plan and annual staff assessment procedures are implemented.

d. Internal audit is carried out by the Legal compartment comprising one legal officer. This is insufficient for an organisation of this size.

Recommendation: two internal auditors are recruited to set up an audit compartment which reports directly to the Board.

4) Delegation and Assignment of Responsibilities: Although job descriptions are prepared for each member of staff, in practice there is little accountability for individual staff performance.

Recommendation: Responsibilities should be clearly assigned and delegated to staff who should be held accountable for them.

5) Planning Capability: There is virtually no formalised planning capability by which annual, medium and long term planning is carried out.

Recommendation: A planning capability is implemented under which a mission statement, objectives, policy statements, performance targets, action plans and scheduling are prepared. Resource plans including a financing plan should also be prepared.

6) Objective Setting and Performance Measurement: There are no procedures to set and monitor objectives from the strategic level down to middle managers and supervisors.

Recommendation: managers performance should be periodically assessed against agreed performance targets and objectives.

7) Financial Management and Financial Systems:

a. There is virtually no formalised financial planning capability by which annual and medium term financial planning is carried out.

Recommendation: annual and medium term financial planning is carried out. Financial planning must be integrated into the strategic planning process.

b. There is no budgetary planning and control system for recurrent or capital expenditure.

Recommendation: a budgetary planning and control system is introduced under which recurrent and capital budgets are established and which underpins the financial planning process.

c. The accounting systems are largely uncomputerised.

Recommendation: a new computerised accounting system is introduced. At the same time the Economics department should be reorganised.

8) Management Information Systems (MIS): There is no MIS capability which provides accurate and timely information to enable managers to make effective decisions and to carry out their responsibilities more efficiently.

Recommendation: An MIS capability should be implemented. As a minimum, simple performance measures like labour productivity should be produced. A list of recommended MIS data requirements is given in Chapter 10 of the Master Plan.

9) Human Resources Capabilities: There is no human resources development program or training provided to staff except for basic skills. In particular managers lack management and financial skills.

Recommendations: A human resources development program should be prepared for the whole staff by the new personnel department. The program should identify training needs and set up annual staff assessment procedures.

In particular a management development program should be provided for senior and middle managers. Development of financial management skills is a priority.

10) Financial Constraints: RASUB is so financially constrained that it relies almost entirely on MB to finance its capital investment. However, MB is now unable to finance RASUB's capex because it is itself financially constrained.

Recommendation: It is recommend0ed that MB finance its SWM services through the proposed waste tax. The tax should be set at a level which ensures that RASUB is sufficiently remunerated under a service contract to finance its functions. It is also recommended that MB ceases to procure any equipment for RASUB.

To ensure that the waste tax is implementable, it is proposed that MB receive technical assistance (TA) from the World Bank to enable it to set and implement the waste tax.